Bibliography of Solid Adsorbents

1943 to 1953

U. S. Department of Commerce
National Bureau of Standards
Circular 566

UNITED STATES DEPARTMENT OF COMMERCE • Sinclair Weeks, Secretary
NATIONAL BUREAU OF STANDARDS • A. V. Astin, Director

Bibliography of Solid Adsorbents

1943 to 1953

An Annotative Bibliographical Survey

Victor R. Deitz

National Bureau of Standards Circular 566

Issued March 1, 1956

For sale by the Superintendent of Documents, U. S. Government Printing Office
Washington 25, D. C. - Price $8.75

INDUSTRIAL SPONSORS OF THE BONE CHAR RESEARCH PROJECT, INC.

The preparation of this volume was conducted as part of a program of research under the cooperative sponsorship of the National Bureau of Standards and the Bone Char Research Project, Inc., a research associateship established at this Bureau in 1939. The current industrial sponsors are listed below.

Acadia-Atlantic Sugar Refineries, Ltd., Halifax, Nova Scotia
American Agricultural Chemical Company, Detroit, Mich.
American Sugar Refining Company, New York, N. Y.
Atlantic Sugar Refineries, Ltd., Saint John, New Brunswick
Baugh & Sons Company, Philadelphia, Pa.
British Charcoals & Macdonalds, Ltd., Glasgow, Scotland
British Columbia Sugar Refining Company, Ltd., Vancouver, British Columbia
California & Hawaiian Sugar Refining Corp., Ltd., San Francisco, Calif.
Canada & Dominion Sugar Company, Ltd., Montreal, Quebec
Colonial Sugar Refining Company, Ltd., Sydney, Australia
Colonial Sugars Company, Gramercy, La.
Companhia Uniào dos Refinadores, São Paulo, Brazil
Consolidated Chemical Industries, Inc., New York, N. Y.
Godchaux Sugars, Inc., New Orleans, La.
Henderson Sugar Refinery, Inc., New Orleans, La.
Hershey Corporation, Central Hershey, Cuba
Hulett's South African Refineries, Ltd., Durban, South Africa
Imperial Sugar Company, Sugar Land, Tex.
National Sugar Refining Company, New York, N. Y.
Refined Syrups & Sugars, Inc., Yonkers, N. Y.
Revere Sugar Refinery, Charlestown, Mass.
Savannah Sugar Refining Corp., Savannah, Ga.
St. Lawrence Sugar Refineries, Ltd., Montreal, Quebec
Tate & Lyle, Ltd., London, England
Tirlemont Refinery, Tirlemont, Belgium
Wed. P. Smits & Zoon, Utrecht, Holland
Westburn Sugar Refineries, Ltd., Greenock, Scotland

FOREWORD

Annotated bibliographies of special topics in science have as their primary purpose the assembly of a scattered literature. From such surveys the research worker may gain a perspective of his field not otherwise possible because of the press of specific problems. In the training of new personnel, the availability of comprehensive reference material by subject is invaluable as the essential starting point to active investigation. It provides background, and it reveals areas where strengthening of knowledge is needed. The present volume furnishes information on these sources in a specific field of science.

The scientific literature in Circular 566, Bibliography of Solid Adsorbents 1943 to 1953, covers a significant period in science and technology. In the highly specialized field of investigation here concerned, that of commercial solid adsorbents, progress has been as exceptional as in other technical fields. Approximately twice as many publications appear in this volume for the period 1943–53 as in Bibliography of Solid Adsorbents 1900 to 1942.

It is gratifying to note that the joint sponsorship of the Bone Char Research Project, Inc. and the National Bureau of Standards has continued without a break since 1939. During this period the industrial sponsors have increased in number and now represent industry in other countries, as well as the United States. The program of fundamental research envisioned at the outset of this project has been maintained. The Cane Sugar Refining Industry and the Bone Char Manufacturers have shown exceptional foresight in maintaining a continuity of effort that can only result in mutual benefits.

The Research Associate Plan of the National Bureau of Standards makes it possible for an industry to cooperate in the prosecution of a fundamental research program. Research Associate projects are required not only to be of value to all groups concerned in a particular field and to the Federal Government, but must also be important from the standpoint of the Nation's sum total of technological knowledge. The publication of Circular 566 is a good example of such cooperation. Those responsible for this volume have rendered a valuable service in the field of adsorption in particular and to science and industry in general.

Allen V. Astin, *Director*.

June 15, 1955.

PREFACE

The decade since the publication of the Bibliography of Solid Adsorbents 1900 to 1942[2] has seen remarkable progress in both basic theory and the applications. The accomplishments of the latter often exhibit spectacular successes. Essentially, the industrial use of an adsorbent involves a relatively simple unit operation and relatively simple equipment, a situation having obvious advantages. The advances in basic theory may appear meager when viewed alongside the striking exhibition made by a successful technical process, but so powerful is the contribution of basic theory that its guiding influence is felt over the complete range of activities in industry, as well as in research.

As articles of commerce, the variety and number of solid adsorbents have increased markedly in the last decade. In the early stages of development, the commercial adsorbent was a by-product, and men with great faith in their product set forth to find applications in established processes of industry. Progress was slow and steady while a generation of chemical engineers was being trained in the fundamentals and possibilities of the adsorption process. A commercial adsorbent became a success when with its use it was possible to do what would otherwise be impractical or uneconomical with some other unit process. In many cases the process has made a success of the adsorbent, but frequently the reverse has been true.

Twice as many publications are cited for the decade covered by this volume as for the previous four decades. There are many reasons that have contributed to this tremendous growth. One of the most important developments has been in the refining of petroleum and the synthesis of various chemicals from petroleum products. Although the first applications of silica and alumina gels were as desiccants, and it was in this capacity that they were used in large tonnages during World War II, the development of catalytic cracking and reforming of hydrocarbons has entailed tremendous quantities of these materials. Scores of publications have been concerned with the many problems involved. A second development has been the ion-exchange synthetic resins, which now are the subject of a significant part of the adsorbent literature. With their aid the removal of inorganic constituents by adsorption was given a selectivity that had immediate applications. A third development has been the growth of chromatography, a subject that has richly endowed the chemist with many and varied techniques having a potential selectivity not hitherto possible. This tool has proved to be very productive in many fields of investigation and is being used by the analyst and the chemical engineer with skill and ingenuity.

No claim for completeness is made in the compilation of this volume. The opportunity has been taken to include references that were omitted in Bibliography of Solid Adsorbents 1900 to 1942. Thanks are due to readers who have kindly called attention to some unintentional omissions. Many references to publications both before and after 1943 have been added from the fields of heterogeneous catalysis and surface reactions on textile materials. However, the coverage in both volumes is still restricted to heterogeneous phenomena at solid-liquid and solid-gas interfaces. As before, the patent literature is not covered. Notwithstanding repeated checking of the subject matter, some omissions are probably present among the 13,763 references contained in this volume. It would be appreciated if the reader would call attention to these.

The sources of the literature references and the abstracts have been many. Published books tabulated on pages 1361 to 1363 have been explored for pertinent references. The abstract given with each entry was prepared from one or more of the following sources: (1) The original publication, (2) Chemical Abstracts, (3) British Chemical Abstracts, (4) Chemisches Zentralblatt. The Chemical Abstract reference is given with each journal reference because of the universal availability of these abstracts. An acknowledgment is herewith made of the general permission granted to use individual abstracts. Periodical abbreviations conform with those used in Chemical Abstracts. These were tabulated in an appendix of Bibliography of Solid Adsorbents 1900 to 1942. A list published by the American Chemical Society in 1951 is available under the title "List of Periodicals Abstracted by Chemical Abstracts."

The author takes this occasion to express his sincere appreciation to the many assistants who have lent a helping hand in the preparation of this work. The aid from those with nontechnical training has been invaluable because of the care and pride they have taken in their work. The author is indebted to his colleagues of the Bone Char Research Project, Inc., for their able assistance in the tedious task of proofreading.

VICTOR R. DEITZ.

June 15, 1955.

---

[1] The "Bibliography of Solid Adsorbents 1900 to 1942" is a volume of 877+lxxxi pages. Copies may be procured from Bone Char Research Project, Inc., c/o J. M. Brown, Secretary, Revere Sugar Refinery, 333 Medford Street, Charlestown 29, Mass.

CONTENTS

Chapter I. ADSORPTION OF GASES AND VAPORS ON SOLID ADSORBENTS

Adsorbents are used in industry for their effects on particular gases, liquids, or solutions. It would have been useful to assemble the literature from this point of view and group the publications on particular systems with the various adsorbents. However, it is not practical to do this in any detail for several reasons. The variations among the same species of adsorbent have been many and the particular systems in which the adsorbents have been used have been too numerous for a convenient classification. Instead, the grouping of the literature has been based on the type of adsorbent and some general aspect of the gas or solution phases. Carbon adsorbents, metal surfaces, inorganic crystals, silica gel, and so forth are examples of adsorbent types; the complete arrangement may be seen by a perusal of the Contents.

During the period 1943–53 there was a notable increase in the number of investigations reported for the adsorption of hydrogen and other gases on metals. About one-third of the papers covered in Chapter I are on this subject. With interest mounting in the fields of high-temperature corrosion-resistant alloys, metal catalysts, and the electrical properties of the solid state, it is probable that the literature covering this field will continue to grow at a rapid rate.

The most significant development in adsorption at the gas-solid interface during the past decade has been the application of the Brunauer-Emmett-Teller [2] model of physical adsorption to the estimation of the surface area of solids. This method was introduced in 1938 and, together with the constructive criticism which followed, it constitutes one of the milestones in the understanding of adsorption phenomena.

The need to identify adsorption sites with more exactness has influenced many investigators to select inorganic crystals and metals for the surfaces to be studied. This has been done with a high degree of success in recent investigations on tungsten of J. A. Becker and C. D. Hartman.[3] One may indeed look forward with anticipation to the results of more investigations of this type for real progress in understanding the properties at solid-gas and solid-solution interfaces.

The voids within the real solid contribute in varying degrees to the adsorption process. The voids may range from simple faults and breaks within an otherwise perfect crystal to the elaborate porosity ascribed to commercial adsorbents and catalysts. Methods have now been published for the evaluation of the size distribution (assumed to be cylindrical pores) and the total volume of the voids. These techniques have greatly aided in elucidating the macro-scale physical structure of solid adsorbents. There is, also, an increasing literature concerned with the important role that this internal structure plays on surface reactions in the solid phase.

The similarity of some of the problems in solid state physics with those in surface adsorption and catalysis should be better appreciated. An increasing number of publications treat systems of overlapping interest, and significant progress can be expected in the future.

The well-established but poorly-defined carbon adsorbents continue to excite further research, although the number of these publications in 1943–53 constitute only 20 percent of Chapter I. More than half of these were concerned with the reaction of carbonaceous residues with oxygen. The chemisorption of oxygen on these adsorbents constitutes an old but as yet little-understood system. Section 5, "Reactions of Oxygen and Carbons," includes not only the subject of the adsorption of oxygen, but also the publications which have dealt with the initial reactions leading to partial or complete oxidation of the solid state.

The Subject Index provides an extensive cross index of subject headings not listed in the Contents. It is a useful aspect of the Bibliography and serves to subdivide further the material covered. A subject that might properly be placed in more than one chapter has been entered but once and may be located by means of the Subject Index. The entries in the latter have been made according to the particular adsorbent and under these are tabulated the various adsorbates that have been investigated.

---

[2] J. Am. Chem. Soc. 60, 309–19 (1938).

[3] J. Phys. Chem. 57, 153–9 (1953).

I-1. Inorganic Gases on Carbon Adsorbents

1. PETERS, KURT. **Adsorption and desorption.** *Reichsamt Wirtschaftsaubau, Prüf-Nr.* **43**, (PB 52003), 113-20 (1940).—*C.A.* **41**, 6105f.

The theoretical and practical aspects of adsorption and desorption as a means of sepn. and purification of gases was reviewed. The sepn. and purification of Kr, Xe, and A, using activated charcoal, was described. Through adsorption and fractional desorption, the m.p. of the purified Kr was found to be −157°C as compared with a previously reported value of −169°C, purified Xe m. −112°C as compared with −140°C previously reported.

2. WICKE, E. **Fundamentals concerning the sorption separation process.** *Reichsamt Wirtschaftsaubau, Prüf-Nr.* **43**, (PB 52003), 103-12 (1940).—*C.A.* **41**, 6105h.

Mixed adsorption over silica gel and over activated charcoal was described. The data showed highly specific adsorption of oxygenated compds. such as esters and ethers on silica gel in the presence of *n*-pentane and related hydrocarbons. A general discussion was included of chromatographic analysis, diffusion analysis, and continuous sepn. processes for gases and liquids from room temp. at 150°C.

3. GERLING, E. K. AND ERMOLIN, G. M. **A method for the separation of helium from neon.** *Compt. rend. acad. sci. (U.S.S.R.)* **32**, 641-3 (1941) (in English).—*C.A.* **37**, 2522^8.

Charcoal adsorbed Ne at −225°C and to find out whether this could be used to separate Ne from He, adsorption of each was studied. At −195.7°C, 3% Ne was adsorbed by He charcoal, at −207°C, 47.1%, at −215°C, 70.6%, at −224.7°C, 95.7%, and at −225°C, 99.7%, pressures varying from 1.15×10^{-3} to 2×10^{-6} mm Hg. At −224.8°C, 3.8% He was adsorbed by charcoal and 6 determinations from −224.8° to −229.4°C at various pressures gave an average adsorption of 5.1%. It was possible to make a separation of the two gases.

4. ALEKSEEVSKII, E. V. AND LIKHAVEV, N. A. **Effect of certain chemical and physical factors on the activity of charcoal. Activation by chlorination.** *J. Gen. Chem. (U.S.S.R.)* **12**, 306-19 (in English, 319-20) (1942).—*C.A.* **37**, 2913^5.

Charcoals from a wide variety of plant sources were treated with Cl_2 at 750°C and 950°C; the sorption of gaseous and dissolved materials (benzene vapor, I_2 solns., solns. of salicylic acid, solns. of H_2O_2, chloropicrin, and Cl_2) on these charcoals were studied. Charcoals activated by Cl_2 may be superior to commercial charcoals. A considerable part of Cl_2 which accumulated during chlorination, could not be washed out by boiling water or alkalies, nor removed by heating in vacuo nor by electrodialysis.

5. IMADA, FUMIO. **Studies on carbon. II. Sorption isotherm of charcoal and the mechanism of its activation.** *Technol. Repts. Kyushu Imp. Univ.* **18**, 53-7 (1943).—*C.A.* **43**, 5572a.

Charcoals prepd. from various trees (yield 24-35%) showed adsorption of 9.8-18.7 cc/g of Cl_2 (satd. at 18°C). Current theories of sorption to explain the activation were reviewed.

6. IMADA, FUMIO. **Studies on carbon. VI. Chlorination.** *Technol. Repts. Kyushu Imp. Univ.* **18**, 72-5 (1943).—*C.A.* **43**, 5572d.

The most active charcoal (after wetting with steam) consumed under similar conditions more Cl_2 (163 cc/g at 20°C) than other materials such as another active charcoal (92 cc/g), and graphite (21 cc/g).

7. IMADA, FUMIO. **Studies on carbon. IX. Evaluation of the results.** *Technol. Repts. Kyushu Imp. Univ.* **18**, 88-93 (1943).—*C.A.* **43**, 5572f.

The observed values showed in part the monomol. adsorption of Langmuir.

8. GLUECKAUF, E. **Simple analysis of the He content of air.** *Trans. Faraday Soc.* **40**, 436-9 (1944).—*C.A.* **39**, 2038^2.

The procedure was based on the adsorption in 3 gas-adsorption charcoal tubes which had been previously outgassed in vacuo at 400°C for 20 min., and then immersed in liquid N_2. Known mixts. of He and air were used to det. the loss of He during this purification process. Air was found to contain normally 5.24 ±0.03 p.p.m. of He.

9. NIKITIN, B. A. AND IOFFE, E. M. **Adsorption of radon on charcoal under dynamic conditions.** *Bul. acad. sci. U.R.S.S., Classe sci. chim.* **1944**, 210-15 (English summary).—*C.A.* **39**, 1583^9.

In adsorption of small quantities of Rn in a stream of air, the max. on the charcoal cannot exceed the product of Henry-law distribution coeff. and the Rn concn. in the air stream. For high grades of charcoal this distribution coeff. may attain the value of 500-1500. Rn, first adsorbed on the surface layers, completely distributed itself within the depth of 5 cm in the course of a few hrs. Foreign materials adsorbed previously, sharply reduced the adsorption of Rn.

10. GLEYSTEEN, LELAND F. AND DEITZ, VICTOR R. **Hysteresis in the physical adsorption of nitrogen on bone char and other adsorbents.** *J. Research Natl. Bur. Standards* **35**, 285-307 (1945) (Research Paper 1647).—*C.A.* **40**, 1375^7.

Adsorption of N_2 at 77°K on bone char, activated charcoal, silica gel, and coconut-shell charcoal showed closed hysteresis loops. Hysteresis became less pronounced in the order of adsorbents given. On coconut-shell charcoal, it occurred only if desorption was begun very close to the satn. pressure, in the region where the Langmuir adsorption equation was no longer obeyed. An interpretation, in terms of the theory of multimol. layer adsorption, postulated the formation of mol. clusters on the surface which remained independent of one another until a certain pressure was reached, when they joined together in some fashion. Desorption occurred from this more stable modified layer. The desorption isotherm remained above the adsorption isotherm until the pressure was so low that the clusters were not stable.

11. MARTIN, FRANCISCO MORENO. **Quantitative separation of gaseous silicon fluoride and carbon dioxide by activated carbon.** *Anales fis. y quim. (Madrid)* **41**, 1303-16 (1945).—*C.A.* **41**, 4404i.

A mixt. of CO_2 and SiF_4 when passed through a granular activated charcoal was sepd. into its components. SiF_4 remained and CO_2 passed through. When SiF_4 was adsorbed, it displaced the CO_2 from the charcoal. This caused a small loss in wt, which prevented exact, gravimetric detn. of SiF_4. The SiF_4 value must be corrected by 2%. HCl dislodged the SiF_4 adsorbed on the charcoal.

12. ANDERSON, ROBERT B. **Improved adsorption vessel.** *Ind. Eng. Chem., Anal. Ed.* **18**, 156 (1946).—*C.A.* **40**, 1702^7.

An adsorption vessel consisted of an adsorbent chamber and special 4-way stopcock. This was light enough to be weighed on an analytical balance.

13. COURTY, CLEMENT AND ROUGEOT, LOUIS. **Oxidation of ammonia fixed on activated charcoal.** *Compt. rend.* **223**, 624-5 (1946).—*C.A.* **41**, 1945b.

NH_3 was adsorbed by activated charcoal which was then exposed to the air. All odor of NH_3 disappeared at the end of 3 hrs. From then on it increased in wt even in an atm. free of moisture and CO_2. After 8 hrs, wash water from the satd. charcoal clearly showed the reducing properties of hydroxylamine. After several days' exposure of the charcoal to pure dry air, the wash water no longer had the properties of hydroxylamine but had those of NH_4NO_2. These oxidation reactions were accelerated by moistening the charcoal after it had been satd. with NH_3.

14. DESORBO, WARREN; MILTON, ROBERT M., AND ANDREWS, DONALD H. **New cryogenic methods of using liquid hydrogen.** *Chem. Rev.* **39**, 403-17 (1946).—*C.A.* **41**, 1133d.

The liquefier was of the Ahlberg type, operating from ordinary tank H_2 purified by passing over charcoal at 90°K. It produced about 1.5 liter of liquid H_2 in 45 min. from 3 standard tanks in which the pressure dropped from 2000 to 1000 lb/in^2.

15. GREGG, S. J. **An electrical sorption balance.** *J. Chem. Soc.* **1946**, 561-2.—*C.A.* **40**, 6302^3.

Construction of a balance suitable for adsorption measurements was described. A glass beam and sample supports, with steel needle and glass-cup bearings, were enclosed in a glass-tube vessel which could be evacuated. The construction permitted out-gassing the sample. The sensitivity was 0.3 mg, independent of the total load, which may be 10-20 g. Balance was obtained by adjusting the current through two solenoids.

16. KEĬER, N. P. AND ROGINSKIĬ, S. Z. **Chemisorption of gases on activated charcoal and the abundance of surfaces with exponential distribution functions.** *Compt. rend. acad. sci. U.R.S.S.* **52**, 781-3 (1946).—*C.A.* **41**, 1523*i*.

Expts. were made on the kinetics of activated adsorption on a sugar charcoal at const. pressure. Adsorption isotherms of H_2 and O_2 followed the equation $q=a\ t^{1/n}$, where q was the quantity of adsorbed gas and t the time. The temp. coeff. of the adsorption was observed.

17. LINDEBOOM , J. **The adsorption of a few gases and of their binary mixtures by carbon, in relation to the regeneration of neon tubes.** *Rec. trav. chim.* **65**, 877-90 (1946) (in French) *C.A.* **41**, 3676h.

The adsorption isotherms were measured of pure N_2, H_2, and Ne and of the mixts. N_2-H_2 at 20°C and 760 mm by 15 g active charcoal, Ne-H_2 at -79°C and 760 mm by 15 g charcoal and Ne-H_2 at -192°C by 1 g charcoal at 760, 50 and 10 mm. The data were given in tables and graphs compared with the straight line and hyperbola calcd. from Henry's law. H_2 was adsorbed more strongly than Ne although its b.p. was lower, whereas for N_2-H_2 mixts. the reverse was true. No satisfactory interpretation of the elimination of H_2 from Ne-H_2 mixts. (used by Claude to purify Ne) could be made. Subjecting the charcoal used for the purification of Ne-H_2 mixts. to vacuum of 10 mm, increased considerably the yield of Ne without increasing the proportion of H_2 appreciably.

18. ANDERSON, ROBERT B. AND EMMETT, P. H. **Surface complexes on charcoal. Gas evolution as a function of vapor adsorption and of high-temperature evacuation.** *J. Phys. & Colloid Chem.* **51**, 1308-29 (1947).—*C.A.* **42**, 1410c.

The gases evolved on evacuating charcoals for gas masks to 1200°C were collected at 300°C intervals and analyzed for CO, CO_2, H_2, H_2O, and CH_4. The O-contg. gases were formed by the decompn. of surface complexes and by the reduction of the inorg. oxides present as ash. The CO and CO_2 evolution reached a max. at about 600°C for charcoals prepd. by the $ZnCl_2$ process, and at 900 to 1200°C for those prepd. from coal. The total O-contg. gases evolved were always equiv. to less than 50% of the charcoal surface. Extg. charcoals with HF and re-exposing them to air resulted in about a twenty-fold increase in the amt. of CO evolved on heating the samples to 600°C. H_2 evolution in the temp. range 600 to 1200°C amounted to 25 to 147 cc. for the various charcoals. Activation of the charcoals by steam was shown to form very little O-complex. NH_3 at 750° to 900°C formed a N-complex on the charcoals that was more stable than the O-complexes.

19. DUBININ, M. M. AND RADUSHKEVICH, L. V. **The equation of the characteristic curve of activated charcoal.** *Doklady Akad. Nauk S.S.S.R.* **55**, 327-9 (1947) Chem. Zentr. 1947, 1, 875.—*C.A.* **43**, 3686g.

The relation between the vol. of the liquid adsorbate (W) and the adsorption potential (ϵ) was studied, and the following equation derived $\epsilon^2 = a^2 \ln W_0/W$, in which W_0 = the vol. of the liquid adsorbate at $\epsilon = 0$. The factor a varied with the nature of the adsorbed vapor, but W_0 was independent, since only the structure of the adsorbent detd. the vol. of the adsorbate. The relation between W and ϵ was applied to the adsorption of CO_2 and alcohol on wood charcoal.

20. HARRIS, G. M. AND TICKNER, A. W. **Reaction of hydrogen atoms with solid carbon.** *Nature* **160**, 871 (1947).—*C.A.* **42**, 3638c.

Thin-soot deposits on glass completely disappeared in an atm. of 20% at. H at 0.4 mm pressure. A typical reaction product contained CH_4, a small amt. of C_2 to C_5 fraction, and no nonvolatile substance.

21. Holmes, James and Emmett, P. H. **Alteration of the size and distribution of pores in charcoals.** *J. Phys. & Colloid Chem.* **51**, 1276-1307 (1947).—*C.A.* **42**, 1102e.

Pore size and surface-area alterations produced in 4 gas-mask charcoals by various combinations of steaming, hydrogenation, oxidizing, sintering, or impregnating with NiO, CuO, Mo_2O_3, Na_2CO_3, Fe_2O_3, or Cr_2O_3 were studied. Adsorption isotherms for N_2 at −195°C were used to judge the changes in pore-size distribution and surface area. The samples included two charcoals made by the $ZnCl_2$ process, one steam-activated coconut shell charcoal and one made from coal by a combination of calcination and steam activation. Suitable combinations of the treating process seem capable of increasing the relative proportion of any particular size of pore that was desired in the charcoals.

22. Holmes, James and Emmett, P. H. **Investigation of low-temperature nitrogen adsorption at high relative pressures.** *J. Phys. & Colloid Chem.* **51**, 1262-76 (1947).—*C.A.* **42**, 1101a.

N_2 adsorption isotherms were detd. at −195°C at relative pressures as high as 0.9995 on porous glass, several charcoals, carbon blacks, and glass microspheres. The porous glass and some of the charcoals showed no increase in adsorption above a relative pressure of about 0.95. Other charcoals and all of the nonporous finely divided solids showed a considerable increase in adsorption above 0.95.

23. Imada, Fusao. **Carbons. XVII. Experiments on the active carbon in dry air-cells. The sorption of hydrogen.** *Kogaku Iho, Kyushu Univ.* (Technol. Rept., Kyushu Univ.) **19**, 243-6 (1947).—*C.A.* **47**, 5819i.

To det. the role of H ion in the electromotive reaction of the dry air-cell, the sorption of H_2 on active carbon was investigated. Active carbon treated with 1.17% Fe adsorbed 6 times as much H_2 as untreated material.

24. Keĭer, N. P. and Roginskiĭ, S. Z. **A differential isotopic method for the investigation of activated surfaces.** *Doklady Akad. Nauk S.S.S.R.* **57**, 157-9 (1947).—*C.A.* **44**, 8194g.

All adsorbed gases were removed from activated sugar charcoal by long heating at 1100°C and protected during subsequent cooling. H_2 and D_2 at the temp. of liquid air were adsorbed and desorption was accomplished by slowly raising the temp. The compn. of the evolved gases was deted. by measuring the change in the resistance of a Wollaston filament through which a const. current flowed. The gas adsorbed last was evolved first; then, a mixt. of H_2 and D_2 was evolved; then, the gas adsorbed first was evolved. The results indicated that the phenomenon was one of "energetic inhomogeneity" of the surface (different adsorption areas) rather than one involving spaces of varying accessibility. The adsorption isotherm obtained was similar to that of Freundlich.

25. Keĭer, N. P. and Roginskiĭ, S. Z. **Investigation of the nonhomogeneity of the surface of active carbon by the activated adsorption of hydrogen and of oxygen.** *Bull. acad. sci. U.R.S.S., Classe sci. chim.* **1947**, 571-83 (in Russian).—*C.A.* **42**, 3638*d*.

Rates of adsorption on sugar charcoal were detd. in a vol. of 240 cc; the pressure was allowed to drop by not more than 5-7% of the initial pressure. The charcoal was evacuated with gradual heating up to 1000-1100°C, kept at that temp. 1 hr, then for 2 hrs at 900°C. Reproducibility of the rate measurements was shown by the coincidence of two curves for O_2 at $p_0 = 6.23$ mm Hg, 204°C, in 2 expts. sepd. by 17 intervening consecutive adsorptions of O_2, H_2, CO, and CO_2. The kinetic equation was $q = At^{1/n}$ where $1/n = aRT$ and $A = f(p_0)$. The exptl. plots of log q against log t for O_2 at $p_0 = 6.23$ mm Hg, temp. 0°, 100° and 204°C, were actually linear, with $1/n = 0.327$ to 0.343, 0.447, and 0.510 to 0.570 at 0°, 100°, and 204°C, resp. The equation held equally well for the adsorption of H_2, with $1/n = 0.29$, 0.44, and 0.53 at 280°, 426°, and 540°C, resp. The activation energies E of adsorption of H_2 as a function of q, check satisfactorily with the values obtained by Arrhenius' equation.

26. Loebenstein, W. V. and Deitz, V. R. **The magnitude of the experimental error in the adsorption of nitrogen at 78°K on various surfaces.** *J. Chem Phys.* **15**, 687-8 (1947).—*C.A.* **41**, 7200d.

Large samples were required to det. a small B.E.T. surface. The exptl. error due to the use of adsorption tubes of various sizes was studied. For samples of cement, cotton, bone char, glass spheres, activated coconut shell charcoal, and TiO_2, weighing 0.7 to 31 g, and with B.E.T. surface areas of 0.7 to 1720 m^2/g, the error was 0.12 to 10.4%. In a general way, the error increased as the surface area decreased.

27. Strickland-Constable, R. F. **Interaction of carbon filaments at high temperatures with nitrous oxide, carbon dioxide, and water vapor.** *Trans. Faraday Soc.* **43**, 769-78 (1947).—*C.A.* **42**, 5316h.

The reactions were detd. at temps. of 900°-2000°C and at pressures of less than 1 mm. All were of the first order above 1200°C but tended to fractional order below this. The rates of reaction of all three gases rose from 900° to 1200°C and then remained approx. const. up to 2000°C, except in the case of N_2O, whose rate increased again above 1600°C. The rates of reaction depended to a certain extent on the immediate past history of the filament, especially from 1200° to 1600°C. Heating the filament at a high temp. reduced the rate of reaction at low temps. Reactions at low temps. increased the rate of subsequent reactions at higher temps. In the reactions N_2O and H_2O the principal O-contg. product was CO; very little CO_2 was formed. The primary product of the reaction of O_2 with C above 1000°C was principally CO and not CO_2.

28. Andreev, E. A. and Kavtaradze, N. N. **Catalytic oxidation of phosphine in adsorbed layers.** *Doklady Akad. Nauk S.S.S.R.* **60**, 1193-5 (1948).—*C.A.* **43**, 6898a.

The catalytic oxidation on dry charcoal in the presence of Cu salts involves as a 1st step the activated adsorption of PH_3 onto the supported Cu salt with an activation energy of about 2 kcal. The activation energy for the reaction of O with the adsorbed PH_3 increases as the O sats. the surface. The kinetics of the oxidation can be described by the equation: $\log(t+t_0) = (\alpha/2.3)q - \log\alpha a$, where q is the amt. reacted, t the time in min. a the original speed of the reaction, and α a const.

29. ARII, KIMIO AND TANSKA, MASAMI. **Sorption of hydrogen sulfide by active charcoal. I. Sorption isotherms.** *J. Chem. Soc. Japan, Pure Chem. Sect.*, **69**, 91-4 (1948).—*C.A.* **44**, 9209*h*.
Sorption expts. at 20°, 30°, and 40°C below 1 atm. were studied statistically with a quartz-spring balance and a spring manometer. The amt. of sorption α in mg/g charcoal at equil. pressure p (mm Hg) was $\alpha_{20°} = 1.63936\ p/(1+0.01092\ p)$, $\alpha_{30°} = 1.09785\ p/(1+0.00752\ p)$ and $\alpha_{40°} = 0.73528\ p/(1+0.00515\ p)$. Equations for sorption at const. wt and at const. pressure, a general equation of sorption, and the differential heat of sorption were obtained or calcd.

30. SAVAGE, ROBERT H. AND BROWN, CALLAWAY. **Chemical and physical adsorption of gases on carbon dust.** *J. Am. Chem. Soc.* **70**, 2362-6 (1948).—*C.A.* **42**, 8574b.
Carbon dust formed by the high wear of graphite rods rubbing against a rotating disk in vacuum adsorbed H_2, N_2, O_2, CO, CO_2, and CH_4 irreversibly at room temp. The chemically active sp surface of the dust was calcd. to be 5.12 m² per g from the H_2 adsorption at room temp.; this was compared to the B.E.T. surface of 435 m² per g. The B.E.T. areas of graphite powder used as raw material in making graphite rods, the graphite rods themselves, and the powder formed by pulverizing the rods in a high-speed impact grinder were 7.7, 1.3, and 4.6 m² per g. The graphite dust was in the form of platelets about 20 A. thick and 3500 A. in diam. Presumably the chemisorbed gases were held by the atoms on the edges of these platelets where fresh valence bonds were opened by the wearing process used in producing the dust.

31. TOMLINSON, R. H. AND FLOOD, E. A. **Flow of gases and vapors through adsorbing porous media.** *Can. J. Research* **26B**, 38-53 (1948).—*C.A.* **42**, 4003*h*.
The flow rates of gaseous He, H_2, N_2, CO_2, Et_2O, and EtCl through highly activated charcoal rods were measured. The adsorbable gases flowed at rates greater than those calcd. on the basis of the Adzumi equation, while the gases that were not highly adsorbed could be satisfactorily correlated by this and similar equations. This new phenomenon may possibly involve mobility of the adsorbed material and rapid surface diffusion. Detailed exptl. methods and data were presented.

32. ETTINGER, I. L. **Sorption of nitrogen by hard coal.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* **1949**, 1719-22.—*C.A.* **45**, 9831i.
Kusnetsk coal was subjected to evacuation for 1.5 months under a pressure of about 10^{-4} mm at 60°C. For each of the samples of coal, representing different stages of metamorphism, isotherms were obtained, at 25° and at 40°C. The point of sorption equil. was completely reversible; this reversibility seemed to confirm the existence of phys. van der Waal's sorption in contrast to chemisorption. All but 1 of the N_2 isotherms were straight lines. The sorption increased with the degree of carbonization of the coal; i.e., as the degree of metamorphism of the coal increased, the sorbing surface increased.

33. FASTOVSKIĬ, V. G. **Determination of small amounts of krypton.** *Zavodskaya Lab.* **15**, 1417-20 (1949).—*C.A.* **44**, 4370f.
To det. 0.1% of Kr in gas mixts. all active gases were removed and the residual Kr, N_2, and A freed of N_2 by powd. Ca at 650-700°C. The residue was analyzed for Kr either by d. detn. on the gas balance, or by detg. the vapor pressure at 90°K.

34. KEĬER, N. P. AND ROGINSKIĬ, S. Z. **Kinetics of desorption of hydrogen adsorbed in an activated process.** *Zhur. Fiz. Khim.* **23**, 897-916 (1949).—*C.A.* **44**, 18f.
H_2 was adsorbed on sugar charcoal. The pressure was then lowered to 10^{-4} mm Hg, and the amt. (D) desorbed was detd. at different times t. Between 510° and 565°C, $D^{1/3} = b(RT\ln t - RT\ln\alpha - E_0)$ where T was °K, ln α was a const. (e.g. −22) and E_0 was another const. (e.g., 32,000 cal/mole). If desorption was stopped before complete degassing and more H_2 added, this was adsorbed more rapidly than during the "primary" adsorption. If the adsorption of H_2 was stopped before equil. was attained, the temp. rose from 565° to 650°C for an hr and again lowered to 565°C, the adsorbed amt. was greater than it would have been at a const. temp. of 565°C. Repeated adsorption-desorption cycles at 565°C were reproducible. When D_2 was brought into contact with the charcoal, it exchanged with 0.5-0.7% H_2 present in the charcoal, so that adsorption of D_2 could not be measured.

35. SCHAEFFER, W. D.; SMITH, W. R., AND WENDELL, C. B. **The adsorption of helium on carbon black at liquid helium temperatures.** *J. Am. Chem. Soc.* **71**, 863-7 (1949).—*C.A.* **43**, 6037b.
The adsorption was measured on 2 carbon blacks, Spheron 6 and Spheron C at 4.2°K. The isotherms were represented by the B.E.T. equation. Heats of adsorption were calculated by assuming a negligible entropy for the adsorbed phase and ranged from 34 to 93 cal per mol.

36. BARTELL, F. E. AND DODD, CHARLES G. **Surface areas of crystalline carbon and carbide powders as measured by adsorption of nitrogen.** *J. Phys. & Collid Chem* **54**, 114-28 (1950).—*C.A.* **44**, 6228h.
N_2 adsorption isotherms (77.3 to 78.1°K) were detd. for relative pressures up to 0.6 for purified powd. samples of four graphites (B, C, D, E), a furnace black ("Standard Gastex"), silicon carbide, and diamond (particle size ~ 2 μ). The results were compared upon application of the Brunauer, Emmett, and Teller (B.E.T.) "complete" and "simple" equations and the Harkins and Jura (H-J) equation to the exptl. data. For silicon carbide and diamond dust the B.E.T. equation was required for establishing unambiguous values for the surface areas and no. of adsorbed layers (n) of N_2. The value of N = 3 and a slight desorption hysteresis for diamond indicate an activated adsorption of N_2. Areas in m²/g were: for graphites B 25, C 105, D 21, E 8.4; furnace black 27; SiC 3.9 (B.E.T.), 3.8 and 4.3 (H-J); and diamond 9.2 (B.E.T.), 9.2 and 11.5 (H-J).

37. CAMPBELL, J. R. AND SKILLING, W. J. **Adsorption of hydrogen sulfide by peat in the presence of ammonia.** *J. Soc. Chem. Ind.* **69**, 153-60 (1950).—*C.A.* **44**, 9657d.
Adsorption of H_2S by peat from gas mixts. contg. NH_3 were investigated to det. the effi-

ciency of the peat for this operation. To explain the results, it was suggested that NH_3 combined with the humic acids of the peat, followed by a decompn. of the ammonium humates with H_2S, and oxidation of the resulting NH_4SH to produce free S and release NH_3 to continue the process.

38. Fulkerson, S. D. and Lambert, F. J. **Apparatus for determining gas permeability of carbon and graphite.** *Anal. Chem.* **22**, 1310-12 (1950).—*C.A.* **45**, 396*i*.

The app. consists of two glass flasks, each provided with manometer and vacuum connection, between which the test specimens is clamped. One of the flasks is also provided with means for introduction of gas under controlled conditions.

39. Gerling, E. K. and Baranovskaya, N. V. **Quantitative separation of argon from small quantities of krypton and xenon by multiple adsorption and desorption.** *Zhur. Anal. Khim.* **5**, 131-8 (1950).—*C.A.* **44**, 6230*b*.

The adsorption of A and Kr on charcoal were detd. at pressures of $1\text{-}1 \times 10^{-3}$ mm and lower, and temps. of -80°, -100°, and -120°C. The Freundlich equation was followed. The coeff. $1/n$ for A was 1 and less that 1 for Kr. The amt. of adsorbed gas that could not be desorbed at 1×10^{-4} mm increased as the temp. decreased: for A it was 0.1% at -80°C and at -120°C 0.5% per g of charcoal; for Kr at -80°C it was 1.7% per g of charcoal. Since Kr was desorbed with more difficulty, a method was worked out to sep. A from shall quantities of Kr. The adsorbed gases were desorbed and readsorbed consecutively in 4 adsorbers. The gases retained in each were desorbed at +100°C. The gases were purified by passing over metallic Ca at 650°C, the charcoal reactivated at 400°C, and the cycle repeated. By this procedure all of the A was recovered and 99% of the Kr remained adsorbed. Xe, if present, remained with the Kr.

40. Goldsmith, M. **The magnetic susceptibility of bromine-graphite.** *J. Chem. Phys.* **18**, 523-5 (1950).—*C.A.* **44**, 9201b.

The magnetic susceptibilities of graphite and graphite-Br were detd.: graphite pure, (298°K) $= -5.29 \times 10^{-6}$ c.g.s. units per g; graphite pure, (75°K) $= -7.43 \times 10^{-6}$; Br/C (wt ratio = 0.051) (298°K) $= 4.17 \times 10^{-6}$; Br/C (=0.051) (75°K) $= -5.42 \times 10^{-6}$; Br/C (= 0.67) × (298°K) $= -0.31 \times 10^{-6}$; Br/C (= 0.67) (75.6°K) $= -0.29 \times 10^{-6}$; Br/C (= 0.71) (299°K) $= -0.31 \times 10^{-6}$; Br/C (= 0.71) (75.6°K) $= -0.29 \times 10^{-6}$. Neither the assumption of free Br atoms nor Br_2 leads to a value of the magnetic susceptibility comparable to the exptl. value.

41. Juza, Robert and Grasenick, Fritz. **The magnetic susceptibility of oxygen sorbed on charcoal, silica, and platinum black at -183°C.** *Z. Elecktrochem.* **54**, 145-52 (1950).—*C.A.* **44**, 6690i.

The magnetic susceptibilities of O_2 sorbed on charcoal, silica, and Pt black were detd. at -183°C by use of a magnetic balance. The values depended on the thickness of the sorbed layer. This varation was related to the displacement of the equil. between paramagnetic O_2 and diamagnetic O_4. The susceptibility for a monolayer on charcoal was at first equal to that of the O_2 mol.; it then decreased to the value for liquid O_2 and lower. The first O adsorbed on silica was equiv. to O_2, but when several layers were present, the value for liquid O_2 was obtained, the original monolayer retaining the value for O_2. The situation on Pt black was similar to silica.

42. Mukherjee, Bibhuti. **Purification of carbon rod by resistance heating.** *J. Sci. Ind. Research* (India) **9B**, 266-8 (1950).—*C.A.* **45**, 5463*h*.

Carbon electrode for spectrum analysis was purified by passing a current of 570 amp. for 90 sec through a rod, 10 cm long and 7 mm in diam. A gas atm. was maintained around the electrode by means of a continuous stream of N_2 which was bubbled through CCl_4. Traces of Fe and Mg were almost completely removed. Cu, which was not completely removed by resistance heating in air, also was almost completely removed. Slight traces of B remained in the rod.

43. Swenson, C. A. **The catalysis of the ortho-para conversion in liquid hydrogen.** *J. Chem. Phys.* **18**, 520-2 (1950).—*C.A.* **44**, 9223f.

This catalysis was of importance for the quantity production of pure para-hydrogen. If liquid H_2 were to be kept for any considerable length of time, it would be much more economical to store liquid para-hydrogen than normal (25% para) liquid H_2. Rough detns. of the conversion const. both in the adsorbed layer of the catalyst and in the actual liquid were given for activated charcoal and for silica gel onto which O_2 had been adsorbed. The heat of mixing of ortho- and para-hydrogen was also measured, and found to be smaller than the accuracy of measurement, 1/2 cal.

44. Szabó, Zoltán. **The examination of a system carbon and hydrogen in the temperature range 1100-2600°C.** *J. Am. Chem. Soc.* **72**, 3497-3502 (1950).—*C.A.* **44**, 10474g.

The concn. of CH_4 in the reaction as a function of temp. shows a min. at 1450°C and a max. at 2000°C. C_2H_2 and C_2H_4 are also obtained above 2000°C. The results indicate that above 1450°C some lower hydride, probably CH_3 or CH_2, is present at higher concn. on the surface of hot carbon rod.

45. Trotter, I. F. **Thermodynamics of carbon disulfide production.** *Ind. Eng. Chem.* **42**, 570 (1950).—*C.A.* **44**, 3773i.

Calcd. equil. consts. of the reaction C (graphite) + $S_2(g)$ combined with vapor pressure data gave results which indicated that the true reactant may be $S_2(g)$. If allowance was made for the varying partial presures of diat. S, no neg. free energies were obtained.

46. Barrett, Elliott P. and Joyner, Leslie G. **Determination of nitrogen adsorption-desorption isotherms. Estimation of total pore volumes of porous solids.** *Anal. Chem.* **23**, 791-2 (1951).—*C.A.* **45**, 8320i.

Observations suggest that pore vol. cannot be estd. accurately by gas adsorption in the case of type II and III isotherms. To be certain of obtaining reliable desorption isotherms of these types, total pore vol. should be measured by d. detns. to assure that the sample has actually attained satn. before desorption.

47. CORRIN, M. L. **Areas of carbon blacks and other solids by gas absorption.** *J. Am. Chem. Soc.* **73**, 4061-5 (1951).—*C.A.* **45**, 9332*h*.

The adsorption isotherms of N_2, A, C_5H_{12} and 1-pentene were measured on 8 carbon blacks, rutile, and rouge. B.E.T. areas are self-consistent for the various gases if the area occupied per mol. in the monolayer is detd. on a solid of known area. It is further shown that 4 condensed films may appear in the isotherm. The use of the Harkins and Jura isotherm method thus involves a choice of the proper const. If only one film is obtained, the choice of the proper H.J. const. involves a knowledge of the area of the solid as detd. by an abs. or the B.E.T. method.

48. CREMER, E. AND PRIOR, F. **Application of chromatographic methods to the separation of gases and determination of adsorption energies.** *Z. Elektrochem.* **55**, 66-70 (1951).—*C.A.* **45**, 9334*h*.

Gaseous compds. in H_2 as a carrier were passed through columns of silica gel and activated charcoal and studied in relation to flow rate, concn. and temp. Thermal cond. was used as an indicator. Difference in av. adsorption energies ($\Delta\lambda$) of a pair was given $\Delta\lambda = RT \ln t_2/t_1$, where t_1 and t_2 were the elapsed times prior to breakthrough. Values of $\Delta\lambda$ for the pairs CO_2/C_2H_2, C_2H_2/CH_2CHCl, and C_2H_4/C_2H_2 were 0.39, 0.65, and 0.67 ± 0.02 kcal/mol., resp. Values of $\Delta\lambda$ were independent of temp.; values of *t* depend on carrier-gas velocity, gas concn., and temp. A mixt. such as C_2H_4/C_2H_2 could be sepd. completely.

49. DAVIS, S. G.; FORAN, M. R.; OGILVIE, J. D. B.; PEARCE, JESSE A., AND WINKLER, C. A. **Dynamic adsorption of ammonia, of butane, of cyanogen chloride, and of water vapor by charcoals.** *Can. J. Technol.* **29**, 190-216 (1951).—*C. A.* **45**, 7844*h*.

The steam activated adsorbents used were coconut shell charcoal, Cu impregnated coal and wood charcoals, and Cu-Cr impregnated nutshell charcoals. The isotherms, the distribution of adsorbate in the adsorbent bed, and the effect of gas concn. and flow rate on break time were all normal. Measured heats of adsorption of *n*-C_4H_{10} on coconut charcoal were related to adsorption wave characteristics.

50. GÜBELI-LITSCHER, O. AND STAMMBACH, K. **The adsorption of radon on activated charcoal and silica gel.** *Helv. Chim. Acta* **34**, 1257-63 (1951). (in German).—*C.A.* **46**, 1329h.

Rn was adsorbed with air as the carrier gas. Measurements were made in ionization chambers with quartz-thread electrometers. At the same temps. charcoal was the better adsorbent. Heats of adsorption were: Silica gel 6800 cal./mole Rn, elmwood charcoal 7510 cal. Both heats of adsorption were based on the Rn concn. of 10^{-13} to 10^{-15} cc./g of adsorbent at 0°C and 760 mm.

51. HITZ, KURT; SCHELLER, WALTER, AND TREADWELL, W. D. **The mixed adsorption of hydrogen, oxygen, and nitrogen with carbon dioxide on linden charcoal.** *Helv. Chim. Acta* **34**, 1783-90 (1951) (in German).—*C.A.* **46**, 2872e.

The conventional method was used at 0, 20, and 40°C; total pressure 730 mm; and permanent gas partial pressure 670-730 mm. The results were represented by the empirical equation: $\Delta\alpha = K_1 [\alpha_{CO_2} - K_2 p^n_{CO_2}]$, where $\Delta\alpha$ is the difference in adsorptions of pure and mixed permanent gas, α_{CO_2} was the adsorption of CO_2 at a partial pressure of p_{CO_2}, and K_1, K_2 and *n* were empirical consts.

52. JOYNER, LESLIE G.; BARRETT, ELLIOTT P., AND SKOLD, RONALD. **The determination of pore volume and area distributions in porous substances. II. Comparison between nitrogen-isotherm and mercury-porosimeter methods.** *J. Am. Chem. Soc.* **73**, 3155-8 (1951).—*C.A.* **45**, 9332*f*.

Pore-vol-distribution curves were detd. for adsorbents (bone char and Synthad) by means of a high-pressure Hg porosimeter. Agreement was obtained with a method based on low-temp. N_2 adsorption.

53. JURA, GEORGE AND CRIDDLE, DEAN. **Phase transitions of argon adsorbed on graphite.** *J. Phys. & Colloid Chem.* **55**, 163-72 (1951).—*C.A.* **45**, 4521*i*.

The adsorption of A on graphite at 65°C and at low surface coverage was detd. Four first-order phase changes were observed, due either to a heterogeneous surface or to polymorphic changes in the adsorbed film. The latter was favored because the heats of transition were low, 50-100 cal/mole, and the structure of graphite would permit many symmetrical arrangements of the adsorbed mols. in the region in which the transitions were observed. The adsorption of A on graphite was sigmoid at coverages of less than one monolayer.

54. LAD, R. A. AND YOUNG, T. F. **Adsorption of xenon on charcoals at room temperature.** *Natl. Nuclear Energy Ser., Div. IV*, **9**, Radiochem. Studies: The Fission Products, Book 3, 1833-43 (1951).—*C.A.* **46**, 5928e.

Two types of charcoal were used: a $ZnCl_2$—activated wood-flour charcoal with an area of about 2500 m^2/g and steam-activated charcoals with areas from 400 to 660 m^2/g. Flow expts. with radioactive Xe as a tracer in large amounts of He showed that the coal charcoal having the smallest area was most effective in removing Xe if the quantity to be removed was small. This was shown to be due to the fact that the absorption isotherms crossed at about 20 mm. It was suggested that the use of successive beds may be more effective for high concns. than any one charcoal used alone.

55. MALHERBE, P. LE R. **Microstructure of some South African coals.** Fuel **30**, 97-109 (1951).—*C.A.* **45**, 5387i.

The low temp. adsorption of A by a no. of South African coals had been studied. B. T. surface areas were calcd. Although these calcns. were rendered somewhat uncertain by a secondary slow sorption process, they indicated that the surfaces accessible to diffusing gas were only about $\frac{1}{16}$ to $\frac{1}{68}$ of the surface areas calcd. from heats of wetting in MeOH.

56. MCDONNELL, F. R. M.; PINK, R. C., AND UBBELOHDE, A. R. **Physical properties associated with "aromatic" electrons. III. Pseudometallic properties of potassium-graphite and graphite-bromine.** *J. Chem. Soc.* **1951**, 191-7.—*C.A.* **45**, 4979*e*.

The marked diamagnetism in graphite is destroyed in both compds. C_8Br is weakly diamagnetic, and C_8K shows a temp. (90, 195, and 288°K) -independent paramagnetism of the same order as for metallic Ca. Both compds. have better elec. cond. than graphite. Magnetic and elec. data on the compd. C_4F, whose structure has not yet been established by other means, suggest a general similarity in behavior with graphite.

57. Miyahara, Yutaka. **The state of adsorbed molecules.** *J. Chem. Soc. Japan, Pure Chem. Sect.* **72**, 455-6 (1951).—*C.A.* **46**, 4880*e*.

The partition functions of adsorbed mols. were estd. from the adsorption data of H_2S, Cl_2, and $COCl_2$ by charcoal. The model in which the adsorbed mols. translate and rotate freely in a space of certain dimensions was in line with the exptl. results.

58. Penchev, N. P. and Iordanov, N. **A new apparatus for rapid determination of helium in natural gas.** *Bulgar. Akad. Nauk. Otdel. Geol.-Geografi. Khim. Nauki, Izvest. Khim. Inst.* **1**, 265-75 (1951) (French summary).—*C.A.* **46**, 7737*b*.

App. for the detn. of He by measuring its vol. after adsorption of the residual gas on nut coal at liquid-air temp. was improved by using Hg stopcocks. The gas quantity required for one detn. could be reduced to 0.1 of that formerly required.

59. Wayne, Lowell G. **A method for obtaining approximate pore-size distribution curves from nitrogen desorption isotherms.** *J. Am. Chem. Soc.* **73**, 5498-501 (1951).—*C.A.* **46**, 9377*c*.

The basis of the method was a rapid graphic approximation of the Wheeler distribution function. The absorbate vol. was obtained from data of the desorption isotherm and expressed in terms of the variable ρ_p (actual radius of a pore) rather than the relative pressure. The transformed isotherm was differentiated graphically or otherwise.

60. Anderson, R. B. and Emmett, P. H. **Surface complexes on carbon blacks. II. The adsorption of NH_3, C_2H_2, C_4H_{10}, CH_3NH_2, and water vapor.** *J. Phys. Chem.* **56**, 756-61 (1952).—*C.A.* **47**, 20d.

For Spheron 6, Black Pearls 1, Mogul, and Lampblack T the surface areas were calcd. by the B.E.T. method, both for the original and for the samples from which the complex had been removed by degassing at 1200°C. The adsorption of C_2H_2 at -78°C and of C_4H_{10} at 0°C appeared phys. in nature and yielded areas in satisfactory agreement with those obtained by N_2 isotherms at -195°C. NH_3 and Me-NH_2 isotherms for Lampblack T gave apparent areas several-fold greater than those obtained from N_2. For after-treated Lampblack and for a lampblack sample degassed at 1200°C the areas obtained from the NH_3 adsorption isotherms at -46°C were in satisfactory agreement with those obtained from N_2 adsorption at -195°C. The water adsorption isotherms were shifted in the direction of higher relative pressures as the complex was removed from the surface by high-temp. degassing.

61. Antropoff, A. v.; Propfe, H. A.; Weil, K.; Kalthoff, F.; Schmitz, L., and Cronenthall, G. Ritter Hänel v. **Investigations of adsorption of gases from very small to very high pressures. III. Adsorption isotherms of the noble gases and of nitrogen at pressures below atmospheric.** *Kolloid-Z.* **129**, 1-10 (1952).—*C.A.* **47**, 3651*a*.

Isotherms on charcoal were found for He, Ne, A, Kr, Xe, and N_2 at temps. up to 20°C and pressures less than 1 atm. Except at pressures below 100-200 mm a linear relation was shown for the ratio of pressure to adsorption *vs.* pressure. Adsorption was slightly greater on charcoal degassed at 600° than at 360°C. The sp. vol. of the charcoal was between 0.617 (as detd. with liquids in a picnometer) and 0.496 (as detd. with He). Calcns. using these vols. gave adsorption values differing by a const. percentage (1.3-1.4%) over the pressure range studied.

62. Antropoff, A. v.; Steinberg, F.; Schaeben, L.; Schröder, H. J.; Jünger, R., and Jüngerich, W. **Investigations of adsorption of gases from very small to very high pressures. IV. Adsorption isotherms of argon and nitrogen up to a pressure of 400 kg/cm^2.** *Kolloid-Z.* **129**, 11-19 (1952).—*C.A.* **47**, 3651*c*.

Adsorbed gas was detd. differentially in an app. having 2 parts: a metal section where gases could be handled up to 400 atms. including the charcoal and pressure gages, and a glass, low-pressure section where vols. of gas taken off were measured, starting at about 400 kg/cm^2 and detg. the "desorption isotherm." Exptl. data were reported for A and N_2 at 20°, 0°, -25°, and -76°C and pressures of 4 to 385 atms. All isotherms passed through max.

63. Bastick, Jack. **The adsorption of ammonia, phosphine, and arsine on activated charcoal.** *Bull. soc. chim. France* **1952**, 169-71.—*C.A.* **46**, 6459*c*.

Adsorption isotherms between -78° and 132°C and pressures up to 600 mm are given. The curves for NH_3 are linear above 50 mm, but the AsH_3 curves follow typical Langmuir isotherms. The adsorption is partially chem. in nature as shown by the differences between the adsorption measured calorimetrically and the isosteric heats derived from these isotherms. The differences are greatest at low concns.

64. Geballe, T. H.; Lyon, D. N.; Whelan, J. M., and Giauque, W. F. **Carbon thermometer-heaters for use at low temperatures. Effects of particle size and adsorption of hydrogen or helium.** *Rev. Sci. Instr.* **23**, 489-92 (1952).—*C.A.* **47**, 1991*a*.

Elec. resistances of 5 carbon blacks, with av. particle sizes ranging from 2×10^{-6} to 12×10^{-6} cm, were measured from 1 to 295°K. The smaller sizes had larger negative temp. coeffs. of resistance. The effect of adsorption of He at low pressures on the elec. resistance was very small at 20°K. At the temps. of liquid He the resistance at first increased and then decreased below the original value, as the pressure of He was increased to its vapor pressure. A similar effect was observed when H_2 was adsorbed at 20°K. When adsorbed H_2 or He gases were pumped off, the effect was found to be reversible within the small limit of error.

65. Kirkpatrick, Harry B. **The adsorption of nitrogen on carbon black.** *Univ. Microfilms* (Ann Arbor, Mich.) *Pub.* No. **3424**, 73 pp (microfilm $1.00, paper enlargements $7.30); *Dissertation Abstracts* (formerly *Microfilm Abstracts*) **12**, 132-3 (1952).—*C.A.* **46**, 7396f.

66. Lavrovskaya, G. K. and Voevodskiĭ, V. V. **Recombination of atoms on solid surfaces.** *Zhur. Fiz. Khim* **26**, 1164-6 (1952).—*C.A.* 47, 958*b*.

The probability of recombination of H atoms was detd. on MoO_3, an aluminosilicate catalyst, and activated charcoal. The values were, resp.: 0.05 to 0.1, 10^{-2}, and 2×10^{-3}. Special expts. confirmed the mechanism $H \rightarrow H_{ads.}$, $H_{ads.} + H \rightarrow H_{2\ ads.}$, $H_{2\ ads.} \rightarrow H_2$. It was observed that the rate of recombination on various surfaces was higher (but reproducible) after the first run. Only after high-vacuum cleaning of the surface could the data of the 1st run be reproduced. This was attributed to the slow rate of desorption $H_{ads.} + H_{ads.} \rightarrow H_2$ which was thus excluded as rate-detg. step in the recombination mechanism.

67. Los, J. M. and Fergusson, R. R. **Measurements of thermomolecular pressure differences on argon and nitrogen.** *Trans. Faraday Soc.* **48**, 730-8 (1952).—*C.A.* 47, 2561*a*.

Data for A and N_2 were required for measurements of the thermodynamic properties of these gases in the adsorbed state at low temps. The integration of the fundamental differential equation for the pressure gradient was expanded into 2 forms. Data for A fit one form and those for N_2 the other. The thermomol. pressure differences were calcd. for all values of pressure, temp., and tube radius, and values fit the exptl. data for 3 glass capillaries with a max. uncertainty of 1 micron. The deviations were less than 2.5 microns in a metal capillary.

68. Mertins, Arnold G. **Fine structure of natural coals.** *Braunkohle* **4**, 353-66 (1952).—*C.A.* 47, 4059*i*.

Gas adsorption (H_2, N_2, CO_2, CH_4) and heat of wetting (H_2O, MeOH, EtOH, PrOH, AmOH, C_6H_6) data gave information on internal surface area, nature of pore systems, and mechanism of swelling due to sorption. The apparent d., true d., vol. % porosity, pore radius (mμ, method *A*), pore radius (mμ, method *B*), particle radius in mμ, and internal surface in m^2/g are given for a no. of coals. Coal structure is pictured as comprising micelles with coordinate valences of peripheral functional groups providing cohesive forces. As coalification advances, these forces are gradually replaced by true valence bonds leading to a coalescence of the micelles and ultimate formation of a graphite-like structure. The application of these concepts to the coking process is discussed.

69. Moench, Guenther C. **The glass Dewar Flask—its quality and a possibility of improving it for the insulation of liquids at low temperatures.** *Glas u. Hochvakuum-Tech.* **1**, No. 1, 9-13 (1952).—*C.A.* 47, 1987*f*.

Dewar flasks for low-temp. liquids can be improved by increase of the vacuum in the double wall and by reduction of radiation from the glass walls. Vacuum can be improved by gas-adsorbing carbon blacks between the 2 glass walls. Radiation is reduced by introduction of a third wall in the vacuum space.

70. Norman, W. S. and Sawyer, C. H. V. **Construction and performance of graphite-block heat exchangers.** *Ind. Chemist* **28**, 317-20 (1952).—*C.A.* 47, 3049*f*.

A heat exchanger is described in which the transfer element is a block of graphite of high thermal conductivity perforated by rows of parallel passages conveying the fluid stream. In the case of gases, narrow slots instead of circular passages have been employed. Heat-transfer coeffs. for this type of graphite-block heat exchangers are given.

71. Smith, Thomas D. **Amorphous carbon.** *J. Chem. Soc.* **1952**, 923-7.—*C.A.* 46, 6458i.

Carbons were prepd. by heating from 400 to 1000°C O-contg. compds. in N_2; mellitic acid; Ba, Hg(ic), and Hg(ous) mellitates; inositol; benzenepentacarboxylic acid; quinol humic acid; methylated humic acid; melanoidin; and oxidized Busty vitrain. The av. dimensions in the *c* direction were about 10 A. for all. The areas (m^2/g) ranged from 8 for melanoidin to 1650 for Ba-mellitate carbonized at 800°C and to 2125 for hexachlorobenzene. The higher values are attributed to intercryst. penetration of the adsorbate, in support of a cross-linked aromatic structure. B.E.T. surface areas were detd. from N_2 adsorption isotherms.

72. Kahle, Heinrich. **Reversible adsorption in the preliminary purification and separation of gas mixtures.** *Chem.-Ing.-Tech.* **25**, 144-8 (1953).—*C.A.* 47, 5733*b*.

Two com. processes are described. The effects of cycle time, operating pressures and temps., partial satn. of adsorbent, and flushing procedure are discussed.

73. Maslan, F. D.; Altman, M., and Aberth, E. R. **Prediction of gas-adsorbent equilibria.** *J. Phys. Chem.* **57**, 106-9 (1953).—*C.A.* 47, 5211*d*.

By considering the adsorbate as a highly compressed gas, its vol. and fugacity can be calcd. by the Polanyi-Dubinin equation. The method is satisfactorily applied to the adsorption of (1) O_2 and N_2 on activated carbon, silica gel, and activated Al_2O_2, both above and below the crit. temp., and (2) H_2 on activated carbon above the crit. temp. The method does not apply to such gases as propane and propylene on activated carbon at 0 to −30°C. With further modification, the equation can be applied to the prediction of binary gas adsorption. Its application is successful for O_2 and N_2 adsorbed on activated carbon.

74. Mignolet, J. C. P. **Simple and multiple gas microintroductors for adsorption studies.** *J. Sci. Instr.* **30**, 15-17 (1953).—*C.A.* 47, 3624*c*.

Volumes from 0.2 to 50 mm^3 can be introduced into the app. at pressures below 10 cm Hg. Diagrams show devices for varying rate of flow, for filling the gas reservoirs, and for multiple introductions.

I-2. Organic Gases on Carbon Adsorbents

75. Chernyaeva, Yu. I. **Determination of benzene hydrocarbons in coke-oven gas by adsorption by activated charcoal.** *Trudy Khar'kov. Nauch.-Issledovatel Uglekhim. Inst.* **1939**, No. 1, 16-17, 155-212; *Khim. Referat. Zhur.* 4, No. 1, 86 (1941).—*C.A.* **37**, 1582^7.

The adsorption capacities of charcoals with respect to benzene were given. The losses during steam-distn., the effect of the gas velocity on the completeness of the adsorption of benzene, and the effect of H_2S and moisture on the activity of charcoals were discussed. The AG charcoal was the most active of all those investigated. Steam-distn. was necessary for the regeneration of charcoal. The optimum velocity of the gas was 200-300 liter/hr. The presence of H_2S decreased the accuracy and the length of the time required for a detn. A method to det. aromatic hydrocarbons in coke-oven gas was described.

76. Radulescŭ, Dan and Radulescŭ, Flŭor. **Discontinuity of capillary adsorption and desorption isotherms and the nature of the capillary layer which delimits the liquid phase.** *Bul. Chim. Soc. Chim. Romania* [2], 1, 38-55 (1939) (in French).—*C.A.* **37**, 3315^9.

Methods and apparatus were described. The adsorption and desorption in charcoal of C_6H_6 (10°, 15°, and 20°C), CCl_4 (0°C) and BzCl (17°C) were studied by both the static and dynamic methods. Desorption occurred in steps. From the breaks in the desorption curves it was deduced that at the surface of contact of a liquid and a solid such as charcoal there existed 3 layers of liquid with different physicochemical properties: a unimolecular or bimolecular adhesive layer in which the molecules were almost immobile as if chemically combined with the surface of the solid, a 2nd capillary layer wherein the molecules were condensed to the point where they were in contact tangentially, and a layer of normal liquid.

77. Figurovskiĭ, N.A. and Feinberg, M.M. **Influence of sorption upon the electrical conductivity of pulverized sorbents.** *Compt. rend. acad. sci. U.R.S.S.* **31**, 344-6 (1941) (in English).—*C.A.* **37**, 1072^5.

Various kinds of activated carbon were deposited from suspensions on small cylinders of pumice, ebonite, porcelain, and other dielectrics. The resistances of the carbon as affected by adsorbed vapors of benzene, toluene, aliphatic alcs., ether, CCl_4, etc., in various concns. decreased in all cases. The rate of decrease and the final value depended on the nature of the adsorbed substance. When the adsorbed substances were desorbed, the resistance increased again. The speed at which equilibrium was attained indicated that only the surface and the macropores were affected.

78. Tamamushi, Bun-ichi **Polarity of molecules and adsorption. The adsorption of isomeric disubstituted benzenes.** *Sci. Papers Inst. Phys. Chem. Research (Tokyo)* **38**, 446-54 (1941).—*C.A.* **41**, 5771*i*.

The adsorption by Al_2O_3 in benzene and by charcoal in MeOH was measured. In nitrophenol and nitroaniline, the *m*-isomer was adsorbed more strongly by Al_2O_3 in benzene, and more weakly by charcoal in MeOH than was the *o*-isomer. Hence, a more polar solute was adsorbed more strongly by a polar adsorbent in a more apolar medium. In dinitrobenzene, the *p*-isomer with a smaller dipole moment was adsorbed more strongly by the apolar adsorbent in the polar medium than the *m*-isomer with a greater dipole moment, which fact was in accord with the other exptl. results. This order of adsorption was, however, not reversed when they were adsorbed by Al_2O_3 in benzene.

79. Engle, H.C., and Coull, James. **Adsorption studies of vapors in carbon-packed towers.** *Trans. Am. Inst. Chem. Engrs.* **38**, 947-65 (1942).—*C.A.* **37**, 16^7.

Data on the adsorption efficiency of carbon-packed towers, as obtained by thermal conductivity measurements on $CHCl_3$ vapor-air mixtures, were successfully correlated. Equations were developed expressing: (1) the efficiency vs. time relations for different concentrations, velocities and bed heights and (2) a correlation between the constants in these equations and the process variables.

80. Sastri, M.V.C. and Krishnaswami, K.R. **Studies on active carbon. I. Evaluation of activated charcoal.** *Quart. J. Indian Inst. Sci.* **5**, No. 2, 1-42 (1942).—*C.A.* **40**, 196^7.

Six com. varieties were evaluated by porosity detns., adsorption of I_2 and of methylene blue from aq. solns., adsorption of benzene vapors, and heat of wetting in benzene. Porosity had little bearing on activity. The adsorption of I_2 and methylene blue were approx. proportional to the adsorption of benzene vapors at very low vapor pressures and the heat of wetting. The heat of wetting was a measure of the "specific activity" or retentivity of an absorbent, but not the cohesive or capillary forces.

81. Bratzler, K. **Sorption methods for the analytical and preparative separation of gases.** *Oel u. Kohle* **39**, 953-60(1943).—*C.A.* **38**, 6154^9.

The difference in the relative volatilities of various adsorbed gases is sufficiently great to make sepns. at temps. that would be too high for effective sepn. by fractional distn. Pure C_3H_8 is obtained from a mixt. with C_2H_6 and C_4H_{10} by passing it slowly at 0° or room temp. over activated charcoal (degassed at 200°C and 0.1 mm Hg). After atm. pressure has been reached, an elec. oven is placed over part of the adsorption tube and some of the gas is desorbed; the desorbed gas comes in contact with the adsorbed gas in the cold part of the tube and exchange of the heavier and lighter components of the gas takes place. The light impurities are driven off first, followed by pure C_3H_8, and the heavy impurities remain adsorbed. The same principle is applied to analytical methods which give satisfactory results if allowance is made for the material that remains adsorbed. This difficulty is avoided by carrying out the desorption under vacuum. If the hydrocarbon mixt.

to be adsorbed contains olefins, the break-through of olefins can be controlled automatically by bromination of the olefins.

82. Poggi, A. Raoul. **A simple apparatus for determination of the adsorbent power of active carbon, and its applications.** *Ann. chim. applicata* **33**, 191-3(1943).—*C.A.* **40**, 7572⁹.

A gas is passed at const. pressure over the active carbon in a special simple app. which contains indicator papers to show when adsorption ceases. The same app. may be used for collecting heavy gases or vapors, to det. the hydrocarbon content of natural emanations, to det. the C_6H_6 derivs. in the gas obtained in the distn. of the coal, etc.

83. Alekseevskiĭ, E.V. and Gorchakov, N.D. **Recovery of vapors of volatile solvents on solid sorbents. VI. Thermal phenomena in sorption of vapors of volatile solvents under conditions of its recovery. Sorption of benzene vapor and ethanol vapor on charcoal.** *J. Applied Chem. (U.S.S.R.)* **17**, 289-98(1944) (English summary).—*C.A.* **39**, 2434⁵.

Under conditions of dynamic sorption of C_6H_6 and EtOH vapors in the packing of activated charcoal in the range (15-30mg/liter) heating was observed which affected the various factors influencing the rate of sorption. It was particularly great in short layers of the sorbent. The temp. gradient along the charcoal layer may be used as a measure of the distribution of concns. of the solvents along the length of the packing.

84. Alekseevskiĭ, E. V. and Gorchakov, N. D. **Recovery of vapors of volatile solvents on solid sorbents. VII. Sorption of vapors of binary solvents on activated charcoal. Sorption of mixed vapors of ethyl alcohol and benzene on charcoal AG.** *J. Applied Chem. (U.S.S.R.)*, **17**, 394-408 (1944) (English summary).—*C.A.* **39**, 3466⁹.

The sorption of mixts. of EtOH and C_6H_6 at const. gas velocity on charcoal "AG" was greatly affected by the warming of the effective layer of the charcoal by the heat of sorption. The distribution of the sorbed components was changed by this heat effect. A method was developed for calcn. of fractional sepn. of the mixt. by sorption in the interval of practical concns.

85. Alekseevskiĭ, E. V. and Gorchakov, N. D. **Recovery of vapors of volatile solvents on solid sorbents. VIII. Sorption of vapors of binary solvents on active charcoal and desorption from charcoal of mixtures of ethyl alcohol and benzene.** *J. Applied Chem. (U.S.S.R.)* **17**, 487-94 (1944) (English summary).—*C.A.* **39**, 3978⁹.

In fractional vapor desorption of ethanol and benzene mixts. on activated charcoal AG (initial mixt. of 80% EtOH), the frontal section of the sorbent displays the displacing tendency of benzene. With a 50-50 original mixt. the displacing tendency of benzene is very much more pronounced, so that the tail of the sorbent layer contains pure EtOH. The effect is rapidly intensified as the benzene concn. in the original mixt. is increased.

86. Amphoux, B. **Selective adsorption of binary or ternary mixtures of various organic vapors.** *Ann. chim.* **19**, 1-57(1944).—*C.A.* **39**, 853².

Marked differences were found with active charcoal according as the static or the dynamic method of adsorption was used. The dynamic method led to a higher ratio of EtOH/water in the adsorbate than in the vapor phase, whereas the static method resulted in an adsorbate that was relatively richer in water than the mixt. of the vapors. Regardless of the method, the adsorption of an alc. was stronger the higher its mol. wt. Mixts. of vapors of benzene and cyclohexane showed no selective adsorption in a static system, but a considerably higher rate of adsorption for benzene than for cyclohexane. In mixts. of isomers such as o-xylene and m-xylene, neither the static nor the dynamic method resulted in the preferential adsorption of the one or the other component of the mixt. of the vapors. The rate of adsorption of benzene was higher than that of any of the alcs.

87. Maggs, F. A. P. **Adsorption of vapors on carbonized coal.** *Proc. Conf. Ultra-fine Structure of Coals and Cokes, Brit. Coal Utilisation Research Assoc.* **1944**, 147-50.—*C.A.* **39**, 1276⁹.

Isotherms at 25°C were detd. by the McBain balance technique for MeOH, water, C_6H_6, n-hexane, BuOH, and benzyl alc. on weakly caking Northumberland coal. No adsorption was detected for BuOH or benzyl alc. Similar expts. with MeOH, EtOH and PrOH were made on the same coal carbonized at 600°, 708° and 807°C. Wts adsorbed per g of coal were extrapolated to satn. vapor pressure. Heats of MeOH wetting and elec. resistivity values were detd. and the monolayer capacity was calcd. from the area given by the heats of MeOH wetting. Time required for MeOH adsorption increased from about 1 hr to about 14 days for the temp. range studied. Desorption also took place with increased difficulty with increased carbonization temp. The difference was ascribed to increased time required for MeOH to penetrate into the pores.

88. Sawyer, Frederick G. and Othmer, Donald F. **Adsorption of solvent vapors on commercial activated carbon.** *Ind. Eng. Chem.* **36**, 894-901 (1944).—*C.A.* **38**, 6155⁵.

Adsorption equil. were detd. for acetone, MeEtCO, iso-BuMeCO, MeOH, CS_2 and Et_2O. Rapid measurement of equil. adsorbate concn. used a cathetometer to observe the elongation of a sensitive Be-Cu spring carrying the adsorbent. The data were plotted first as isotherms, and then isosteres were crossplotted by a graphical method. Heats of adsorption were calcd. by the same method.

89. Alekseevskiĭ, E. V. and Vanyushina, Z. S. **Recovery of vapors of volatile solvents on solid sorbents. IX. Desorption of volatile solvents from charcoal.** *J. Applied Chem. (U.S.S.R.)* **18**, 193-207 (1945) (English Summary).—*C.A.* **40**, 3306⁷.

The desorption of EtOH and benzene from charcoal AP by means of steam proceeded simultaneously with sorption of water vapor. The latter was a function of charcoal temp., time, the nature of the displaced solvent, and the retaining capacity of the charcoal. The poorer the miscibility of the solvent with water, the less intense was the sorption of water in the above displacement. Generally, 10 min. were sufficient to displace 45-85% of the adsorbed solvent.

90. ALEKSEEVSKIĬ, E. V. AND VANYUSHINA, Z. S. **Recovery of volatile solvent vapors on solid sorbents. XI. Desorption of solvents from solid sorbents by water vapor. Desorption theory.** *J. Applied Chem. (U.S.S.R.)* **18**, 658-65 (1945) (English summary).—*C.A.* **40**, 6316^7.

Desorption of benzene and alc. from charcoal using water vapor was investigated further. The desorption rate was connected with the residual amt. of solvent vapor by the equation: $-da/dt = bu^n$, where a = solvent concn., t = time, b = exptl. const., as was n, and da/dt was the rate of sorption. Benzene was desorbed more rapidly than alc. and the amt. of desorbed vapor was linearly dependent on the depth of the charcoal layer.

91. GORCHAKOV, N. D. AND POGODIN, I. I. **Desorption of solvents from activated charcoal by inert gases. I.** *J. Applied Chem. (U.S.S.R.)* **18**, 538-47 (1945) (English summary).—*C.A.* **40**, 5616^5.

Charcoal AP was statically tested for activity to benzene, EtOH, and Et_2O vapors. The results showed the highest retentivity for benzene and least for EtOH. Desorption of EtOH by CO_2 was studied and the optimum values were 125-30°C, CO_2 flow 0.5 liter/cm²/min., and a time of 15 min. Under these conditions up to 89% EtOH was desorbed.

92. GORCHAKOV, N. D. AND POGODIN, I. I. **Desorption of solvents from activated charcoal by inert gases. II.** *J. Applied Chem. (U.S.S.R.)* **18**, 666-8 (1945).—*C.A.* **40**, 6316^4.

The desorption rate of EtOH from charcoal by CO_2 was detd. at various rates of CO_2 flow (from 0.1 to 1.5 liter/cm²/min.). The optimum conditions were 125-30°C, CO_2 flow rate of 0.5 liter/cm²/min. and 15-min. duration. In such a case up to 88.4% of adsorbed EtOH was desorbed with utilization of 1 m³ of CO_2 per kg of EtOH.

93. GORCHAKOV, N. D. AND POGODIN, I. I. **Desorption of solvents from activated charcoal by inert gases. III.** *J. Applied Chem. (U.S.S.R.)* **18**, 669-79 (1945).—*C.A.* **40**, 6316^5.

Desorption of EtOH from charcoal AP was studied by using CO_2 for desorbent at 95-8°C, 110-12°C, 125-30°C. The optimum condition was 125-30°C with CO_2 at 0.5 liter/cm²/min. Desorption by CO_2 and N_2 was also studied under conditions of const. use of the charcoal layer. The only amt. of CO_2 actually needed was that required to fill the app. The method was considerably superior to the commercially used steam desorption.

94. ROBSON, G. W. **Benzene recovery by activated carbon.** *Gas World* **123**, 399-400(1945); *Gas J.* **246**, 687, 689(1945).—*C.A.* **40**, 443^7.

The Morpeth plant has a capacity for 400,000 ft³ of gas per day. Each of the two adsorbers contains about 300 lb. of charcoal. The complete cycle comprises: (1) adsorbing light oil from the gas, (2) steaming the light oil out of the charcoal, and (3) drying the charcoal with stripped gas from the outlet of the plant. The temp. of the drying gas is raised in a preheater 33-39°C above the normal gas temp. The longest cycle is 60 min. adsorbing, 30 min. steaming, and 30 min. drying. The general life of a charge of charcoal is about 100 days. Spent charcoal can not be satisfactorily reactivated at the plant. Drying of the charcoal is a very important factor in maintaining its life.

95. DANBY, C. J.; DAVOUD, J. G.; EVERETT, D. H.; HINSHELWOOD, C. N., AND LODGE, R. M. **Kinetics of the adsorption of gases from an air steam by granular reagents.** *J. Chem. Soc.* **1946**, 918-34.—*C.A.* **41**, 1145^a.

A theoretical treatment of the removal of a gas from an air stream by passing it through a granular solid with which it reacts or by which it is irreversibly adsorbed. The following relations were studied in particular: (a) escaping concn. as a function of time, column length, flow rate, and initial concn., (b) distribution of gas or reaction product in the column, and (c) effect of granule size. Special consideration was given to charcoals contg. various addn. agents.

96. DOLE, MALCOLM AND KLOTZ, IRVING M. **Sorption of chloropicrin and phosgene on charcoal from a flowing gas stream.** *Ind. Eng. Chem.* **38**, 1289-97 (1946).—*C.A.* **41**, 897^f.

The break times did not change much with temp. The slope of the c/c_0-time curve (c = concn.) at the mid-point was, however, directly proportional to k (and also to c_0) according to theory. From an estimate of the slopes at 0° and 22°C the activation energy for adsorption of chloropicrin was about 3000 cal. per mole. The mass transfer of the gas to the charcoal surface from the flowing air stream could not be the entire rate-detg. process, because the crit. bed depths did not extrapolate to zero at zero particle size, the max. slope of the c/c_0-time curve was not so dependent on flow rate as the gas phase diffusion theory required, and the max. slopes depended so markedly upon influent concn., contrary to predictions of the diffusion theory.

97. DUBININ, M. M. AND TIMOFEEV, D. P. **Adsorption of vapors on active charcoals in relation to the properties of the adsorbate.** *Compt. rend. acad. sci. U.R.S.S.* **54**, 701-4 (1946) (in English).—*C.A.* **41**, 7198f.

The characteristic curves for different vapors were all described by an equation relating adsorption potential, coeff. of affinity, and the vol. of adsorbed vapor in the liquid state. The affinity could be detd. from a knowledge of polarizabilities, van der Waals' attraction consts., or diamagnetic susceptibilities. The polarizability of mols. approx. varied directly as the molar vol. of the adsorbate in the liquid state. Exptl. values were detd. by using a sorption wt method and compared with values calcd. The suggested method seemed to give close exptl. agreement. The vapors used were: C_6H_6, C_5H_{12}, C_6H_{12}, C_7H_{16}, toluene, MeCl, CH_2Cl_2, $CHCl_3$, CCl_4, EtCl, MeOH, EtOH, HCOOH, AcOH, Et_2O, Me_2CO, CS_2, CCl_3NO_2, NH_3.

98. GORCHAKOV, N. D. AND VANYUSHINA, Z. S. **Desorption of solvents from activated charcoal by inert gases. IV.** *J. Applied Chem. (U.S.S.R.)* **19**, 97-101 (1946).—*C.A.* **40**, 6316^6.

The dynamic activity of charcoal AP at a layer depth of 100 cm and benzene concn. of 30 mg/liter was 20-30%, in desorption of benzene by means of

CO_2. The optimum time for desorption was 15 min. at 180°C at 0.5 liter/cm^2/min. rate of CO_2 flow. It was possible to condense 72% of benzene which was adsorbed on the charcoal under the above conditions.

99. JURA, GEORGE; HARKINS, WM. D., AND LOESER, EDWARD H. **Surfaces of solids. XVII. A first- and a second-order phase change in the adsorbed film of heptane on graphite.** *J. Chem. Phys.* **14,** 344-7(1946).—*C.A.* **40,** 4275^6.

Films of n-C_7H_{16} between 25° and 40°C exhibited a 1st-order transition between the gaseous and liquid expanded phases and a 2nd-order transition between the liquid expanded and liquid intermediate phases, and between the gaseous and liquid intermediate phases above the crit. temp. The crit. consts. for the gaseous film were detd.: temp. 31°C, area 400 A^2. per mol., film pressure 1.05 dynes per cm. These values differed from those found for n-C_7H_{16} on Fe_2O_3. The heat of transition for the 1st-order change was estd. as 13,000 ± 5000 cal. per mole at 25°C.

100. KIRILLOV, I. P. AND RAKHLIN, E. S. **Adsorption of methane by charcoal.** *J. Applied Chem. (U.S.S.R.)* **19,** 511-16(1946) (in Russian).—*C.A.* **41,** 2299^c.

Activated charcoal (BAU 20) retains initially almost all CH_4 from a mixt. with N_2 and H_2. At 16°C, flow rate of 16 ml/min./cm^2, 3.3% CH_4 concn. in the mixt., the time of protective action is given by $\theta = 4.4L - 0.8$, where θ is the time of protective action in min., L is the thickness of the layer in cm. The temp. effect is given by $\theta = 15.5 - 0.1$ t, where t is temp. Increase of pressure increases the quantity of CH_4 adsorbed by a unit of the charcoal.

101. LUÁCES, E. L. **Vapor-adsorbent carbons.** *Colloid Chemistry* **6,** 840-8(1946).—*C.A.* **40,** 2039^3.

The mechanism of adsorption and nature of active carbon is discussed. Other topics are: recovery of volatile solvents and app.; recovery of gasoline from natural gas, of alc. from fermentation gases, and of CS_2 vapors in rayon production.

102. VOLMAN, D. H. AND KLOTZ, I. M. **Adsorption isotherms for hydrogen-bonded liquids on charcoal.** *J. Chem. Phys.* **14,** 642 (1946).—*C.A.* **41,** 1906^d.

In van der Waals adsorption on charcoal, a plot of the wt adsorbed as a function of the relative pressure (p/p_0) of the vapor gives curves roughly the same for most compds. The exceptions are characterized by strong H-bonds in the liquid state. There is a strong parallelism between the adsorbability and condensation properties of a gas. In the absence of H-bonding, water would boil at -80° to -100°C, and would have a vapor pressure of 20,000 mm at room temp.

103. BARROW, R. F.; CANBY, C. J.; DAVOUD, J. G.; HINSHELWOOD, C. N., AND STAVELY, L. A. K. **Re-distribution desorption of absorbed gases.** *J. Chem. Soc.* **1947,** 401-16.—*C.A.* **41,** 4992i.

The adsorption of gases by active charcoal from a current of air consists of the following stages: (a) adsorption, in which enough gas is introduced to sat. only the initial layers of the charcoal; (b) re-distribution, in which the gas diffuses along the column; and (c) desorption, in which the gas reaches the final layer of the column and is desorbed into the effluent stream of air. HCN, CCL_4, CNCL, and water are used as the exptl. gases. Equil. between the gas stream and small finite elements is assumed to be reached very rapidly. The math. treatment is not rigorous, but good approximations are obtained.

104. COFFIN, C. C. AND LONG, B. F. **The heterogeneity of activated cocoanut-shell charcoal.** *Can. J. Research* **25B,** 502-8(1947).

The individual adsorption capacities of over 500 pieces of 6 to 10 mesh activated cocoanut-shell charcoal for CCl_4 vapor were detd. by weighing each piece separately on a microbalance before and after saturation. The particle capacities were found to be distributed over a probability curve represented by the following equation: $y = 14.6\ e^{-0.0036x^2}$. Small particles adsorbed more CCl_4 than large ones and dense particles more than those of lesser density.

105. COURTY, CLEMENT. **Comparative adsorptions of chloropicrin and carbon disulfide on active carbon.** *Compt. rend.* **224,** 1638-9 (1947).—*C.A.* **41,** 7198*e*.

The adsorption on active charcoal of water, chloropicrin, and CS_2 was investigated by magnetic susceptibility measurements. The av. amts. adsorbed at ordinary temps. were resp., 0.48 g, 0.60 g, and 0.73 g. With water and CS_2 air was displaced, whereas with chloropicrin air was adsorbed.

106. DOLE, MALCOLM. **The rate of adsorption of phosgene and chloropicrin on charcoal.** *J. Chem. Phys.* **15,** 447-54(1947).—*C.A.* 41, 6105*i*.

It is possible to det. an abs. rate of adsorption of $COCl_2$ and CCl_3NO_2 on charcoal from exptl. data. Diffusion to the most accessible part of the charcoal surface will occur faster than the observed rate, but more slowly to the least accessible surface areas. Rates of adsorption calcd. by use of statistical equations are of the correct order of magnitude when plausible assumptions are made concerning the nature of the activated state. Both diffusion and surface-reaction mechanisms must be postulated for a complete model of the adsorption rate of the two gases, but with diffusion being less important in the case of $COCl_2$.

107. DUBININ, M. M. AND TIMOFEEV, D. P. **Adsorbability and physicochemical properties of vapors. I. Adsorption of vapors by active carbons.** *J. Phys. Chem. (U.S.R.R.)* **21,** 1213-22 (1947) (in Russian).—*C.A.* **42,** 2489*c*.

Adsorption of 14 vapors by active charcoal, from hazel-nut shells (ash 0.23%) and from anthracite + wood tar (ash 1.18%) was detd. at 20°C from 0.0001 mm Hg to satn. Quartz spiral balances allowed simultaneous measurement of 4 isotherms. The amt. adsorbed at 10 mm Hg increased for anthracite charcoal in the order $CH_3Br < C_2H_5Cl <$ pentane < heptane < hexane < cyclohexane < toluene < $CCl_4 < CHCl_3 < C_6H_6 < CH_3OH <$ AcOH $< HCO_2H < H_2O$. The order for nut charcoals differed little, but it was much altered when the adsorbed amts. were compared at 0.1 mm Hg: $CH_3Br < CH_3OH < C_2H_5Cl <$ pentane $< CHCL_3 < HCO_2H <$ cyclohexane < hexane < $CCl_4 < C_6H_6 <$ heptane < toluene < AcOH.

108. DUBININ, M. M. AND TIMOFEEV, D. P. **Adsorption of vapors on active charcoals in relation to the physical properties of the adsorbate.** *Compt. rend. acad. sci. U.R.S.S.* **54**, 137-9(1947) (in English).—*C.A.* **41**, 7198i.

Introduction of a coeff. of affinity into the characteristic equation of the Polanyi theory led to expressions with 2 consts. characterizing the adsorbent and relating adsorbability to the molar vol. of the vapor and the relative vapor pressure. Measurements at 20 °C at 0.1, 1.0, and 10mm Hg on charcoal for C_6H_6, C_5H_{12}, C_6H_{12}, $C_6H_5CH_3$, C_7H_{16}, CH_3OH, CH_3COOH, HCOOH, C_2H_5Cl, and $CHCl_3$ confirmed the equations, with exception of the data for CH_3OH.

109. DUBININ, M. M.; ZAVERINA, E. D., AND RADUSHKEVICH, L. V. **Sorption and structure of active carbons. I. Adsorption of organic vapors.** *J. Phys. Chem. (U.S.S.R.)* **21**, 1351-62 (1947) (in Russian).—*C.A.* **42**, 5209b.

Nine active carbons were prepd. by heating sugar charcoal at 850° or 1000 °C for different lengths of time in CO_2. The wt loss of 850 °C ranged from 3.7% to 62.5%. The C_6H_6 adsorbed (liquid vol.) at 20 °C from the vapor at the relative pressure $p = 1$ ranged from 0.101 cc/g to 0.880. These values should be equal to the vol. of the micropores, if the pores are not too small for the C_6H_6 mol. The adsorption of C_6H_6 and MeOH vapors by these carbons was completely reversible. A 10th specimen was made by heating CO with Fe at 450 °C. The adsorption of C_6H_6 and MeOH by this carbon was accounted for by the B.E.T. theory and the specific surface was 164 m^2/g.

110. GARD, C. D. AND BOYD, T. F. G. **Development of air-fractionated charcoal test method and procedure.** *Calif. Oil World* **40**, No. 24, 15-23 (1947).—*C.A.* **42**, 2086*h*.

When a pure hydrocarbon gas is adsorbed on activated charcoal, the mols. form a thin layer of liquid over the intragranular surface of the pores. Whether the liquid layer completely fills the pores or not depends on the thickness of the liquid layer and the diam. of the pores. When CH_4 is adsorbed on an av. 50-min. activated cocoanut-shell charcoal at atm. pressure and 80 °F, approx. 7 cc. of CH_4 at S.T.P. is adsorbed on 1 cc. of bulk charcoal and the pore space in the charcoal is not completely filled with liquid methane. The pore space is not completely filled with liquid because the same vol. of bulk charcoal, under the same adsorbing conditions would have adsorbed approx. 85 cc. of C_3H_8 at S.T.P.

111. HAINES, R. S. AND MCINTOSH, R. **Length changes of activated carbon rods caused by adsorption of vapors.** *J. Chem. Phys.* **15**, 28-38 (1947).—*C.A.* **41**, 2299*g*.

The length variations of two $ZnCl_2$ activated charcoal rods caused by the adsorption of EtCl, C_4H_{10}, Me_2O, methylpropene, MeOH, n-C_6H_{14}, and H_2O were reported. A relation between % extension of the rod and calcd. spreading pressure of the adsorbed film agreed well with expt. for org. vapors about 1/3 satn. of the monolayer capacity. It did not agree in the low adsorption region nor along the desorption branch of the water isotherm. A marked contraction of the rod below its original length was noted when water was desorbed.

112. INNES, W. B. AND ROWLEY, H. H. **Adsorption isotherms of mixed vapors of carbon tetrachloride and methanol on activated charcoal at 25°C.** *J. Phys. & Colloid Chem.* **51**, 1154-71 (1947).—*C.A.* **42**, 1101*d*.

The adsorption from a mixt. of CH_3OH and CCl_4 on activated charcoal was studied. The mole fraction of each adsorbate when the surface was completely covered agreed satisfactorily with an equation which assumed that the areas occupied by each mol. species were independent of those occupied by the other. Partial and total spreading pressures were calcd. from the adsorption data.

113. MCINTOSH, R.; HAINES, R. S., AND BENSON, G. C. **The effect of physical adsorption on the electrical resistance of activated carbon.** *J. Chem. Phys.* **15**, 17-27 (1947).—*C.A.* **41**, 2299^e.

The changes of elec. resistance of several rods of activated carbon on the adsorption of vapors of Me_2O, C_4H_{10}, iso-C_4H_{10}, SO_2, H_2O, EtCH:CH_2, methylpropene, He, CO_2, EtCl, and NH_3 were detd. The direction and extent of change appeared to depend on the adsorbate and were not necessarily due to the variations in contact resistance between the granules.

114. RADUSHKEVICH, L. V. **Theory of dynamics of adsorption on a real particulate adsorbent.** *Doklady Akad. Nauk S.S.S.R.* **57**, 471-4 (1947).—*C.A.* **46**, 4880i.

The adsorption of a gas passing through a layer of granular adsorbent, making use of the Einstein-Fokker equation for summation of individual transfers in irregularly packed aggregate, is derived. It is confirmed in general terms by following interferometrically the adsorption of EtOH and CCl_4 vapors on activated charcoal.

115. TAYLOR, HAROLD N. AND BONILLA, CHARLES F. **Adsorption of butadiene on activated charcoal.** *Ind. Eng. Chem.* **39**, 871-6(1947).—*C.A.* **41**, 6106d.

Adsorption and desorption isotherms on a $ZnCl_2$-activated wood charcoal were detd. at 0°, 25°, 56.7°, 76.5°, and 100 °C up to 1000 mm Hg. Repeated cycles indicated that the adsorptive capacity did not fall off with time at 76.5 °C and lower. A Polanyi plot showed agreement of all results below 100 °C. The heat of adsorption of butadiene on charcoal was about 290 B.t.u. per lb. The presence of water or the previous degassing of the charcoal did not decrease polymerization of butadiene on the charcoal at 100 °C.

116. BROUGHTON, D. B. **Adsorption isotherms for binary gas mixtures.** *Ind. Eng. Chem.* **40**, 1506-8 (1948).

An equation based on the second law of thermodynamics is derived between the isothermal adsorption equilibria for single components and their binary mixts. at const. total pressure. It provides a method for analyzing data to det. whether true equil. has been obtained in binary gas mixts. The equation is derived from an extension of the Langmuir theory to binary mixts. Available data for adsorption of A and N_2 on two silica gels are analyzed by the proposed method.

117. DUBININ, M. M. AND TIMOFEEV, D. P. **Adsorbability and physicochemical properties of vapors. II. Rules from the viewpoint of the potential**

theory of adsorption. *J. Phys. Chem. (U.S.S.R.)* **22**, 133-43 (1948) (in Russian).—*C.A.* **42**, 5298*g*.

If *p* is the relative pressure of a vapor, *a* the adsorption at *p*, and *v* the mol. vol. of the liquid adsorbate, then $RT\ln p = \beta f\ (av)$, the function f being characteristic for the adsorbent and independent of temp. and the nature of the vapor, and β being a factor characteristic of the vapor. If β of C_6H_6 is set equal to 1, the β of MeOH, MeBr, HCO_2H, EtCl, C_3H_8, $CHCl_3$, butane, AcOH, cyclohexane, CCl_4, pentane, toluene, hexane, and heptane is 0.40, 0.57, 0.61, 0.76, 0.78, 0.86, 0.90, 0.97, 1.04, 1.05, 1.12, 1.25, 1.35, and 1.59, resp.; its values are almost identical for the two carbons used. The adsorbability depends on more than one property of the vapor and also on the adsorbent.

118. Dubinin, M. M. and Timofeev, D. P. **Calculation of adsorption isotherms of vapors on active carbons.** *Doklady Akad. Nauk S.S.S.R.* **60**, 821-4(1948).—*C.A.* **43**, 16f.

Affinity coeffs., permitting calcn. of the isotherm of a given vapor from that of another vapor, were calcd. or recalcd., partly from new detns. These were tabulated for all pairs formed between C_6H_6, MeOH, EtOH, EtCl, CS_2, Me_2CO, CCl_4, Et_2O, chloropicrin, C_3H_3, C_4H_{10}, C_5H_{12}, C_6H_{14}, C_7H_{16}, cyclohexane, $CHCl_3$, MeBr, HCO_2H, AcOH, and PhMe.

119. Dubinin, M. M. and Zaverina, E. D. **Structure and sorption properties of active carbon from phenol-aldehyde resins.** *Doklady Akad. Nauk S.S.S.R.* **61**, 1053-6(1948).—*C.A.* **43**,838*b*.

Bakelite was heated in a covered crucible gradually to 500°C; the grain-size fraction 0.5-1.0 mm of the coke was heated 1/2 hr at 1000°C *in vacuo*. The product was subjected to activation with excess CO_2 at 1000°, 850°, and 750°C. Combustion occurred throughout the whole mass of the grains and their dimensions underwent no appreciable change; the rate of combustion in CO_2 was, consequently, proportional to the mass, *m*, of the sample: $-dm/dt = km$, the rate const. for 1000°, 850°, and 750°C being, resp., 0.14, 0.019, and 0.011 hr^{-1}. The rate consts. for charcoal from sucrose were: $k = 0.13$ and 0.010 at 1000° and 850°C, resp. In sorption of C_6H_6 vapor at 20°C, the time necessary to attain equil. along the initial portion of the adsorption isotherm, increased from 10 to 30 min. for prepns. from 1000° to 750°C, at not too great depths of combustion; this effect was even more marked in sorption from soln. Consequently, at low pressures or concns. establishment of sorption equil. was slower, the finer the micropores.

120. Josefowitz, Samuel and Othmer, Donald F. **Adsorption of vapors. A new apparatus, and data for the lower ketones, benzene, and hexane on activated carbon.** *Ind. Eng. Chem.* **40**, 739-43(1948).—*C.A.* **42**, 4422*b*.

A modified McBain-Bakr adsorption balance using a Be-Cu spring permitted degassing at 500°C to 10^{-5} mm, and the detn. of adsorption up to 550°C at pressures below the vapor pressure of the adsorbate at room temp. This was used to det. the adsorption of C_6H_6, n-C_6H_{14}, Me Et Ketone, Me iso-Bu Ketone, and acetone on 3 commercial activated carbons. No hysteresis was observed between 40° to 200°C. Equilibria seemed to be attained faster on adsorption than desorption.

121. Khodot, V. V. **Potential methane content of some bituminous coals.** *Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk* **1948**, 1753-72.—*C.A.* **45**, 8737*a*.

Four samples of bituminous coal, characterized by different stages of metamorphism and different petrographic compn., were studied with respect to their potential CH_4 content in the pressure range from 0 to 1000 atm. at a temp. of 25°C. Study of the sorption isotherm of CH_4 on activated charcoal of two different kinds showed that both curves had the same analytical expression and deviated only in const. ratio. On the basis of the behavior of the activated charcoal, bituminous coal was considered as a kind of colloidal structure, in which the elasticity or brittleness studied was related to the stage of metamorphism shown by the sample.

122. McBain, James W. and Sessions, R. F. **Sorption of vapors by sugar charcoal over a period of twenty years.** *J. Colloid Sci.* **3**, 213-18 (1948).—*C.A.* **42**, 6198e.

The sorption of various vapors by sugar charcoal at 120°C were detd. using silica-spring sorption balances. CCl_4, $Cl_2C{:}CCl_2$, PrCOOH, $CHCl_3$, and toluene were sorbed to a satn. value that did not change during the entire period, but the sorption of Et_2NH, Et_3N, and pyridine increased slightly during the 19.5 years. The isotherm obtained with H_2O was completely altered by the water-gas reaction that occurred between H_2O and charcoal over long periods of time. The silica springs did not stretch to any appreciable extent in the presence of org. vapors for 19.5 years, but stretching did occur in the presence of H_2O vapor. The springs that had been exposed to CCl_4 and $Cl_2C{:}CCl_2$ vapors for 19.5 years did not stretch under these conditions, but they stretched over 1% when removed from the org. vapors and exposed to air for one day.

123. Mennessier, André and Boucher, Raymond. **Rates of adsorption by active carbon.** *Compt. rend.* **226**, 914-16 (1948).—*C.A.* **42**, 4422*a*.

The rate of adsorption by dry C_6H_6 on active carbon during the first 60 sec, was linear, exponential in the interval 60-800 sec, and tended towards and asymptotic value, m_o, after 800 sec. It was proposed that the value, $m_o/2$ was a valid comparison between the activities of various samples of active carbon provided that the ratio of final pressure to satn. pressure was in the range 0.005-0.4.

124. Pal'velev, V. T. **Sorption of methane on active carbon under high pressures.** *Doklady Akad. Nauk S.S.S.R.* **62**, 779-82 (1948).—*C.A.* **43**, 1237*h*.

Isotherms of excess adsorption (in cc./g of CH_4 at 25°C) on two different samples of active charcoal pass through a max. at about 100 kg/cm^2, then fall to zero at about 700-900 kg/cm^2. The fall is due to increasing predominance of neg. term involving the vol. of the adsorption space; zero excess adsorption corresponds to equality of the d. of the gas in the free space and in the adsorption space. The true d. of the adsorption layer becomes max. and const. at 200 kg/cm^2. From the vol. of the adsorption space, 0.18 and 0.24 cc., resp., for the 2 samples (as against a micropore vol. of, resp., 0.31 and 0.35 cc.), the limiting adsorption is, resp., 3.8 and 4.5 millimoles/g. The effective diam. of a CH_4 mol. in the adsorbed layer, 4.8 and 5.0 A., resp. is about 20% higher than in the CH_4 crystal. The pore surface areas of the 2 samples are 572 and 677 m^2/g, resp. Langmuir's equation fits the true adsorption isotherm satisfactorily, and surface heterogeneity is present only at lowest pressures.

125. PAPPAS, ALEXIS C. **Porous fillers for dissolved acetylene (storage).** *Tids. Kjemi, Bergvesen Met.* **8**, No. 4, 48-52, No. 5, 68-75 (1948).—*C.A.* **45**, 287*g*.

Fillers used in C_2H_2 cylinders with Me_2CO as the solvent were: (a) powd. filler contg. peat, kieselguhr, and charcoal; (b) pumice and kieselguhr; (c) charcoal; (d) kapok; and (e) a charcoal, kieselguhr, asbestos, and binder mixt. The latter was found to be most satisfactory after consideration of the chem. reactions between C_2H_2 and the fillers, the phys. properties of the fillers, and the resistance of the full cylinder to shock, heat, and internal explosion.

126. TUCK, N. G. M.; MCINTOSH, R. L., AND MAASS, O. **The density of adsorbates.** *Can. J. Research* **26B**, 20-37(1948).—*C.A.* **42**, 4422*f*.

The apparent d. of the adsorbate and the adsorption isotherm were detd. for CCl_4 and Et_2O on charcoal. The apparent d. of the adsorbate was lower than the normal liquid. These low d. could not be explained on the basis of co-existence of vapor and liquid adsorbed phases, but agreed with the postulation that the adsorbate blocked off internal voids of the charcoal. The Langmuir equation and the Harkins-Jura equation were used in interpreting the data and the regions of validity for each detd. Ne was appreciably adsorbed on charcoal at 25°C and hence could not be used in comparison with He to study the effect of mol. size on the apparent d. of the adsorbate.

127. VOLMAN, DAVID H. AND ANDREWS, LAWRENCE J. **Configuration and adsorption. A comparison of the adsorption of the cis and trans isomers of dichloroethylene on activated carbon.** *J. Am. Chem. Soc.* **70**, 457-62(1948).—*C.A.* **42**, 3639*f*.

Cis- and *trans-* dichloroethylene was adsorbed on activated carbon from 30° to 90°C. The B.E.T. areas and isosteric heats of adsorption for const. surface fraction covered were detd., with no comparative differences being found between *cis* and *trans* isomers. The selection of the two isomers offered a study of adsorption on two compds. varying widely in dipole moment (zero for trans and 1.8 Debyes for the cis isomer). By using a modification of the B.E.T. equation, where n was between 1 and 2, it was shown that the considerably lower and more const. monolayer areas were obtained over the temp. range for n = 1.6 than for n = 1.0. The values of isosteric heat of adsorption for equal areas covered were: 8.5 kcal/mole for *trans* and 9.0 kcal/mole for *cis* compd.

128. WILLIAMS, H. LEVERNE. **Adsorption and decomposition of nickel carbonyl on the surface of respirator charcoals.** *Can. J. Research* 26B, 541-9(1948).—*C.A.* **42**, 9122*g*.

Ni carbonyl is adsorbed by activated (impregnated or unimpregnated) coconut-respirator charcoals without decompn. in the absence of O_2. The amt. adsorbed is reduced if the charcoal has previously adsorbed Ni carbonyl, CCl_4, $COCl_2$, or H_2As and has not been degassed thereafter. The adsorbed Ni-carbonyl is oxidized rapidly by O_2, liberating CO_2, CO, and leaving an amorphous deposit on the charcoal. This deposit is slightly more than half Ni and does not yield an x-ray diffraction pattern. Ni carbonyl is adsorbed in a manner similiar to CCl_4 and upon oxidation forms a hydrous Ni carbonate-Ni oxide complex. Assuming that adsorption is in the form of unimol. films the area of the charcoal is 858 m^2/g.

129. BARNARTT, S. AND FERGUSON, J. B. **The isopiestic method applied to sorption isotherms.** *Can. J. Research* **27B**, 87-100 (1949); **27B**, 25 (1949).—*C.A.* **43**, 4922b.

The sorption of CCl_4 and H_2O vapors was detd. on activated coconut-shell charcoals. Duplicate samples exhibited differences in activites ranging from 1 to 5%; adsorption and desorption were run on some samples. Isotherms formed by plotting the isopiestic charges of 2 charcoals one against the other consisted of 3 linear sections for both CCl_4 and H_2O. If the pressure isotherm of one charcoal was known, those of other charcoals could be calcd. from it by weighing relatively few isopiestic charges. The linear relation between the isopiestic charges afforded a simple criterion of rejection for the Langmuir and Freundlich equations proposed to fit the pressure isotherms. It also threw into relief the structural regularities in activated charcoals. The existence of discontinuities in the sorption process was supported by the isopiestic data.

130. BARNARTT, S. AND FERGUSON, J. B. **An isopiestic investigation of charcoal activation.** *Can. J. Research* **27B**, 101-15 (1949).—*C.A.* **43**, 4922*e*.

CCl_4, H_2O, MeOH, and C_7H_8 was adsorbed on a series of coconut shell charcoals at different stages of activation by steam. The sorption of H_2O by 2 charcoals of this series impregnated by benzoic acid was also investigated. The isopiestic charges of this activation series were linearly related over wider pressure ranges than were those of unrelated charcoals. The activation process created surfaces, probably of a heterogeneous character, that were active to all the vapors studied. The various types of surfaces increased in abundance with activation at the same relative rate up to a certain stage where the production of the surfaces active at relatively low pressures began to decline. This indicated that new pores were being created more slowly in comparison with the widening of existing pores. The activation process also produced some chemically selective centers that were active at minute relative pressures.

131. DUBININ, M. M. AND ZAVERINA, E. D. **Structure and adsorptive properties of zinc chloride-activated carbon.** *Doklady Akad. Nauk S.S.S.R.* **68**, 91-4 (1949).—*C.A.* **43**, 8790*b*.

Charcoals were prepd. by heating sucrose with $ZnCl_2$ in various wt proportions ($i = ZnCl_2/\text{sucrose}$) for 1 hr at 600° or 850°C and willow lignin with $ZnCl_2$ at 650°C. Yields from sucrose ranged from 25 to 36% and adsorption isotherms of C_6H_6 at 20°C were linear in the plot of log a vs. $(\log p_s/p)^2$

for i from 0.04 to 0.40 (1st structural type), and in log a vs. log p_s/p from $i = 1.0$ to 5.0 (2nd structural type). In the 1st type the const. W_o (limiting vol. of the adsorption space) of the adsorption isotherm equation increased with i. A very marked increase of the vol. of micropores resulted in a decrease of the sp. surface area. Similar results were obtained in activation by K_2CO_3 or KCNS.

132. DUBININ, M. M. AND ZAVERINA, E. D. **Structure types of active carbons.** *Doklady Akad. Nauk S.S.S.R.* 65, 295-8(1949).—*C.A.* 44, 10441i.

Activated carbons were classified by the variation of adsorption potential (ϵ) with the diam. of the pores. The 1st type, represented by moderately activated carbons, up to 50% wt loss, was characterized by a relation of the form $W = W_o exp(-k\epsilon^2)$ (where W_o = limiting vol. of the adsorption space), and a corresponding adsorption isotherm equation $a = (W_o/v)\exp[-B(T^2/\beta^2) \log (p/p_s)^2]$, where a = adsorption at the relative pressure p/p_s and temp. T, v = mol. vol. of the liquefied vapor at T, β = affinity coeff., and k and B are consts. This equation held for moderately activated carbons in a p/p_s range of 1×10^{-5} to 0.4-0.5, W from 0.15 to 0.95. The equation became inapplicable altogether at activations corresponding to over 75% wt loss. This type was illustrated by various carbons activated to 80-95% at 850-1000°C, different kinds of lampblack, and adsorption data of C_6H_6 vapor at 20°C. It included, besides coarse-porous highly activated carbons, also nonporous highly dispersed carbon prepns.

133. ETTINGER, I. L. **Sorption of methane by the hard coals of the Kuznets basin.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* 1949, 986-90.—*C.A.* 45, 8738*a*.

Nine samples of coal were studied by the static-vol. method for which 28 sorption isotherms of CH_4 were taken. Expts. were made with pressures from 0 to 800 mm Hg and from 0° to 40°C. The sorption of CH_4 by coal was phys. in nature and the CH_4 capacity of hard coal increased in the direction from rich to poor coal. It was shown that the Freundlich equation for sorption isotherms was applicable for the interval of temp and pressure studied.

134. NAY, M. A. AND MORRISON, J. L. **The molecular adsorption areas of hydrocarbon gases on charcoal.** *Can. J. Research* 27B, 205-14 (1949). *C.A.* 43,6488*f*.

The low-temp. adsorptions of C_2H_2, C_4H_{10}, iso-C_4H_{10}, C_2H_6, C_2H_4, CH_4, N_2, and C_3H_8 were detd. on a series of coconut charcoals of various degrees of activity. Langmuir isotherms were obtained and measurements indicated horizontal orientation of the hydrocarbon mols. on the charcoal surface. By assuming a mol. adsorption area of 16.2 A.^{2} for N_2, the following av. adsorption areas were obtained: C_2H_2 19.8, C_4H_{10} 42.1, iso-C_4H_{10} 47.4, C_2H_6 24.9, C_2H_4 23.1, CH_4 19.4, C_3H_8 36.0 A.^{2}.

135. PAL'VELEV, V. T. **Interaction between molecules in the sorbed layer under high pressures.** *Doklady Akad. Nauk S.S.S.R.* 65, 875-8 (1949).—*C.A.* 44, 7616c.

The observed adsorption isotherms of CH_4 on active charcoal and on natural coal increased in both cases up to 50-100 kg/cm^2, but then decreased with further rising pressure to zero at p = 700-900 for charcoal, but remaining const. (up to p = 1000) on coal. The sorbed CH_4 occupied no addnl. space other than the vol. of the coal and the later did not increase as the result of sorption. If it was borne in mind that, under the given exptl. conditions of drying, the coal had retained considerable amts. of H_2O, it was obvious that under sufficiently high P the adsorbed CH_4 formed with H_2O a solid hydrate $CH_4 \cdot H_2O$. This process was completed at about 100 kg/cm^2. The amt. of H_2O necessary to bind the total CH_4 adsorbed at room temp., about 0.7 millimole/g, was about 8%, and that amt. was retained by the coal after low-temp. drying *in vacuo*.

136. PHILLIPS, C. S. G. **The chromatography of gases and vapors.** *Discussions Faraday Soc.* **1949**, No. 7, 241-8.—*C.A.* 45, 1460*f*.

A simplified arrangement is described for the chromatographic analysis of gas and vapor mixts. by employing a carrier gas (N_2) contg. a const. concn. of a more strongly adsorbed material (EtOAc). N_2 obtained from a cylinder through a large buffering vol. is passed (50-100 ml/min.) through a simple compensating flowmeter, a saturator contg. EtOAc (0°), the column, 3-10-cm tubes (internal diams. of 15 mm, 8 mm, and 2 mm) and finally the analyzer, a thermal cond. cell connected to an automatic recorder. Samples are brought on to the column by condensing them in a liquid-air trap through which the N_2 can be passed. Activated charcoal (40 mesh) and dried at 120°C is used as the adsorbent. The sepn. of various hydrocarbons, ethers, ketones, alcs., and esters are presented.

137. PIERCE, CONWAY; WILEY, J. W., AND SMITH, R. NELSON. **Capillarity and surface area of charcoal.** *J. Phys. Colloid Chem.* 53, 669-83 (1949).—*C.A.* 43, 6036*g*.

Isotherms were detd. on graphite, Saran charcoal, and steam-activated Saran charcoal for EtCl at 0° and -78°C, CCl_4 at 0°C, NH_3 at -78°C, and H_2O at 28.9°C. All detns., except NH_3, were made gravimetrically by removing and weighing the sample tube after each addn. of vapor. When capillary condensation occurred, it was impossible to det. the surface area of a porous solid from an adsorption isotherm and the commonly accepted values were much too large. In capillaries a few mol. diam. in width the Kelvin equation was inapplicable. Retentivity was greater for slightly activated samples than for more highly activated ones.

138. SHEFFER, H.; WALDOCK, K. T., AND FERGUSON, J. B. **The testing of activated charcoals by the isopiestic method.** *Can. J. Research* 27B, 25-34(1949).—*C.A.* 43, 4536d.

The "activities" or sorptive capacities of nine different activated charcoals were detd. by the isopiestic method using CCl_4, H_2O, AmCl, C_6H_6, MeOH, hexane, mustard gas, and phosgene. The results, as ratios of vapor adsorbed at satn., were compared with those obtained by a flow method. A simple method for testing activated charcoals was included.

139. Taylor, R. J. **The activation of alumina.** *J. Soc. Chem. Ind.* **68**, 23-6 (1949).—*C.A.* **43**, 3981*i*.

Methods of prepg. Al_2O_3 of predetd. activity and porosity from Gibbsite, crystalline $Al_2O_3 \cdot 3H_2O$, were given. Samples (5 g) were heated and removed from the oven at intervals over a period of hrs; the following studies were made at 225° and 300° to 1000°C steps. The dehydration curves showed a conversion to the monohydrate at 225°C in about 7 hrs, while between 225° and 500°C, a state of equil. was reached quickly. The X-ray photographs could be fully explained if there was no intrinsic temp. for conversion of the monohydrate. The conclusion was that activated Al_2O_3 was a transitional product in a heat-controlled, solid reaction, at first highly disordered but rearranging to an orderly state. In no case was a significant change in particle size distribution found, showing that it could be controlled by the hydrate from which it was produced. The results showed that Al_2O_3 of any given activity, within a wide range, could be prepd. by merely heating Gibbsite at a specific temp. for a specific time.

140. Toropov, S. A. and Pylaev, A. V. **Adsorptive properties of oxidized carbon for hydrogen sulfide and benzene vapor.** *Zhur. Priklad. Khim. (J. Applied Chem.)* **22**, 568-71 (1949).—*C.A.* **44**, 18i.

Activated carbon (oxidized by 1-8 hrs boiling in 10, 90, or 100% HNO_3, dried at 105-110°C and heated 1 hr to red glow) showed high adsorption for H_2S (1.8 mg/liter air flowing at 1.57 liter/min.), in contrast to unoxidized material which did not adsorb H_2S. Activation with 10% HNO_3 resulted in optimum adsorptive capacity. Adsorption of C_6H_6 was highest if the length of the treatment with HNO_3 did not exceed 1-3 hrs; longer treatment impaired the adsorptive capacity for C_6H_6. Preliminary adsorption of H_2S on oxidized carbon raised its adsorptive capacity for C_6H_6.

141. Turkeltaub, N. M. **Chromatographic titrimetric gas analyzer.** *Zavodskaya Lab.* **15**, 653-60(1949).—*C.A.* **44**, 9747e.

An elaborate gas analyzer is described in which part of the gas stream is oxidized on heated Pt wire to give total hydrocarbon content. The other part is adsorbed on charcoal and eluted stepwise by air with subsequent combustion, giving CH_4, C_2H_6, and the sum of higher hydrocarbons. A relative error of 5% is claimed.

142. Zabezhinskii, Ya. L.; Zukhovitskii, A. A., and Tikhonov, A. N. **Occlusion of gas from an air current by a layer of granular material. III.** *Zhur. Fiz. Khim.* **23**, 192-201 (1949).—*C.A.* **43**, 5255b.

Vapor of Et_2O (10-20 mg/liter) was forced at 14°C and a rate (k) of 300-2000 cm/min. through a layer of active charcoal of particle diams. (d) between 0.17 and 0.22 mm and a length of 1, 2, 3, 5, and 8 cm. The adsorption of Et_2O yielded a Langmuir-type isotherm. The kinetic coeff. β was approx. proportional to $\rho^{0.5}/d^{1.5}$, similar to the heat transfer to a bundle of tubes. The time for the Et_2O concn. behind the adsorbent to reach 1/2 the original concn. was proportional to the length.

143. Chipalkatti, V. B. and Giles, C. H. **Use of glass springs for adsorption measurements.** *Nature* **165**, 735(1950).—*C.A.* **44**, 7094i.

Spiral annealed Pyrex springs were used at temps. up to 100°C for 6 months in the McBain and Bakr balance. Example: original length at 25°C with a 0.4-g load, 16.209 cm; length after heating at 200°C for 8 hrs, and cooling to 25°C, 16.239 cm; after heating at 100°C for 3 hrs, and cooling to 25°C, 16.236 cm. The dimensions were: fiber diam. 0.008 in., coil diam. 0.75 in., turns per in. 12, sensitivity 17.45 cm/g.

144. Dubinin, M. M. and Zaverina, E. D. **Adsorption of gases by active carbons.** *Doklady Akad. Nauk S.S.S.R.* **72**, 319-22 (1950).—*C.A.* **44**, 7615*h*.

The equation of the adsorption isotherm applicable to active carbons with relatively fine micropores was: $a = (W_o/v)\ \exp.\ [-B(T^2/\beta^2)\ \log\ (p/p_s)^2]$, where W_o = limiting vol. of the adsorption space, v = mol. vol. of the liquefied gas, and the concomitant equation $W = W_o\ \exp.\ [-k(\epsilon^2/\beta^2)]$ relating the occupied vol. W of the adsorption space and the adsorption potential ϵ. These were tested by the linearity $\log a = E - F\ [\log\ (31.4\ T/bp]^2$, where $E = \log\ (W_o/b)$ and $F = 9.05\ kT^2/\beta^2$. The linearity between $\log a$ and $[\log\ (31.4\ T/bp]^2$ was confirmed for 3 types of charcoal (from sugar, wood, and coal) of moderate activation (loss not over 50%), in the adsorption of C_2H_4 and of C_6H_6 vapor at 20°C. From the graphically detd. const. B, the coeffs. k were calcd.: $k = (B/2.30\ R)^2 - (B/20.75)$.

145. Ettinger, I. L. and Lidin, G. D. **The effect of moisture on the sorption of methane by coal.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* **1950**, 1198-1203.—*C.A.* **46**, 1227c.

The amt. of CH_4 sorbed by coal at 25-38°C and any given pressure (range: 200-900 mm Hg) decreases regularly as the moisture content of the coal increases. The presence of 2-3% H_2O reduces the CH_4 sorption by approx. one-half.

146. Eyraud, I. **Automatice adsorption balance.** *J. chim. phys.* **47**, 104-7(1950).—*C.A.* **44**, 7095*a*.

The details of construction are given for a sensitive adsorption balance capable of automatically recording and plotting a curve for the rate of adsorption of a gas by a solid.

147. Lewis, W. K.; Gilliland, E. R.; Chertow, B., and Cadogan, W. P. **Adsorption equilibria. Pure gas isotherms.** *Ind. Eng. Chem.* **42**, 1326-32 (1950).—*C.A.* **44**, 8731i.

Adsorption-desorption isotherms were obtained from CH_4, C_2H_2, C_2H_4, C_2H_6, C_3H_8, C_3H_6, $i\text{-}C_4H_{10}$, and 1-butene on coal-base and coconut-shell activated charcoals, and silica gel. When the adsorbent became satd. with gas, the amt. adsorbed was related to the molal vol. of the gas. With the charcoals, vapor pressure seemed to be the predominant factor detg. adsorption, although unsatn. plays a part when volatilities are close. With silica gel, unsatn. had a significant effect in increasing adsorption. A method of correlation based on Polanyi's adsorption potential theory gave good results for 18 adsorption isotherms on 3 different adsorbents at 25°C over the pressure 0.2 to 20 atm. Satd. and unsatd. gases showed different correlation curves on silica gel and at low temp. on charcoal. The temp. dependence of the adsorption isotherm up to 200°C was also correlated by this method.

148. Lewis, W. K.; Gilliland, E. R.; Chertow, B., and Cadogan, W. P. **Adsorption equilibria. Hydrocarbon-gas-mixtures.** *Ind. Eng. Chem.* 42, 1319-26(1950).—*C.A.* 44, 8732d.

The use of activated charcoal and silica gel in the adsorption sepn. of binary and ternary mixts. of gaseous hydrocarbons (0.3 to 20 atm. and at from 0° to 40°C) was investigated. Mol. wt, structure, and liquid b.p. affected the adsorption on silica gel more than on charcoal. The pure gas for which an adsorbent had the greatest capacity was preferentially adsorbed from a mixt. In mixts. each component adsorbed interfered with the adsorption of another, and, at const. pressure, the quantity of gas mixt. adsorbed per g of adsorbent lay between the values for the pure gas. By means of a modified Polanyi adsorption-potential method, the relative volatities of gases in mixt. over the gel could be calcd. from adsorption data for pure gases. The calcn. was more accurate for silica gel than for charcoal. The methods were fully developed for binary systems and could be extended for ternary systems.

149. Lewis, W. K.; Gilliland, E. R.; Chertow, B., and Hoffman, W. H. **Vapor-adsorbate equilibrium. I. Propane-propylene on activated carbon and on silica gel.** *J. Am. Chem. Soc.* 72, 1153-7(1950).—*C.A.* 44, 5180*c*.

The adsorption isotherms of C_3H_8 and $CH_3CH{=}CH_2$ on activated charcoal and on silica gel were detd. at 25.0°C and also the equil. behavior of binary mixts. at the same temp. All adsorptions were entirely reversible. There was very little difference in the relative volatilities of these gases over activated charcoal; there was substantial difference over silica gel. However, the adsorption capacity per unit wt of charcoal was greater for these hydrocarbons than that for the gel. In both these vapor-adsorbate equil. C_3H_8 was the more volatile component, whereas in the vapor-liquid equil. for this hydrocarbon system C_3H_8 was the less volatile component.

150. Lewis, W. K.; Gilliland, E. R.; Chertow, B., and Milliken, W. **Vapor-adsorbate equilibrium. II. Acetylene-ethylene on activated carbon and on silica gel.** *J. Am. Chem. Soc.* 72, 1157-9 (1950).—*C.A.* 44, 5180*d*.

Adsorption-desorption isotherms were measured for C_2H_2 and for C_2H_4 on silica gel and on activated charcoal at 25°C. Vapor-adsorbate equil. curves at barometric pressure and 25°C were detd. for mixts. of these two gases on each adsorbent. C_2H_2 was more volatile than C_2H_4 over the activated charcoal and was the less volatile component over the silica gel used. The adsorption phenomena reported were reversible.

151. Lewis, W. K.; Gilliland, E. R.; Chertow, B., and Bareis, D. **Vapor-adsorbate equilibrium. III. The effect of temperture on the binary systems ethylene-propane, ethylene-propylene over silica gel.** *J. Am. Chem. Soc.* 72, 1160-3 (1950).—*C.A.* 44, 5180*f*.

Adsorption-desorption isotherms at 0°,25°, and 40°C were detd. for C_2H_4, C_3H_8, and C_3H_6 on silica gel. Vapor-adsorbate equil. curves at one atm. were obtained for the binary systems C_2H_4-C_3H_8 and C_2H_4-C_3H_6 at 0°,25°, and 40°C. C_2H_4 was relatively more volatile than C_3H_8 or C_3H_6 in the isobaric, isothermal binary systems. C_2H_4 exhibited a much greater relative volatility in the C_3H_6 system than in the C_3H_8 system; this demonstrated the influence of the double bond. The adsorption phenomena reported were reversible.

152. Pierce, Conway and Smith, R. Nelson. **Adsorption-desorption hysteresis in relation to capillarity of adsorbents.** *J. Phys. & Colloid Chem.* 54, 784-94(1950).—*C.A.* 44, 9768i.

Adsorption and desorption isotherms were shown for EtCl at 0°C on graphon H_2O on graphon, at 28.9°C, EtCl on charcoal at −78°C, H_2O on charcoal at 28.9°C, and H_2O on graphite at 28.9°C. Water on graphon showed hysteresis closing at 0.8 relative pressure, and H_2O on graphite showed hysteresis closing at 0.5 relative pressure. EtCl on graphon showed no hysteresis. It was postulated that hysteresis resulted from small clumps of water mols. formed around active spots coalescing at higher relative pressures into larger clumps. In the large clumps it was assumed that long-range forces from the surface would extend a greater distance than if only small clumps were present. The adsorbate in large clumps during desorption would have lower vapor pressure than when the same amount of adsorbate during adsorption was in smaller clumps.

153. Poggi, A. Raul. **Adsorptive powers of active carbons.** *Ann. chim. (Rome)* 40, 63-7(1950).—*C.A.* 45, 7388f.

A streaming app. in which air is first satd. in a wash bottle contg. CCl_3NO_2, CCl_4, or $COCl_2$ and aspirated through the column of active carbon is described. Experiences on the uptake of various European active carbons are tabulated.

154. Ray, G. C. and Box, E. O. Jr. **Adsorption of gases on activated charcoal.** *Ind. Eng. Chem.* 42, 1315-18(1950).—*C.A.* 44, 8731i.

Fundamental adsorption data are presented for H_2, N_2, CO, CO_2, C_2H_4, C_2H_2, CH_4, C_2H_6, C_3H_6, C_3H_8, and n-C_4H_{10} on a single sample of coconut charcoal at pressures from 0 to 215 lb/in^2 and from 100° to 450°F.

155. Roginskii, S. Z. and Yanovskii, M. I. **Desorption of gases in dynamic conditions.** *Zhur. Fiz. Khim.* 24, 137-43 (1950).—*C.A.* 44, 6230*f*.

Mixts. of air with CO_2, ethylene, or propene were passed at 20°C through 4 tubes filled with activated charcoal (bulk d. 0.47, particle size 1.5–2.75 mm) until the outgoing gas had the concn, of the incoming gas (approx. 0.012 mol./liter). Then pure air (a few cc./min.) was forced through the 4 tubes and 4 addnl. tubes, equally filled, all in series, and the concn. c was detd. after every tube as function of the vol.(V) that passed through. The rate of displacement increased from propene to ethylene to CO_2; e.g., the concn. after the 4th tube became 0.002 mol./liter after V = 4500, 2500, and 100, resp. The adsorption isotherms of CO_2, in the mixts. were detd. up to 0.04 mol./liter. The equation $V/XM = (da/dc)[1-(c/c_o)]^2$ was valid; X was the distance from the inlet, M the amt. of adsorbent per cm of the column, and c_o is the total concn. of air and the mixt.

156. SMITH, R. NELSON; PIERCE, CONWAY, AND CORDES, HERMAN. **Adsorption of benzene and cyclohexane by graphite.** *J. Am. Chem. Soc.* **72**, 5595-7 (1950).—*C.A.* **45**, 4995c.

Adsorption isotherms were detd. on "Graphon," a partially graphitized carbon black, at 5.5° and 28.6°C. The Vm values and the av. area covered per mol. (in $A.^2$) were calcd. from the location of point B in the isotherms: These were cyclohexane 38 $A.^2$, and benzene 41 $A.^2$, compared with computed values of 32 and 28 $A.^2$ for sym. mols. (from $V^{2/3}$), and with values of 39 and 41 $A.^2$ from mol. models for mols. lying flat on the surface. Both mols. lay in the adsorbed state flat on the surface. The same conclusion applied to the mols. of MeOH, EtCl, butane, pentane, and decane in their adsorbed state on Graphon. The isotherms and the isosteric heats of adsorption computed from them showed that, in the first adsorption layer, cyclohexane was more strongly held than benzene.

157. TURKEL'TAUB, N. M. **Chromatographic method for separate determinations of microconcentration of hydrocarbons in air.** *Zhur. Anal. Khim.* 5, 200-10(1950).—*C.A.* **44**, 9856*b*.

A chromatographic titrometric gas analyzer for detg. hydrocarbons in air under field conditions was devised. A gas sample was freed of acidic components and divided into 2 parts. On one of these total C was detd. by combustion over a hot Pt wire and titration of the $BaCO_3$ formed by absorption in $Ba(OH)_2$. The other part was passed through a column of activated charcoal which absorbed all of the hydrocarbons. The latter were eluated by passing air through the adsorber column. The first 400 cc. of air removed all the methane. The next 500 cc. was free hydrocarbons and was used as check. The following 2000 cc removed all the ethane. The content of CH_4 and C_2H_6 in the eluant was detd. separately by combustion.

158. VREEDENBERG, H. A. **Adsorption of carbon disulfide vapor flowing through a tube filled with activated charcoal.** *Rec. trav. chim.* **69**, 1233-51 (1950).—*C.A.* **45**, 1837d.

The course of the adsorption of CS_2 vapor from a mixt. of air and CS_2, which flows through a long tube filled with Norit, was calcd. as a function of the time and place in the tube. Nomograms were constructed for the detn. of consts. involved in the math. relations. Conclusions derived from the theory were applied to total adsorption, relative pressures, velocity, and place in the adsorption tube, with good agreement.

159. AVGUL, N. N.; DZHIGIT, O. M.; DUBININ, M. M., AND KISELEV, A. V. **Structure of active carbons and their properties towards different vapors.** *Doklady Akad. Nauk S.S.S.R.* **79**, 451-4(1951).—*C.A.* **46**, 18*a*.

The early stage of sorption of org. vapors by active charcoal was pure adsorption, whereas later stages involved simultaneous adsorption and capillary condensation. The ratio of the two depended on the pore structure type of the active charcoal. Adsorption isotherms were detd. of H_2O (at 25°C), MeOH, C_7H_{16}, C_6H_6, and BuOH vapors (at 20°C), on a fine-pore charcoal prepd. by activation of sucrose charcoal with CO_2 at 1000°C until a loss of wt of 45%, and on another sucrose charcoal activated with a 5-fold excess of $ZnCl_2$ heat-treated at 650°C and washed. Org. mols. filled the whole pore vol. of the former already available to adsorption during the 1st stage. There was no capillary condensation of the org. compds.; on the other hand, the major part of the adsorption of the smaller H_2O mols. was due to capillary condensation in the micropores. In the $ZnCl_2$ charcoal capillary condensation was responsible for the major part of the adsorption of the org. vapors also. In accord with the pore-structure types the adsorption isotherms on the sucrose charcoal were representable by $a = (W_o/V_m) \exp [-B(T^2/B^2) \log (Ps/P)^2]$ with the values (for C_6H_6, C_7H_{16}, BuOH, MeOH) $W_o = 0.59, 0.55, 0.54, 0.61$ cc./g., $10^6B/\beta^2 = 1.00, 0.43, 1.01, 0.76$, $\beta = 1.00$ (by convention), 1.53, 0.99, 0.36. The isotherms on $ZnCl_2$ activated charcoals were given by $a = (W'_o/V_m)$ emp $[-A(T/\beta) \log (Ps/P)]$, with $w'_o = 1.50$, 1.60, —, 1.85 cc./g, $10^3A/\beta = 2.83$, 1.93, —, 8.52, $\beta = 1.00$, 1.47, —, 0.33.

160. CARMAN, P. C. AND RAAL, F. A. **Diffusion and flow of gases and vapors through micropores. III. Surface-diffusion coefficients and activation energies.** *Proc. Roy. Soc.* **A209**, 38-58 (1951).—*C.A.* **46**, 6997a.

When less than a complete monolayer is present, surface-diffusion coeffs. decrease rapidly with decreasing coverage. This is attributed to variation in heats of adsorption over the adsorbent surface. Diffusion is due to the most loosely bound mols., and these tend to disappear first as coverage decreases. Surface diffusion coeffs. compared at const. temp. and const. coverage differ for various mols. according to differences in mol. size, shape, and polar character. Measurements in this region have only limited reproducibility. The importance of pore structure for the shape of adsorption isotherms is stressed. The systems studied were SO_2 and CF_2Cl_2 on Linde silica II and CF_2Cl_2 and CO_2 on Carbolac 1. Data are discussed for comparison of surface diffusion coeffs. and activation energies for the following systems: C_7H_{16}—charcoal, C_7H_{16}—silica gel, MeOH—silica gel, toluene—silica gel, CF_2Cl_2—silica, SO_2—silica, CF_2Cl_2—carbon black, and CO_2—carbon black.

161. CRAMER, ERIKA AND MILLER, R. **Separation and determination of small quantities of gases by chromatography.** *Mikrochemie ver. Mikrochim. Acta* 36/37, 553-60(1951).—*C.A.* **45**, 5057h.

A formula is derived for the migration velocity of the zones in the chromatographic sepn. procedure. It is shown that a characteristic quantity (difference of the adsorption energies of the adsorbed materials) can be calcd. from every 2 migration rates. Sepns. are made with N_2, C_2H_4, C_2H_2, CO_2, and $CH_2{:}CHCl$ by passing 1-10 mg over an adsorption medium such as charcoal or silica gel with H_2 as the eluting gas. The detn. of the thermal cond. is used in the analysis. Plotting the galvanometer deflections of the measuring setup against the time gives curves from which the above-mentioned quantities of energy can be calcd. with an accuracy of 0.02—0.06 kcal. per mole. A mixt. of C_2H_4 and C_2H_2 is completely sepd. in 8 min. at 30°C.

162. DRESEL, E. M.; DRYDEN, I. G. C., AND FARENDEN, P. J. **An approximate adsorption**

isotherm for the ethylenediamine-coal system. *Research (London)* 4, 579-81(1951).—*C.A.* 46, 4195b.

The adsorption of ethylenediamine by a coal having an internal surface area of 2×10^6 cm²/g was studied by means of a sorption balance and also by passing the gas through a packed bed of coal and detg. changes in vapor concn. in the gas stream. Adsorption data at 25°C were given in curves. At a relative pressure of 0.5 mm Hg the coal adsorbed 40 g of ethylenediamine per 100 g.

163. Dubinin, M. M.; Zaverina, E. D., and Timofeev, D. P. **Affinity coefficients for carbons of the second structure type.** *Doklady Akad. Nauk S.S.S.R.* 77, 823-6(1951).—*C.A.* 45, 6453 g.

Adsorption isotherms of vapors of C_7H_{16}, PhMe, C_6H_6, EtCl, and MeOH at 20°C, were detd. on 3 samples of coarse-pore (2nd-type) carbons, activated by impregnation with $ZnCl_2$, activated by CO_2 at 950°C to a wt of 80%, nonporous lampblack with spherical particles. The values of W_o' (cc./g) and 10^3A in the adsorption equation $a = (W_o'/v) \exp [-AT \log (P_s/P)]$ were resp.: 1.210 and 2.36 (P/Ps $1 \times 10^{-5} - 0.05$); 1.140 and 2.12 ($1 \times 10^{-5} - 0.25$); 0.089 and 3.63 (0.01-0.50). Curves of the adsorption potential $\epsilon = RT \ln (Ps/P)$ as a function of the surface coverage for all 5 substances on each adsorbent showed satisfactory affinity. The affinity coeffs. $\beta = \epsilon/\epsilon_o$ relative to C_6H_6 ($\epsilon_o = 1$), on the three carbons compared with β on fine-pore carbons of the 1st structure type were: C_7H_{16} 1.50, 1.63, 1.70, and 1.59; PhMe 1.16, 1.27, —, and 1 25; C_6H_6 1; PhCl 0.70, 0.77, 0.78, and 0.76; MeOH 0.35, 0.39, 0.41, and 0.40.

164. Gomez Aranda, Vicente and Auria Arbunies, Jose. **Analytical methods in the chemistry of coal. II. Low-temperature distillation of coal. Glass apparatus for laboratory tests.** *Combustibles (Zaragoza)* 11, 319-23(1951).—*C.A.* 46, 9283i.

An app. for low-temp. distn. of coal consists of a hard-glass tube divided by constrictions into 3 parts, one at the sealed end for the sample, one for dried asbestos, and a third for active charcoal. The sample is heated in an elec. furnace and the "light oil" and "heavy oil" are retained in the charcoal and asbestos, resp., both of which are maintained at 105°C by an elec., heater. Water and H_2S are retained by U-tubes filled with $CaCl_2$ and $CuSO_4$, resp. Gas is measured in a gasometer. Components are detd. by weighing the adsorbents after the app. is cut apart. Complete data on repeatability are given for a series of 8 detns. on an Aragonese lignite.

165. Hammar, C. G. Bertil. **A simple apparatus for adsorption analysis of gases.** *Svensk Kem. Tid.* 63, 125-35(1951).—*C.A.* 45, 10551g.

An app. is described for the sepn. of hydrocarbons according to mol. wt by selective adsorption on activated charcoal. The dried and measured sample (100-200 ml) is forced into the previously evacuated adsorption column (1.5—2 g adsorbent) to a max. adsorption pressure of 300 mm Hg abs., the column being cooled with Dry Ice and alc. When inerts (H_2, N_2) are present, the gas is vented through a Cartesian manostat and more sample introduced at the same time, while keeping the pressure approx. const. This "enrichment" is stopped before C_2 hydrocarbons appear in the vented gas (this point is detd. by preliminary analysis). For desorption, the column is heated in steps by an elec. oven which travels upward around the column. Each time the desorption pressure reaches 300 mm Hg, controls are activated to stop and brake the motor, and at the same time the Cartesian manostat opens to pass the desorbed gas to a cond. cell in which the fractions are identified. Desorption usually is incomplete and a developer (pentane vapor) is fed through the system until the C_5 level is reached in the cond. cell. Known mixts. of pure compds. and hydrocarbon fractions from shale oil were analyzed. The method gives sharp sepn. of components with different C nos., and also of isobutane from butane.

166. Innes, W. B.; Olney, R. B., and Rowley, H.H. **Adsorption isotherms of mixed vapors of benzene and methanol on activated charcoal at 25°.** *J. Phys. & Colloid Chem.* 55, 1324-34 (1951).--*C.A.* 46, 7398g.

Isotherms were detd. by a method that entails keeping the adsorbate compn. nearly const. by introducing vapor of fixed compn. to the adsorbent and then measuring the compn. and total vapor pressure of the vapor phase in equil. with the adsorbate. The amt. adsorbed when the surface was completely covered was detd. as a function of the mole fraction in the adsorbate and found in fair agreement with a relation derived by averaging the mol. areas of the adsorbed phase. This was in agreement with the earlier results on CCl_4-MeOH. All the partial-pressure data for a given component fit common curves regardless of surface compn. when the fraction of the surface covered was plotted against the relative partial pressures. Total spreading pressures were evaluated and the data discussed from kinetic and mol. standpoints.

167. Khodot, V. V. and Yanovskaya, M. F. **Sorption and filtration volumes of coals.** *Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk* **1951**, 593-600. *C.A.* 46, 11629f.

The sorption vol. of coal was detd. by the method of sorption of CH_4 at high pressures and by the method of sorption of vapors of MeOH at relative vapor pressures up to 0.5. Satisfactory quant. results were obtained. The extent of the pores of coal, detd. by the He method, led to a sorption vol. of 46 to 60% (av., 55%) and to a filtering vol. of 54 to 40% (av., 45%) of the total pore vol. The expts. made permit one to evaluate the applicability of the equation of subterranean hydraulics to cases of finely porous sorbing media and to give an explanation of the relatively small porosity, filtering capacity of coal.

168. Wiig, Edwin O. and Smith, Stanton B. **Vacuum desorption of ethyl chloride from activated carbon.** *J. Phys. & Colloid Chem.* 55, 27-44 (1951).—*C.A.* 45, 3221c.

Adsorption and desorption isotherms and measurements of the rates of desorption were made for EtCl at 25-56.5°C for a series of charcoals prepd. from a char made from bituminous coal and subjected to steam activation for periods of 30,90, 150, 270, and 300 mins., resp. B.E.T. surface area for the various charcoals were detd. Pore distributions were calcd. from water desorption isotherms for pores smaller than approx. 10^3 A. For larger pores the distributions were obtained by a Hg porosimeter method. A log-log plot of the fraction of the EtCl retained at time t placed all of the samples from the base char to the one that was most highly activated on a uniform series of curves which in all cases were linear for the last fraction of the EtCl removed. These curves became steeper the greater the amt. of activation. Values for the isosteric heats of adsorption decreased from about 14.7 kcal. for the first portion of EtCl adsorbed down to about 7.8 kcal. for the last portion adsorbed. The adsorption isotherms were shown to fit the equation of Sips $\theta = A_p{}^n/(1 + A_p{}^n)$, where θ was the fraction of the surface covered by adsorbate at pressure P and n was a const. less than unity. Curves for the heat distribution were detd. similar to the pore distribution curves for the various charcoals.

169. Akahira, Takeo; Shimamune, Shoji, and Tsuboyama, Mitsuru. **Carbon film resistor. I. Improvement on the preparation of carbon film resistors.** *Repts. Sci. Research Inst. (Japan)* **28**, 205-11 (1952).—*C.A.* 47, 4767*h*.

Benzene vapor was passed under steady low pressure (adjusted through a tubing system with a gas reservoir attached to a vacuum pump) into a vacuum quartz tube in an elec. furnace to be pyrolyzed at 1020°C (optimum) to deposit carbon on porcelain rods or cylinders placed within the tube. The carbon-film resistor thus prepd. showed a resistance of 100 kilo-ohms/unit area.

170. Avgul, N. N.; Dzhigit, O. M., and Kiselev, A. V. **Adsorption of vapors on a nonporous active carbon, lampblack.** *Doklady Akad. Nauk S.S.S.R.* **86**, 95-8(1952).—*C.A.* 47, 1458*a*.

On a Spheron lampblack (100 m^2/g) preliminarily heated *in vacuo* 2 days at 900°C the adsorption isotherm of C_6H_6 had the normal S shape, and was reversible up to $p/p_s = 0.8$; hysteresis appeared at higher p/p_s. The H_2O vapor adsorption isotherm had an entirely different shape. The adsorption was very small up to $p/p_s = 0.3$ at which point not more than 15-20% of the surface was occupied by H_2O. Adsorption increased sharply with further increasing p/p_s, particularly in the range 0.45-0.50; at 0.6-0.7, the amt. adsorbed was sufficient to cover all of the surface with a dense unimol. layer. With further increasing p/p_s, the increase of the adsorption became slower. The adsorption isotherm of MeOH was intermediate between that of C_6H_6 and of H_2O. At very small p/p_s, the adsorption was approx. proportional to the pressure, then became slower as the 1st layer was completed; there appeared to be an inflection at about $p/p_s = 0.5$, where a bimol. layer was approx. completed. A trimol-layer thickness was reached at approx. $p/p_s = 0.8$-0.9; from then on, the adsorption increased rapidly. Considerable hysterisis, apparently due to very slow release of adsorbed MeOH, was found below $p/p_s = 0.3$.

171. Bering, B. P. and Serpinskii, V. V. **Simultaneous adsorption of ethylene and propylene on active carbon.** *Doklady Akad. Nauk S.S.S.R.* **85**, 1065-8(1952).—*C.A.* 47, 4684*g*.

The adsorption of C_2H_4 and C_3H_6 was measured by the same method and on the same active charcoal at 7° and at 25°C between 0-300 mm Hg. From the adsorption of C_3H_6 at $p_1 = 0$, 50, 100, 150, 200, 250 mm, it was seen that C_2H_4 even in large amts. lowered the adsorption of C_3H_6 only slightly, and did not change the shape of its adsorption isotherm. In contrast, even small amts. of C_3H_6 lowered the adsorption of C_2H_4 considerably and brought its shape closer to linear. The adsorption isosteres of C_3H_6 between 0.6 and 2.5 millimoles/g were practically straight lines, whereas the family of the C_2H_4 isosteres between 0.05 and 1.0 represented a system of curves with a curvature progressively diminishing with increasing p_1. Isosteres of the total adsorption were straight lines throughout, both at 25° and at 7°C. With the aid of Gibbs' equation, the integral heat of adsorption of the binary gas mixt. was calcd. The adsorption isotherms of C_2H_4 could be adequately described by a Langmuir isotherm.

172. Bering, B. P. and Serpinskii, V. V. **Adsorption of mixtures of gases. II. Adsorption of ethylene and propylene on active carbon.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* **1952**, 997-1007.—*C.A.* 47, 5756*f*.

Measurements of the amts. adsorbed a (in millimoles/g) as a function of the pressure p (mm Hg) at 7° and at 25°C, were given: C_2H_4, 7°C, p_1 4.5 ($a_1 = 0.214$) to 338.3 ($a_1 = 1.928$); 25°C, p_1 4.1 ($a_1 = 0.093$) to 771.3 ($a_1 = 2.030$); C_3H_6, 7°C, p_2 0.2 ($a_2 = 0.161$) to 333.8 ($a_2 = 3.240$); 25°C, p_2 3.3 ($a_2 = 0.570$) to 325.5 ($a_2 = 2.760$). For mixts. $(C_2H_4 + C_3H_6)$, a_1 and a_2 was given as functions of p_1 and p_2, over the whole range of variation of p_1 and p_2 in the total pressure range 0-300 mm. Sections of the surface a_2 by planes $p_1 =$ const. $= 0$, 50, 100, 200, and 250 mm, at 25°C, showed that, even at high concns., C_2H_4 decreased the adsorption of C_3H_6 only slightly.

173. Berkowitz, N. and Schein, H. G. **Calculation of surface areas from room-temperature adsorption isotherms.** *Nature* **169**, 373(1952).—*C.A.* 46, 5400*d*.

Monolayer capacities calcd. from adsorption isotherms for CH_3OH on lignites at 25°C were up to 50% higher than those calcd. from the B.E.T. graph. Where the slope of the linear portion of a sigmoid isotherm increased with temp., the B.E.T. method yielded reliable results only at very low temp.

174. Bonnetain, Lucien; Duval, Xavier, and Letort, Maurice. **Stepwise adsorption isotherms for methane on graphite and various other solid adsorbents.** *Compt. rend.* **234**, 1363-6 (1952).—*C.A.* 46, 6896*d*.

The authors found stepwise phys. adsorption isotherms for CH_4 at −195°C on 5 different types of graphite, on MoS_2, $CdCl_2$, CdI_2, and $CdBr_2$. A nearly vertical rise in the adsorption isotherm occurred at a relative pressure of about 0.35 and 0.75 for the graphite as well as for the MoS_2. The upper end of the vertical rise corresponded to the completion of about 2 layers at 0.35 relative pressure and 3 layers at 0.75 relative pressure. At −166°C with CH_4 and at −195°C with N_2 the discontinuities in the adsorption isotherms were absent. The vertical rises in the isotherms at about 0.35 relative pressure were as sharp as those that have been interpreted in the past as 1st-order phase changes.

175. Chernyshev, A. B.; Kel'tsev, N. V., and Khalif, A. L. **Adsorption equilibrium of a propane-butane gas mixture on activated carbon.** *Doklady Akad. Nauk S.S.S.R.* **82**, 75-7(1952).—*C.A.* **46**, 4881*f*.

Mixts. of dry C_3H_8 and C_4H_{10} (mixts. of normal and iso) of different compns. were passed over activated charcoal (grain size 0.4-1 mm), preliminarily evacuated 3 hrs at 100 °C, in an adsorption column 2 cm in diam., 50 cm long, at the rate of 100 cc./min. The outgoing gas was initially C_3H_8; after more prolonged passage, the ds. of the incoming and the outgoing gas became equal. The amt. and compn. of the adsorbed gas were detd. by fractionation after desorption with superheated steam and freezing out. With gas mixts. of 40.30, 58.80, 77.10, 87.65 mole % C_3H_8, the mole % of C_3H_8 in the adsorbed phase was, at 20 °C, resp., 14.80, 23.60, 40.60, 63.88, and at 100°C, 14.86, 30.20, 44.00, 61.98. The "coeff. of sepd. capacity" $K = y_1x_2/y_2x_1$, where y = mole fraction in the gas, and x = mole fraction in the adsorbed phase, was, at 20°, 3.89, 4.63, 4.93, 4.03, and at 100°, 3.87, 3.31, 4.28, 4.35.

176. Chernyshev, A. B.; Kel'tsev, N. V., and Khalif, A. L. **Separation of butane-propane mixtures in a moving layer of adsorbent.** *Doklady Akad. Nauk S.S.S.R.* **84**, 757-60 (1952).—*C.A.* **46**, 10774*g*.

The sepn. (coeff. $K = x_2y_1/x_1y_2$ where the x are the mole fractions of the components in the adsorbed, and the y the mole fractions in the gaseous phase), after n consecutive passes of the initial mixt. over the adsorbent is given by $n \log K = \log (y_2/y_1)_n - \log (y_2/y_1)_1$, where the subscripts n and 1 refer to the gas-phase compn. after the nth and the 1st pass, resp. The same sepn. effect can be obtained in one single pass if the adsorbent layer is made to move countercurrent to the desorbed gas. The compns. of the gaseous and of the adsorbed phases change continuously along the height of the column and the countercurrent operation is analogous to a no. of repeated sepns. With Z being the height of the adsorbent column equiv. to one single stage of sepn., and L the height of the whole column, one has $n = L/Z$, and hence $\log (y_2/y_1)_n - \log (y_2/y_1)_1 = (L/Z) \log K$. Exptl. results with $C_3H_8 + C_4H_{10}$ mixts., plotted in the coördinates $[\log (y_2/y_1)_n - \log (y_2/y_1)_1]$ as a function of L, give a straight line which at higher L curves upwards; at this point, further increase of the height of the column evidently results in no further improvement of the sepn.

177. Davies, R. G. **The use of benzene adsorption isotherms in evaluating surface and pore characteristics of activated carbons.** *Chemistry & Industry* **1952**, 160-5.—*C.A.* **46**, 5928*c*.

Adsorption and desorption isotherms on 13 charcoals are detd. by passing air contg. a fixed partial pressure of C_6H_6 over the charcoal until const. wt is obtained. Surface area and heat of adsorption are calcd. from the Langmuir form of the B.E.T. equation and pore-size distributions from the Kelvin equation by using the desorption branch of the isotherms. Hysteresis begins in all cases at a vapor pressure corresponding to a capillary radius of about 14 A. The decolorization of molasses depends on the presence of pores of radius in the range 20-40 A. as well as the area. Charcoals prepd. from certain nutshells contain relatively fine pores, those from briquetted coals larger pores, and those from wood, lignite, and different type nutshells still larger pores.

178. Dryden, I. G. C. **Thermodynamic functions of the coal ethylenediamine system.** *Chemistry & Industry* **1952**, 193-5.—*C.A.* **46**, 5817*b*.

The thermodynamic properties of the coal ethylenediamine system are detd. from available data. The "adsorption" isotherm at 25°C appears to consist of 3 parts: chemisorption (up to 7% adsorbed), normal phys. adsorption, and the process of soln. and diln. Abs. values of Gibbs function, heat function, and entropy are tabulated. The system appears to resemble the agar—agar—water system rather than the "regular" polymer-solvent system such as rubber and benzene.

179. Dubinin, M. M. **Influence of a porous structure of the adsorbents on the form of the adsorption isotherm of vapors.** *Doklady Akad. Nauk S.S.S.R.* **84**, 539-42 (1952).—*C.A.* **46**, 9378*a*.

The previously reported coincidence of adsorption isotherms referred to unit surface area of MeOH vapor and of N_2 on different adsorbents was evidence of the preponderant role of the electrostatic factor in the adsorption of these mols. on various silica gels. With C_7H_{16}, the dispersion factor became significant, and hence, on account of the increase of the adsorption potentials in fine pores, the adsorption was higher on a fine-pore gel. In contrast to the polar silica gels, phys. adsorption even of polar org. mols. on the nonpolar active carbon was due mainly to dispersion interaction. In active carbons with well-developed micropores, adsorption isotherms for carbons with different micropore dimensions could not coincide. In carbons with the dimensions of micropores approaching those of intermediate pores, adsorption isotherms should coincide and this was actually observed.

180. Evdokimov, V. B.; Ozeretskovskii, I. N., and Kobozev, N. I. **Paramagnetism of catalytically active layers of iron.** *Zhur. Fiz. Khim.* **26**, 135-44 (1952).—*C.A.* **46**, 9960*g*.

Magnetic properties of adsorbed iron on sugar charcoal are studied by the Faraday method. Samples are prepd. by impregnating the charcoal with $Fe(CO)_5$ in abs. ether, decompn. of the carbonyl, and subsequent reduction in H_2 at 400-450 °C. Surface coverage θ is varied between 0.000052 and 1.0. Up to $\theta = 0.005$, the magnetic susceptibility does not depend on field strength. From $\theta = 0.118$ upward, a weak ferromagnetism becomes apparent; the latter becomes pronounced at $\theta = 0.86$. Crystn. takes place during oxidation of the sample, as shown by the magnetic susceptibility after subsequent reduction. Anomalously high values per g are measured when θ decreases, for $\theta \sim 10^{-3}$, 6×10^{-3}. This effect is also observed with dil. monolayers of $Ni(NO_3)_2 \cdot 6H_2O$ on charcoal.

181. Griffiths, J.; James, D., and Phillips, C. **Adsporption and partition methods. Gas chromatography.** *Analyst* 77, 897-904(1952).—*C.A.* 47, 1530*b*.

Examples are given of the chromatographic sepn. and analysis of volatile org. mixts. from charcoal columns at 100°C with results within 1%. An account is also given of some elution analyses by the use of partition columns. The sepns. have been followed by a thermal-cond. cell, but a most promising device depends on surface-potential changes and is sensitive to extremely low concns. of vapor and enables gas-chromatographic methods to be extended to relatively nonvolatile materials.

182. Kadaner, D. G.; Luk'yanovich, V. M., and Radushkevich, L. V. **Adsorption and capillary condensation of vapors on non-porous carbon black.** *Doklady Akad. Nauk S.S.S.R.* **87**, 1001—4 (1952).—*C.A.* **47**, 6734*f*.

Calcns. of the relative roles of adsorption and of capillary condensation of C_6H_6 were made for a lampblack, heated at 1000°C in H_2, with spherical particles ranging from 800 to 3000 A. in diam. (mean 1600 A.) and surface area 19.4 m^2/g. On pelleting under pressure, the porosity increased up to 0.41 under 800 atm., and then remained const. up to 5000 atm. With a model consisting of 160 smooth paraffin-coated balls of 9 mm diam., compressed to the same porosity of 0.41, the av. no. of contacts per sphere was found to be 8. On that basis, it was estd. that up to relative pressures of 0.5, sorption of C_6H_6 on the pelleted carbon black consisted predominantly of adsorption on the free surface.

183. Koble, Robert A. and Corrigan, Thomas E. **Adsorption isotherms for pure hydrocarbons.** *Ind. Eng. Chem.* **44**, 383—7 (1952).—*C.A.* **46**, 5398*d*.

Published data for the range 180° to 480°C show that the concn. C_A of CH_4, C_2H_6, C_3H_8 C_2H_4, C_3H_6, and C_4H_{10} on activated charcoal can be represented by the equation $C_A = LKp^n/(1 + Kp^n)$, where p is the pressure of the adsorbate and L, K, and n are consts. A logarithmic plot of $(1/C_A) - (1/L)$ against $1/p$ is made linear by proper selection of L. The consts. n and L are independent of temp.; n is in the range 0.5 to 1 for the hydrocarbons adsorbed. Log K is linear with $1/T$.

184. Malherbe, P. le R. and Carman, P. C. **Swelling of coals by methanol and its significance.** *Fuel* **31**, 210-19 (1952).—*C.A.* **46**, 4764*c*.

A study was made of adsorption of O_2, Freon-12, MeOH, and methylamine on a single coal sample up to high relative pressures. The results with Freon-12 and C_4H_{10} confirmed those for low-temp. gas adsorption, giving an internal surface of a lower order of magnitude than by heat of wetting in MeOH. MeOH sorption was completely different in character and was in accord with expectation from heats of wetting. Sorption of water vapor and of MeOH vapor by coal was closely analogous to sorption of water vapor by proteins, starch, and other high polymers and should be interpreted similarly as sorption at definite sites, presumably where H-bonds could be formed. Methylamine could not only form H bonds, but could also form salt links so that it should be strongly chemisorbed. Hence, methylamine was much more strongly sorbed than MeOH, thus producing much greater swelling.

185. Minchin, L. T. **Methane from coal mines.** *Coke and Gas* **14**, 93-6, 131-5, 167-73 (1952).—*C.A.* **46**, 7305*c*.

The occurrence of CH_4 in coal mines and its liberation during mining operations is discussed. The transformation of wood to coal, the adsorption of CH_4 by coal, and the availability and compn. of CH_4 are reviewed. The more important methods of extn. employed on the Continent and in England include boreholes in the roof, headings in the overlying seam, pack cavities, drainage from underlying virgin seam, and drainage of old workings and blowers. The uses of CH_4, cracking plant, colliery boilers, power for compressor stations, gas for road transport, and coke ovens are reviewed.

186. Smith, R. Nelson. **Phase transitions in surface films on solids.** *J. Am. Chem. Soc.* **74**, 3477-9 (1952).—*C.A.* **46**, 10779*h*.

Isotherms of heptane on Fe_2O_3 and graphite were redetd. at several temps. by a gravimetric method and with a McLeod gage. No evidence of the phase transitions was found for either system.

I-3. Carbon Dioxide on Carbon Adsorbents

187. Wicke, E. and Kallenbach, R. **Surface diffusion of carbon dioxide in activated charcoals.** *Kolloid-Z.* **97**, 135-51 (1941).—*C.A.* **37**, 814³.

Sintered glass, granulated clay and granules of medicinal, activated charcoal were cemented into glass tubes. A mixt. of N_2 and CO_2, at a const. partial pressure of CO_2 (100 mm), was kept flowing by one side of the diffusion plug. A second stream (N_2) swept the CO_2 away from the other side of the plug, the CO_2 content of the resulting mixt. being detd. in a sensitive heat-conducting app. empirically calibrated. The N_2 partial pressure varied from 0 to 660 mm, the temp. from 0° to 300°C. The transport in the sintered glass took place mainly by normal diffusion except at low pressures, whereas Knudsen flow prevailed in the granulated clay below 1 atm. The charcoal was intermediate in behavior. Similar measurements on two technical activated charcoals gave isotherms and isobars which showed that in this case surface diffusion accounted for an appreciable part of the total transport.

188. Hoehne, Karl. **Determination of the reactivity of coke.** *Gluckaüf* **79**, 166-70 (1943).—*C.A.* **37**, 6111⁴.

The continuous measurement of the reactivity of coke towards CO_2 was detd. The method depended upon the action of CO_2 on hot coke, whereby CO was formed. An equil. was reached and the amt. of unchanged CO_2 measured. The ratio of changed to unchanged CO_2 in percentage was designated as reactivity. Samples of coal having various origins were tested.

189. VREEDENBERG, H. A. AND NOUHUYS, H. L. VAN. **The adsorption of carbon disulfide vapor and water vapor by active charcoal.** *Rec. trav. chim.* **65**, 235-45 (1946) (in English).—*C.A.* **40**, 6931^7.

The isotherms and rates of adsorption of CS_2, H_2O, and mixts. of the two were measured for Norit charcoal. From a mixt. contg. 0.0068 and 0.95 relative pressures of CS_2 and H_2O, resp., in air, the total CS_2 adsorption went through a max. and then decreased, whereas the adsorption of the H_2O increased continually with time. All exptl. results were explained by a theory differing from that of Langmuir by the assumption that the rate of desorption of mols. was proportional both to the fraction of the surface covered and to (1-x), where x is the relative pressure of the adsorbate.

190. MUNEMORI, MAKOTO. **Adsorption of carbon dioxide by charcoal in water.** *Science Repts. Tohoku Univ.* **35**, 165-72 (1951).—*C.A.* **46**, 9931d.

The adsorption of CO_2 at 400 mm Hg at 0°C in the absence of water was about 64, 47, and 39 cc. per g of grainy charcoal (probably Norit), a com. active charcoal, and Kahlbaum's active charcoal, resp.; the corresponding values in the presence of water were about 12, 8.5, and 7 cc., resp. For these 3 charcoals 2, 2.5, and 3.4 cc. of water per g of charcoal, resp., were used. The adsorption data obeyed the Freundlich adsorption equation over the 30 to 730-mm pressure range covered. Calcd. heats of adsorption based on runs at 0° and 30°C showed heat values of 5.8 to 5.6 kcals. per mole in the absence of H_2O and 6.3 to 6.7 in the presence of H_2O.

191. SIDILLO, MICHAL AND PIOTROWSKI, TADEUSZ. **Adsorption of the carbon dioxide by coals of the Lower Silesia coalfield.** *Prace Glównego Inst. Górnictwa, Komun.* No. **87**, 7 pp. (1951) (English summary).—*C.A.* **46**, 11631*a*.

Coals originating from seams, where frequent outbursts occurred, showed great tendency towards CO_2 adsorption. These tendencies were shown especially by soft and brittle coals of high vitrain content. Coals of low volatile content behaved similarly. Adsorption and desorption detd. in autoclaves under pressure gave different curves for various coals. Under atm. pressure coals ceased to adsorb CO_2 at 90°C. The rate of desorption increased with the decrease of size of the grain.

192. BERING, B. P. AND SERPINSKII, V. V. **Adsorption of mixtures of gases. I. Adsorption of ethylene and carbon dioxide on active carbon.** *Zhur. Fiz. Khim.* **26**, 253-69 (1952).—*C.A.* **47**, 4683*i*.

Adsorption separately and in mixts. at 25.4°C was measured in the equil. total pressure range from 0 to 300 mm Hg (thermocond. analysis of the gas phase). C_2H_4 was adsorbed more abundantly than CO_2. Adsorption of CO_2 was described by a Freundlich isotherm, $a_1 = 0.0197\ p_1^{0.656}$, where the amt. adsorbed was expressed in millimoles/g, and the pressure p in mm Hg. The adsorption of C_2H_4 was not described by a Freundlich isotherm. Langmuir-type equations did not apply accurately. Very good agreement was found with the equation $\log a = [\log(W_0/b)] - 0.434 \times 20.8\ k(T^2/\beta^2)\ [\log(31.4\ T/bp)^2]$, where b was the van der Waals const., and β the affinity coeff. of the characteristic curve of the gas relative to a standard gas. The less adsorbable gas (CO_2), even at high concns., lowered the adsorption of the more adsorbable gas (C_2H_4) only slightly; but even small amts. of the more adsorbable gas lowered considerably the adsorption of the less adsorbable gas and also brought the adsorption isotherm closer to linear.

193. GORING, G. E.; CURRAN, G. P.; TARBOX, R. P., AND GORIN, EVERETT. **Kinetics of carbon gasification by steam. Effect of high temperature pretreatment on reactivity of low temperature char to steam and carbon dioxide.** *Ind. Eng. Chem.* **44**, 1051-7 (1952).—*C.A.* **46**, 7733*h*.

By using the integral gasification rate by steam or CO_2 at 1600°F and 1 atm. as an index of reactivity, the effect on a low temp. char of various pretreatment times (0 to 24 hrs) in N_2 at 1600°F was detd. Differences in gasification rate of over twofold were observed, although the differences diminished asymptotically with increasing pretreatment time. All exptl. work was carried out in a fluidized bed, operated batchwise with respect to the charge of 65- to 150-mesh char and continually with respect to the fluidizing gas.

194. GULBRANSEN, EARL A. AND ANDREW, KENNETH F. **Reactions of artificial graphite. Reaction of carbon dioxide with pure artificial graphite at temperatures of 500° to 900°C.** *Ind. Eng. Chem.* **44**, 1048-51 (1952).—*C.A.* **46**, 7734*g*.

The reaction of graphite with CO_2 at 500°C and 7.6 cm Hg corresponded to the formation of 1/40th or less of a monolayer of surface oxide. Elemental Fe greatly accelerated this reaction. Preoxidation was found to change the initial rate of reaction with only a minor effect on the long-term reaction. The surface oxide observed on degassing was not a preliminary step in the reaction.

I-4. Water Vapor on Carbon Adsorbents

195. SCOTT, G. S. **Mechanism of the steam-carbon reaction.** *Ind. Eng. Chem.* **33**, 1279-85 (1941).—*C.A.* **35**, 7806^6.

Published data are reviewed. It is probable that the initial reaction is $C + 2H_2O = CO_2 + 2H_2$, though some of the data appear to disagree with this interpretation. Possible causes of disagreement among the various data are discussed. The most logical first step for further research would be a crit. study of lab. methods.

196. DUBRISAY, RENE AND AMPHOUX, BERNARD. **Separation of volatile liquids by selective adsorption.** *Compt. rend.* **215**, 157-9 (1942).—*C.A.* **38**, 6155^7.

An aq. alc. soln. was distd. and the vapor passed over active charcoal and then condensed (liquid A). The adsorbed vapors were desorbed by heating in a vacuum then condensed (liquid B). "A" contained less, "B" more, alc. than the original vapor. The enrichment of "B" in alc. was caused by a more rapid rate of adsorption of alc. as compared with water.

197. Warner, B. R. **Mechanism of the steam-carbon reaction.** *J. Am. Chem. Soc.* **65**, 1447-51 (1943).—*C.A.* **37**, 5640^8.

The primary products of the reaction were CO and H_2; CO_2 was formed from the water-gas reaction which reached or tended to reach equil. The rate of gasification was governed by an adsorption isotherm for the steam, and a steam satn. pressure existed (its value depended on the carbon and the temp.) above which the rate of gasification at a given temp. became const. The postulated reaction scheme was: $C + H_2O \rightleftarrows C, (H_2O)_{ads.} \rightleftarrows (CH_2O)_{ads.} \rightleftarrows CO + H_2$, and $CO + H_2O \rightleftarrows (CO)_{ads.}(H_2O)_{ads.} \rightleftarrows (HCO\text{-}OH)_{ads.} \rightleftarrows CO_2 + H_2$.

198. Emmett, P. H. and Anderson, R. B. **The adsorption of water vapor on carbon black.** *J. Am. Chem. Soc.* 67, 1492-4 (1945).—*C.A.* **39**, 5149^7.

Evacuation of two typical carbon blacks at 1000 to 1200°C so altered the nature of their surfaces as to yield water adsorption isotherms resembling those found for steam-activated charcoal. However, N_2 adsorption isotherms before and after this evacuation showed that the samples did not develop porosity and did not increase their surface areas during degassing.

199. Courty, Clément. **The penetration of water into active charcoal.** *Compt. rend.* **222**, 880-2 (1946).—*C.A.* 40, 5317^3.

Gas-mask charcoal that had been dried to const. wt at 110°C and subjected to vacuum at room temp. adsorbed 0.08% O_2 in 1 month; the same charcoal if satd. with H_2O before being subjected to vacuum at room temp., adsorbed 2.2% O_2 in the same time. Four different samples of gas-mask charcoal were dried to const. wt at 110°C and then held in an atm. of 90% relative humidity for 2 yrs. The samples were removed and dried to const. wt at 110°C at the end of each 3-month period, and then returned to the humid atm. The dry wts decreased gradually. The total loss in wt was 0.2-1.2% at the end of 2 yrs.

200. Courty, Clément. **The slow penetration of water vapor into active carbon.** *Compt. rend.* **222**, 1385-6 (1946).—*C.A.* 40, 5976^9.

Data were presented on the quantity of water adsorbed, the quantity lost on later drying, and the quantity of air displaced during humidification or adsorbed during drying. The coeff. of magnetization of the active carbon was greater as more air was adsorbed. Magnetic measurements are of value in a study of adsorption.

201. Fineman, M. N.; Guest, R. M. and McIntosh, R. **The pore structure and adsorptive properties of some activated charcoals. I. The adsorption of water vapor and its dependence on pore size.** *Can. J. Reserach* **24B**, 109-23 (1946).—*C.A.* 40, 7573^2.

The influence of the structure of charcoal adsorbents on the form of the water-adsorption isotherm was studied by detns. of (1) surface areas of a series of charcoals of varying degrees of activation (N_2 and butane as adsorbates); (2) total pore vol. of each adsorbent by d. measurements in He and in Hg; (3) d. of adsorbents when immersed in water; (4) adsorption isotherms for water vapor; and (5) surface areas of charcoals partly satd. with water vapor. Certain very small and certain very large voids in charcoal were not occupied by water vapor at any relative pressure. Estimates of the submicro, micro, and macro pore sizes showed fair agreement when these are based upon either the capillary condensation theory or measurements of the total area and vol. of the charcoal pores.

202. Givaudon, J.; Delion, R. and Boivin, C. **The relation between the volatile content of charcoals and their capacity for adsorbing atmospheric humidity.** *Ann. mines & carburants, Mém.* **135**, 104-12 (1946).—*C.A.* 40, 6788^9.

The adsorption of H_2O from air, satd. at 25°C was studied. Charcoals prepd. in the woods from pine and a leafy wood and similar factory-prepd. samples were used. The charcoal was heated until the volatile content was at a predetd. value between 23% to 2.5%. The initial moisture adsorption rate was higher for samples of high volatile content. The adsorption rate of sample of low volatile content became much higher after 6-8 hrs. The equil. was usually reached in 28-32 hrs; sample of low volatile content showed greatest adsorption in all cases.

203. South Metropolitan Gas Co. **Moisture sorption of coals and its relation to their coking quality.** *Fuel* **25**, 42-50 (1946).—*C.A.* **42**, 5644h.

The agglutinating, coking, and swelling properties of a coal depended largely on the sorptive power of the infusible humic components for the "resinic" components during the fusion stage of the latter. If the sorptive power was naturally high, or if it was increased by slight oxidation (activation, weathering), the plastic stage, and thence the tendency to cohesion, was partly or wholly suppressed by sorption of the fused material.

204. Dubinin, M. M. and Zaverina, E. D. **Sorption and structure of active carbons. II. Sorption of water vapor.** *J. Phys. Chem.* **21**, 1373-86 (1947) (in Russian); *Doklady Akad. Nauk S.S.S.R.* **56**, 715-18 (1947).—*C.A.* **42**, 5299*f*; 44, 8194*i*.

The adsorption of H_2O vapor by carbons B-1 and B-2 and by a nonporous carbon from CO was reversible. Hysteresis was more pronounced with other carbons which had greater pore vol. The H_2O adsorption of porous carbons increased first very little and then rapidly. Except for specimens with very fine pores, the "hydrophobicity" increased with the pore vol. and with the temp. of activation (850° and 1000°C). Also, the liquid vol. of H_2O adsorbed at 20°C from vapor was almost identical with the vol. of micropores detd. by means of MeOH. The adsorption of H_2O by the carbon from CO agreed with B.E.T. between $p = 0.3$ and $p = 0.65$. A carbon was oxidized by moist air at 350°C adsorbed NaOH; when heated to 950°C it did not. Oxidized charcoals were less hydrophobic.

205. Dulhunty, J. A. **Determination of maximum inherent moisture in coal by controlled vaporization of adherent moisture.** *J. Proc. Roy. Soc. N. S. Wales* **81**, 60-8 (1947).—*C.A.* **42**, 4325h.

Values of capillary-held moisture in coals of all rank and texture from peat to nathracite were obtained. Maintaining wet coal at a const. temp. (± 0.01°) in an atm. of water vapor and approx. satd. air, under pressure which just vaporizes water, caused vaporization of adherent moisture. Inherent moisture with subnormal vapor pressure will remain in the coal and can be detd. by drying at 105°C in a current of dry N_2. The method is recommended for standardizing more simple industrial lab. tests.

206. Imada, Fusao. **Carbons. XVIII. The sorption of mixtures of gases.** *Kogaku Iho, Kyushu Univ.* **19**, 247-55 (1947).—*C.A.* **47**, 5819i.

In addn. to the sorption of H_2 on active carbon, the sorption of air and H_2O was investigated. The mechanism of electromotive reaction of the dry air-cell was discussed qualitatively on the basis of the quantum theory.

207. Strickland-Constable, R. F. **Interaction of steam and charcoal at low pressures.** *Proc. Roy. Soc. (London)* **A189**, 1-10 (1947).—*C.A.* **42**, 1481i

The reaction was studied up to 700°C and at pressures of less than 1 mm. Water vapor, H_2, and CO were reversibly adsorbed. H_2 was adsorbed strongly and rapidly; CO was adsorbed in considerably smaller quantity and much more slowly. When charcoal reacted with water vapor at low pressures, the pressure fell during the rapid initial adsorption of the water vapor, and subsequently rose during the desorption of the product gases. The kinetics of the reaction at higher pressures was explained on the basis of the adsorption data. Reasons were given for supposing that the water vapor was adsorbed as H_2O. When water vapor is allowed to react with a charcoal previously outgassed at a much higher temp., the water adsorbed and the pressure fall to a very low figure. The water in the absorbed condition reacts to form CO and H_2 but these are likewise retained by strong adsorption on the surface.

208. Terent'ev, A. P.; Kadaner, D. G., and Kopchenova, Yu K. **Determination of active hydrogen by Grignard reagents in a carbon dioxide atmosphere. V. Determination of moisture in technical products.** *J. Gen. Chem. (U.S.S.R.)* **17**, 913-16 (1947).—*C.A.* **42**, 1527b.

The active H-detn. was used successfully to det. moisture in tech. products. MeMgI was used in 2.5 N concn. in dry Et_2O: Place 0.1-0.05 g of sample in the reaction flask, cover with 1-3 cc. dry Et_2O, and carry out the detn. as described. Activated charcoal gave, after satn. with H_2O vapor, 19.2% H_2O by drying at 110°C, 19.0% H_2O by drying over H_2SO_4, and 22.02-22.3% H_2O by the MeMgI method. Charcoal heated to 800°C failed to show H_2O by any method.

209. Campardou, J. **The decomposition of water by the metalloids. III. Special case of carbon.** *Bull. Soc. chim. France* **1948**, 364-9.—*C.A.* **42**, 5789e.

Carbon reacted endothermically with water vapor at 700-1100°C to give H_2, and either CO_2 or CO, or both; it also reacted exothermically below 500°C to yield CH_4 and CO_2. Occluded gas must first be eliminated by prolonged treatment with a current of steam at 300°C. At 420°C a continuous evolution of gas was obtained which contained 20-30% CH_4, 50-55% CO_2, and a little H_2 and CO. Natural fuels treated similarly gave a mixt. of liquid and solid hydrocarbons, mostly saturated, comparable to natural petroleum.

210. Dubinin, M. M. and Zaverina, E. D. **Sorption of water vapor on active carbons.** *Doklady Akad. Nauk S.S.S.R.* **61**, 79-82 (1948).—*C.A.* **42**, 8575*e*.

Shift of the steep portion of the S-shaped adsorption isotherm to higher relative equil. pressures, as a result of progressive activation and decrease of the differential heat of adsorption, was brought about by preliminary adsorption of small amts. of readily adsorbable vapors, blocking the region of the finest micropores. Such shifts, increasing with the amt. of C_6H_6 preliminarily adsorbed at 20°C were observed on carbon, pure and with 0.535, and 1.96 millimoles C_6H_6/g; with increasing amt. of C_6H_6 the adsorption-desorption hysteresis loops increased in width and area. Along the initial portions of the isotherm, H_2O can be desorbed completely by evacuation at 20°C, but only on prolonged evacuation did desorption of C_6H_6 become noticeable; it was quant. only at 450°C. The shift to lower pressures, due to the formation of new micropores, was observed after de-ashing, by extn. with HCl and HF, followed by washing and drying, of granulated anthracite activated with H_2O at 850°C. The max. amts. of H_2O adsorbed coincided for all samples with the vols. of the micropores.

211. Emmett, P. H. **Adsorption and pore-size measurements on charcoals and whetlerites.** *Chem. Revs.* **43**, 69-148 (1948).—*C.A.* **42**, 7598*g*.

The B.E.T. method appeared to yield reliable surface areas for finely-divided or coarsely-porous solids. Take-up of H_2O vapor by activated charcoals was a combination of adsorption and capillary condensation at relative pressures above 0.5; its desorption was invariably accompanied by marked hysteresis. The decrease in surface area with H_2O in the sample yielded a pore distribution ranging from 16 to 500 A. These curves for several hundred charcoals joined smoothly those obtained by a Hg porosimeter for the range 1000-150,000 A. Steaming, hydrogenation, or oxidation by air (with or without impregnation by oxides of Fe, Cr, Ni, and Cu) modified a given charcoal to a great variety of pore distributions. Surface complexes on charcoal differed in the temp. at which they can be removed in the range 25-1000°C. Surface complexes formed with Cl and S were tightly held and profoundly affected the adsorptive properties. H_2S, PH_3, CNCl, BF_3, HCl, C_2H_2, and NO on A-whetlerites reacted in excess of a monolayer even at room temp.; H_2S, CNCl, BF_3, and HCl reacted rapidly with the entire mass of CuO. CO, SO_2, H_2O, C_2H_2, and NH_3 were chemisorbed to less than a monolayer on the CuO in the whetlerite.

212. Kramer, W. J. and McKee, J. H. **The drying of coal.** *Bull. Brit. Coal Utilisation Research Assoc.* 12, 157-75 (1948).—*C.A.* 42, 9113g.
The occurrence of water in coal is reviewed and the nonthermal and thermal methods of drying described.

213. Lyons, Orville R. and Richardson, A. C. **The thermal drying of fine coal.** *Am. Inst. Mining Met. Engrs. Coal Technol.* 3, No. 3, Tech. Pub. No. 2399, 23 pp (1948).—*C.A.* 42, 9113f.
Factors considered as affecting the drying rate of 24 driers were surface moisture of the wet and dried coal, wt of inlet gases, temp. of inlet and exhaust gases, and the av. particle size of the coal being dried. The total heat input to the furnace per unit wt of H_2O removed in the drier was found to correlate with most of the factors thought to influence drier effectiveness, and apparently was a usable indicator of drier effectiveness.

214. Dubinin, M. M. and Zaverina, E. D. **Sorption and structure of active carbons. III. Alteration of the porosity characteristics of carbon and sorption of water vapor.** *Zhur. Fiz. Khim.* 23, 57-70 (1949).—*C.A.* 43, 4075g.
Charcoal contg. adsorbed dibutyl phthalate adsorbed less C_6H_6 than did the original. If the vol. of H_2O (as liquid) adsorbed by charcoal at 95% relative humidity is a_o and the vol. of contaminating C_6H_6 (as liquid) is a_1, the vol. of H_2O adsorbed by the contaminated charcoal is approx. $a_o - a_1$. The ash of an anthracite charcoal had a very small adsorption capacity. Dissolving away the ash of the charcoal increased a_o.

215. Johansson, C. H.; Persson, G., and Svensson, Borje. **Sorption in flow through a granular layer.** *Acta Polytech. No.* 29 (Chem. Met. Ser. 1, No. 7), 5-31 (1949) (in English); *Ing. Vetenskaps Akad. Handl. No.* 200.—*C.A.* 43, 6872*h*.
The flowing medium contained a low concn. of one component taken up in the granular layer by pure phys. sorption, so that change in flow velocity and heat of sorption could be disregarded. Exptl. detns. were made at 18°C of the sorption of chloropicrin and water vapor in activated charcoal and of water vapor in silica gel. Complete analyses by isotherms and isochrones were given. The process was studied for an isotherm concave towards the abscissa and for a linear isotherm. The sorption process was to a large degree dependent on the form of the isotherm and on the position of the operating point on the isotherm.

216. Ledoux, Edward. **Redistribution of adsorbate by diffusion.** *J. Phys. & Colloid Chem.* 53, 960-6 (1949).—*C.A.* 43, 7288f.
The redistribution of H_2O in a bed of charcoal was expressed mathematically. By expressing data for known systems in terms of dimensionless variables, it was possible to det. the diffusivities in other systems.

217. Pearse, J. F. Oliver, T. R. and Newitt, D. M. **The mechanism of the drying of solids. I. The forces giving rise to movement of water in granular beds during drying.** *Trans. Inst. Chem. Engrs.* (London) 27, 1-8 (1949).—*C.A.* 46, 6870i.
The theoretical aspects of moisture movement in granular solids is discussed and an over-all equation developed based upon the assumption that the movement was due to capillary, gravitational, and frictional forces acting on the liquid. Exptl. data were presented which indicated that, while the theoretical treatment was applicable to relatively coarse granular solids, it was not equally valid for beds composed of fine particles. This limitation might be due to vaporization of H_2O within the bed arising from the high suctions developed.

218. Wiig, Edwin O. and Juhola, A. J. **Adsorption of water vapor on activated charcoal.** *J. Am. Chem. Soc.* 71, 561-8 (1949).—*C.A.* 44, 402*c*.
As successive increments of water were adsorbed, activated charcoal underwent an initial contraction followed by an expansion such that the original length was exceeded. The d. of water adsorbed at 24°C on two activated charcoals was less than normal and decreased with decrease in relative pressure. Both observations were in qual. agreement with the assumption of capillary condensation of the water.

219. Courty, Clément. **Magnetic measurements applied to adsorption.** *Compt. rend.* 230, 745-7 (1950).—*C.A.* 44, 5661g.
The adsorption of water and air on activated charcoal was studied by measuring the magnetic susceptibility of the adsorbent contg. air and water. The value for pure water, -0.72×10^{-6}, was found const. for adsorbed water also. The value for air, $+24.16 \times 10^{-6}$ decreased slowly to $+14.94 \times 10^{-6}$ at 20°C.

220. Ettinger, I. L. **Sorption of carbon dioxide by mineral coal.** *Izvest. Akad. Nauk U.S.S.R., Otdel. Tekh. Nauk* 1950, No. 5, 721-8.—*C.A.* 45, 9991*h*.
In the sorption of purified CO_2 by coal, by the static vol. method, the temp. was maintained to within 0.1°C. Previously the coal to be used had been subjected to a vacuum of 10^{-4} mm and at a temp. of 60-70°C. Thirty samples of coal from 4 basins were studied, ranging from long-flame coal to anthracites. Sorptions were studied at 20°, 30°, and 40°C and at 50-900 mm Hg. Other expts. were performed using graphite as the sorbent. The formula of Langmuir was valid for the sorptions carried out. The sorption of CO_2 by coal was of a purely phys. nature and was 3.5-4.5 times greater than that of CH_4, and 15-20 times greater than that of N_2.

221. Hendry, R. and Scott, A. W. **Some fundamental aspects of air-drying of solids.** *J. Inst. Fuel* 23, 286-94 (1950).—*C.A.* 45, 399*d*. The properties of air-water vapor mixts. were summarized. The construction of the psychrometric chart and its application to the analysis of drier performance were outlined. Different methods of presenting exptl. data on drying were described, and consideration given to application of such data to the calcn. of drying times in full-scale driers.

222. Kurbatov, L. N. **The dielectric properties of adsorbed vapors.** *Zhur. Fiz. Khim.* 24, 899-912 (1950).—*C.A.* 45, 1398*f*.
The orientation polarization of adsorbed dipolar mols. of little vibration and free rotation of

the dipole within a limited space was detd. The adsorption study was made by measurement of the dielec. const. of the adsorbate. The transition from single-layer to double-layer adsorption was accompanied by a change in the dielec. properties. The degrees of polarization of Me_2CO and H_2O were calcd. and these values interpreted in terms of the derived formula.

223. McDermot, H. L. and Tuck, N. G. M. **Density of water sorbed on charcoal.** *Can. J. Research* **28B**, 292-7 (1950).—*C.A.* 45, 1404*d*.
The apparent vol. of water sorbed by a $ZnCl_2$-activated charcoal was greater over the whole course of the isotherm than the vol. of an equal wt of water in the liquid state. It was slightly higher on desorption than on adsorption. The app. used was designed to eliminate water carry-over and subsequent sorption.

224. Razouk, R. I. and El Gobeily, M. A. **The expansion of charcoal on the adsorption of gases and vapors.** *J. Phys. & Colloid Chem.* **54**, 1087-98 (1950).—*C.A.* 45, 3220*i*.
The expansion of a piece of willow-wood charcoal was measured with a silica extensometer as a function of the adsorption of MeOH at 25°C; CO_2 at -78°, -38°, 0°, and 25°C; NH_3 at -78°, -38°, 0°, and 30°C; O_2 at -185° and -78°C; and SO_2 at 0°C. The expansion was found to be proportional to the lowering of surface free energy accompanying the adsorption. The proportionality const. was independent of temp. and of the adsorbate. The adsorbed films appear to be mobile. The surface of the charcoal was estd. to be 575 m^2/g; the amt. of adsorption in all cases corresponded to less than a monolayer.

225. Belcher, R. and Mott, R. A. **Observations on the inefficacy of a desiccator in determining the moisture in coal.** *J. Applied Chem. (London)* **1**, 204-9 (1951).—*C.A.* **45**, 7773*h*.
Dried coal in an uncovered dish in a desiccator absorbed moisture regardless of the efficiency, age, or location of the desiccant used. The amt. of moisture absorbed increased with the time of standing after cooling. The rate of adsorption increased markedly as the particle size decreased to about 100 mesh, but remained almost const. with further reduction in particle size. Dried coal in dishes covered with well-fitting lids adsorbed only slight amts. of moisture whether they were in the open air, an empty desiccator, a desiccator contg. water, or a desiccator contg. silica gel, and there was little difference in the rates of adsorption of water by the coal.

226. Carpeni, Georges. **Interpretation of the dielectric absorption curves ϵ'' of adsorbed water in the kilometer-wave range. I. Relations and numerical data. II. Determination of the real surface and the point of rupture of the adsorbent.** *Compt. rend.* **233**, 158-60, 249-51, 309-11 (1951).—*C.A.* 46, 3351g.
The curves ϵ'' (T) presented 2 bands, one of which was independent of the degree of hydration (abscissa fixed at approx. -100°C), while the other varied with hydration. Linear relations existed between hydration and the intensities of both bands. The sum of the band heights was const. The exptl. detn. of the absorption, ϵ'', as a function of temp. and of the degree of hydration of the adsorbent permitted, on the basis of the relations previously established and through linear extrapolation, the evaluation of 2 consts.: the active surface and the point of rupture of the adsorbent.

227. Davies, D. A. **Artificial stimulation of rain at Kongwa.** *Nature* **167**, 614 (1951).—*C.A.* 45, 8306d.
The expts. were based on the principle that AgI particles may act as sublimation nuclei in supercooled clouds. Two methods were used, namely: (1) charcoal impregnated by immersion in an acetone soln. of AgI is burned in a ground generator relying on natural vertical currents to convey the particles to levels where they become effective; and (2) the AgI particles are produced by explosion of small charges of gunpowder. Each charge was carried into suitable clouds by H_2-filled balloons, the explosion being effected by a time-fuse set to explode at about 15,000 ft, the freezing level.

228. Hills, D. C. and Holmes, C. R. **Moisture content of various coke sizes.** *Ind. Eng. Chem.* **43**, 1635-8 (1951).—*C.A.* 45, 8232i.
The moisture content of by-product coke tended to increase as the size of the coke decreased, with the exception that the moisture content decreased with the pea and breeze sizes. Hot coke when immersed in water until completely cool absorbs more moisture than does cooler coke. Decrease in size of coke is assocd. with increase in moisture due to the drying caused by the heat retained in the larger sizes. Explanations for the increase in dryness of the smaller sizes appear to be their segregation on the floor of the quenching car, and greater drying than intermediate sizes owing to heat from the larger sizes.

229. Honda, Hidemasa and Kurihara, Fukuji. **Fundamental studies on the manufacture of binderless briquet. X. Evaporation of moisture in pulverized coal by heating.** *J. Chem. Soc. Japan*, Ind. Chem. Sect. 54, 171-2 (1951).—*C.A.* 47, 1914i.
The change of wt accompanying heating was studied by means of a thermobalance for samples of different moisture contents. The evapn. of moisture starts at 60° and proceeds step by step at about 85°, 105°, and 125°C, resp. The combined water is driven off above 125°C and the coal begins to decomp.

230. Kreulen, D. J. W. **The adsorption water of coal.** *Chem. en Pharm. Tech.* (Dodrecht) 7, 23-4 (1951).—*C.A.* 46, 2778e.
Coal is satd. with H_2O, then exposed *in vacuo* at 30°C to a relative humidity of 97% (over satd. K_2SO_4 soln.). Moisture is then detd. by heating the coal in N_2 at different temps., 100-400°C. The loss in wt was const. until 250°C, when a rapid increase in loss occurred, indicating decompn. of the coal. The moisture detd. at 250°C was appreciably greater than that at 105°C. The temp. now used in the detn. of adsorption water is too low, especially for high-moisture coals.

231. Lecky, J. A.; Hall; W. Keith, and Anderson, Robert B. **Adsorption of water and methanol on coal.** *Nature* **168**, 124-5 (1951).—*C.A.* **46**, 11630e.

The true surface area of coal is probably not measured by adsorption of MeOH and H_2O, since these polar compds. are not physically adsorbed in the usual sense. Hence they are not amenable to the treatment for derivation of surface area.

232. Lyons, Orville. **Filter-cake particle size and moisture relationships.** *Trans. Am. Inst. Mining Met. Engrs., Tech. Pub.* No. **3165-F** (in *Mining Eng.* 3, 868-70) (1951).—*C.A.* **45**, 9921i.

Relations between the av. particle size of the cake and cake moisture (surface moisture for coal and total moisture for minerals) in dewatering fine solids by a variety of makes and types of filters are shown graphically.

233. Miller, H. M. S. **Drying of peat.** *J. Inst. Fuel* **24**, 49-50 (1951).—*C.A.* **45**, 4427b.

Water occluded or held mechanically in spongy peat can be removed by mech. pressure, but the capillary water was difficult to remove completely by mech. means. In thermal drying of milled peat of 55% moisture content, or sod peat of 35% moisture content, most colloidal and capillary water was removed. For economic reasons it was not practicable to remove water by thermal methods from peat with a moisture content above 60%. None of the methods so far devised for drying peat entirely by artificial heat were com. feasible.

234. Nadziakiewicz, Julian; Warmuziński, Janusz, and Balczewski, Antoni. **The influence of moisture content in coal on the coking process.** *Prezglad Górniczy* 7, 160-3 (1951).—*C.A.* **45**, 8741g.

A decrease in H_2O content of the coal from 9.6% to 8.3% reduced the coking time by 4.1%. A decrease from 10.4 to 8.3% H_2O raised the yield of crude benzene by 4.6%, of $(NH_4)_2SO_4$ by 6.6%, and of gas by 6.3%, while tar decreased by about 1.4%. Despite the lower H_2O content, no appreciable increase in fines occurred during the usual grinding of the coal charge to an 80% content of particles less than 3 mm size.

235. Nukherjee, P. N.; Basak, N. G., and Lahiri, A. **Chemisorption of moisture on coal.** *Fuel* **30**, 215-16 (1951).—*C.A.* **45**, 9242*h*.

Desorption and sorption isotherms of water vapor on coal indicated that, contrary to expectations, the amt. adsorbed increased with temp. Apart from oxidation, some other factor was involved which was responsible for increased sorption of moisture at progressively higher temp. The surface of the coal was activated by the rise of temp. and part of the moisture was held on the surface by chemisorption which increased with rise of temp. within the range investigated.

236. Pierce, Conway; Smith, R. Nelson; Wiley, J. W., and Cordes, H. **Adsorption of water by carbon.** *J. Am. Chem. Soc.* **73**, 4551-7 (1951).—*C.A.* **46**, 4317f.

H_2O isotherms were given for porous and nonporous carbons. A nonporous carbon adsorbed little H_2O as compared with other vapors, but activated charcoals hold nearly the same liquid vol. of H_2O as of other vapors. The net heat appeared to be zero for the initial adsorption of H_2O, then as more mols. were adsorbed, the net heat became pos. At elevated temps. the initial net heat of adsorption appeared to have a large neg. value. H_2 and CO_2 were produced in the reaction and some of the O_2 held as a surface complex, which increased the surface affinity for H_2O. An upturn in a H_2O isotherm below 0.95% p_0 appeared to be assocd. with the presence of capillaries. Water isotherms were used to detect capillaries in certain carbon blacks.

237. Wenzel, Leonard A. **The drying of granular solids in superheated steam.** *Univ. Microfilms* (Ann Arbor, Mich.), *Pub.* No. **2474**, 332 pp. (microfilm $4.15, paper enlargements $33.20); *Microfilms Abstracts* **11**, No. 2, 243-4 (1951).—*C.A.* **45**, 7387e.

238. Westlin, Arne. **The dehydration of peat.** *Tek. Tid.* **81**, 717-23 (1951).—*C.A.* **46**, 2779h.

Dry peat substance is essentially a colloidal org. material of extremely complex and variable compn. By virtue of its colloidal structure, adsorption plays a major role in its water-carrying properties and since heats of adsorption are of a lower order of magnitude than those of evapn., theoretically at least dehydration should be effected by desorption rather than by evapn. This can be done with reduction of swelling and filter pressure by adjusting pH to the optimum point; by adding org. liquids, e.g., acetone, MeOH and EtOH; by conditioning with salts and tannins and with filter aids in the form of peat dust or peat char; or even by freezing the hydrated mass. At present the only practical method for artificial drying is with air with either direct or indirect heating. In the main it is reserved for the final drying (below 25% water) of naturally dried peat; in other applications it cannot compete in cost. The most promising procedures are desorption followed by mech. pressing, use of superheated steam, and high-temp. extn. processes.

239. Aleksandrov, V. A.; Dubinin, M. M.; Zaverina, E. D.; Plachenov, T. G., and Chepurnoi, S. G. **The porous structure of active carbons.** *Doklady Akad. Nauk S.S.S.R.* **84**, 301-4 (1952).—*C.A.* **46**, 9377g.

In adsorption of H_2O vapor the micropore vol. is filled mainly as a result of capillary condensation; the coarser transition pores are not filled. The distribution of the micropore vol. over pore radii is detd. from the desorption branch of the isotherm for H_2O vapor. The differential distribution curves have a max. located for different active carbons between 1.1×10^{-7} and 2.5×10^{-7} cm. One active carbon sample showed a max. at $r = 1.8 \times 10^{-7}$ cm corresponding to micropores with a vol. $v = 0.19$ cc./g and a sp. surface area $s = 240$ m^2/g; 2nd max., at $r = 1.4 \times 10^{-6}$, $v = 0.49$, $s = 150$, corresponds to intermediate pores; 3rd max., at $r = 7.9 \times 10^{-5}$ cm, $v = 0.43$, $s = 1.9$, corresponds to coarse pores. In general, active carbons have all 3 types of pores. In many kinds of carbons, the vol. of intermediate pores is very small; on activation, micropores go over into intermediate pores, and the micropore vol. may become very small.

240. Dubinin, M. M. **Porous structure of adsorbents.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* **1952**, 577-82.—*C.A.* 47, 940*b*.

Active carbons show 3 types of porosity. Macropores may attain a few thousandth of a cm; the surface area does not exceed 1-2 m^2/g. Intermediate pores, visible under an electron microscope, can be derived from the hysteresis in desorption-adsorption of org. vapors; the most frequent diams. of these pores lie between 70 and 170 A., and their surface depending on the pore vol., can vary from a few to 100 m^2/g. Micropores can be detd. from adsorption measurements with mols. of different known sizes. Sorption of org. vapors by active carbons consists essentially in filling the vol. of the micropores, and capillary condensation filling the vol. of intermediate pores; multimol. adsorption at the surface of the intermediate pores is secondary. An exception is sorption of H_2O vapor, which consists essentially in filling the micropores through capillary condensation, whereas the coarser intermediate pores do not as a rule become filled. Silica gels show only one type of porosity; specifically, macropores are largely absent, as pores with $r > 1000$ A. have at most a vol. of 0.05 cc./g, more frequently less.

241. Goring, G. E.; Curran, G. P.; Tarbox, R. P., and Gorin, Everett. **Kinetics of carbon gasification by steam. Effect of pressure and carbon burn-off on rate of interaction of low-temperature char with steam-hydrogen mixtures at 1600°F.** *Ind. Eng. Chem.* 44, 1057-65 (1952).—*C.A.* 46, 7734*a*.

The kinetics of the char-steam system at 1600°F covered the effects of 3 independent variables on the gasification rates: (1) percent gasified (carbon burn-off), 0 to 50%; (2) total pressure, 1 to 30 atms.; (3) gas compn., H_2/H_2O ratio varied from 0.1 to ~1.0. Sporadic runs were also made with a feed gas of pure H_2. By using a graphical extrapolation technique, the directly measured integral gasification rates were processed to yield, indirectly, a set of differential gasification rates. Two types of differential rates were detd., the total gasification rate ($CO + CO_2 + CH_4$) and the methane-formation rate. These are unique functions of specific values of the 3 variables and gave basic information on the mechanism of char-steam interaction.

242. Juhola, A. J.; Palumbo, A. J., and Smith, S. B. **A comparison of pore-size distributions of activated carbons calculated from nitrogen and water desorption isotherms.** *J. Am. Chem. Soc.* **74**, 61-4 (1952).—*C.A.* 46, 2872d.

Pore-size distribution curves for several activated carbons computed from the low-temp. N_2 desorption isotherms were compared with pore-size distribution curves computed from water desorption isotherms. A semiquant. agreement was found between the curves obtained by the 2 methods in the 22 to 300-A. radius range. Below 22A. radius the method based on N_2 adsorption was not theoretically applicable. The water-adsorption method was applicable to the complete gamut of pores in activated carbons, and the method yielded distribution curves from which surface areas were computed. B.E.T. areas were in essential agreement with these values.

243. Klyucharev, A. E. and Shalygina, V. S. **Thermal moisture conductivity in peat.** *Torfyanaya Prom.* **29**, No. 5, 25-6 (1952).—*C.A.* 46, 8829*e*.

The simultaneous gradient of moisture and temp. was designated the thermal-moisture cond. For lowland peat 40% decayed, the value of this function was of the order of 0.25-0.50% moisture/degree. The max. value was at 85% moisture content. The moisture content at max. thermal moisture cond. was the max. admissible moisture content for drying a particular peat.

244. McDermot, H. L. and Arnell, J. C. **Charcoal sorption studies. I. Pore distribution in activated charcoals.** *Can. J. Chem.* **30**, 177-84 (1952).—*C.A.* 46, 8458c.

Results of pore-distribution calcns. using H_2O isotherms were compared with those using low-temp. N_2 isotherms. Charcoal *A* was a steam-activated coconut-shell charcoal, *B* was *A* further activated in a stream of H_2 at 1000°C, and *C* was a $ZnCl_2$-activated maple sawdust charcoal. All samples were degassed by evacuating 12 hrs at 200°C. Pore vols. were detd. from the difference in d. of the charcoals when immersed in Hg and in C_6H_6. Surface areas (m^2/g) and pore vols. (cc./g) for *A*, *B*, and *C*, resp., were 1375, 0.81; 1610, 0.95; and 1530, 1.10. Curves show the exptl. results for H_2O and low-temp. N_2 isotherms for *A*, *B*, and *C* for both adsorption and desorption. If cos θ in the Kelvin equation (where θ is the wetting angle) is assigned a value of 0.65 (instead of 1), the pore distributions calcd. from the H_2O isotherms are in general agreement with those from the N_2 isotherms. There is a difference in the mechanism of desorption of N_2 and H_2O from charcoal, and the assumption of capillary evapn. with residual multilayers in the case of N_2 and capillary evapn. alone in the case of H_2O appears adequate to account for the difference.

245. Peck, Ralph E.; Griffith, Russell T., and Rao, K. Nagaraja. **Relative magnitudes of surface and internal resistance in drying.** *Ind. Eng. Chem.* 44, 664-9 (1952).—*C.A.* 46, 5899f.

Equations were developed relating the effective diffusivity to the av. total moisture content of material and the drying conditions for application in design calcns. Drying schedules were calcd. according to the equation: $(C/C_o)^{1-n} - 1 = (1-n) M'\theta/C_o^{1-n}$, where C and C_o were av. and original water concns., resp.; M' was a const. and θ the time in hrs.

246. Volman, D. H. and Doyle, G. J. **The retentivity of charcoals by the approximate isotherm method. The effect of moisture on the retentivity for methyl ethyl ether, neopentane, and methanol.** *J. Phys. Chem.* 56, 182-5 (1952).—*C. A.* 46, 8457i.

Approx. isotherms for MeOEt, neopentane, and CH_3OH were detd. by the retentivity method for charcoal equilibrated with H_2O vapor at 80% relative humidity. The presence of moisture on the charcoal had a highly deleterious effect on the retentivity for neopentane, which is insol. in H_2O; it had an appreciable lessening of retentivity for MeOEt, which is somewhat sol. in H_2O; but it had no effect on the adsorption of CH_3OH, which is completely miscible with H_2O. If the total sorption of a given adsorbate consists of one part in the displacement of H_2O from the surface, and another to the soln. of the adsorbate in H_2O on the surface, it was possible to calc. quantitatively the retentivity isotherm for the adsorbate in the presence of H_2O vapor from the isotherm in the absence of H_2O vapor together with the adsorption isotherm for H_2O.

247. Hunt, B. E.; Mori, Shiro; Katz, Sidney, and Peck, R. E. **Reaction of carbon with steam at elevated temperatures.** *Ind. Eng. Chem.* **45**, 677-8 (1953).—*C.A.* 47, 6633*h*.

Data at 1150°C on product-reactant ratios of 4 principal reactions and on conversion ratios in 3-, 5-, and 7-in. fuel beds showed that the only reaction reaching equil. was: $CO + H_2O = CO_2 + H_2$. There was a possible transition from a chem. or surface- to diffusion-controlled reaction above 1150°C.

248. Mukherjee, P.; Basak, N. G., and Lahiri, A. **Moisture in coal.** *J. Sci. Ind. Research (India)* **12B**, 15-24 (1953).—*C.A.* 47, 6633*i*.

The sorption and desorption of moisture on coals were studied with air and N_2 moisture carriers. Static and dynamic methods gave curves quite similar in shape. The moisture content should be estd. between 0 and 95% relative humidity in N_2 instead of air. The coal sample should be kept under water to avoid shrinkage effects. The desorption branch of the first cycle should be chosen and sorption expts. should be carried out at temps. below 40°C to avoid enhanced sorption due to activation effects. The B.E.T. area from sorption isotherms at 110°F was 94.3 m^2/g and at 130°F 151.9 m^2/g. The heat of wetting in CH_3OH at 35°C indicated a surface of 177 m^2/g.

249. Parry, V. F.; Landers, W. S.; Wagner, E. O.; Goodman, J. B., and Lammers, G. C. **Drying and carbonizing fine coal in entrained and fluidized state.** *U.S. Bur. Mines, Rept. Invest.* No. 4954, 43 pp. (1953).—*C.A.* 47, 6116d.

Fluidized or entrained drying is a process of mixing fine coal with hot gases (as hot as 2500°F) in such proportions that the resultant mixt. reaches a temp. of 275 to 325°F. The coal must remain in this environment long enough to be heated to about 250°F, where 90 to 95% of the inherent moisture is evapd. Approx. 50 sec. is required for particles of $\frac{1}{4}$ in. by 0 size. Fluidized carbonization involves heating the dried coal particles to about 900°F while they are in suspension in a vertically moving gas stream. The particles remain in the reactor for 10 to 15 min. yielding a mixt. of tar vapors, process gas, char, and H_2O vapor which moves out of the system at high velocity into cyclone separators to remove the solids. Any coal contg. over 12% O in the pure coal (ash- and moisture-free) can be carbonized by these processes.

I-5. Reactions of Oxygen and Carbons

250. Fieldner, A. C.; David, J. D.; Selvig, W. A.; Thiessen, R.; Reynolds, D. A.; Holmes, C. R., and Sprunk, G. C. **Carbonizing properties of West Virginia coals and blends of coals from the Alma, Cedar Grove, Dorothy, Powellton A, Eagle, Pocahontas and Beckley beds.** *U.S. Bur. of Mines, Bull. No.* **411**, 162 pp. (1938).—*C.A.* **33**, 1910^{3}.

Complete data on the compn., phys. and chem. properties, and carbonizing properties of 7 West Virginia coals were given. Ash was 2.9 to 6.8, S, 0.4 to 1.5%; and softening temp. of ash 2370° to 2910° F. None of the coals contained enough fusain to affect coking power appreciably. Largest coke was produced at 700°C; at higher temps., shrinkage cracks developed. Resistance to shock and abrasion (shatter and tumbler tests, resp.) rose to a max. at 800°C.

251. Chukhanov, Z. F. and Karzhavina, N. A. **The combustion of carbon. V. Combustion of a charcoal layer.** *J. Tech. Phys. (U.S.S.R.)* **10**, 1256-67 (1940); *Fuel* **20**, 186-94 (1940).—*C.A.* **35**, 3060^{1}; **37**, 2542^{6}.

The velocity of combustion was proportional to the 1.6 power of the O_2 concn. The proportionality coeff. depended on the linear velocity of gas flow. Its dependence on temp. was very complicated. Formulas were developed for computation of the amt. of O_2 used, the rate of gas formation, and the compn. of gas. The theory agreed well with exptl. results.

252. Kimoto, Toraki; Morikawa, Kiyoshi, and Abe, Ryonosuke. **Direct determination of oxygen in organic compounds by hydrogenation. IV. Determination of oxygen in coal.** *J. Chem. Soc. Japan* **62**, 1001-5 (1941).—*C.A.* **41**, 2658e.

When the sample contained S, the H_2S formed interfered with the detn. of O. By placing diatomaceous earth contg. 20% reduced Cu before the Ni catalyst, H_2S was removed.

253. Martin, O. **A derivation of the thermochemical equilibrium.** *Mitt. Forsch.-Anstalt. Gutehoffnungshutte-Konzern* **9**, 77-84 (1941).—*C.A.* **37**, 2250^{7}.

The free enthalpy G, was defined by $G = TS - H$ instead of $G = H - TS$. The relation of equil. const. to degree of reaction and total pressure was generally derived for the reaction $A_2 + 1/2B_2 = A_2B$ and represented in the form $K_p = \beta p\gamma$, where β was the degree of reaction. Values for β and pressure exponent γ were tabulated for some reactions (γ with reversed sign). The relation between equil. const. and degree of dissociation was illustrated for the reaction $[C] + CO_2 = 2CO$, and by various homogeneous and heterogeneous gas reactions.

254. Sihvonen, A. **The phenomena in carbon oxidation.** *Chimie & industrie* **45**, Suppl. to No. 3, Special No., 332-3 (1941).—*C.A.* **37**, 3245^{3}.

A review chiefly of the author's investigation.

255. Kantarovich, B. V. **Thermal conditions of the gasification process in a layer of carbon particles.** *J. Tech. Phys. (U.S.S.R.)* **12**, 647-56 (1942).—*C.A.* **37**, 4225^9.

An increase of velocity of gas blowing through the layer first caused a sharp increase in temp. and then a more gradual increase. A decrease of reaction surface caused retention of heat and, therefore, the temp. in the burning zone increased. An excessive decrease of reaction-surface caused the production of gas of lower quality.

256. Oza, T. M. and Shah, M. S. **The mechanism of the action of charcoal on potassium nitrate. I. The effect of temperature, time, etc.** *J. Univ. Bombay* **11**, Pt. 3, 56-69 (1942).—*C.A.* **37**, 4642^4.

Expts. with mixts. of KNO_3 and 20% (of wt of KNO_3) charcoal for 1 hr showed that the amt. of KNO_3 used increased with rise in temp. and the amts. of K_2CO_3, N_2, and CO_2 increased. A comparison of the amts. of N_2, CO_2 and K_2CO_3 produced up to 390°C showed a regular rectilinear relation between the amts. of N_2 and K_2CO_3 formed. The amts. of NO, CO, and N_2O_3 up to 380°C were smaller than in expts. at 390°C. The expt. could not be continued at 390°C for 1 hr, as the reaction steadily gained speed and flashed in about 25 min. Expts. with KNO_3 and 20% charcoal to the pt. where the evolved gas exerts the same pressure showed that KNO_2 was always produced in the interaction. Expts. with KNO_3 and 20% charcoal allowed to proceed to different stages at 375°C showed that at the start of reaction the amt. of CO_2 was higher and of N_2 smaller than at high pressures.

257. Tachibana, Taro. **The effect of inorganic substances on the combustion of paper.** *J. Chem. Soc. Japan* **63**, 924-8 (1942).—*C.A.* **41**, 3357*a*.

Sheets of filter paper were dipped into aq. solns. of various salts, and dried at room temp., and ignited. There was a lowering, in the presence of the salt, of the ignition temp. of the carbon formed by the decompn. of cellulose.

258. Courty, Clément. **Magnetic properties of oxygen adsorbed in active charcoal.** *Compt. rend.* **216**, 769-71 (1943).—*C.A.* **38**, 4481^4.

Coconut charcoal was dried and degassed without heating, and its magnetic susceptibility measured. The sample was then satd. with O_2 and measured again. The value for the magnetic susceptibility thus obtained agreed with results by other methods. Possibly, the difference when charcoal was degassed at high temps. might be due, among other things, to the presence of water.

259. Fuchs, Walter; Polansky, T. S., and Sandoff, A. G. **Coal oxidation.** *Ind. Eng. Chem.* **35**, 343-5 (1943).—*C.A.* **37**, 1845^6.

A central Penna. coal was oxidized in a rotary furnace 30-60 min. up to 350°C with countercurrent air or air-O_2 mixts. Formation of acid groups in the coal was followed by titration with NaOH, and acid strength of the oxidized product was estd. by its ability to release HOAc from $Ca(OAc)_2$. NH_4NO_3 was the most effective catalyst. Treatment of 100 g of this preoxidized coal with 100 cc. of concd. HNO_3 1-2 hrs at 100°C gave 120 g of hydroxycarboxylic acids 90% sol. in furfural.

260. Imada, Fumio. **Studies on carbon. V. Effect of activation of charcoal on chemical reactivity. Oxidation.** *Technol. Repts. Kyushu Imp. Univ.* **18**, 67-71 (1943).—*C.A.* **43**, 5572*c*.

Active carbon and charcoal were heated with dry O_2 at a definite temp. for 15-30 min. in a combustion tube and the O_2-consumption was detd. at definite intervals (also continuously with a quartz spring balance). The active carbon prepd. at the optimum temp. consumed O_2 rapidly at first and slowly later. A surface oxide, such as—C_xO_y, formed first then after an equil. was reached, rearranged and finally released CO, CO_2, $(COOH)_2$ and perhaps formed a complex C_nO_m.

261. Imada, Fumio and Iki, Hiroshi. **Studies on carbon. VIII. Sorption of oxygen by active carbon. A preliminary experiment.** *Technol. Repts. Kyushu Imp. Univ.* **18**, 81-7 (1943).—*C.A.* **43**, 5572*e*.

At 30° and 45°C the observed adsorption agreed with that calcd. by Freundlich's formula when the pressure was below 400 mm Hg. Under higher pressure agreement was with that calcd. by the Langmuir formula, indicating that the adsorption was phys. in nature.

262. Imada, Fumio. **Studies on carbon. XII. Sorption of oxygen under low pressure and preparation of graphitic acid and pyrographite.** *Technol. Repts. Kyushu Imp. Univ.* **18**, 242-56 (1943).—*C.A.* **43**, 5572*h*.

The adsorption of O_2 by active charcoal at 30-45°C and 70-200 mm seemed physical at the beginning. On supplying more thermal energy the O_2 migrated deeper and entered into chem. adsorption (forming excited complex compds.). Natural and Acheson graphites were oxidized with dry air by Brodie's method to graphitic acid (O content 19.86, 20.79, 22.05, and 21.31%) which was converted into pyrographite by removing the O by heating in vacuum until an explosion occurred.

263. Klibanova, Ts. M. and Frank-Kamenetskiĭ, D.A. **Ignition of carbon and the kinetics of its reaction with oxygen.** *Acta Physicochim. U.R.S.S.* **18**, 387-405 (1943).—*C.A.* **39**, 857^8.

A study of the kinetics of the reaction of O_2 on a carbon filament, made smooth by prolonged heat-treatment in hydrocarbon vapors, showed that at 1200°K, the abs. reaction velocity was approx. 10^{-4} moles/cm^2 sec. The energy of activation was 100 ± 30 Cal./mole, and the order of reaction was between 0.4 and 0.8 with respect to O_2.

264. Radspinner, John A. and Howard, H. C. **Determination of surface oxidation of bituminous coal.** *Ind. Eng. Chem., Anal. Ed.* **15**, 566-70 (1943).—*C.A.* **37**, 6435^5.

Three typical bituminous coals were oxidized at 75°, 100° and 125°C for varying periods in equipment which permitted the analysis of gases leaving the coal. Carboxyl-group detn. of the coal showed that from a few to 40% of the total fixed O_2 reacted as carboxyl. A linear relation was found between fixed O_2 and oxides of C evolved by thermal decompn. of the oxidized coals at 350°C in the vacuum. Detn. of carboxyl groups was based on decompn. of Ca acetate by acid groups and detn. of acetic acid by the liberation of CO_2 from $CaCO_3$.

265. Audubert, Rene and Racz, Charles. **The function of the large quanta of energy in the phenomenon of carbon combustion.** *Compt. rend.* **219**, 254-6 (1944).—*C.A.* **40**, 1380^{5}.

Above 1500°C the over-all reaction was represented by the equation $3C + 2O_2 = 2CO + CO_2$, energy of activation 90 kcal. The combustion of carbon was accompanied by an ultraviolet radiation (2500-2000 A). The energy of activation of the emitting process, detd. from its spectrum, was 84 kcal. The above reaction, responsible for this radiation, was probably due to the reverting to a normal state of activated CO_2 mols. This type reaction was of zero order, and it was very probably a chain reaction made possible by the large energy quanta set free: $3C + 2O_2 \rightarrow C_3O_4 \rightarrow 2CO + CO_2^*$; $CO_2^* + C_3O_4 \rightarrow 2CO + CO_2 + CO_2^*$.

266. Hiles, J. and Mott, R. A. **The effect of particle size on the combustion reactions in a bed of coke.** *Fuel* **23**, 134-9 (1944).—*C.A.* **39**, 403^{7}.

Hand-screened coke 2-1/2 to 1/8 in. made from compressed charges of S. Yorkshire slacks in 21-in. coke ovens on 30-hr coking time was used in an 8-in. diam. furnace with forced draft. When the O_2 content of the gases exceeded 1%, CO was not present in appreciable quantities; when O_2 was less than 1%, the CO content of the gas might rise almost to 30%. Two definite zones were shown: a lower one in which the reaction, $C + O_2 \rightarrow CO_2$, predominated; an upper zone where the reaction occurring was $CO_2 + C \rightarrow 2CO$. The oxidation reaction occurred on the coke surface and required 8 ft^{2} of surface per ft^{2} of grate area for the coke sizes tested. For normal fuel beds (50% voids), the oxidation zone was 2.66 times the mean particle size. The reduction reaction was complete 1 to 1-1/2 in. from the grate when 1/4- to 1/8-in. coke was used. The max. temp., near the top of the oxidation zone, was substantially the same, 1400°C, for all coke sizes of the same coke.

267. Kondrat'ev, V. N. **Combustion of oxygen + carbon monoxide mixtures in quartz vessels.** *J. Phys. Chem. (U.S.S.R.)* **8**, 110-14 (1944).—*C.A.* **39**, 2245^{8}.

When an equimol. mixt. of O_2 and CO (with little H_2O or H_2O and H_2) was passed through a quartz tube at 650-700°C, the CO oxidized was often less than 1% and independent of the length of the tube (15-50 cm). When the mixt. was passed through 2 tubes, the second of which was kept at 700°C, the CO oxidized in the first tube increased with temp. (540-600°C), but that in the second tube simultaneously diminished so that the total remained nearly const. The effect must be due to trapping of water mols. in the vessel, as addn. of water to the mixt. between the tubes raised the CO oxidized in the second tube; about 70 mols. of CO_2 were produced for 1 H_2O. The trapping was not a simple adsorption.

268. Roberts, John. **The combustion of carbon.** *Coke Smokeless-Fuel Age* **6**, 211-14 (1944).—*C.A.* **39**, 1282^{7}.

Fuels with low ignition temps. burned with shallow beds, but those with high ignition temps. required deep fuel beds and air streams of relatively high velocity. Ignition temps. ranged from 180°C for earthy lignite to 516°C for anthracite, from 484° to 550°C for high-temp. cokes, and from 405° to 475°C for low-temp. coke. Coke buttons prepd. by carbonizing 50:50 mixts. of coal and coke breeze at various temps. from 450° to 1000°C were ground to pass a 60-mesh I.M.M. sieve and their ignition temps. detd. At 850°C there was a crit. stage in carbonization of the particular coal used.

269. Romwalter, A. **Coalification and carbonization.** *Hung. Palatine-Joseph Univ. Tech. Econ. Sci. Pubs. Dept. Mining Met.* **16**, 77-89 (1944-47).—*C.A.* **42**, 6282a.

The role of bacteria in coal formation ended with the destruction of proteins and saccharoids and the re-synthesis of the resultant fragments into giant mols. did not involve living organisms. O_2 dissolved in H_2O could produce anthracite from either sapropelic or xyloidal peats, with the catalytic aid of S. Graphitic structure could result eventually from thermal agitation.

270. Strickland-Constable, R. F. **Interaction of oxygen and carbon filaments at high temperatures.** *Trans. Faraday Soc.* **40**, 333-43 (1944).—*C.A.* **38**, 6168^{4}.

The principal product (CO) of the interaction of O_2 and a graphite filament between 900° and 2000°C was a primary product and only small quantities of CO_2 were produced. Between 0.02 to 0.05 mm, the reaction was of the 1st order. The rate of reaction rose from 900° to 1100°C, and was const. between 1600° and 2000°C. There was a zone in between in which the rate was very sensitive to the immediate past history of the filament. Precautions must be taken at the high temp. to avoid reactions due to the activation of gas mols. by thermionic emission from the filament. O_2 was not sorbed as surface oxides in appreciable quantities by a freshly outgassed filament at high temps.

271. Warner, B. R. **Pressure dependence of the rate of gasification of carbon.** *J. Am. Chem. Soc.* **66**, 1306-9 (1944).—*C.A.* **38**, 5131^{3}.

Data were given for the rate of gasification of carbon in the presence of steam. Isotherms and the satn. pressures in the reaction were similar in form to those for monomol. adsorption on a solid adsorbent.

272. Akamatsu, Hideo and Hamada, Hiroshi. **Ignition temperature of carbon.** *J. Chem. Soc. Japan* **66**, 8-9 (1945).—*C.A.* **42**, 7145b.

The ignition temps. of charcoal and carbon black were measured with a thermobalance. Carbons with a sharp X-ray diffraction pattern had the higher ignition temp. The ignition temp. depended on the ash content, mainly on cations and not so much on anions. Alkali metals, especially K, had a great effect. Cu and Ag were next, then alk. earths, Zn and Ca. Al scarcely affected the ignition temp., Fe-group elements resembled the alk. earths, whereas Pb resembled K and Cu.

273. Alekseevskiĭ, E. V. and Musin, Ya. D. **Instrument for determination of ignition temperature and kinetics of oxidation of activated charcoal.** *J. Applied Chem. (U.S.S.R.)* **18**, 505-8 (1945) (English summary).—*C.A.* **40**, 5625^{8}.

The oxidation kinetics and ignition temp. of charcoal were observed in a combustion chamber (vertical tube) that was connected to a $Ba(OH)_2$ absorption tube.

274. Audubert, René and Racz, Charles. **Emission of ultraviolet radiation in the combustion of carbon and the mechanism of the oxidation of carbon.** *Bull. soc. chim.* **12**, 318-29 (1945).—*C.A.* **40**, 278^{5}.

Carbon filaments were heated to 1000-1300°C in a stream of N_2 contg. 5% O_2. The ultraviolet radiation produced was detd. by a photocounter. Blackbody radiation from the filament was negligible compared to chemiluminescence. Detns. with a monochromator showed the intensity of the radiation was roughly independent of wave length at 2000-2800 A. The apparent activation energy E for production of the radiation over the range 1050-1250°C was approx. 68 kg-cal. at 250 mm pressure, 84 at 100 mm and 90 at 50 mm. Emission of 2000 A. indicated accumulation of 150 kg-cal. in a single mol. This might be derived from the heat of combustion of C to CO_2 (94 kg-cal.) plus the heat of activation (80 kg-cal.) (assumed to be activated adsorption); a great part of this total energy went to the CO_2 mol., which occasionally lost it by radiation. Ordinarily the excited CO_2 mol. gave up its energy to a surface complex of C and O_2, causing reaction with formation of a new excited CO_2. The chain was broken by emission of a quantum of radiation.

275. Audubert, René and Racz, Charles. **Mechanism of the oxidation of carbon.** *J. chim. phys.* **42**, 40 (1945).—*C.A.* **40**, 5323^{7}.

Oxidation below 1500°C was expressed by $4C + 3O_2 \rightarrow 2CO + 2CO_2$. Above that temp. the reaction was essentially $3C + 2O_2 \rightarrow 2CO + 2CO_2$ with the emission of ultraviolet of 2600-2000 A. (measured by means of CuI photometer). This was a chain reaction and could be expressed $3C + 2O_2 \rightarrow 2CO + CO_2^{*}$ (activated); $CO_2^{*} + 3C + 2O_2 \rightarrow 2CO + CO_2 + CO_2$. The sum of these reactions was expressed $CO_2^{*} \rightarrow CO_2 + h\nu$.

276. Courty, Clément. **Oxidizing properties of active carbon saturated with air.** *Compt. rend.* **221**, 27-9 (1945).—*C.A.* **40**, 2062^{4}.

The oxidizing properties of active carbon were attributed to the O_2 adsorbed by it. The activity of the O when thus adsorbed was due to its being in the atomic state. Results with As_2O_3 were considered particularly satisfactory and were given in some detail.

277. Eichner, Ch. and Prettre, M. **Kinetics of the system: carbon dioxide-carbon monoxide-combustible solid.** *Mem. services chim. etat* **32**, 240-52 (1945).—*C.A.* **42**, 4430*b*.

The change in CO on passing mixts. of CO and CO_2 over charcoal, activated carbon, and coke was measured at 1000°, 1100°, and 1200°K. The initial "reactivity" of all samples decreased with time at 1000°K; this decrease was less pronounced at 1100° and disappeared at 1200°K. The presence of CO in the gas mixt. strongly inhibited the reduction of CO_2 and vice versa. The quantity of CO_2 reduced was essentially independent of the flow rate between 1 and 4 liters per hr. These observations were explained on the basis of the adsorption of CO and CO_2 on the solid.

278. Jones, R. E. and Townend, D. T. A. **Mechanism of the oxidation of coal.** *Nature* **155**, 424-5 (1945).—*C.A.* **39**, 2859^{2}.

Freshly ground coal exposed to air accumulated peroxide-O, attaining a max. of 0.06 wt % after several weeks. The rate of formation increased at higher temps., but above 80°C the max. fell, owing to decreasing stability. In 6 coals the rate of weathering paralleled the max. of peroxidation. If an exposed coal was heated above 80°C in an inert atm., the peroxide O disappeared.

279. Jones, R. E. and Townend, D. T. A. **Institution Gas Research Fellowship Report, 1943-44. The mechanism of the oxidation of coal.** *Inst. Gas Engrs., Commun.* No. **271**, 21 pp. (1945).—*C.A.* **40**, 6784^{9}.

The formation of peroxidic bodies was followed by a colorimetric method depending upon the formation of $Fe(CNS)_3$ by reaction of a peroxide with a soln. contg. ferrous Fe and NH_4CNS. The estn. was carried out in a sealed system in N_2. At room temp. finely-divided fresh coal had been found to accumulate peroxygen on exposure to the atm., a max. content being reached after several weeks. At high temps. its rate of formation progressively increased, but ultimately the max. content fell owing to increasing stability. Expts. with 6 bituminous coals have shown the known ease of weathering to fall into line with the degree of peroxidation.

280. Jones, R. E. and Townend, D. T. A. **Institution Gas Research Fellowship Report, 1944-45. The mechanism of the oxidation of coal. II.** *Inst. Gas Engrs., Commun.* No. **287**, 23 pp. (1945); *Gas World* **123**, 619, 623 (1945).—*C.A.* **40**, 6785^{5}.

The initial reaction appeared to involve chemisorption, which, in the presence of water, was followed by the formation of a C-O-water complex. The normal, inherent water content of coals was a function of their internal surface; this was a min. with coals contg. about 89% C. The peroxygen content of coals showed a similar variation with C content, but was unstable above approx. 70°C. Below 70°C the complex was formed easily and remained relatively stable. Above 70°C, the complex started to break down, although with C it did not appear to be completely destroyed until 350°C was reached. Oxidation above 70°C was also marked by a big increase in the O content of a coal. CO_2 then preponderated over the CO.

281. Kodama, Tatsuhiko and Kimura, Osamu. **Ignition temperature of active charcoal.** *J. Chem. Soc. Japan* **66**, 33-4 (1945).—*C.A.* **43**, 7668*c*.

The influence of minute quantities of various salts on the ignition temp. of active charcoal was studied. The ignition temp. was lowered by the addn. of salts. The temp. variation was nearly linear with the square root of the amt. of the salt.

282. Kolodtsev, Kh. I. **Dynamics of gas formation in a carbon layer.** *J. Phys. Chem. (U.S.S.R.)* **19**, 417-28 (1945).—*C.A.* **40**, 1722^{9}.

A layer of electrode carbon (C 98.63, ash 1.01%) was ignited from the top, and air blown through it from above. The layer was 19 cm deep, and 7 cm under its top surface gas samples were taken and temp. (T) measured. The C grains were either 3.1 ± 0.6 cm or 5.4 ± 0.6, 6.6 ± 0.6, and 8.1 ±0.9 mm. During the first stage T increased rapidly and the gas contained no O_2; the concn. of CO passed through a max. and that of CO_2 through a min. During the sec. stage T rose slowly, the concn. O_2 increased rapidly, and CO and CO_2 rapidly fell.

283. KOLODTSEV, KH. I. **Computation of the laminar combustion of carbon.** *J. Phys. Chem. (U.S.S.R.)* **19**, 657-64 (1945).—*C.A.* **40**, 3247².

Equations were given for the rate of combustion of a carbon bed through which air was forced. If it was assumed that the rate of oxidation of CO to CO_2 was negligible and the rate of oxidation of C to CO_2 was very high, the theoretical outcome agreed with the expt. From the exptl. dependence of the reaction consts. on the rate of air blow and the C-particle radius it was concluded that both the oxidation and the reduction processes took place only on the surface of the C grains.

284. ARTHUR, J. R. **Combustion of carbon.** *Nature* **157**, 732-3 (1946).—*C.A.* **40**, 5221⁹.

An electrically heated carbon tube was used to approximate the conditions which would occur in a single channel in a fuel bed. Probes for gas sampling were very fine and were water-cooled to the extreme tip. CO, in concns. of 0.5-2.0% adjacent to the wall, nearly disappeared in the remainder of the tube as long as there was an excess of O_2. In the presence of 0.9-1.8% of the inhibitors Cl_2, CCl_4, or $POCl_3$, 14-22% CO appeared at the expense of CO_2, while there remained 1.2-4.4% O_2. Very rapid quenching was of the first importance when a reliable analysis was required of a hot gas mixt. contg. CO and O_2.

285. BLINOV, V. I. **Combustion of ash coal. I.** *Compt. rend. acad. sci. U.R.S.S.* **52**, 507-10 (1946) (in English).—*C.A.* **41**, 4291c.

The rate of combustion was deduced for the case of a sphere, a cylinder, and parallel walls of coal. It was assumed that reaction occurred at the ash-coal boundary which moved slowly forward and that the O-distribution was governed by the usual diffusion relations.

286. BLINOV, V. I. **Combustion of ash coal. II.** *Compt. rend. acad. sci. U.R.S.S.* **52**, 683-6 (1946) (in English).—*C.A.* **41**, 4291d.

The temp. distribution in coal for 3 shapes was deduced by assuming that the delivery of heat from the coal obeyed Newton's law.

287. BRIDGER, G. W. **Combustion of carbon and carbon monoxide.** *Nature* **158**, 236 (1946).—*C.A.* **40**, 6782¹.

In the combustion of coke with air, the $CO/(CO + CO_2)$ ratio was increased by the addn. of small amts. of Cl_2, HCl, or CCl_4 to the air. The effect was not due to catalysis of $CO_2 + C \rightarrow 2CO$, since no change in gas compn. occurred when $Cl_2 + CO_2$ was passed through coke at 1000°C. The combustion of 10% CO in air + N ($O_2/CO = 1$) could be inhibited by Cl_2; it was 0.55 vol. % at 1000°C. Starting with a CO + air mixt. contg. slightly less than the crit. concn. of Cl_2, inhibition became complete when the temp. was decreased sufficiently and did not cease when the temp. was raised. Larger voids in the fuel bed favored the production of CO_2. The compn. of combustion gases was considerably controlled by conditions in the fuel bed above the combustion zone, where the reduction of CO_2 was the predominant reaction.

288. CASSAN, HENRY. **The kinetics of heterogeneous reversible reactions—application to the reactivity of solid fuels.** *Chaleur et ind.* **27**, 75-84, 103-13 (1946).—*C.A.* **40**, 6236⁵.

The concept of reactivity of the solid surface was extended to cover complex reversible heterogeneous reactions involved in water-gas formation. An expression was developed which correctly represented the exptl. results; this was extended to water-gas manufacture with excellent concordance. The method could be applied to all reactions in which a gaseous phase was in contact with a solid phase comprising a catalyst or an autocatalyst.

289. CONSTANTINIDES, GIORGIA. **Coal-autoxidation measurements.** *Ann. Triestini* **18**, No. 1/2, 3-18 (1946); *Pubb. facoltà sci. e ing. univ. Trieste, Ser. B*, No. **13** (1947).—*C.A.* **46**, 8345*f*.

Published results were compared by the equation $x = cT^b$, where x was the total amt. of O_2 consumed, expressed as percentage of dry coal, T was time in days, and b and c were const. Reliable results were obtained up to 50°C, where the amts. of CO_2 and of CO evolved were too small to influence the manometric readings.

290. GADSBY, J.; HINSHELWOOD, C. N., AND SYKES, K. W. **The kinetics of the reactions of the steam-carbon system.** *Proc. Roy. Soc. (London)* **A187**, 129-51 (1946).—*C.A.* **41**, 1533i.

Essentially similar results were obtained with coconut shell charcoal at 700°C and coal charcoal at 800°C in the range 10-760 mm. The reaction, the primary product of which was CO, was of fractional order with respect to steam and strongly retarded by H_2. The CO_2-carbon reaction was of fractional order with respect to CO_2 and strongly retarded by CO. The rates of both these reactions could be represented closely by an expression of the form rate $= k_1p_1/(1 + k_2p_2 + k_3p_1)$, where p_1 and p_2 were, resp., the pressures of steam and H_2 for the steam reaction, and of CO_2 and CO for the CO_2 reaction. The water-gas reaction $CO + H_2O = CO_2 + H_2$ took place predominantly on the charcoal surface, and the approach to equil. was studied from both sides. In the water-gas reaction, no simple expression was applicable, and the lack of reproducibility, possibly occasioned by changes in catalytically active impurities, made it difficult to distinguish between various types of more complicated expressions.

291. GOSSELIN, A. **Remark on the paper of Audubert and Racz: Emission of radiation during combustion of carbon.** *Bull. soc. chim.* **1946**, 271.—*C.A.* **40**, 7003².

The quanta of 150, 128, and 105 kg-cal. per mole, previously observed, were ascribed to chemiluminescence on combination of free C and O atoms to give CO in 2 different states, and C atoms with O_2 mols. to give CO_2. The weakness of the luminescence was due to the low concn. of free atoms.

292. Kartvelishvili, G. A. **Spontaneous inflammability of Tkvibuli coal.** *Ugol* **21**, No. 12, 34-5 (1946).—*C.A.* **41**, 4291b.

A study was made of samples of coal taken from various beds of the Tkvibuli (Georgian SSR) coal deposit to det. the cause of numerous mine fires. The oxidizability, content of volatile matter, and the ignition temp. characterized this coal as safe. However, the low C and high H content increased its ability to adsorb O_2. Thus, the coal was not spontaneously inflammable yet quite dangerous and required carefully worked out mining procedures and ventilation.

293. Kramers, W. J. **The action of oxygen on coal at moderate temperatures.** *Bull. Brit. Coal Utilisation Research Assoc.* **10**, 395-404 (1946).—*C.A.* **41**, 2553*a*.

The oxidation of coal on storage was reviewed and the humic acids and sol. acids obtained from coal described.

294. Kucera, Eduard and Klima, Josef. **The determination of reactivity of coke.** *Paliva a voda* **26**, No. 2-3, 17-20 (1946).—*C.A.* **41**, 5704*e*.

The reactivity of solid fuels, which depended on the relation between the temp. of the fuel in contact with a stream of O_2 and the temp. of the heating medium, were compared. An improved arrangement was recommended. On aging for several months, some samples slightly increased, whereas others decreased in reactivity.

295. Letort, Maurice and Martin, Jean. **The mechanism of the formation of surface oxides in the combustion of graphite.** *Compt. rend.* **222**, 1049-51 (1946); *Nature* **157**, 874-5 (1946).—*C.A.* **40**, 4280^9.

Acheson graphite (200-mesh) was degassed in a vacuum for 1 hr at 900°C. Then it was burned in a bed 6 mm deep at 510°C by a const. stream of air dried over P_2O_5. The mean speed of combustion was 8.5 and the $CO_2 + CO$ formed analyzed 23.5% CO. Standing in pure N_2 1 hr at 900°C and burning at 510°C checked the vacuum degassing results. Burning at 495°C after 2 hrs degassing at 800°C gave a speed of 10.55, and CO was 19.3% of $CO + CO_2$. If the burning was stopped after 3 to 15 min. by a N_2 stream, then restarted an hour later, the speed of combustion increased to 1.6 to 2.7 times the previous value, resp., the percentage CO dropping in the meantime. On repeating the stopping and restarting of combustion the speed decreased about 20%.

296. Ravich, M. B. **Surface combustion, its theoretical bases, and prospects of application in connection with the utilization of fuel gas.** *Bull. acad. sci. U.R.S.S.; Classe sci. tech.* **1946**, 833-46 (in Russian).—*C.A.* **41**, 2550f.

The rate of combustion of gases in quartz tubes was increased when the tube was packed with crushed refractories; the effect began to be noticeable at 400°C and was very pronounced at 900°C. Further substantial acceleration was obtained by activation of the refractory (chamotte) with oxides of Fe, Ni, V, Ce, or Th; at 400°C, combustion of firedamp in an empty quartz tube amounted to 10% in 1 hr, with chamotte filling 20%, while in the presence of Fe or Ni oxides combustion was complete in 0.5 min. The accelerating effect of the activators was also confirmed in the combustion of H_2 and CO under atm. pressure.

297. Šimek, Břeislav G.; Kučera, Eduard, and Klíma, Josef. **The effect of inorganic additives on the reactivity of coke.** *Paliva a voda* **26**, 49-55 (1946).—*C.A.* **41**, 5704*f*.

Lab. coke samples were prepd. by using various coking conditions, coal blends, and mineral additives, (Fe_2O_3, CaO, a blend of $Fe(OH)_3$ and $Ca(OH)_2$, magnetite, MgO, Na_2CO_3, Cu salts, magnesite). The reactivity of the coke was measured by the initial temp. of reaction with O_2. More-active coke was produced by lower coking temp. and more rapid coking; less-active coke, by using coal blends of higher bulk d. and by longer maturing time. Mineral additives varied in their effects on the reactivity. Low-ash coal yielded coke of higher reactivity.

298. Trombe, Félix and Foëx, Marc. **The combustion of graphite in air.** *Compt. rend.* **222**, 442-4 (1946).—*C.A.* **40**, 3247^4.

Below 1300°C O_2 penetrated into graphite and the reaction was proportional to the pressure. Above 1500°C the reaction took place on the surface and was independent of pressure. The combustion of graphite rods in air showed that the temp. limit between the two reactions was higher in air (1500°C) than in O_2 (mean 1400°C). The velocity of the convection current depended on the temp. of the rod and the combustion increased strongly with the temp. of the rod. Above 1500°C, it was shown that the velocity of the combustion increased very slowly with the temp., because convection currents no longer intervened.

299. Vulis, L. A. **Calculation of the absolute rate of combustion of carbon.** *J. Tech. Phys. (U.S.S.R.)* **16**, 83-8 (1946).--*C.A.* **40**, 7559^7.

From data on 15 kinds of graphite, electrode carbons, cokes, it appears that the consts. k_0 and E (activation energy) in Arrhenius' equation are related by $\log k_0 = a + bE$. The consts. for the combustion reaction, $C + O_2$ (subscript 1) and those for the reduction reaction, $C + CO_2$ (subscript 2) are: $a_1 = a_2 = 1.5$; $b_1 = 1.75 \times 10^{-4}$; $b_2 = 125 \times 10^{-4}$. $E_2/E_1 = \epsilon = 2.2$. $T^*_1 = 1240°K$, $T^*_2 = 1740°K$, and $T^*_3 =$ approx. 2620°K are termed "universal temperatures." At $T = T^*_1$ or $T = T^*_2$, resp., the rates of combustion or of reduction, resp., of all types of carbon are the same; at $T < T^*$, the rate of reaction (combustion or reduction) decreases with increasing E, whereas at $T > T^*$ it increases. At $T = T^*_3$, for a given type of carbon, the rate of combustion and that of reduction are the same. It accounts for the increased content in CO in accelerated combustion of coal.

300. Vulis, L. A. **Calculation of the time of combustion of coal particles.** *J. Tech. Phys. (U.S.S.R.)* **16**, 89-94 (1946).—*C.A.* **40**, 7560^2.

From the equation of the material balance of the quasi-stationary combustion process the effective rate const. of combustion can be represented as $1/K_e = (1/K) + (1/\alpha)$, where K = true rate const. of the chem. reaction and α = coeff. of material exchange, formally analygous to the coeff. of heat transfer. These are limiting cases, for complete combustion of the general formulas developed for partial combustion from an initial radius R to a final radius r. The formulas are checked against exptl. data on combustion of electrode carbon ($K_0 = 3.5 \times 10^6$ cm/sec) and gas coal coke ($K_0 = 1.87 \times 10^7$ cm/sec) coked at various temps. (1000°, 800°, and 400°C). Calculations at 1200°, 1500°, and 1800°K, by assuming the initial Reynolds no. 1, combustion to CO, activation energies of 20 and 30 kg-cal/mole, lead to the correct order of magnitude of the time of combustion of coal dust and show the actually observed shift of the combustion to the kinetic region with decreasing particle size.

301. Vulis, L. A. **Velocity of combustion of coal particles with a high-ash content.** *J. Tech. Phys. (U.S.S.R.)* **16**, 95-100 (1946).—*C.A.* **40**, 7560⁷.

The effect of a growing layer of ash on the rate of combustion of coal particles is treated mathematically and laws are derived for the rate of thickening of the inert coat. For curve-shaped, hemispheric, and cylindrical particles this growth may lead not only to a slowing down but, in special cases, to an acceleration of the combustion.

302. Audubert, René. **Activation energy accompanying oxidation of carbon at high temperature.** *Compt. rend.* **225**, 114-16 (1947).—*C.A.* **41**, 7230*b*.

The kinetics of the chain reaction are discussed. The energy of activation for maintaining the chain and the energy of deactivation are nearly the same, the former being greater by 6 kcal. per mole.

303. Audubert, René. **Mechanism of the oxidation of carbon.** *Compt. rend.* **225**, 1311-13 (1947).—*C.A.* **42**, 2846*f*.

When carbon was burned at temps. higher than 1500°C and at low pressures, the oxidation was a chain reaction with activated CO_2 mols. as the probable chain carriers. The chain length of this reaction at 2354°K was calcd. from the difference in activation and deactivation energy of the chain, which was about 6 kcal./mol. The calcd. value ($1\text{-}3 \times 10^5$) was in good agreement with exptl. results.

304. Chufarov, G. I. and Antonova, M. F. **The retardation of the Bell reaction $2CO = C + CO_2$.** *Classe sci. tech.* 1947, 381-9 (in Russian).—*C.A.* **42**, 3648*i*.

The decompn. of CO on an Fe catalyst was a first-order reaction over a CO pressure range 2-200 mm between 350-750°C. Between 350-450°C the reaction rate changed according to the Arrhenius equation with the activation energy of 34,000 cal./mole. The addn. of $CuSO_4$, $Al_2(SO_4)_3$, or $MnSO_4$ to the Fe catalyst caused a marked retardation around 450°C, 5% of $CuSO_4$ or $Al_2(SO_4)_3$ completely inhibiting the reaction. At 650-750°C 5% $CuSO_4$ retarded the reaction by a factor of 40, whereas 5% $Al_2(SO_4)_3$ retarded it by a factor of 12. Na_2SO_4, $MgSO_4$ and $CaSO_4$ were less effective in retarding the reaction.

305. Courty, Clément. **Oxidizing properties of active carbon saturated with air.** *Bull. soc. chim. France* **1947**, 642-52.—*C.A.* **42**, 1102*h*.

Arsenious acid was oxidized by the adsorbed-O on active carbon, as well as being adsorbed directly by the carbon itself. The ratio of the two actions was extremely variable—depending on the carbon, its condition, time, etc. Magnetic measurements over long periods of time (up to a year) indicated that an equil. content of at. O was slowly established.

306. Duval, Xavier. **The elementary reactions for the oxidation of graphite.** *J. chim. phys.* **44**, 296-301 (1947).—*C.A.* **42**, 7145*d*.

The observed CO/CO_2 ratios have been explained in terms of different modes of adsorption of O in the graphite lattice: (1) penetration of O_2 into the lattice; (2) adsorption of O_2 on marginal C atoms. Objections to this interpretation are: (1) at the pressure involved (10^{-3} mm Hg) preferential adsorption of O_2 on glass walls of the reaction vessel would leave no O_2 for more than an incomplete unimol. layer with the C; (2) the increased elec. resistance of the filament in the presence of O_2 can be explained simply in terms of surface adsorption in that the filament is porous; (3) even mols. as small as H_2 show difficulty in penetrating the graphite lattice. Consequently, a mechanism involving adsorption of O_2 on marginal C atoms is to be preferred. The reactions of graphite with CO_2 or H_2O are both of zero order with an activation energy of 90.

307. Fast, J. D. **Reaction between carbon and oxygen in liquid iron.** *Philips Research Repts.* **2**, 205-27 (1947).—*C.A.* **42**, 439*c*.

The reaction $[FeO] + [C] = [Fe] + CO$ is investigated, the brackets indicating the components of a homogenous liquid phase. If a liquid mixt. of Fe and FeO is assumed to have a Gibbs entropy of mixing and a Van Laar heat of mixing, the activity of FeO is related to the observed soly., x_{FeO} (mole fraction). The equil. const. for the reaction $C + CO_2 = 2CO$ is given by the relation $\log K = \log ((p^2_{CO})/(p_{CO_2})) = -(8435/T)^2 + 8.835$, where the activity of carbon, a_c, is related to the mole fraction, x_c, by the relation $a_c = x_c \exp. [(1800/T) -1.5]$.

308. Gumz, W. **Chemistry and physics of combustion, gasification, and metallurgical processes.** *Bergbau-Arch.* **7**, 96-110 (1947).—*C.A.* **44**, 2729*g*.

The methods of calcn. of combustion temp. and equil. consts. are given, and the extent to which equil. will be attained in gas producers and furnaces is examd. The metallurgical processes of the blast furnace are treated thermodynamically and among the reactions considered are the following: $C + O_2 = CO_2$, $CO_2 + C = 2CO$, $H_2O + C = H_2 + CO$, $2H_2 + C = CH_4$, $MnO + CO = Mn + CO_2$, and the reactions of CO and H_2 with FeO, Fe_2O_3, and Fe_3O_4.

309. Hagerbaumer, W. A. and Lee, Russell. **Combustion of coke deposit on synthetic bead cracking catalyst.** *Oil Gas J.* **45**, No. 45, 76-80, 97 (1947).—*C.A.* **41**, 3941*h*.

The major process variables affecting the rate of burning were found to be O_2 concn., temp., and the concn. and distribution of coke on the catalyst particles. The effects of these variables have been correlated by graphical methods. Data for regenerating bead catalyst were presented and discussed. The correlated data have been applied successfully in designing com. kilns.

310. Howie, T. W. and Mackenzie, J. **The stability of carbon bricks in carbon monoxide.** *Trans. Brit. Ceram. Soc.* **46**, 161-73 (1947).—*C.A.* **41**, 7078*f*.

The action of CO on exptl. carbon bricks was detd. with addns. of Fe and Fe_2O_3, and on 3 com. brands of brick. The nature of the gas will influence the result obtained. With wet gas the major part of the CO_2 formed resulted from the interaction of CO and water vapor and C and water vapor, and was not due to the normal dissociation reaction, $2CO \rightarrow C + CO_2$. Metallic Fe, in an active state, appeared to be the catalyst of the dissocn. reaction. The 3 com. brands of brick examd. showed neither C deposition nor disintegration in tests of 100-hr duration.

311. Marskell, W. G. **Combustion on traveling-grate stokers.** *Inst. Fuel (London), Bull.* **1947**, 100-7, 116.—*C.A.* **41**, 4288*c*.

The fuel ignites at the surface and a plane of ignition travels down through the fuel bed distg. off the volatile matter. At low air rates the combustion rate is less than the ignition rate, so that the ignition plane leaves a coke bed behind, which does not burn until all the volatile matter has been evolved, presumably because the O_2 is consumed by the volatile matter in lower fuel bed layers. The coke combustion starts from the bottom. At high air rates the grate and fuel bed are cooler than at low air rates. Primary air temps. up to approx. 300°F do not essentially alter the course of combustion. Once the fuel bed is thoroughly ignited the higher the air rate the better the fuel bed conditions, but in practice the max. air rate is limited by the ejection of fine material from the fuel bed and blow-hole formation.

312. Mueller, Wm. A. **Oxygen and the combustion process.** *Ohio State Univ. Eng. Expt. Sta. News* **19**, No. 5, 21-4 (1947).—*C.A.* **42**, 2740*i*.

Calcns. are presented showing the effective heat losses above 2000°C due to dissocn. of CO_2, H_2O, blast-furnace gas with 10% excess O_2, and producer gas of heating value 152.6 B.t.u. with 10% excess O_2. Recombination of dissocd. gas as it leaves the high-temp. zone liberates heat. Disadvantages which may be encountered when O_2 is substituted for air in combustion are dissocn. losses and damages sustained by exit ports because of recombination.

313. Nérot, Georges and Marianvalle, Albert. **The reactivity of cokes.** *Compt. rend. congr. ind. gaz* **64**, 225-48 (1947).—*C.A.* **44**, 8624*i*.

The behavior of coke toward CO_2 and H_2O (the latter in a current of N_2) at 700-1100°C was investigated by analyzing the gaseous reaction products. A 2nd series of expts. was carried out in which CO_2 was decompd. in a bed of coke, the undecompd. CO_2 was removed by absorption, and the CO formed was then burned in a current of O_2. This was assumed to give a direct measure of the reactivity. The coke was gasified in a generator, but the results so obtained did not agree with those obtained in the lab. In the generator the behavior of the ash appeared to outweigh the influence of the reactivity.

314. Pourbaix, Marcel. **Method for studying complicated equilibriums.** *Rev. Met.* 44, 292-301 (1947).—*C.A.* **42**, 4438*b*.

All variables characterizing a given equil. are divided into two groups, one comprising two factors which are the same for all equil. and which are considered as independent variables, and the other combining all other factors and considered as a parameter. The method is illustrated by the treatment of equil. of the following systems: O_2, C-O (O, O_2, O_3, solid C, gaseous C, gaseous C_2, and gaseous CO, CO_2), Zn-O, and Zn-C-O.

315. Predvoditelev, A. S. **The process of gas formation in the combustion of coal in beds.** *Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk* **1947**, 1329-40.—*C.A.* **42**, 7004*g*.

There are 3 possible chem. mechanisms: (1) CO_2 is formed on the surface or in the interior of the coal and CO results from the secondary reduction on the coal surface; (2) CO and CO_2 are formed simultaneously on the surface or in the interior of the coal and consumption produces either oxide; (3) CO forms on or near the coal surface, where there is sufficient O_2 and the reduction of CO_2 on the surface is possible, especially outside the limit of the O_2 zone. All consumption of O_2 occurs on or near the surface.

316. Rowley, L. N. and McCabe, J. C. **How fuel burns.** *Power* **91**, No. 8, 71-3 (1947).—*C.A.* **41**, 7073*c*.

The mechanics of combustion are outlined. Heat is essential to accelerate the chem. reaction between air and fuel and adequate mixing with O_2 and sufficient time are necessary. These factors are applied to the burning of solid as well as pulverized coal.

317. Spooner, C. E. **The direct determination of oxygen in coal.** *Fuel* **26**, No. 1, 15-23 (1947).—*C.A.* **41**, 2553*b*.

Coal (0.5 g with moisture content in equil. with lab. air) was heated to 1200°C in a stream of N_2 freed from O_2, H_2O, and CO_2. The resultant products were passed over charcoal at 1200°C, converting all H_2O and CO_2 to CO. The gas mixt. was then passed through a filter and through Cd-acetate soln. to remove H_2S; air was drawn into the stream and the mixt. passed through activated alumina, soda asbestos, anhydrone, and P_2O_5, thence through Hopcalite catalyst maintained at 90-95° to oxidize the CO to CO_2; the latter was absorbed in a tared soda asbestos absorption tube. The O_2 was calcd. and corrected for the moisture in the coal sample. The app. was standardized with benzoic acid. Results were in good agreement with those calcd. from ultimate analysis.

318. Thau, Adolf. **Status of low-temperature carbonization of bituminous coal in Germany.** *Gas—u. Wasserfact* **88**, 97-101 (1947).—*C.A.* **42**, 4729*a*.

Three types of ovens are in use: the heated-surface oven, the recirculated-gas oven, and the ceramic-chamber oven; the latter appear to predominate, especially in Upper Silesia. Since the German coking coals are used entirely in gas plants and coke ovens, use must be made of the geologically younger coals, high in O_2 and tar, which are not adapted to coke manuf. by the usual means.

319. TSUKHANOVA, O. A. **The effect of secondary reactions on the combustion of carbon.** *Bull. acad. sci. U.R.S.S., Classe sci. tech.* **1947**, 375-80.—*C.A.* **42**, 1719*h*.

The combustion at the walls of tubes of electrode carbon (520° to 1400°C) was followed by detg. the concn. of CO_2, CO, and O_2 in the exit gas. Data were given for an air flow of 20 liter/min. through a tube 12 mm in diam. and 95 cm long and for an air flow of 5 liter/min. through a tube 6 mm in diam. and 23 cm long. In the latter case the input air contained I_2 vapor. The results were interpreted from a consideration of the 2 reactions $2C + O_2 \rightarrow 2CO_2$ and $2CO + O_2 \rightarrow 2CO_2$. I_2 vapor, known to inhibit the combustion of CO, was found to increase the CO yield markedly between 700-900°C. Above 900°C, the CO concn. became unstable; it might be either higher or lower than the concn. at 900°C, depending on the conditions of ignition.

320. TSUKHANOVA, O. A. **Reduction of carbon dioxide by carbon along the walls of a carbon channel.** *J. Phys. Chem. (U.S.S.R.)* **21**, 653-8 (1947) (in Russian).—*C.A.* **42**, 2164g.

When CO_2 (concn. C_0) streamed through a carbon tube, the amt. reacting per unit area of the wall in unit time, divided by the gas concn. next to the wall, was 6.94×10^6 exp.(-44250/RT) between 800° and 1400°C for rates of flow between 0.7 and 8.3 liters/min. This value did not represent a true reaction const. because the reaction took place within a relatively thick surface layer of carbon, not only along its surface. The carbon tubes once heated in CO_2, but not in N_2, gave at once steady C/C_0 values. When C_0, the other component being N_2, was varied between 8 and 96%, the concn. of CO in the outgoing gas was proportional to the av. concn. of CO_2 within the tube, in agreement with the theory. The tube of electrode carbon was 37 cm long and 0.7 cm in diam. The CO_2 stream was preheated to 600-700°C.

321. TSUKHANOVA, O. A. **Approximate solution of the equations for the combustion of a carbon tube, considering the reaction of carbon monoxide with oxygen.** *Classe sci. tech.* **1947**, 717-21.—*C.A.* **42**, 3928f.

Equations were derived giving the concn. of O_2 and CO integrated along the cross-section of a carbon tube through which hot gases were flowing. The variables were the gas velocity, tube radius, diffusion const., velocity consts. of the combustion reactions, and the ratio of CO to CO_2 formed at the tube wall. For a tube 6 cm long and 5 mm in diam. with gas flow rate of 1-10 liter/min. at temps. of 400-900°C, the CO:CO_2 ratio at the wall was found to be approx. 1:1 above 850°C. The temp. coeff. of the $C + O_2$ reaction suggested an activation energy of approx. 22,000 cal/mol. The agreement with the exptl. data was sufficient for practical purposes.

322. ZAREMBO, K. S. **Secondary processes in the thermal decomposition of solid fuels.** *Bull. acad. sci. U.R.S.S., Classe sci. tech.* **1947**, 857-62 (in Russian).—*C.A.* **42**, 1719*a*.

Shale was heated to 540°C ± 10° in a tube 20 mm diam. and 111.5 cm length, composed of 6 sections of equal length assembled by ground joints. The yields of half-coke were detd. in each section. The yield had a distinct max. towards the middle of the tube, on the av. in the 3rd section from the bottom. This can be conceived as a result of a secondary process taking place at the interface of the grains, following primary cracking of org. matter in the bulk of the grain; the products were carried to more outlying layers of the column and there were adsorbed on the grain surface.

323. BLINOV, V. I. **Combustion of ash-containing coal. III.** *Doklady Akad. Nauk S.S.S.R.* **59**, 257-60 (1948).—*C.A.* **43**, 5569*h*.

The differential equation governing the combustion zone around a sphere is $(dT/dx) = (3\beta/ckx)(aT - aT_0 - kq)$, where x is the ratio of the radius of the unburned carbonaceous core to the radius of the sphere, β is the O/C ratio in the reaction products, c is the sp. heat of carbon, k is the sp. velocity of burning, a is a reduced heat transfer coeff., T_0 is the temp. of the surrounding atm., and q is the heat of reaction. This and related equations are applied to coal under various sets of conditions.

324. BREWER, R. E.; REYNOLDS, D. A.; STEINER, W. A., AND VAN GILDER, R. D. **Carbonizing properties of coking coals--effect of oxidation in storage.** *Ind. Eng. Chem.* **40**, 1243-54 (1948).—*C.A.* **42**, 6088*i*.

Eleven coking coals were subjected to accelerated oxidation and stored at room temp. A correlation was found between the agglutinating value and time of storage whereby the effect of storage on the coking properties (durability of coking power) of coals can be estd. The av. time in storage at room temp. before the coke-strength index was decreased by 15% was estd. at 5 years.

325. BRIDGER, G. W. AND APPLETON, H. **Inhibition of the combustion of carbon and carbon monoxide.** *J. Soc. Chem. Ind.* **67**, 445-9 (1948).—*C.A.* **43**, 3592*f*.

Oxidation of 95% of the CO at 1000°C in the presence of excess O_2 may be prevented if the inhibitor is present in the inlet gases at a concn. greater than a crit. value which increases with an increase in temp. HCl 5-11, CCl_4 0.1, and Cl_2 0.5-2.5% are satisfactory inhibitors when air is passed into a bed of burning coke. The inhibition is at the expense of the CO_2. Inhibition of the oxidation is most effective when the surface area of the reaction vessel is greatest. In an empty reaction tube and with the CO and Cl_2 preheated separately, no crit. Cl_2 concn. was found and inhibition was poor. CO_2 is produced by the oxidation of CO.

326. CAHEN, PAULE AND LETORT, MAURICE. **Determination of small quantities of carbon monoxide in a rapid stream of air.** *Bull. soc. chim. France* **1948**, 1163-5.—*C.A.* **43**, 2892*i*.

The study of the kinetics of combustion of graphite necessitates the detn. of traces of CO in a very rapid stream of air (0.1-0.2% by vol., 30 liter/hr). Oxidation of CO on CuO, hopcalite, I_2O_5, or Pt (platinized or smooth) is unsatisfactory for various reasons. A method which gives results within about 1% is based upon the catalytic oxidation of CO in contact with platinized glass, and absorption of the CO_2 formed by Ascarite.

327. Chukhanov, Z. F. **Nonisothermal combustion of carbon tubes under laminar conditions.** *Doklady Akad. Nauk S.S.S.R.* **62**, 333-6 (1948).—*C.A.* **43**, 2495*a*.

The combustion of hot carbon tubes with O_2 flowing through them is given by: $(dc/dz) = fkc$, where c is the concn. of O_2, z is the distance along the tube, f is a transfer coeff. related to the Reynolds no., and k is a const. This equation fits the exptl. data for O_2 flowing through a tube at 1000°C and a Reynolds no. of 500, under which conditions the process is controlled by diffusion. The limiting temp. below which combustion is nonisothermal can be calcd. if the O_2 concn., Reynolds no., and tube diam. are known.

328. Cohen, J.; Jonakin, P.; Corey, R., and Jain, B. **Measurement of the reactivity of solid fuels by the crossing-point method.** *Am. Soc. Testing Materials, Proc.* **48**, 1269-89 (1948).—*C.A.* **43**, 6805*f*.

In a modified reactivity app. the order of reaction with respect to O_2 was 0.81 for a Pittsburgh Bed coal, 0.65 for an Indiana No. 5 Bed coal, and 0.71 for a 900°C exptl. coke. The heating rate per unit surface varied only slightly with the sieve size of the Pittsburgh coal and coke, but varied considerably with that of the coarsely-banded Indiana coal.

329. Diehl, Harvey; Hach, Clifford C.; Harrison, George C.; Liggett, Lawrence M., and Brouns, Richard J. **Apparatus for determining the capacity and rate of oxygenation of solid materials.** *Iowa State Coll. J. Sci* **22**, 150-64 (1948).—*C.A.* **42**, 6692*e*.

For detg. both capacity and rate of oxygenation a differential manometric method was used. Four pressure chambers (2 of approx. 75 ml and 2 of approx. 700 ml) were interconnected by tubes fitted with stopcocks, so that the 2 large, the 2 small, or 1 large and 1 small chamber could be connected. A weighed sample of deoxygenated material was placed in 1 small chamber, both small chambers, were evacuated, and all 4 chambers were placed in a bath at the chosen absorption temp., both large cambers charged with O_2 at a pressure somewhat higher than the desired absorption pressure and cut off from the O_2 supply and from each other. Simultaneously, the 2 large chambers were connected to the 2 small chambers. A differential manometer recorded the difference in pressure in the 2 systems. Methods of measurement, calibration, and calcn. were given.

330. Dufraisse, Charles. **Oxygen and carbon.** *Rev. gen. caoutchouc* **25**, 471-3 (1948).—*C.A.* **43**, 2477*g*.

The roles of O_2 and carbon in nature and the possibilities of making profitable use of their reactivity by biochem. and artificial means are discussed.

331. Gadsby, J.; Long, F. J.; Sleightholm, P., and Sykes, K. W. **The mechanism of the carbon dioxide-carbon reaction.** *Proc. Roy Soc.* **A193**, 357-76 (1948).—*C.A.* **43**, 3694*i*.

The exptl. techniques for the static and dynamic study using coconut-shell charcoal were described. The pressures of the gases were varied from 10 to 760 mm and the temps. from 700° to 800°C. The first step in the reaction was the decompn. of the CO_2 into an atom of O, which was adsorbed by the carbon, and a mol. of CO, which passed into the gas phase. Only certain sites on the carbon surface seemed to take part in the reaction; they represented about 0.5% of the total area and probably consisted of some less firmly bound C atoms situated at lattice discontinuities. The rate of the first step was accounted for by assuming that reaction occurred in those collisions in which the combined energy of the active C atom and the indicent CO_2 mol. exceeds 68 kcal. The 2nd step was the evapn. of the adsorbed O atom, together with an atom of C from the solid to form gaseous CO; the activation energy was thought to be 38 kcal., and the low value of the frequency factor, 10^7/sec, was discussed.

332. Juza, R. **Magnetochemical investigation of oxygen sorption on various active materials.** *Angew. Chem.* **60A**, 254 (1948).—*C.A.* **46**, 9358*a*.

The magnetic susceptibility of O_2 sorbed at −183°C was measured. On active SiO_2 the first 100 mg per g of SiO_2 was sorbed as O_2, while susceptibility at satn. 530 mg per g of SiO_2, corresponded with the degree of assocn. of liquid O_2. On active charcoal, O_2 showed no definite assocn. steps. Initial assocn. corresponded to O_2 and finally surpassed the degree of assocn. of liquid O_2. On Pt black O_2 at 7 mg per g the susceptibility of the total O_2 sorbed was equal to that of liquid O_2, in contrast to the two previous systems investigated.

333. Kantorovich, B. V. **The motion of a carbon particle during its combustion in an air stream.** *Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk* **1948**, 1079-84.—*C.A.* **44**, 5183*c*.

The relative linear velocity of a particle of burning carbon is characterized in terms of the ratio of outer to inner reaction surface and the fraction of the original particle radius remaining. The math. treatment is based on considerations of particle dynamics and the kinetics of combustion.

334. Key, Arthur. **53rd Report of the Joint Research Committee of the Gas Research Board and the University of Leeds. The investigation of the use of oxygen and high pressure in gasification. V. The reactions between coke and steam at high pressure.** *Gas Research Board,* Copyright Pub. No. **40**, 36 pp. (1948).—*C.A.* **41**, 3277*c*.

Preliminary expts. with an app. designed for high-pressure experimentation at temps. up to 1100°C indicated that appreciable quantities of CH_4 were produced by the action of steam on cokes at all temps. within the limits of the app., and where the velocity of reaction was appreciable. The value of the product $(CO)(H_2O)/(CO_2)(H_2)$ was always higher than its equil. at ordinary pressure. The CH_4 produced in the reaction probably arose from the direct action of H on a coke surface which was at the same time undergoing erosion by steam. Cokes contg. Na_2CO_3 produced smaller amts. of CH_4. An investigation of 2 cokes with widely different reactivities has indicated that the most important factor in detg. reactivity is the proportion of the coke surface covered with the complex under standard conditions.

335. Khitrin, L. N. **Characteristics of the heterogeneous reaction in the combustion of carbon.** *Izvest. Akad. Nauk. S.S.S.R., Otdel. Tekh. Nauk* **1948**, 341-8.—*C.A.* **42**, 6622*h*.

An appropriate approx. boundary condition was given for the case of the combustion ($C+O_2$) taking place wholly at the outer surface of the solid or at both the surface and inside the solid. Equations of this type held for any of the heterogeneous processes taking place at the surface; not only for $C+O_2 \rightarrow CO_2$, but also for $C+CO_2$.

336. Khitrin, L. N. **Combustion of a spherical carbon particle. The effect of secondary reactions on the fundamental characteristics of the process.** *Izvest Akad. Nauk S.S.S.R. Otdel.Tekh. Nauk.* **1948**, 561-78.—*C.A.* **43**, 5268*a*.

A rate equation was derived for carbon burning in immobile gas (i.e., the diffusion-dominated conditions). This equation gave results in qual. agreement with available exptl. data for burning spherical carbon particles in air streams. It seemed to have broader significance than for the selected case for which it was developed, and can be used to calc. coeffs. of reaction interchange and diffusion transfer in practical problems involving the combustion of small carbon particles.

337. King, R. O. **The oxidation, ignition, and detonation of fuel vapors and gases. IV. The cause of detonation or combustion knock in engines.** *Can. J. Research* **26F**, 228-40 (1948).—*C.A.* **42**, 7514*c*.

A nuclear theory of self-ignition was described which was based on the substitution of finely divided carbon for the nuclear drops of the Callendar theory. The finely divided carbon appeared in the gaseous combustible mixt. as a result of pyrolysis of lubricating oil or of the fuel. Previous expts. have shown that flameless oxidation of fuel occurred solely on hot surface, not in the body of the gas. In an engine these surfaces might comprise areas of metal, metallic oxides, adherent carbonaceous matter, or carbon distributed in the combustible mixt. as fine particles.

338. Kunugi, Masanaga; Uda, Hiromu, and Jinno, Hiromu. **Combustion of solid fuel. I, II, III.** *J. Japan. Ceram. Assoc.* **56**, 27-30, 141-43 (1948), **57**, 4-5 (1949).—*C.A.* **45**, 7334*i*.

Cylindrical test pieces 1 cm high and 1.2 cm in diam. were made with a mixt. of coke 90% and clay 10%. The loss in weight of these test pieces at 700° to 1200°C was measured with the thermobalance. The velocity of combustion, i.e., the weight decrease, was expressed by a curve of second degree in which the diffusion velocity of O_2 through the layer of ash plays a controlling role. The combustion of a single coke briquet in a stream of air was discussed. Combustion in a bed of coke was discussed. The temps. of the solid and the gas phase were measured, and the gases were analyzed.

339. Long, F. J. and Sykes, K. W. **The mechanism of the steam-carbon reaction.** *Proc. Roy. Soc.* **A193**, 377-99 (1948).—*C.A.* **43**, 3694*e*.

The static and dynamic exptl. techniques were described for a study with coconut-shell charcoal. The pressures of the gases varied from 10 to 760 mm, and the temps. 680° to 800°C. Steam first reacted to give O and H atoms separately adsorbed on neighboring sites; an initial dissocn. into an adsorbed H atom and OH radical was probably followed by the more rapid transfer of the 2nd H atom to the C. Only about 2% of the total surface took part in the reaction, but these sites were thought to be atoms at the edges of the lattice planes. Adsorbed O_2 reacted more slowly to form gaseous CO; this CO had no retarding effect and was not appreciably adsorbed by the sites accessible to steam.

340. Majumdar, K. K. **Burning rates of Indian graphites.** *J. Sci. Ind. Research* (India) **7B**, 187-8 (1948).—*C.A.* **45**, 7772*a*.

Burning rates and ash contents have been detd. for graphites from Madagascar, Ceylon, Travancore, East Godavari, and Patna State. The results are tabulated.

341. Majumdar, K. K. **Identification of different types of graphite.** *J. Sci. & Ind. Research* **7B**, No. 12, 201-2 (1948).—*C.A.* **43**, 4180*f*.

Dry 0.5 g of powder at 110°C for 2 hrs, spread uniformly in a porcelain boat and heat in a tube furnace at 900°C ± 5°. Det. the loss in wt after heating 20 min.; then complete the combustion and weigh the ash. Calc. graphitic C by deducting ash from wt of original sample, ignoring volatile matter. Rate of oxidation is 31.5-33.5 mg/g/min. for amorphous and 42.6-44.4 mg/g/min. for flaky (cryst.) graphite under identical conditions. The diff. in rate suffices to distinguish between the 2 varieties.

342. Orning, A. A.; Mallov, S., and Neff, M. **Reactivity of solid fuels to air and oxygen.** *Ind. Eng. Chem.* **40**, 429-32 (1948).—*C.A.* **42**, 3549*h*.

New app. and procedure were described in detail. Duplicate detns. for bituminous coals and for high-temp. cokes gave a precision of ±3° and ±10°, resp., which was poorer than with the old procedure. Sensitivity to preheating was regarded as a factor causing the lower precision. On the basis of the new values, the equations for the reactivity indexes T_{15} and T_{75} defined as those temps. at which the self heating rates would be 15° and 75°C per min., as a function of the volatile content, V, were: $T_{15} \pm 8.1°C = 229.7 - 0.01022 (V-27.5)^3$ and $T_{75} \pm 11.2°C = 285.9 - 0.01282 (V-27.5)^3$.

343. Parent, J. D. and Katz, Sidney. **Carbon oxygen steam reactions studied.** *Am. Gas Assoc. Monthly* **30**, No. 1, 21-4 (1948).—*C.A.* **42**, 2417*f*.

Equil. concns. of gaseous products resulting from the interaction of graphite and steam were calcd. for a range of 1 to 100 atm., 900° to 1750°K., and a molar O_2-to-steam ratio of from 0 to 0.70. Increased pressure and decreased temp. favored the formation of CH_4 and CO_2, both of which have pos. heats of formation from their elements. Of course, these equil. values are not attained in practice. The reaction of carbon and steam increased rapidly with temp., although it was very slow below 2000°F unless the carbon was in a very highly activated state. At temps. exceeding 1800°F the only stable products were CO and H_2 in equimolar proportions if the pressure was one atm. Little steam should remain undecompd. in this range if adequate time of contact can be allowed.

344. PARENT, J. D. AND KATZ, SIDNEY. **Equilibrium composition and enthalpy changes for the reactions of carbon, oxygen, and steam.** *Inst. Gas Technol., Research Bull.* **2**, 110 pp (1948).—*C.A.* **43**, 2076*g*.

The equil. compns. and enthalpy changes (ΔH) of the reaction of graphite, O_2, and steam were computed from 900° to 1750°K and at pressures from 1 to 100 atms. for O_2-steam ratios between 0.0 and 0.70 in presence of an excess of C. At temps. above 1800°K and atm. pressure the equil. products are almost completely CO and H_2. At elevated temps. CO_2 and CH_4 formation are suppressed and steam decompn. is promoted. An increase in the O_2:steam ratio is necessary to maintain a const. ΔH with reduction of p. For a fixed O_2:steam ratio, the ΔH increases as p increases.

345. POSPEKHOV, D. A. **Mechanism of the formation of metal carbonyls.** *Zhur. Obshchei Khim.* **18**, 610-11 (1948).—*C.A.* **43**, 56*f*.

The fact that no lower carbonyls seemd to exist than $Ni(CO)_4$ and $Fe(CO)_5$ might be explained by intermediate formation of polymeric mols. $(CO)_n$. These appeared probable on account of the known existence of C_5O_4, C_4O_3, or C_5O_3, possibly formed through $C_nO_n \rightarrow C_{n-1}O_{n-2} + CO_2$. Formation of such polymers should be favored by high pressures, which are known to favor formation of metal carbonyls; it might also be heterogeneously catalyzed in the adsorbed layer on the metal.

346. PUSHKIN, V. S. **Problems of burning.** *J. Tech. Phys. (U.S.S.R.)* **18**, 49-60 (1948).—*C.A.* **45**, 4019*g*.

Three problems are considered: (1) combustion of coal particles, (2) burning-out of coal seams from the surface, and (3) combustion of coal walls in a channel.

347. RILEY, H. L. **Some structural aspects of carbon oxidation.** *Chemistry & Industry* **1948**, 569-71.—*C.A.* **43**, 26*a*.

The relation of crystal structure and the chem. purity of a carbon to the kinetics of its combustion and of its oxidation by liquid reagents are discussed.

348. RUESS, G. L. AND VOGT, F. **Exfoliated carbon from graphitic oxide.** *Monatsh* **78**, 222-42 (1948).—*C.A.* **42**, 7126*h*.

Carbon prepd. by the explosion of graphitic oxide has a different structure than any other form. Studies indicate that it consists of very thin graphite layers which show the property of increasing specific resistance with increasing pressure. From detns. of the methylene blue adsorption and the catalytic activity in synthesizing HBr, it is concluded that the crystal faces are active rather than only the unsatd. atoms in the edges of the faces.

349. SCHMIDT, L. D.; MCGEE, J. P., AND SLONE, M. C. **A pilot plant for gasifying powdered coal entrained in oxygen and steam.** *Chem. Eng. Progress* **44**, 737-44 (1948).—*C.A.* **43**, 378*a*.

A pilot plant built at West Virginia Univ. was described and some of the factors involved in its design are considered. Coal of the fineness ordinarily used in pulverized fuel steam plants was entrained in highly superheated steam contg. O_2. Gasification took place in a simple, high-temp. generator working at nearly atm. pressure.

350. WEISZ, R. S. AND JAFFE, S. S. **Mechanism of the reduction of oxygen at the air electrode.** *J. Electrochem. Soc.* **93**, No. 4, 128-41 (1948).—*C.A.* **42**, 3680*b*.

In acidic solns. the reduction of O_2 to H_2O_2 at carbon electrodes is irreversible. A tentative explanation for this is offered. In acidic and in alk. air-depolarized cells H_2O_2 disappears by catalytic decompn. alone. The mechanism by which O passes through air-depolarizing electrodes is shown to be diffusion, and a method for obtaining the diffusion coeff. is described.

351. WELLER, SOL AND YOUNG, T. F. **Oxygen complexes on charcoal.** *J. Am. Chem. Soc.* **70**, 4155-62 (1948).—*C.A.* **43**, 2840*d*.

Treatment of a low-ash charcoal with O_2 at 400°C increases its power to remove alkali from soln. and decreases its ability to remove acid. The rate of adsorption, but not the limit, increases from 25 to 40°C or on grinding to pass a 60-mesh screen. The limit is itself a function of concn. and approaches a limit as concn. is increased. Most of the HCl adsorbed by untreated charcoal is not readily extd. with water, but it can be removed by aq. NaOH. Both Na and OH ions are removed from soln. by a base-adsorbing charcoal. Similarly, both H^+ and Cl^- are removed by an acid-adsorbing material. The high-temp. outgassing of a treated charcoal reverses the changes in acid- and base-adsorptive properties produced by treatment with O_2. When O_2 is pumped off (as CO_2 etc.), the vol. of the charcoal decreases correspondingly, so that the apparent d. changes very little. O_2 treatment increases the surface area of a charcoal. In addn., there is a striking increase in the adsorption of H_2O at low pressures.

352. ZAWADZKI, J.; GAJEWSKI, W., AND GLETKIER, H. **The kinetics of the Boudouard reaction.** *Bull. intern. acad. polon. sci., Classe sci. math. nat., Ser. A.* **1940-1946**, 113-18 (1948) (in English).—*C.A.* **43**, 7309*b*.

The velocity of the reaction, $CO_2 + C \rightleftharpoons 2CO$, was measured in both directions over a wide range of temp. Pure CO_2 or CO, or the mixt. was passed through heated carbon at elevated temp. and at various speeds. The resulting gases were analyzed. A provisional formula was suggested for evaluating the velocity of reaction under the conditions.

353. ARTHUR, J. R.; BANGHAM, D. H., AND THRING, M. W. **Combustion in fuel beds.** *J. Soc. Chem. Ind.* **68**, 1-6 (1949).—*C.A.* **43**, 3592*c*.

Evidence indicates that the total energy of the gas increases as it passes through the fuel bed. Apparently CO, the primary combustion product of the C and O_2 surface reaction, reacts with surviving O_2 in the voids between the particles. Mere thermal quenching seems insufficient to "freeze" the reaction between CO and surviving O_2. The introduction of small quantities of volatile Cl-contg. materials with the carefully dried ingoing air appears to inhibit the gas-phase reaction. After the ingoing air travels a path length equiv. to a single particle length, virtually all tech. fuel beds begin to function as producers. Since the phys. mixing of the broad stream of producer gas with secondary air is otherwise incomplete, it is ordinarily necessary to run with excess air.

354. Arthur, J. R. and Bowring, J. R. **The combustion of carbon: Inhibition of secondary reactions by volatile reagents added to the oxidizing gas.** *J. Chem. Soc.* **1949**, S1-12.—*C.A.* **43**, 9417*a*.

The effects on the combustion of electrode carbon at 858°C under identical conditions of concn., temp., and time of contact were examd. quantly. Inhibitors used in order of effectiveness were: $POCl_3$, PCl_3, Cl_2, CCl_4, $CHCl_3$, $SnCl_4$, CH_2Cl_2, HCl, I_2, and SO_3. All inhibitors used increased the CO/CO_2 ratio in the combustion gases. The increases in CO and O_2 and the decrease in CO_2 agreed with the gas-phase reactions consuming CO and O_2. In all cases these changes occurred at <1% of the added inhibitor. Further addn. did not appreciably alter the analyses. The inhibition produced by CCl_4 was largely destroyed by addn. of H_2 or H_2O to the air-stream. The results were interpreted in terms of an interruption of the chain cycle responsible for CO oxidation.

355. Bergkampf, E. Schwarz. **A general combustion diagram.** *Radex Rundshau* **4**, 135-43 (1949).—*C.A.* **44**, 3234*d*.

The stoichiometric principles of the fuel combustion process are summarized in a diagram. The fuels are expressed in vol. %, as detd. from analyses. Generally, all combustions with either a surplus or deficiency of air can be traced, as well as those with extraneous O_2 and CO_2.

356. Blinov, V. I. and Rozet, T. A. **Some problems of the theory of coal combustion.** *Doklady Akad. Nauk S.S.S.R.* 67, 521-4 (1949); **73**, 363-6 (1950).—*C.A.* 44, 2729*i*; 45, 2648*b*.

If combustion of coal is a reaction of the first order and $c_w = \bar{c}_w$, where c_w is O_2 concn. on the surface of the burning object and $\bar{c}_w$ is av. value of O_2 on the surface, then $\bar{k}_s = k\bar{c}_w = \alpha(c_o - \bar{c}_w)$ and $\bar{k}_s = kc_o/(1 + k/\alpha)$ where k is const. of reaction of O_2 with C, α is coeff. of gas exchange, and c_o is concn. of O_2 in surrounding medium. The values of k_s/kc_o calcd. differed by not more than 5% combustion of plates and not more than 6% for cylinders.

357. Brewer, R. E. and Ghosh, J. K. **Desulfurization of coal during carbonization with added gases.** *Ind. Eng. Chem.* **41**, 2044-53 (1949).—*C.A.* **43**, 9414*b*.

A lowering of the S content in the coke produced by carbonizing coal was effected (1) by addn. of NH_3, H_2, or N_2 during coal carbonization, (2) by introduction of these gases at temps. lower than the final carbonization or reaction temp., (3) by continued treatment of the coal or coke sample at the reaction temp. with these added gases, and (4) by use of fine-size coke. Carbonization of coal with added NH_3 gas caused a large percentage of the S to be converted to volatile S compds. NH_3 was superior to H_2 and H_2 was more effective than N_2. The desulfurizing effects of NH_3, H_2, and N_2 when added to sized coal samples and their lump cokes were studied at 700°, 800°, and 875°C. Numerous tests were made with NH_3 introduced at 500°C and with H_2 at room temp.

358. Burshtein, R. Kh. and Miller, N. B. **The state of oxygen adsorbed by carbon and its ability for forming hydrogen peroxide and water.** *Zhur. Fiz. Khim.* **23**, 43-9 (1949).—*C.A.* **43**, 4075*i*.

Sugar charcoal was heated in H_2 at 950°C, degassed, cooled, and introduced into gas-free aq. H_2SO_4. Then it was filtered off either directly or after a 10-min. contact with O_2 of 2×10^{-4} to 245 mm Hg. In the first case H_2SO_4 was titrated in the filtrate and the amt. ("molecularly") adsorbed (A_1) calcd. In the 2nd case, the amt. adsorbed (A) was detd. as before, but the amt. X of O_2 adsorbed and the amt. Y of H_2O_2 formed also were detd. When the final concn. of H_2SO_4 was 0.0081, 0.1442, and 0.8455 N, A_1 was 0.008, 0.186, and 0.312, resp. the ratio X:Y varied irregularly between 15 and 63. The difference ($A - A_1$) was the acid adsorbed by displacing adsorbed-O.

359. Busch, H. W.; Berger, L. B., and Schrenk, H. H. **The "carbon-oxygen complex" as a possible initiator of explosions and formation of carbon monoxide in compressed-air systems.** *U. S. Bur. Mines, Rept. Invest.* No. **4465**, 22 pp. (1949).—*C.A.* **43**, 5952*c*.

Expts. have shown the existence of a C-O complex on carbon deposits from air compressors. Two samples of deposits produced definite evidence of exothermic reaction, by measurement of sensible heat, when heated to 250° in air. Decompn. of the C-O complex on the carbons studied began at somewhat below 100°. The use of automatic, temp. actuated, shut-off mechanisms reflecting excessive temp. in discharge lines of air compressors should prove effective in averting accidents.

360. Busso, Raoul H. **Identification of molecules activated by photogenesis in the combustion of carbon.** *Compt. rend.* **228**, 683-4 (1949).—*C.A.* **44**, 25*h*.

Two components are identified in the activated combustion of carbon with liquid air and CCl_4. These are relatively long-lived (some sec) mols. of activated CO at lower pressures than 3 cm. Hg and short-lived (some 10^{-3} sec) mols. of activated CO_2 at higher pressures than 3 cm Hg.

361. Busso, Raoul H. **Explanation of the kinetic changes in the oxidation of carbon at 1450°.** *Compt. rend.* **228**, 1946-8 (1949).—*C.A.* **43**, 7798*c*.

The rate of oxidation of graphite passes through a max. at 1450°C. The oxidation proceeds on the edges of the graphite planes where active centers attract O_2 and the reactivity of these active centers increases with increasing temp. From 1300° to 1400°C graphite begins to recrystallize, and the active centers are destroyed; thus the rate of oxidation is decreased so that a max. is reached at 1450°C. At 2000°C the active centers have too short a life to be effective, but the C atoms start to sublime so the rate oxidation again starts to increase.

362. Busso, Raoul H. **Application of the methods of theoretical chemistry to the study of the reactivity of graphite.** *Compt. rend.* **229**, 619-21 (1949).—*C.A.* **44**, 895*b*.

The index of free valence of graphite is calcd. to be 0.215, compared with 0.458 for benzene. The atoms in the graphite planes are very slightly reactive. Activation of carbon consists in increasing the ratio of the no. of atoms in prismatic surfaces to the no. in planes. Chemisorption takes place at crystal edges, where the index of free valence is high. The instability of the atoms of high free valence at high temps. explains the change in the kinetics of graphite combustion at 1500°C.

363. Chukhanov, Z. F. **Nonisothermal combustion of carbon tubes under turbulent conditions.** *Doklady Akad. Nauk S.S.S.R.* **64**, 675-8 (1949).—*C.A.* **43**, 6896*a*.

The differential equation governing combustion of hot carbon tubes through which O_2 is flowing turbulently is $(dc/dz) = -fkc - [(b+1)dkcx/Rp]$, where c is the O_2 concn., z is the distance along the tube, f is the transfer coeff. along the stream, b is a function of the ratio of c to the sum of the individual concns. considered, d is the tube diam., x is a function of the temp. gradient, R is the Reynolds no., p is the Prandtl no., and k is a const. not otherwise identified. The practical verification of the math. relations developed is difficult in view of the lack of exptl. data.

364. Chukhanov, Z. F. **Nonisothermal combustion of carbon particles in a layer.** *Doklady Akad. Nauk S.S.S.R.* **65**, 673-6 (1949).—*C.A.* **45**, 425*f*.

The previously-derived equations governing combustion of hot carbon tubes through which O_2 is flowing were found to conform to exptl. data given O_2 concn. as a function of the distance along the tube.

365. Clusius, Klaus and Huber, Max. **Flames. II. Does carbon suboxide burn in dry air?** *Helv. Chim. Acta* **32**, 2400-15 (1949).—*C.A.* **44**, 2832*i*.

Yes, but the character of the flame differs when C_3O_2 is burned in moist or dry air. A flame that has become nonluminous by the addn. of dried air is extinguished when addnl. dry air is added. In a dry C_3O_2 flame, CO is formed, which disproportionates into CO_2 and C. The luminosity is due to C. The explosive limit for dry mixts. of air and C_3O_2 at 490 mm is 16 to 31%; for moist, 6 to 30% C_3O_2.

366. Dunoyer, Jean M. **Theoretical kinetic study of the reaction of a gas on a solid in which it diffuses.** *Compt. rend.* **228**, 1729-31 (1949).—*C.A.* **44**, 1309*h*.

The effect of diffusion is considered in the reaction of a finely divided solid with a gas in which it is suspended. An equation is derived for the no. of gas mols. contained at a given time in a homogeneous spherical portion of the solid.

367. Fredersdorff, C. Von. **Continuous gasification of powdered-coal suspensions by air-oxygen and air-oxygen-steam mixture.** *Proc. Am. Gas Assoc.* **31**, 705-24 (1949).—*C.A.* **44**, 8623*c*.

Although a satisfactory gasification was accomplished from the standpoint of gas calorific value, it will be necessary to employ steam superheated to at least 2000°F to (1) decrease the make-gas CO_2 content, (2) decrease the O_2 required for gasification, (3) increase the carbon conversion, and (4) shift the point of max. thermal efficiency to closer correspondence with the point of max. calorific value.

368. Golovina, E. S. **Oxidation of coal.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* **1949**, 1343-51.—*C.A.* **45**, 4425*e*.

Spherical samples of about 1.5 cm diam. were prepd. by compression and coking of finely powd. material (below 43 μ grain size), or by turning from electrode carbon, anthracite dust, Moscow-region coal, massive natural anthracite. The diam. of the samples varied from 1.45 to 1.57 cm and the d. 1.15-1.17 g/cc. Rates of combustion in a stream of air (3-60 cm/sec), detd. by the loss of wt, are expressed in $k = g/cm^2$ sec. With electrode carbon oxidation became noticeable at 416°C; above 525°C the temp. rose spontaneously very rapidly, ending in ignition. Twelve-fold variation of the velocity of the air stream (5-60 cm/sec) had no effect on the rates of oxidation. The apparent activation energy E, from plots of log k as a function of $1/T$, was const. (35.5 kcal/mole) up to about 490°C, but showed a break above that temp., indicating a slowing-down of the process. The preponderant role of phys. structure appeared from samples both chemically identical (anthracite). The slowing-down of the reaction above 500°C was ascribed to changing penetration of O_2 into the interior of the sample; in the higher-temp. range, the reaction took place mainly in a spherical layer following the surface of the sample.

369. Jones, R. E. and Townend, D. T. A. **Oxidation of coal.** *J. Soc. Chem. Ind. (London)* **58**, 197-201 (1949).—*C.A.* **43**, 9412*d*.

The initial reaction appears to involve chemisorption which is followed by the formation of a $C\text{-}O\text{-}H_2O$ complex. The oxidation of coals follows a similar course to that of hydrocarbon oils, rubbers, and some food. The presence of adsorbed water is necessary for the formation of the complex. With coals the amt. of the complex formed in the course of a given exposure to air is a function of particle size and pore structure. The complex formed on moist charcoal is stable on heating to 50°C in vacuo; it breaks down slowly at 80°C but is still detectable after heating in vacuo at 350°C. On coal exposed to air at ordinary temps. the peroxygen complex builds up to a max. concn. and then decays. The overall oxidation proceeds without interruption even when the peroxygen concn. has become very small.

370. Juza, R.; Lübbe, H., and Heinlein, L. **The sorption of oxygen and bromine on charcoal, estimated by magnetic measurements.** *Z. anorg. Chem.* **258**, 105-20 (1949).—*C.A.* **43**, 6038*b*.

The total O_2 adsorbed on sugar charcoal increased 2.5-fold with increase in the outgassing temp. from 20° to 1150°C. The proportion bound as mol. O_2, as estd. by magnetic measurement, decreased from 100% at 20° and 100°C to 47-49% between 950° and 1150°C. Outgassing at the higher temps. frees more surface for chemisorption. Sorption of O_2 on charcoal, outgassed at 700°C was studied for various pressures and times. As the total increased, the wt of chemisorbed-O_2 increased sharply at first followed by a gradual, linear increase. The wt of physically adsorbed-O_2, at first negligible, rose steeply and linearly. As a result, the O-bound as oxide decreased rapidly from 100 to 18-27%. The sorption of Br_2 by activated and recrystd. sugar charcoals and Ceylon graphite was studied. With activated carbon, surface adsorption predominated but intercalation may be involved in adsorption of the first Br_2.

371. KWIECIŃSKI, ALFRED W. **Processes of the combustion of carbon regarded in a new light.** *Przeglad Górniczy* **5**, 1133-5 (1949).—*C.A.* **44**, 5203*c*.

The difference between the heat of combustion of carbon to CO_2 and to CO (97 − 29.3 = 67.7 kcal/mole) involves other factors besides the purely thermal effect. The joining of each O atom to the C atom by a double bond consumes 167.6 kcal/mole, the inactivation of two valencies of C (i.e. the change from C^{IV} to C^{II}) accounts for 40.8 kcal/mole, and one-half of the energy of dissocn. of the O mol. accounts for 59.1 kcal/mole. Thus, for $CO + \frac{1}{2}O_2 \rightarrow CO_2$, the combustion heat is 167.6 − 40.8 − 59.1 = 67.7 kcal/mole.

372. LEWIS, W. K.; GILLILAND, E. R., AND MCBRIDE, GUY T., JR. **Gasification of carbon by carbon dioxide in fluidized powder bed.** *Ind. Eng. Chem.* **41**, 1213-26 (1949).—*C.A.* 43, 6807*h*.

The reaction rates at atm. pressure of CO_2 with two types of carbon were detd. between 1465° to 2000°F. The data have been correlated by a Langmuir-type equation, where the rate of reduction of CO_2 per unit quantity of carbon in the bed equals: $k_1p_{CO_2}/(1+k_2p_{CO_2})$, where the k terms are functions of temp. only, and the p terms represented the partial pressures of each component. For each carbon, k_1 rose rapidly with temp. while k_2 and k_3 fell. The observed conversions fell far below the values calcd. from the equation at low reaction temps., and were far higher than calcd. at high reaction temps.

373. LOEBENSTEIN, W. V. **Quantitative prediction of the combustion of carbon adsorbents.** *Proc. Tech. Session Bone Char* **1949**, 271-83.—*C.A.* **43**, 8648*f*.

The fraction of C burned was expressed as a function of time for any carbon adsorbent under conditions of const. temp. and O_2 concn. These conditions were realized in containers constructed of wire screening which support the samples during the oxidation in a lab. muffle furnace with temp. control. Two samples of a given char were burned for known periods of time according to the procedure described and carbon detd. in the residues. It was then possible to predict the time required to reduce the carbon in the original sample to any designated value.

374. LOEBENSTEIN, W. V.; GLEYSTEEN, L. F., AND DEITZ, V. R. **Kinetic study of the reaction of carbon adsorbents with oxygen.** *J. Research Natl. Bur. Standards* **42**, 33-41 (1949) (Research Paper No. 1948).—*C.A.* **43**, 4546*h*.

The results for activated carbons and bone chars were expressed in terms of the fraction of C burned per hr at known values of O_2 between 250° and 390°C and total rate of flow. The rate of oxidation could be expressed either in terms of simple first-order or retarded first-order relations. A nomograph was developed to obtain a rapid estimate of the total fraction of C burned at any time for a given rate const. and degree of retardation. The relation between the reaction-rate const. and O_2 was linear for a given adsorbent under the same conditions of temp. and flow. The effect of temp. on the rate disclosed deviations from the Arrhenius equation even over a 100°C interval. The necessary conditions for attaining the optimum uniformity in the carbon content of bone char were discussed.

375. LOEBENSTEIN, W. V. AND PENNINGTON, N. L. **Fundamental aspects of the reaction of oxygen with carbon adsorbents.** *J. Research Natl. Bur. Standards* **43**, 87-96 (1949) (Research Paper No. 2009).—*C.A.* **43**, 8839*g*.

The rate const., k, for the oxidation by O_2 of coconut-shell charcoal and of various bone chars was independent of sample wt and only slightly affected by flow rate. The ratio of CO_2 to CO increased with increased sample wt, indicative of a catalytic oxidation of CO to CO_2. A plot of k against x, the mole fraction of O_2, was linear for any one temp. Both the positive intercept on the k axis and the slope increased with temp. The equation: $k = A \exp(-E_1/RT) + Bx \exp(-E_2/RT)$, where A, B, E_1, and E_2 are parameters, can account for the data. For coconut charcoal $A = 2.93 \times 10^6$ hr^{-1}, $B = 6.09 \times 10^5 hr^{-1}$, $E_1 = 21{,}800$ cal., and $E_2 = 16{,}900$ cal. For a typical bone char, $A = 1.16 \times 10^6$, $B = 1.63 \times 10^{13}$, $E_1 = 19{,}700$, and $E_2 = 34{,}800$.

376. MANTEL, WALTHER. **Determination of the oxygen content of solid fuels.** *Brennstoff-Chem.* **30**, 92-6 (1949).—*C.A.* **43**, 7661*d*.

The O-content in a no. of low-ash Ruhr coals was calcd. from lab. carbonization products: aq. condensate, CO, CO_2, and the O_2 in tar and coke. When the percentage of volatile matter (pure coal basis) was plotted against the O_2 percentage a smooth curve resulted. The low point on this curve (around 19-20% volatile matter) corresponded to the min. volatile matter content of coal to form a good solid coke.

377. NOVELLA, ENRIQUE COSTA. **Gasification of coal in a fluid medium with carbon dioxide.** *Anales real soc. españ. fís. y quím.* **45B**, 627-46 (1949).—*C.A.* **44**, 3697*i*.

The data (785° to 985°C at atm. pressure) were related by two equations of the Langmuir type: reduction rate of CO_2/ unit wt coal $= \alpha P_{CO_2}/(1 + B'P_{CO_2}) = \alpha P_{CO_2}/(1 + \gamma P_{CO} + BP_{CO_2})$. CO_2 partial pressure varied from 0.1 to 1.0 atm. The consts.

in both were only a function of temp., a increased rapidly with increasing temp., B', B, and γ decreasing. Both equations related equally well the data obtained in this study.

378. RHEAD, T. F. E. AND PICKERING, E. T. **Coke for use in open fires from continuous vertical retorts. Some aspects of its production and characteristics.** *Inst. Gas. Engrs.*, Copyright Publ. No. **343/156**, 41 pp. (1949).—*C.A.* **44**, 308*f*.

Ease of combustibility was detd. by the time required for the fire to reach a "cheerful" state, which was considered to have been achieved when a radiation emission of 5600 B.t.u. per hr was reached. The time, taken in min., for a fire to reach the "cheerful" state was regarded as the initial combustibility index. The ease of combustibility of the domestic-size sales coke was affected mainly by the quality of the dry coke substance, the size grading, and the moisture content. The radiation emitted was measured by means of a set of thermopiles which operated a recording milli-voltmeter.

379. SCHMITZ, GEORGE. **Temperature distribution in free-burning carbon arc lamps.** *Z. Physik* **126**, 1-11 (1949).—*C.A.* **43**, 8915*a*.

The d. distribution in the atm. around a carbon arc in air was detd. interferometrically and the temp. distribution calcd. The true arc column can be distinguished from the external region. The effect of convection air currents was important in the external region but not in the arc column.

380. TAYLOR, J. AND POLLOK, F. **Effect of various chemicals, more particularly sodium bicarbonate, on the ignition of cellulose, coal dust, and activated charcoal.** *Fuel* **28**, No. 4, 77 (1949).—*C.A.* **43**, 4468*c*.

Pure cotton cellulose in the form of ash-free filter paper when heated in an air bath showed incipient decompn. at about 200°C and ignited at about 340°C. When $NaHCO_3$ was in contact with the paper, marked decompn. occurred with smoldering at about 200°C. In tests with about 400 chemicals, which were listed and classified, all those which promoted smoldering lowered the ignition or smoldering point to about 200°C, but the rate at which they caused decompn. of the cellulose varied. Oxidizing agents lowered the ignition point below 200°C. In tests in a different app. the ignition points of bituminous coal dust and activated charcoal were lowered in the presence of $NaHCO_3$.

381. ARTHUR, J. R. AND BANGHAM, D. H. **The mechanism of energy release in the combustion of solid carbonaceous fuels.** *J. chim. phys.* **47**, 559-62 (1950).—*C.A.* **44**, 10473*b*.

Recent investigations are reviewed of the effect of inhibitors on the compn. of combustion products of various carbonaceous solids. The expts. indicate a two-stage mechanism, with CO forming at the carbon surface and being oxidized to CO_2 in the gas phase. Certain aspects of the process are still obscure.

382. ARTHUR, J. R. AND BOWRING, J. R. **Effects of inorganic impurities on the mode of combustion of carbon.** *J. chim. phys.* **47**, 540-2 (1950).—*C.A.* **44**, 11058*g*.

Addn. of salts ($CuCl_2$, $ZnCl_2$, KCl, KI, NaCl, Na_2CO_3) to electrode carbon increased the rate of gasification in air at 500-700°C. The CO_2/CO ratio was also increased in each case. It was proposed that the two effects were related.

383. AUDUBERT, R. AND BUSSO, R. H. **Production of light and mechanism of oxidation of carbon.** *J. chim. phys.* **47**, 331-8 (1950).—*C.A.* **44**, 7177*b*.

Ultraviolet light (2000-2600 A.) was emitted during the oxidation of graphite, by excited gaseous mols. By means of a flow system and a CuI photo-elec. cell, mean life of these "active centers" was measured as a function of pressure. Two types of emitters were present, with different mean lives; tests with a liquid air trap and CCl_4 inhibitor identified these as activated CO (2 ± 0.5 sec) and activated CO_2 ($2 \pm 1 \times 10^{-3}$ sec). At 1500°, the CO predominated below 30 mm and the CO_2 above 30 mm.

384. BANGHAM, D. H. AND DRYDEN, I. G. C. **Accessible oxygen of bituminous coals.** *Fuel* **29**, 291-2 (1950).—*C.A.* **45**, 1322*d*.

There appeared to be some connection between the heat of wetting of British coals, their natural O-content, and their degree of oxidation. Heat of wetting in MeOH was of such an order as to indicate merely phys. interaction, while heat of wetting in ethylenediamine is 2 or 3 times greater for low-rank bituminous coals. Oxidation of the coals caused an increase in both the heat of wetting in MeOH and the difference in heat of wetting between MeOH and ethylenediamine.

385. BANGHAM, D. H. AND TOWNEND, D. T. A. **The combustion of carbon: an outline of the work of the B.C.U.R.A. Laboratories 1939-49.** *J. chim. phys.* **47**, 315-21 (1950).—*C.A.* **44**, 7044*h*.

Various types of evidence indicate that CO rather than CO_2 is the primary product of the carbon-oxygen reaction. The down-jet burner is described. Internal burning within fuel particles is discussed. An explanation of the anomalous increase of the sum of thermal and chem. energy of the gas on passing through the fuel bed is offered.

386. BOWRING, J. R. AND CRONE, H. G. **Rate of combustion of carbon. Some effects of internal structure and inorganic impurities.** *J. chim. phys.* **47**, 543-7 (1950).—*C.A.* **44**, 10469*h*.

Temps. of single particles of various solid fuels were measured as combustion proceeded in a furnace of controlled temp. Temp. rises were observed when about 90% of the wt loss had occurred. Studies with ash-free carbon revealed a tendency to disintegrate, especially when the air was very dry or when $POCl_3$ was added to the air. Addn. of Na_2CO_3 or Li_2CO_3 to the C prevented disintegration.

387. CHAKRAVORTY, S. L.; LONG, R., AND WARD, S. G. **Formation and decomposition of peroxygen in low temperature air-oxidation of coals.** *Fuel* **29**, No. 3, 68-9 (1950).—*C.A.* **44**, 3695*i*.

Peroxygen formation was studied for 7 Indian coals and 1 British coal. The thermal decompn. of the peroxygen in an inert atm. at different temps. was found to approx. a 1st order reaction. The energy of activation for the decompn. was found to approx. that for hydroperoxide decompn.

388. Courty, Clément. **On the evolution of the magnetic properties of oxygen adsorbed on activated charcoal which has been activated in a vacuum at elevated temperature.** *Compt. rend.* **230**, 1588-9 (1950).—*C.A.* **44**, 10403*e*.

The coeff. of magnetization was calcd. for O_2 adsorbed on charcoal activated at 0.02 mm for 6 hrs at 900°C. When this charcoal was put into contact with O_2, the adsorption was accompanied by the release of 5.6 cal. This was attributed to the formation of CO_2. The decrease in the paramagnetism is of the same order for charcoal which has been activated either in the cold or at high temps.

389. Crone, H. G. **Modes of burning of solid fuel.** *J. chim. phys.* **47**, 563-4 (1950).—*C.A.* **44**, 11058*g*.

The stages in the combustion of solid fuels are discussed, with particular reference to the formation of ash deposits bonded by alkali sulfates and phosphates.

390. Deringer, H. **A simple calculation of the composition of gasification gases in equilibrium with carbon.** *Festschr. Paul Schlapfer* **1950**, 57-61.--*C.A.* **46**, 708*f*.

Equations are set up and solved to det. the gas compn. in several gasification processes.

391. Duval, Xavier. **Reaction of oxygen with carbon filaments at high temperatures and very low pressures.** *J. chim. phys.* **47**, 339-47 (1950).--*C.A.* **44**, 7177*c*.

The oxidation was studied from 5×10^{-5} to 3×10^{-3} mm Hg and 1200° to 2200°K. When the Hg vapor from the McLeod gage was condensed, the high-temp. reaction gave almost pure CO. The reaction was first order, starting at 2000°K, and the rate was nearly independent of temp. (1900°-2200°K). When Hg vapor was present, CO_2 appeared in appreciable quantities and the combustion rate was accelerated considerably. Data were presented below 1800°K where CO is again the primary product.

392. Friedman, Louis D. and Kinney, Corliss R. **Humic acids from coal. Controlled air-oxidation of coals and carbons at 150° to 400°.** *Ind. Eng. Chem.* **42**, 2525-9 (1950).—*C.A.* **45**, 1748*f*.

Coals were oxidized to alkali-sol. acids by air oxidation in electrically heated tubes; reaction times were 120-180 hrs. At first the rate of air flow was limited to keep the temp. const.; after 25-75 hrs it was possible to admit a large excess of air. The max. temp. of oxidation of lignitic and subbituminous coals was 250°C, that of bituminous coals 300°C, that of anthracite, carbon, and lamp-black 350°C, and that of graphite 400°C. Ease of oxidation decreased with increasing percentage of fixed C. All oxidation products oxidized at 200°C were at least 90% sol. in alkali.

393. Fritsche, Wolfram. **The water-gas equilibrium and its relation to practical gasification processes.** *Brennstoff-Chem.* **3**, 337-50 (1950).—*C.A.* **45**, 1749*c*.

The heterogeneous equil. (reactions of H_2O with carbon) is not completely established during the gasification process and equil. is reached only at a higher temp. than that corresponding to the equil. const. Two heterogeneous water-gas reactions exist simultaneously during the gasification process. The equil. const. for the water-gas reaction is characterized by the product of the consts. of the two sep. reactions, corresponding to the extent to which they occur, and not by the quotient, as has been erroneously concluded. The decompn. of steam first occurs at a higher temp. than the decompn. of CO_2 on carbon. The conversion of CH_4 with steam and the decompn. of steam over carbon is practically complete at the temps. under consideration. Consideration of the effect of temp. on the consts. for CH_4 splitting with CO_2 indicate that steam can be partly replaced with CO_2; however, no saving in steam is actually realized.

394. Gel'd, P. V. and Esin, O. A. **Effect of salts on the rates of dissociation and reduction processes.** *Doklady Akad. Nauk S.S.S.R.* **73**, 541-4 (1950).—*C.A.* **45**, 27*a*.

The rate of the reduction of chromite ($FeO\cdot Cr_2O_3$) by H_2 or graphite to $Fe + Cr_2O_3 + H_2O$ (or CO) was detd. by the amt. reduced in 1 hr at const. temp. between 300° and 1200°C. It was strongly accelerated by the addn. of 3% K_2CO_3. Expts. remained far below the equil., which cannot be reached even in 15 hrs. Reduction by graphite was faster than by H_2. The dissocn. $CaC_2 \rightarrow 2C + Ca$ (vapor), very slow at 1200°C, was markedly accelerated by 5% CaF_2 or $CaCl_2$, and even more by 5% $BaCl_2$. At 1300°C, the order of increasing accelerating effectiveness was 5% CaF_2, $CaCl_2$, K_2CO_3, NaCl.

395. Gol'denberg, S. A. **Turbulent heterogeneous combustion.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* **1950**, 1154-64.--*C.A.* **46**, 1336*i*.

The combustion of carbon was investigated by passing O_2 under turbulent flow conditions (22-145 m/sec.) through heated cylindrical carbon tubes at 500-1050°C. The coeff. of gas exchange in the equilibria between O_2 and CO_2 is approx. $8.5\times10^5 \exp(-18{,}000/RT)$.

396. Grosskinsky, Otto. **New knowledge of the action of oxygen on coal.** *Gluckauf* **86**, 988-95 (1950).—*C.A.* **45**, 3144c.

Various kinds of coal were heated in air at 200-300°C to form O-contg. products, which on further heating can be converted to activated carbon. If the products of the "pre-oxidation" are further oxidized in the liquid phase, these result in cyclic C acids of varying comp. which can be used to make lacquer, resin, plasticizers, drugs, etc.

397. Jones, R. E. and Townend, D. T. A. **The role of the peroxidic complex in the low-temperature oxidation of carbon.** *J. chim phys.* **47**, 348-52 (1950).—*C.A.* **44**, 7128*h*.

Dry carbons, on exposure to moist air, form a peroxygen complex, the amt. of which is roughly proportional to the amt. of water adsorbed. This holds for different carbons. The complex is not removed by the removal of adsorbed moisture at ordinary temps.; it is stable at 55°C, breaks down slowly at 80°C, and rapidly but measurably at 350°C. Abnormally high heats of adsorption of O_2 on carbon that have been reported are attributed to this complex. It is proposed that the presence of H atoms is essential for formation of the complex.

398. Juza, Robert. **Chemisorption, adsorption, capillary condensation, and adsorption estimated by magnetic measurements.** *Chem.-Ztg.* **74**, 55-7 (1950).—*C.A.* **44**, 6699*i*.

On outgassing at room temp. 3 mg of O are bound per g of charcoal by phys. adsorption; on outgassing at higher temp. the phys. adsorption remains about the same, but chemisorption increases with temp. and at 1150°C the chemisorption amounts to 3.5 mg per g and the total amt. bound is 7.2 mg. The oxide decreases from 100 to 20% as the amt. of O sorbed increases to 12 mg per g of charcoal. Magnetic susceptibility can also be used to study the sorption of O_2 on SiO_2 at -183°C. The liquid O_2 curve is parallel to the actual curve above 100 mg of O_2 per g of SiO_2, indicating that the liquid phase is bound by capillary condensation in this region.

399. Karzhavina, N. A. **Effect of pressure on the rate of the reduction of carbon dioxide by carbon.** *Doklady Akad. Nauk S.S.S.R.* **73**, 971-3 (1950).—*C.A.* **44**, 10467*h*.

The yield of CO in the passage of CO_2 mixts. with N_2 (300 ml/min.) over a layer of charcoal or electrode carbon at 990°C does not vary with the total pressure between 1 and 13 atm., at any fixed concn. of CO_2. The yield is approx. of the 1st order up to about 50% CO_2, but then becomes and remains independent of it (zero order). In terms of the height of the layer (grain size 2-3 mm), the CO content increases with increasing height of column, but is not proportional to it.

400. Lesher, C. E. **Low-temperature coke as a reactive carbon.** *Trans. Am. Inst. Mining Met. Engrs.* **187**, Tech. Pub. No. **2874-F** (in Mining Eng. **187**, 805-10) (1950).—*C.A.* **44**, 7514*e*.

The reactivities of 950° and 1650°F cokes were measured by relative rates of reduction of Fe oxides up to 2200°F. Three standardized combinations of Lake Superior brown Fe ore with coke were tested: (1) mech. mixt. of carefully sized high-temp. 1650°F coke with the ore; (2) mech. mixt. of the ore with Disco obtained by carbonizing the identical coal at 950°F, and (3) agglomerate prepd. by carbonizing the coal and ore at 950° F, premixed in proportions to give as nearly as possible the same relative amts. of coke and ore as the mech. mixts. The agglomerate was most active, the mixts. of Disco and ore next, and coke the least reactive.

401. Letort, Maurice and Magrone, Robert. **Influence of particle shape in the study of the rate of combustion of graphite.** *J. chim. phys.* **47**, 576-82 (1950).—*C.A.* **44**, 10469*e*.

Two graphites were studied, one with 0.22% ash and the other with less than 0.01% ash. The combustion rate at about 600°C of the first decreased with time while that of the second increased with time, in each case approaching an asymptotic value. The rate depended not only on grain surface, but also on penetration of combustion into the interior. Activation energies of 48 and 50 kcal were reported for the two graphites.

402. Letort, Maurice; Petry, Mme. J.; Barret, P.; Collart, F.; Labaeye, P., and Martin, J. **Work in progress on the mechanism of graphite combustion at low temperature (450-600°): phenomenon of "excess combustibility." Desportion of the reaction gases.** *J. chim. phys.* **47**, 548-58 (1950).—*C.A.* **44**, 11059*d*.

Dry air was passed over powd. graphite in a heated tube. A phenomenon of "excess combustibility" was found wherein the oxidation proceeds several times as fast when stagnant air is left in the tube as when air is flowing; this effect was assocd. with traces of Cu in the graphite. Evolution of surface-bound oxides was studied by a N_2 purging technique with analysis of this exit gases.

403. Leye, Alexander R. **The "available" hydrogen and sulfur content in combustion calculations.** *Brennstoff-Chem.* **31**, 278-80 (1950).— *C.A.* **45**, 2176*c*.

It is assumed that the "available" H is equal to total H—(O/8), on the assumption that all of the combined O is in the form of H_2O. The available H is really equal to total H—(β O/8) in which β is a min. of 0.45 for low-volatile coals and a max. of 0.55 for high-volatile coals, av. 0.53 for most gas coals. S corrections are required only for high-S coals.

404. Long, F. J. and Sykes, K. W. **The catalysis of the oxidation of carbon.** *J. chim. phys.* **47**, 361-78 (1950).—*C.A.* **44**, 7132*d*.

The reactions of coconut-shell charcoal with steam and CO_2 were studied after removing catalytic impurities. The range 700° to 884°C and pressures of the gases from 10 to 760 mm were used. The general form of the reaction mechanism was not changed by the presence of the catalysts, but the rates of certain stages were increased. The activation energies of processes in which O_2 was transferred to the charcoal were slightly reduced. The no. of active sites was not significantly altered by removal of the impurities.

405. Loon, W. van and Smeets, H. H. **Combustion of carbon.** *Fuel* **19**, No. 5, 119-21 (1950).— *C.A.* **44**, 5563*b*.

A simple test was outlined in which a carbon particle was burned in a vortex chamber with O_2. The $CO/(CO+CO_2)$ ratio in the combustion products increased with the rate at which the O_2 was supplied. Primarily CO was formed at the carbon surface and this CO may be secondarily burned to CO_2 in the diffusion layer on the particle. Under certain conditions traces of O_3 were formed in the combustion gases.

406. Mertens, E. **The primary combustion of carbon.** *J. chim. phys.* **47**, 353-5 (1950).—*C.A.* **44**, 7177*e*.

O_2 was passed over graphite, and the product sampled with a water-cooled probe; there were obtained 81.4% CO_2 and 18.2% CO. Addn. of CCl_4 (80 mg or more of Cl_2 per liter of O_2) suppressed CO_2 formation, giving 9.2% CO_2 and 90.6% CO. Thus, CO was the primary reaction product.

407. Meyer, Lothar. **The primary reaction of graphite with oxygen, carbon dioxide, and water vapor.** *J. chim. phys.* 47, 328-30 (1950).—*C.A.* **44,** 7128*i*.

Published results differ as to nature of primary products, order of reaction, activation energy, sorption of O, and effect of impurities and structure of the graphite filaments. The differences are due to cracks present. Reaction products formed in such a crack would return to the hot surface many times before leaving, thus leading to secondary reactions.

408. Omori, T. T. and Orning, A. A. **Effect of pressure on the combustion of pulverized coal.** *Trans. Am. Soc. Mech. Engrs.* **72,** 591-7 (1950).—*C.A.* **44,** 7511*b*.

Exptl. investigation, in the absence of an extended flame (so that the source of radiant heat could be independently controlled), showed an adverse effect of elevated pressures upon completeness of combustion of a suspended sphere which was much larger than the beneficial effect of increased partial pressure of O_2. Apparently the increased pressure, through a lower initial heating rate, produced less reactive combustion residues which lost ignition before combustion was complete.

409. Oreshko, V. F. **Oxidation of hard coal under nonisothermal conditions.** *Zhur. Priklad. Khim. (J. Applied Chem.)* **23,** 306-16 (1950).—*C.A.* **45,** 2174h.

Expts. with a hard coal (C 88.34, H 5.11, N 1.33, S 1.50%; ash 3.48, moisture 0.95, volatile 23.0%; grain size 0.2 ± 0.1 mm), (1-g) in a stream of O_2 at 65 ml/min. showed an initial stage of gain of wt followed by a loss of wt, a min., then a rapid rise of the wt up to a sharp peak, and finally steep fall of the wt leading to rapid loss of wt as a result of inflammation. The temps. corresponding to the min. were 132-4°C, of beginning increase of wt, 146-8°C, and of the peak of wt, 235-7°C. In the range between the 146°C and the peak, the rate of formation of C-O complexes stable at these temps., exceeded the sum of the rates of formation of peroxides + decompn. of the stable C-O complexes. In the range of decreasing wt, between ~70 and ~130°C, the (predominating) rate of decompn. of the peroxides must be proportional to their surface concn. at any given moment.

410. Oreshko, V. F. **Oxidation of hard coal.** *Doklady Akad. Nauk S.S.S.R.* **70,** 445-8 (1950).—*C.A.* **45,** 5388*i*.

Oxidation of coal in a stream of O_2 proceeds in 2 stages. On the 1st stage, the decrease of wt x follows the law $dx/dt = k_1(a - x)e^{-E_1/RT}$, where a = max. decrease of wt (approx. proportional to the initial concn. of peroxides in the coal) and k_1 depends on the surface area and the concn. of O_2; a and x are expressed in mg/g, t in min. In the 2nd stage at higher temps., the rate of increase of wt is $dx/dt = k_2e^{-E_2/RT}$. These relations were tested and confirmed in expts. with coal samples. The near constancy of E_1 (6500 cal) indicates close similarity of the nature and compn. of the peroxides in coals of different ages. The effect of the nature of the coal is much more pronounced in the 2nd stage, that of formation of more stable C-O complexes.

411. Oreshko, V. F. **Rates of oxidation of Kuznetsk coals.** *Doklady Akad. Nauk S.S.S.R.* 74, 327-30 (1950).—*C.A.* **45,** 2175*f*.

The rate of change of wt dx/dt of 11 samples of Kuznetsk-basin coals with volatile matter contents ranging from 7.07 to 42.29% followed the same law as previously reported for Donets-basin coals, i.e., at lower temps., at the stage of decompn. of the peroxide complexes, $dx/dt = k_1(a - x) e^{-E_1/RT}$, and at higher temps., at the stage of formation of stable oxidation complexes, $dx/dt = k_2e^{-E_2/RT}$. The av. $k_1 = 3.6 \times 10^3$ min.$^{-1}$, av. $E_1 = 7.5$ kcal/mole, independently of the volatile matter. In the 2nd stage of the oxidation, E_2 is const. (~16.5 kcal/mole) up to 26%, volatile matter then fell with further increase.

412. Orleanskaya, G. L. **Oxidation as a factor in the self-ignition of coal.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* **1950,** 1071-9.—*C.A.* **45,** 8739b.

The self-ignition of coal was measured by placing a sample, ground to 0.15 mm, and an oxidizing agent (optional), such as $NaNO_2$, in a thermostatic block 5.5 cm in diam. and 10 cm high having a centrally mounted thermocouple. In a typical expt., the ratio of coal to oxidizing agent was 2:1, the charge formed a layer 0.5-1.0 cm high, and the heating rate was 5°/min. The temp. registered by the thermocouple at the instant of self-ignition was recorded as T, the observed values of which were of the order of 300-400°C. Treating coal with dil. aq. solns. of surface-active agents was effective in lowering self-ignition, but others have the opposite effect and were inhibitors of self-ignition.

413. Parker, W. G. and Wolfhard, H. G. **Carbon formation in flames.** *J. Chem. Soc.* **1950,** 2038-49.—*C.A.* **45,** 934g.

The carbon formation in simple diffusion flames of C_2H_2 and O_2 or air was pressure dependent in a reproducible manner for a given burner regardless of mass flow for the range investigated. The particles were of uniform size over the entire luminous area in a nonsmoky flame, but in a smoky flame some larger particles are found. No aromatic absorption bands were observed during the pyrolysis of C_2H_4 and C_2H_2. In the C_6H_6 diffusion flame the C_6H_6 bands disappeared before the luminous zone was reached. Two possible mechanisms were: (1) Higher hydrocarbons, formed by pyrolysis, build up a concn. great enough for fine droplets to condense; (2) Large, unstable mols. are formed. In either case graphite crystallites are then produced.

414. Parry, R. W. and Comings, E. W. **Reactions between ammonium nitrate and charcoals. Alkali metal salts as combustion catalysts.** *Ind. Eng. Chem.* 42, 557-60 (1950).—*C.A.* 44, 4654*d*.

Pressed blocks of NH_4NO_3 and charcoal, with and without linseed-oil binder and acid or salt additives, were burned in the open and in vol. flowmeters. The burning rate was increased by aging, by alkali nitrates, sulfates, carbonates, and mono-H phosphates; chlorides, cyanides, and alk. earth salts were less effective; H_3PO_4 decreased the burning rate. Carbonates, org. salts which produce CO_3^{--} upon combustion, and salts of oxidizing acids were most effective in catalyzing the oxidation.

415. Parry, R. W.; Comings, E. W., and Raila, M. H. **Reaction between ammonium nitrate and charcoals. Surging in combustion.** *Ind. Eng. Chem.* **42**, 560-5 (1950).—*C.A.* **44**, 4654*f*.

Cyclic combustion or "surging" was observed, i.e., alternating fast and slow burning in a cycle ranging from 2 to 50 sec. The surge tendency and violence increased with gas pressure. Surging was promoted by increasing the pH, lowering the preignition temp., and storing at room temp.; it was reduced by addn. of linseed oil and by increasing the amt. of charcoal. The surging charcoal was difficult to wet. The trough (slow) reaction produced more NO_2(CO_2: CO ratio was about 16) than the crest (fast) reaction.

416. Patai, Saul and Hoffmann, E. **The oxidation of carbon black by solid potassium perchlorate.** *J. Am. Chem. Soc.* **72**, 5098-5101 (1950).—*C.A.* **45**, 2806*g*.

The reaction between solid $KClO_4$ and carbon black was studied with different initial amounts of the reactants in the range 320-85°C, $dx/dt = k_1(a-x)(b-0.5x)$ and $dx/dt = k_2(a-x)(b-0.5x)/0.5x$, resp., correspond to the 1st and 2nd parts of the exptl. curves.

417. Perry, H.; Corey, R. C., and Elliott, M. A. **Continuous gasification of pulverized coal with oxygen and steam by the vortex principle.** *Trans. Am. Soc. Mech. Engrs.* **72**, 599-610 (1950).—*C.A.* **44**, 7510*h*.

The basic principles of reactor design and an illustrative example of their application were given. The carbon conversions were low, and the resultant gas high in CO_2. The uniformity and the method of coal distribution strongly influenced the amt. of carbon conversion, the quality of the gas produced, and the max. and min. throughputs.

418. Riley, H. L. **Chemical and crystallographic factors in carbon combustion.** *J. chim. phys.* **47**, 565-72 (1950).—*C.A.* **44**, 11059*c*.

The structure of graphite and amorphous carbons are reviewed. The solid C-O complex, chemically combined foreign matter in carbons, and modes of O_2 attack are discussed.

419. Sands, A. E.; Wainwright, H. W., and Egleson, G. C. **Organic sulfur in synthesis gas: occurrence, determination and removal.** *U.S. Bur. Mines, Rept. Invest. No.* **4699**, 51 pp. (1950).—*C.A.* **44**, 9136*e*.

This is a progress report on exptl. work. No thiophene was found in synthesis gas made from pulverized coal, steam, and O. Addn. of 0.038 lb of hydrated lime per lb of coal lowered the org. S content of the gas but had no effect on H_2S content. Increasing the steam to coal ratio greatly decreased the org. S concn. in the gas. A modified I.G.T. combustion method appeared to be best for the detn. of total organic S. Expts. were made with catalysts which simultaneously removed organic S and H_2S (Huff catalysts gave good results). Purification can be effected to leave less than 0.1 grain of total S per 100 ft^3 of purified gas.

420. Sawai, I.; Kunugi, M., and Jinno, H. **The rate of reaction in carbon dioxide-coke system.** *Mem. Faculty Eng. Kyoto Univ.* **12**, 87-94 (1950).—*C.A.* **46**, 2782*c*.

A quant. formulation was given under conditions where either diffusion or chem. reaction may be expected to control the reaction rate. In the range of 900-1400°C either diffusion or chem. reaction can be rate detg. The importance of the ash layer overlying unreacted coke was emphasized.

421. Scartazzini, Hubert. **Combustion of pulverized coal in oxygen and in oxygen-nitrogen mixtures.** *Compt. rend.* **231**, 1144-5 (1950).—*C.A.* **45**, 5904*b*.

Flames of pulverized coal in O_2, in air, and in intermediate mixts. were prepd. and their spectra studied between 6800 and 2800 A. Their brightness and true temps. were detd. pyrometrically.

422. Silver, R. S. **Application of the Reynolds analogy to combustion of solid fuels.** *Nature* **165**, 725-6 (1950).—*C.A.* **44**, 7509*g*.

Above a certain temp., the rate of transport of O_2 to the surface of a solid fuel becomes more important than the temp. of the surface. With air as the fluid, carbon as the fuel, and CO_2 the product, $R = 0.0825\ h/c_p = 0.0875\ pvf/2$, where R is the reaction rate (wt of C/unit area), h is the heat-transfer coeff., c_p is the sp. heat, p is the fluid d., v is the mass velocity, and f is the friction coeff. For air, h/c_p is about 10^{-3} g/sec/cm^2 and R about 10^{-4} g/sec/cm^2.

423. Strickland-Constable, R. F. **The kinetics of the oxidation of carbon. A survey of some recent results.** *J. chim. phys.* **47**, 322-6, discussion 326-7 (1950) (in English); *Chemistry & Industry* **1948**, 771-4.—*C.A.* **44**, 6710*e*; **43**, 1632*g*.

H_2O and CO_2 react with carbon at 800°C in a reaction that is between first and zero order to give a common product, CO. Expts. with carbon filaments between 900° and 1600°C appear to show a remarkable degree of similarity in the behavior of N_2O, CO_2 and H_2O, indicating a similar reaction mechanism. N_2O, however, reacts at 400°C with charcoal to give CO_2, whereas CO_2 and H_2O do not react with charcoal below 700°C; N_2O also reacts with CO in the presence of charcoal to give CO_2.

424. Strickland-Constable, R. F. **Some comments on the work of Key on the reactions between coke and carbon dioxide and between coke and steam.** *J. chim. phys.* **47**, 356-60 (1950).—*C.A.* **44**, 7044*d*.

The reactions of CO_2 and H_2O with coke proceed by a 2-stage mechanism: 1st, a surface oxide is formed; 2nd, which is common to both reactions, the surface oxide decomposes to give CO. The H_2O reaction is strongly retarded by H_2 due to strong adsorption of H_2. The rate of the CO_2 reaction with coke is much slower than the reported rate with charcoal.

425. Strimbeck, G. R.; Holden, J. H.; Rockenback, L. P.; Cordiner, J. B., Jr., and Schmidt, L. D. **Pilot-plant gasification of pulverized coal with oxygen and highly superheated steam.** *U.S. Bur. Mines, Rept. Invest.* No. **4733**, 41 pp. (1950).—*C.A.* **45**, 844*f*.

Exptl. work was reported on the gasification of 90% through 200-mesh, strongly coking Sewickley-bed coal with O_2 and with steam in temp. ranges of 2700 to 3400°F, 1600 to 2000°F, and 230 to 250°F. The av. requirements per 1000 standard ft^3 of $CO + H_2$ produced at a steam temp. of 2904°F were 33.3 lb coal, 171 ft^3 O_2, and 81.1 lb steam. At a steam temp. of 1899°F the requirements were coal 37.3 lb, O_2 326 ft^3, and steam 42.5 lb. At 238°F coal 42.3 lb, O_2 394 ft^3, and steam 29.1 lb were required.

426. Strimbeck, G. R.; Holden, J. H.; Rockenback, L. P.; Cordiner, J. B., Jr., and Schmidt, L. D. **Pilot-plant gasification of pulverized coal with oxygen and highly superheated steam.** *Am. Gas Assoc. Proc.* **32**, 501-3 (1950).—*C.A.* **46**, 10582*d*.

In the pilot-plant gasification of pulverized coal to produce low cost synthesis gas from raw coal, 31 runs were made with a total of 56,000 pounds of 90% through 200 mesh, strongly coking coal, at feed rates of 200 to 450 lb of coal per hr. Gasification with steam was carried out in 3 temp. ranges.

427. Totzek, Friedrich and Osthaus, K. H. **The basis of the Koppers-Totzek process for gasification of powdered coal.** *Brennstoff-Chem.* **31**, 173-80 (1950).—*C.A.* **44**, 8622*i*.

Diffusion is shown to be the predominant factor in high-temp. gasification. Since the diffusion velocity is comparatively low, a short diffusion path with a high concn. gradient must be maintained during gasification. The relative velocity between the gaseous and the therein suspended solid reactants should be relatively slight to give the optimum conditions for diffusion. O_2 must be used as the gasification medium rather than air.

428. Vaidyeswaran, R. and Iyengar, M. S. **Carbon formation in flames.** *Rept. Proc. Symposia on Fuels, Fats & Oils and Research & Ind.* (India) **1950**, 94-6.—*C.A.* **46**, 10833*c*.

Expts. were conducted on the effect of CO_2 on the luminosity of flames produced from several org. materials (hexane, heptane, octane, decane, EtOH, iso-PrOH, BuOH, iso-BuOH, and AmOH). The crit. rate of CO_2 addn. required to suppress the luminosity decreases with increase in mol wt in a given homologous series.

429. Vaidyeswaran, R. and Iyengar, M. S. **Combustion of noncaking Hyderabad coals in a fuel bed.** *Rept. Proc. Symposia on Fuels, Fats & Oils and Research & Ind.* (India) **1950**, 97-9, discussion 99-100.—*C.A.* **46**, 8346*b*.

Expts. were conducted on the combustion of coal in a pipe, 6 in. in diam. and 9 in. tall in which the fuel bed was supported on a metal grate 3 in from the bottom. The introduction of flue gas (CO_2) with the primary air for combustion of Hyderabad coal will minimize boiler depositions and hence improve boiler efficiency.

430. Veselovskiĭ, V. S. and Terpogosova, E. A. **The temperature of ignition of coals as a characteristic of their tendency toward self-ignition.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* **1950**, 1204-11.—*C.A.* **46**, 1227*d*.

Hot air is blown through a bed of coal that may contain an oxidizing agent (e.g., $NaNO_3$) and the temp. difference between the inlet air and selected points in the bed is measured with thermocouples. The temp. of ignition is a useful index of the tendency of a given coal to self-ignition.

431. Whittingham, G. **Spectrum of the glow of burning carbon.** *Fuel* **29**, 244 (1950).—*C.A.* **45**, 327*h*.

Dry air was passed through a cylinder of electrode carbon placed in a quartz tube maintained at 850°C. This resulted in a blue glow which was recorded on a small quartz spectrograph. A banded spectrum superimposed on a continuous background extended through the ultraviolet region and no OH bands were present. Strong Na D-line emission was given and the faint bands appearing in the blue-green were probably due to the abnormally high B content of the C.

432. Wilson, J. H. and Bolam, T. R. **Chemisorbed oxygen on charcoal and the sorption of strong inorganic bases and acids.** *J. Colloid Sci.* **5**, 550-66 (1950).—*C.A.* **45**, 3681*d*.

The sorption is due to the presence of chemisorbed O, not chemisorbed H_2O. The chemisorbed O exists in 2 types of complex, one with 2 atoms of O per mol. of sorbed NaOH, and the other with 4 atoms O per NaOH. Sugar charcoal and C_6I_6 charcoal fix large quantities of O at 400°C. All, or almost all, of this O is involved in the sorption of bases from aq. solns., but plays no part in the sorption of acids.

433. Yohe, G. R. **Coal oxidation: active oxygen and Russell effect.** *Fuel* **29**, 163-5 (1950).—*C.A.* **44**, 7510*b*.

Materials which are capable of producing images when placed on contact with a photographic film in the dark are substances susceptible to peroxide formation. The earliest exptl. evidence for peroxygen intermediate in coal oxidation was that obtained by Russell in his expts. with photography.

434. Arthur, J. R. **Reactions between carbon and oxygen.** *Trans. Faraday Soc.* **47**, 164-78 (1951).—*C.A.* **45**, 10011*a*.

An artificial graphite and a coal char (made by carbonization of Warwickshire coal in a stream of com. O_2 free N_2) were studied with a flow method. From 480° to 900°C, the CO/CO_2 ratio with both carbons (uniquely detd. by temp.) increased exponentially with temp. $POCl_3$ vapor was added to the oxidizing gas to suppress the formation of CO_2 from CO. Two reactions were responsible for the gasification of carbon by O_2 and one leads to CO_2 formation, the other to CO formation. The relative rates for both carbons are given: $CO/CO_2 = 10^{3.4} \exp(-12{,}400/RT)$.

435. Arthur, J. R.; Bangham, D. H., and Crone, H. G. **Topochemistry of fuel beds.** *Ind. Eng. Chem.* **43**, 525-8 (1951).—*C.A.* **45**, 3144f.

Expts. with actively burning fuel beds showed the extreme localization of the gasification zone.

An apparent anamolous increase in total energy of the gases as they traversed the bed was probably due to combustion within the gas-sampling probes. Expts. with single carbon tubes in the presence and absence of inhibitors showed the entirely different pattern of gasification with distance through the tube. The high CO contents of gases sampled in the presence of inhibitors are compared with the concns. obtained during the last stages of burning of under-feed fuel beds.

436. Arthur, J. R. and Bowring, J. R. **Physiochemical aspects of the combustion of solid fuels.** *Ind. Eng. Chem.* **43**, 528-33 (1951).—*C.A.* **45**, 3143*c*.

Materials with a strong affinity for H_2 or H_2O increased the proportion of CO to CO_2 in the combustion products from the carbon tubes. Most of the inhibitors were halogens or volatile halides. When inorg. halides were added to the fuel, only small inhibiting effects were observed. The formation of CO_2 during the combustion of solid fuels at high temps. was dependent on the presence of sufficient H-contg. species which propagate the CO-combustion reaction. By controlling the concn. of these species it was possible in principle to control the nature of the end product, and so obtain CO or CO_2 as desired.

437. Baetke, F. W. **The reaction mechanism of combustion of carbon at atmospheric pressure.** *Z. Elektrochem.* **55**, 655-7 (1951).—*C.A.* **46**, 4407*h*.

Dry air was passed through a carbon tube at 1000°C and 1 atm. at velocities from 30 to 100 m per sec, producing mainly CO. The exit gas contained a considerable amount of unburned O_2. By addn. of 0.15% CCl_4 or by lowering the pressure to 0.1 atm., the yield of CO increased to 90-95%, based on total CO+ CO_2 produced. CO was the primary combustion product at atm. pressure.

438. Banerjee, S. and Sarjant, R. J. **Reactivity of coke.** *Fuel* **30**, 130-9 (1951).—*C.A.* **45**, 6823*e*.

Coke was burned in a fuel bed under specific conditions, which involve a const. size, a const. rate of air supply, and controlled temp. of preheat of air and of the walls of the reaction chamber. The temp. of the fuel bed was maintained at 1300°C. Two charts have been prepd. which help to present in concise form the relationship between reactivity and available heat in industrial fuel beds. The most significant factor that influenced the reactivity of coke was the character of the parent coal from which the coke was made; reactivity was also affected by the carbonizing temp.

439. Behrens, Hans. **Mechanism of the Boudouard reaction and carbon combustion at high temperature.** *Naturwissenschaften* **38**, 187 (1951).—*C.A.* **46**, 2266*e*.

The Boudouard reaction at high temp. was studied by the temp. at which it freezes in cooling gases. It consisted of $CO+OH=CO_2+H+25$ Cals; $H+CO=C_{sol.}+OH+16$ Cals. The freezing temp. of the latter reaction, which detd. the rate, was about 1500°K. The heat effect of the last reaction was only enough to give soot at flame temp. The presence of small amts. of H accelerated the combustion of solid carbon.

440. Bonner, Francis and Turkevich, John. **Study of the carbon dioxide-carbon reaction using C^{14} as a tracer.** *J. Am. Chem. Soc.* **73**, 561-4 (1951).—*C.A.* **45**, 4535*h*.

The reaction between CO_2, CO, and charcoal was studied in a recycling system with continuous monitoring of C^{14}. Radiochem. measurements were correlated with changes of compn. of the gas and with pressure measurements. A rapid reaction of the CO_2 with the surface was postulated to give an oxygenated surface and a radioactive CO and a subsequent slow two-stage unimol. decompn. of the oxygenated surface into nonradioactive CO and charcoal.

441. Casamassima, G. and Meo, F. **Oxidation of coal.** *Riv. Combustibili* **5**, 143-55 (1951).—*C.A.* **45**, 7774*h*.

The complex reactions of the oxidation of coal with atm. O_2 and the production of coke are discussed. The use of the dilatometric method furnishes important information in the range of 20 to 600°C and permits estn. of the degree of oxidation of the coal.

442. Cines, M. R. **Surface oxidation of furnace black and resulting rubber properties.** *Rubber Age* (N.Y.) **69**, 183-8 (1951).—*C.A.* **45**, 5962*f*.

Surface oxidation of an MAF black (Philblack-A) and an HAF black (Philblack-O) can yield pH values from 9.5 to 3 by treatment with O_2 at 700-1000°F. Surface oxidation increased progressively the C-O complex, with consequent increase of content of volatile substances and lowering of the pH value. Surface oxidation increased the content of volatile substances and the surface area, but did not lead to any loss of carbon oxides. Expts. on the reinforcing effects of these oxidized blacks in natural rubber vulcanizates showed that the state of cure is a more determinant factor than is the pH value of the oxidized black.

443. Ershov, V. N. and Pomerantsev, V. V. **Reduction of carbon dioxide by coke.** *Zhur. Priklad. Khim.* **24**, 520-6; *J. Gen. Chem.* **21**, 569-76 (1951).—*C.A.* **46**, 8829*a*.

Coke was obtained by calcination of a natural coal at 850°C in a stream of N_2 until cessation of the sepn. of volatiles. The ground particles (70-80 μ) were again placed in N_2 at 900°C until const. wt. The heating and cooling of the samples (1.5 to 2 hrs) between reaction with CO_2 were done in N_2. Expts. were made in a range of 600-1000°C. Consumption of CO_2 amounted to 1.2 cc/sec. The kinetic characteristics of the reaction $C+CO_2=2CO$ were detd. for different coals at temps. below 950°C.

444. Euler, Joachim. **Changes in activated charcoal in air-oxygen cells.** *Z. Elektrochem.* **55**, 316-22 (1951).—*C.A.* **45**, 8375*d*.

The electrodes consisted of active charcoal, acetylene black, graphite, and NH_4Cl; the electrolyte was aq. NH_4Cl and $ZnCl_2$, with a small amt. of $HgCl_2$. After discharge, the electrode was crushed, the NH_4Cl leached out with water, and the residue extd. with benzene. The amt. of benzene ext. was between 1 and 15 mg. After the oxidation was initiated, it continued at the same rate even when the discharge was stopped. The initiation occurred when the gas used was air or O_2; in the latter case, O_3 or oxides of N were detected. Initiation could be accomplished without discharge by using O_2 contg. O_3 or N oxides. The oxidation product had a mol. wt, detd. by lowering of freezing pt., of 800 ± 40°C.

445. Gillet, A. **The solubility-conferring oxidation of coal.** *Fuel* **30**, 181-7 (1951).—*C.A.* **45**, 8230*b*.

Coal is an assembly of micro-mols. of various sizes, strictly definable only in terms of the "monomer" from which they are produced by polymerization. This substance appears to have the approx. formula $C_{29}H_{22}O_2$. When this substance is oxidized, the no. of C atoms remaining in the oxidized coal is close to 20; the empirical formula $C_{20}H_8O_8$ appears to apply to all of the products of oxidation of the various coals. Possible structural formulas are presented which account for the products of oxidation beyond the anthraxylic acid stage.

446. Givaudon, J. and Nessler, Andrée. **The reactivity of the fixed carbon of spent (oil) shales.** *Oil Shale and Cannel Coal Conf., Inst. of Petroleum, London* **2**, 467-88 (1951).—*C.A.* **47**, 1365*b*.

O_2 was completely removed from the gas mixt. passed up through a bed of crushed spent shale at 750-950°C. When a current of air, or of 40% air in CO_2 and N_2, was passed through a bed of spent shale at 300°C the temp. increased; this indicated reignition. The index of reactivity of the fixed C with CO_2 is given as $p = 100x/(x + 2z)$, where $x =$ the CO and $z =$ the CO_2 content of the exit gas. Allowance must be made for any decompn. of carbonates. The indexes of the shales ranged from 57 to 97 at 800° but from 97 to 100 at 900°C.

447. Gol'denberg, S. A. **Study of turbulent combustion taking into account secondary reactions.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk.* **1951**, 657-66.—*C.A.* **46**, 2775*g*.

Turbulent heterogeneous combustion, as carried out experimentally by flow of O_2 at 500-1000°C through cylindrical carbon tubes, is affected significantly by the secondary reactions of CO_2 reduction and CO combustion. Under these conditions the coeff. of gas formation $= 4.3 \times 10^7$ exp-$(-28{,}500/RT)$.

448. Helfinstine, Roy J. **Correlation of domestic stoker combustion with laboratory tests and types of fuels. IV. Combustion tests of Illinois and other coals.** *Illinois State Geol. Survey, Rept. Invest.* No. **151**, 46 pp (1951).—*C.A.* **46**, 3730c.

The uniformity of heat release during combustion, with some exceptions, increased with decrease in the percentage of ash. The relationship of uniform heat release was poor with: clinker formation and ash fusion, the free swelling index of the coal and the fluid properties of the coal. No relationship was observed for the percentage of volatile matter. Other combustion criteria showed little or no correlation with lab. tests. Actual combustion tests were the only satisfactory way to det. the suitability of a coal for stoker combustion.

449. Jílek, Jaromír. **Self-ignition and storage of brown-coal semi-coke.** *Paliva* **31**, 225-30 (1951).—*C.A.* **46**, 709e.

The semi-coke of brown coal in bulk storage tends to ignite spontaneously, particularly in summer. Heat is generated by processes such as adsorption of gases, oxidation, and absorption of H_2O. Granular semi-coke of grain sizes larger than 10 mm is safe. Finer particles tend to self-ignite at the base of the pile, with the ashes formed preventing further burning. Large piles can be stored safely when sprayed with a H_2O suspension of lime.

450. Karavaev, N. M.; Sevast'yanov, Yu. L.; Dolgopolov, N. N., and Bur'yan, Yu, L. **Pyrolysis of coal under the action of a high-frequency current.** *Doklady Akad. Nauk S.S.S.R.* 77, 871-4 (1951).—*C.A.* **45**, 6819*i*.

Heating to 1000°C was done with the aid of a tube generator of 7 m wave length (frequency 4.3×10^7 sec^{-1}). The compn. of the semicoke produced in the dielec. heating is little different from that obtained in conventional heating to the same temp. However, the yields of tar and of gas were considerably lower.

451. Karzhavina, N. A. **The combustion of carbon in a stratum.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* **1951**, 1165-77.—*C.A.* **47**, 7187*i*.

Gas formation by combustion of electrode carbon or of charcoal was studied at temps. of 300-1100°C, blast speed of 0.05-0.4 m/sec, and O_2 concns. in the blast of 2.5-21%. For the combustion of particles of 1-2 mm, the depth of the O zone (at temps. higher than 700°) was from 1 to 2 rows of particles.

452. Kiyama, Ryo and Osugi, Jiro. **The ignited combustion of dispersed powders.** *J. Chem. Soc. Japan*, Pure Chem. Sect., **72**, 982-5 (1951).—*C.A.* **46**, 7770*f*.

The lowest ignition temp. of starch, charcoal, coal, biocellulose, active carbon, coke, resin, and S have been detd. The ignition temp. of active carbon falls in the presence of salt in the order: $KOH > NaOH > K_2CO_3 > Na_2CO_3 > NaHCO_3 > Ca(OH)_2$.

453. Kowalski, Jerzy and Lewandowski, Wladyslaw. **Sulfur recovery in brown coal low-temperature carbonization.** *Przeglad Górniczy* 7, 237-42 (1951).—*C.A.* **45**, 9244*d*.

The method is applicable to brown coals containing 0.5%-4% S. The process is divided into two phases: (1) absorption of H_2S in the Alkacid system and (2) combustion: $H_2S + O \rightarrow H_2O + S$ in Claus furnaces. For the absorption stage NH_4CH_2COOH or $CH_3CH_2NH_2COOH$ or mixture of both are used. By heating desorption occurs. The modified Claus furnace gives a 2-stage reaction: $H_2S + 3/2\ O_2 = SO_2 + H_2O$; $2\ H_2S + SO_2 = 3\ S + H_2O$. Impurities in resulting S are less than 0.1%.

454. Loon, W. van. **The combustion of carbon.** *Chem. Weekblad* **47**, 233-9 (1951).—*C.A.* **45**, 7774*i*.

When air or O_2 is injected into an incandescent layer of coke, the temp. of the layer is controlled by the O_2 concn. The relation between the layer temp. and O_2 concn. is computed to det. the min. layer temp. and min. O_2 temp. required for maintaining stable conditions in operation. This was between 1000° and 1300°K.

455. LORENZEN, GERHARD. **Low-temperature carbonization of bituminous coal.** *Brennstoff-Chem.* **32**, 324-31 (1951).--*C.A.* **46**, 1227*f*.

It is more economical both from the viewpoint of coal requirements and cost of operation to convert bituminous coal into liquid fuels by low-temp. carbonization rather than by hydrogenation. The use of a limited amt. of recirculated gas is desirable. The capacity of two types of coking ovens is relatively high, owing to the relatively short carbonization times as compared with high-temp. ovens; the coke has satisfactory properties.

456. MAEZAWA, MASATAKE. **Oxidation of coal and its ignition temperature.** *J. Fuel Soc. Japan* **30**, 190-7 (1951).—*C.A.* **46**, 1734*b*.

The ignition temp. of coal, might be detd. from activation energy relating to the chem. properties of coal and a const. relating to frequency index and coeff. of thermal cond., which, in turn, depend on the phys. conditions.

457. MARSH, J. D. F. **Some aspects of the mechanism of gasification of carbon by carbon dioxide and steam.** *Inst. Gas Engrs.*, Copyright Pub. No. **393**, 21 pp. (1951).—*C.A.* **46**, 3238*i*.

When the sample was reduced with H_2 and then treated with CO_2 at a temp. below that necessary for gasification, CO and a surface layer of O was produced. The vol. of CO_2 reacting depended on the temp., the B.E.T. surface area of the carbon, and the nature of the surface, which is modified by ash constituents. The surface-O could be removed as H_2O by subsequent treatment with H_2. In a series of consecutive runs with high-temp. coke, the av. wt of water formed was equiv. to the av. vol. of CO formed during the CO_2 treatments. Most of the surface-O could be removed as CO_2 by treatment with CO. The vol. of CO_2 reacting to give CO and surface-O on a sample of high-temp. coke did not vary greatly with the partial pressure of the CO_2.

458. NADZIAKIEWICZ, J. AND PAMPUCH, R. **The thermal decomposition temperature of coals.** *Prace Glównego Inst. Górnictwa Komun.* No. **79**, 16 pp. (1951).—*C.A.* **46**, 8827*f*.

Volatile-matter content was inversely proportional to thermal decompn. temp., with a correlation coeff. $r = -0.841$. The tested coals could be sepd. into 2 groups: (1) flame-coals and ortho-coking coals, and (2) lean-coals and anthracite-coals. The thermal stability of the 1st group probably depended on the polar-atom (O, S, N) content, since thermal stability is an inverse function of polar-atom content. When the polar-atom content was less than about 5%, all types of tested coals showed high thermal stabilities.

459. ORESHKO, V. F. **Oxidation of petrographic ingredients of hard coal.** *Doklady Akad. Nauk S.S.S.R.* **81**, 663-6 (1951).—*C.A.* **46**, 9826*b*.

The fusain from long-flame coal gives a considerably higher temp. of ignition (323°C) than vitrain from the same coal (240°C), just as the fusains of coking coal give lower temps. of ignition (340-342°C) than the vitrains of coal (376°C). The fusain concentrate has an ignition temp. like that of coked coal (345°). The screening and classifying of coal to remove dust and fines can promote safety of storage of the coal.

460. ORESHKO, V. F. **Oxidation of coals of various degrees of metamorphism.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* **1951**, 1031-40.—*C.A.* **46**, 10579*d*.

If the yield of volatile matter (*Y*), (7 to 42%) was less than 26%, the max. temp. on oxidation in O_2 was 235°C and the min. temp. on oxidation in O_2 or air was 145°C. If *Y* was higher, these temps. were inverse functions of *Y*. In air oxidations, the max. temp. decreased uniformly with increasing *Y* throughout the range studied. Special significance was attached to the limiting value of $Y = 26\%$. For most of the coals studied, the over-all oxidation process was approx. represented by: $\text{coal} + O_2 \rightarrow CO_2 + 2/3CO + 5/2H_2O$.

461. OYAMA, YOSHITOSHI; KUWAI, GENTEI, AND OGATA, KATSUHIKO. **Effect of oxygen concentration upon the combustion rate of carbon.** *Repts. Sci. Research Inst.* (Japan) **27**, 183-90 (1951).—*C.A.* **46**, 6526*b*.

The combustion rate of a carbon rod for arc-lamp electrodes in a stream of O_2 mixed with N_2 in various ratios in an elec. furnace preheated at 710-29° increased with higher O_2 concns. (e.g., with 99% 6.45 times that with 20.5%), and at 0.7-0.8 power of the temp., but linearly when the concn. was kept const. Since higher concns. raised the temp., both affected the rate simultaneously.

462. PANCHENKOV, G. M. AND GOLOVANOV, N. V. **Kinetics of the regeneration of aluminosilicate catalysts. Nature of the processes of oxidation of the "coke" on aluminosilicate catalysts.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* **1951**, 1513-21.—*C.A.* **47**, 4717*c*.

On 2 granular catalysts, 1 hr operation at 475°C at a space velocity of the gas oil of 0.7 gave carbon deposits of 3.9 and 6.1%, resp., of the wt of the catalyst. In the initial stages of the oxidation at 464-555°C, the rate of the oxidation increases with the flow velocity of the gas only up to a certain limit, after which it increases no further. At very low velocities of flow, the rate of oxidation becomes practically independent of the temp. At const. feed rate, the initial rate of oxidation varied little with the temp. up to 470°C, and began to increase rapidly with the temp. from 470°C up, at different rates of different catalyst prepns. For each catalyst, plots of log (relative rate of oxidation) as a function of 1/T were linear below a certain temp.; different catalysts were nearly equal to an activation energy of 31 kcal/mole.

463. POUND, G. S. **The development of low-temperature carbonization of coal.** *J. Inst. Fuel* **24**, 61-8 (1951).--*C.A.* **45**, 4424*i*.

Low-temperature carbonization processes should be of increasing importance in the production of smokeless fuel and a high yield of liquid products. The latter products include fuel oil, creosote, pitch residue, motor fuel, and Diesel oil; the whole range of tar acids from phenol to the high-boiling tar acids; and many other materials having specialized uses.

464. Ríus, A. and Fuentes, M. **The combustion of carbon at low temperature.** *Anales real soc. españ. fis. y quím.* **47B**, 555-66 (1951).—*C.A.* **46**, 3731h.

The reaction of Merck's activated, coconut char, a granulated Spanish carbon, and graphite, with atm. O_2 was studied at temps. below 300°C and at 774 mm. The oxides were dislodged by purging with gases or vapors that are preferentially adsorbed, viz., CCl_4, SiF_4, HCl, and N_2. Humidified air is more active than dry air except in the case of graphite. No formation of CO or CO_2 was observed at room temp. nor at 100°C. At 155° in a 5-hr flow of 265 cc. of air over 65 g of Merck's carbon previously washed with HCl, 0.180 and 0.005 cc. of CO_2 and CO, resp., were formed per g of carbon. At 230° and at 320° 107 g of graphite over which 2000 cc. of air passed a 2-hr period, yielded 0.005-0.210 cc. CO_2 and 0.0008-0.017 cc. CO per g C. Adsorption activity and rates of combination with O_2 were not necessarily proportional.

465. Rius, A.; Molera, M. J., and Fuentes, M. **A kinetic-chemical study of the reactivity of a sample of carbon.** *Anales real soc. españ. fis. y quím.* **47B**, 109-20 (1951).—*C.A.* **45**, 6022d.

Coconut charcoal was oxidized by mixts. of pure N_2 and O_2 at const. temps. between 190 and 300°C. The product was a mixt. of CO and CO_2 for all temps. and ratios of N_2/O_2. The activation energy was the same for the production of CO_2 as for CO. During the combustion the activation energy increased, but the oxidation effect and the relation CO_2/CO decreased. The order of the reaction was between 1 and 0.

466. Ruof, Clarence H.; Savich, T. R., and Howard, H. C. **Nuclear structure of the water-soluble polycarboxylic acids from oxidation of bituminous coal.** *J. Am. Chem. Soc.* **73**, 3873-9 (1951).—*C.A.* **46**, 3729*h*.

Mixed aromatic acids (50-60%) were obtained from 15 lb of 100-mesh Pocahontas No. 3 coal in 15 gal water contg. 45 lb com. flake NaOH treated for 2-3 hrs with O_2 at 900 lb/in^2 and 270°C. The phys. and chem. properties of the products demonstrated the presence of significant amts. of compds. with nuclear structures more complex than the C_6H_6 ring. Certain fractions of the hydrogenolysis products contained appreciable amts. of O and had properties corresponding closely to phthalans.

467. Sabel, Franz. **The oxygen slagging gas producer.** *Gas-u Wasserfach* **92**, No. 19 (Gas) 273-7 (1951).—*C.A.* **46**, 708*c*

The slagging gas producer using O_2 requires a fuel bed only about 10 to 12 ft deep. A wide variety of fuels can be used varying from waste coke (from water gas generators) to noncaking bituminous coals, both high and low-volatile. While steam is normally used with O_2 other gases, including CO_2 and coke-oven gases, can be used. In the latter case, the two gases are introduced separately; the coke-oven gas is reformed by the glowing coke to a mixt. of CO and H_2. The life of the refractories is relatively long, and the O_2 slagging producer can be shut down and again restarted without difficulty.

468. Satterfield, Charles N.; Kavanagh, Geo. M., and Resnick, Hyman. **Explosive characteristics of hydrogen peroxide vapor.** *Ind. Eng. Chem.* **43**, 2507-14 (1951).—*C.A.* **46**, 1767*a*.

The explosive limits were detd. by using hot wire, heated surfaces, and catalytic surfaces for ignition. At 1 atm. vapors contg. 26.0 mole % or more could be exploded. The lower limits at 200 and at 40 mm Hg were 33 and 55 mole %, resp. At 1 atm. vapors within the explosive region could be exploded by contact with a noncatalytic surface at 150°C or with a catalytic surface initially at room temp. The min. concn. for explosive vapor over aq. H_2O_2 was about 74 mole %.

469. Sawai, Ikutaro; Kunugi, Masanaga, and Jinno, Hiroshi. **The reaction between coke and carbon dioxide. I. Influence of diffusion velocity.** *J. Chem. Soc. Japan,* Ind. Chem. Sect. **54**, 301-3 (1951).—*C.A.* **47**, 2962*f*.

A formula was derived for the rate of reaction between coke and CO_2, taking both factors, diffusion and reaction rate, into consideration. It has been shown that below 1000°C the influence of reaction rate, and above 1400°C, that of diffusion predominate. Between 1000 and 1400°C the combined effect of the two factors should be considered.

470. Spalding, D. B. **Combustion of fuel particles.** *Fuel* **30**, 121-30 (1951).—*C.A.* **45**, 6817*i*.

The combustion of small particles of oil and carbon under conditions where convection was absent was extended to the cases of variation of thermal cond. with temp. and dissocn. of the gases. Dissocn. had the effect of doubling the combustion rate of carbon particles, above a certain temp. level, by producing a zone outside of the particle where CO burned; its effect on the combustion rates of oil droplets was likely to be small. Oil droplets burned about 13 times faster than carbon particles of the same size.

471. Terada, Hiroshi. **The relation among carbonizing temperature, carbonizing time, and width of chamber of coke oven.** *Chem. Eng.* (Japan) **15**, 348-53 (1951).—*C.A.* **46**, 1233*i*.

The carbonizing process in a coke oven is compared with the practice. An approx. formula is obtained as follows: $\epsilon = (536.99T - 68.051T^3 + 8.2646T^5) \times 10^{-4}\, {}^1\!/_2\, t$, where ϵ = width of chamber; $T = c_1/1000$; c_1 = temp. of the inside wall of the carbonizing chamber; and t = carbonizing time. This is found to coincide fairly well with the exptl. results carried out in a test oven (width = 450 mm).

472. Veselovskiĭ, V. S. and Orleanskaya, G. L. **The initial state of oxidation in hard coal.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* **1951**, 1041-5.—*C.A.* **46**, 10579*c*.

For a harder coal, the ignition temp. did not show a systematic variation with depth, but could be correlated with the petrographic character of the coal. The ignition temp. was highly sensitive to the oxidation character of the test conditions. Pretreatment with H_2O_2 consistently lowered the ignition temp. by 10°C or more. In one case, addn. of benzidine increased the ignition temp. by 31°C.

473. VOZNESENSKIĬ, N. P. AND CHERNYSHEV, A. B. **The structure of the boundary layer in the burning of solid fuel.** *Doklady Akad. Nauk S.S.S.R.* 77, 433-4 (1951).—*C.A.* **46**, 703*e*.

The combustion of charcoal particles was subjected to motion picture studies under a 250-fold magnification. When burning was carried out in a gaseous stream of velocity = 3 m/sec, the combustion formed an ash layer 0.2-0.3 mm thick on surfaces parallel to the stream. Perpendicular to the stream the ash layer was 0.03-0.04 mm thick in some regions corresponding to "dead gas" zones and 0.2 mm or more elsewhere. The existence of such "dead gas" zones emphasized the importance of the structure of the boundary layer in the combustion of solid fuels.

474. WICKE, E. **Flow diffusion and reaction in the combustion of coal.** *Chem.-Ing.-Tech.* **23**, 420-2 (1951).—*C.A.* **46**, 235*b*.

Data were presented for CO formation as function of coal sample size, temp. and reaction time. The $CO:CO_2$ ratio was influenced equally by reaction kinetics and transport processes.

475. WILDENSTEIN, RAOUL. **New method of direct determination of oxygen particularly applicable to coals.** *Chaleur & ind.* **32**, 293-8 (1951).—*C.A.* **46** 705*i*.

The sample was pyrolyzed in a current of purified H_2. The effluent gas was cracked on platinized pumice at 900°C. Then S was removed by reduction on Ni, NH_3 was absorbed with H_3BO_3, H_2O was absorbed by $Mg(ClO_4)_2$, and CO_2 by NaOH plus asbestos. The residual CO was then oxidized to CO_2 with I_2O_5. The CO_2 was absorbed in 0.1 *N* NaOH contg. a little $Na_2S_2O_3$, which prevented discoloring effects of HOI and HI.

476. ANDERSON, R. B. AND EMMETT, P. H. **Surface complexes on carbon blacks. I. High-temperature evacuation studies.** *J. Phys. Chem.* **56**, 753-5 (1952).—*C.A.* **47**, 20c.

Surface complexes were studied by heating the carbon blacks during evacuation at temps. as high as 1200°C and collecting and analyzing the evolved gases. Much of the water vapor and CO_2 was given off at or below 600°C. The CO and H were evolved primarily in the 600-900° and 900-1200°C regions, resp. Surface-area measurements showed that the gas evolution from Spheron 6, Black Pearls 1, and Mogul could be accounted for by a unimol. layer of surface complexes. The gas from Lampblack T was several fold too great to be attributed to a single layer of surface complex.

477. ARTHUR, J. R. AND BLEACH, J. A. **Mode of energy release in combustion of carbon.** *Ind. Eng. Chem.* **44**, 1028-33 (1952).—*C.A.* **46**, 7733*d*.

Glow in a burning fuel bed was traced to the oxidation of CO and was found to depend largely on the rate of air flow and the quantity of water vapor present in the air. The intensity of the flow could be increased by pretreating the fuel with Na_2CO_3 or $CuCl_2$.

478. BASTICK, MARTHE. **Direct determination of oxygen in coal. I. Carbon reduction method.** *Bull. soc. chim. France* **1952**, 308-9.—*C.A.* **46**, 7304*i*.

The sample was pyrolyzed in a current of N_2, and O-contg. decompn. products transformed to CO on a carbon column at 1200°C. The best method of oxidizing the CO to CO_2 was found to be by means of platinized Pyrex beads as a catalyst. The interference caused by mineral matter was studied. The O content of $CaSO_4$ and $CaCO_3$ was included in the detn., that of Fe oxides partly.

479. BEHRENS, H. **Elementary processes in the combustion and gasification of coal.** *Chem.-Ing.-Tech.* **24**, 349-52 (1952).—*C.A.* **46**, 8345*f*.

A treatise based on new exptl. data reported by English and Russian authors interpreted by reaction kinetic studies. The presumable reactions of the 3 reaction stages are: $C(s) + \frac{1}{2}O_2 = CO$, $CO + \frac{1}{2}O_2 = CO_2$, and $CO_2 + C(s) = 2CO$.

480. BLACKWOOD, J. D. AND BOWDEN, F. P. **The initiation and thermal decomposition of gunpowder.** *Proc. Roy. Soc.* (London) **A213**, 285-306 (1952).—*C.A.* **46**, 10623f.

Initiation is due to formation of local hot spots which may be formed by adiabatic compression of air pockets or by friction of grit particles. The necessary hot-spot temp. is 130°C which suffices to melt the S. The formation of liquid phase is important, and it is suggested that the process starts with the reaction of molten S with oxyhydrocarbons present. The initial reaction develops until the oxidation of charcoal by KNO_3 is established. High-speed camera reveals that the gunpowder grains burn slowly layerwise. The rapid propagation from grain to grain is probably due to emission of hot spray of molten droplets of K salts.

481. BLANZAT AND BARBE. **Rapid method of determining oxygen in coal.** *Bull. soc. chim. France* **1952**, 569-73.—*C.A.* **46**, 9825*i*.

The coal is pyrolyzed in a current of N_2, the O-compds. formed are reduced to CO with benzene black at 1200°C, the CO is oxidized to CO_2 in the cold with I_2O_5 on SiO_2 gel, and the CO_2 is absorbed in ascarite and weighed. The method differs from others of similar type by using com. N_2, a reaction tube of fritted Al_2O_3, and a very efficient I_2O_5 reagent. S compds. in coals do not interfere, but a correction is needed for the O-content of the ash.

482. BRENDER Á BRANDIS, G. A. AND FELSBOURG, J. **The reactivity of coke especially to steam.** *Gas World* **135**, 689-90 (1952).—*C.A.* **46**, 7742*e*.

The quantity of steam which is passed through the column of hot coke during a certain time can be accurately detd. on completion of the test. The proportion of steam decompd. can be accurately detd. The results of tests on the reactivities of 6 cokes in this app. are included.

483. BROWN, F. **Exchange of carbon^{14} between elementary carbon and its oxides.** *Trans. Faraday Soc.* **48**, 1005-14 (1952).—*C.A.* **47**, 5223*g*.

Sugar carbon or graphite acquires C atoms from the gas $C^{14}O$ or $C^{14}O_2$. At room temps. to 700°C no reaction takes place and no activity is acquired by the surface. The radioactivity acquired above 700°C is due to elementary C; the sample could be pumped out repeatedly as high as 1000°C without any change in its radioactive counting rate; also, treatment of the sample with boiling water and hot acids did not remove the activity. When CO_2 is reduced on a surface, a fraction (perhaps 1-2% with sugar carbon) of the reacting CO_2 deposits C atoms into the surface so that the O atoms depart, as CO, with two new C atoms derived from the surface. In the remaining majority of cases only one C atom is taken from the surface and no deposition made. The fraction of CO_2 reacting in this special way is much lower with graphite.

484. CEDERQUIST, K. N. AND BERING, P. **Wet combustion, a process for the utilization of peat.** *Acta Polytech., Chem. Met. Ser.* **3**, No. 1, 5-34 (1952).—*C.A.* **47**, 2959*f*.

The crude peat, contg. 85-95% water, is heated by oxidation of 10-20% of the solid material with O_2 or air under a pressure of 15-30 kg/cm^2 to a temp. of 170-200°C. The colloidal form of the peat is broken down and the material becomes a free-flowing suspension. Filtration and pressing reduce the water content to about 50%.

485. CHÉREAU, JEAN. **A thermogravimetric study of the air oxidation of a coal between 100° and 270°.** *Compt. rend.* **234**, 1165-6 (1952).—*C.A.* **47**, 289*g*.

A coal contg. 34% volatile material was heated for periods up to 3 days. A plot of percent change in wt *vs.* time gave a group of isochronic curves, all of which showed an initial gain in wt followed by a loss at the higher temps. The max. of each curve was at a point corresponding to a 6.7% gain in wt. A test of the same coal showed that I_2 was adsorbed in an amt. equiv. to 6.8% of O_2. The expts. indicated that O_2 was adsorbed by the coal by adding to double bonds.

486. CHÉREAU, JEAN. **An anomaly in thermogravimetric isothermal curves registered with coal heated in contact with air.** *Compt. rend.* **234**, 1368-70 (1952).—*C.A.* **46**, 6807*f*.

On heating powd. coal in a thermobalance at const. temp., a sharp max. in the mass-time curve appeared as soon as the moisture was expelled, in the presence of air but not N_2 alone. This anomaly became more marked the higher the temp. and the smaller the particle size. This was attributed to a surface activation owing to grinding.

487. DEINUM, H. W. AND GOEDKOOP, M. L. **The direct gravimetric determination of moisture in coal.** *Chem. Weekblad* **48**, 170-3 (1952).—*C.A.* **46**, 6807*d*.

Approx. 2 g of coal (less than 0.3 mm) is accurately weighed in a Ni boat which is then immediately placed in a combustion tube. The coal is heated for 30 min. at 105°C while a stream of O_2 free N_2 (36 liter/hr) carries the H_2O into an absorption tube filled with Anhydrone. Excellent checks are obtained by either weighing the Anhydrone with the H_2O or by weighing the residual coal sample. Heating of the coal sample to 150°C during the analysis has very little influence on the results.

488. DONNELLY, R. P.; BROADBENT, R. AND O'LEARY, B. J. **Influence of iron oxide on the reactivity of low-rank coals from Collie, Western Australia.** *Fuel* **31**, 418-28 (1952).—*C.A.* **46**, 11634*f*.

The reactivity of perlignitous coals is low when Fe_2O_2 is absent from the intrinsic ash but high where it is present. Fe_2O_3 in the extraneous ash has no effect. HCl vapor removes Fe_2O_3 from reactive surfaces and thereby reduces reactivity towards CO_2; but where Fe_2O_3 is already absent from reactive surfaces HCl enhances reactivity. Fe_2O_3-free coals, because of low reactivity, are used preferentially as a substitute for coke in water-gas plants and on cupolas.

489. DUVAL, XAVIER. **Study of oxygen adsorption by its thermoelectric emission.** *Compt. rend.* **234**, 208-10 (1952).—*C.A.* **46**, 4881*e*.

The thermoelec. emission was measured for a carbon filament at 1150° to 2000° K in a highly evacuated tube to which O_2 was admitted at 5×10^{-5} to 5×10^{-4} mm. The O_2 had no detectable influence on emission, and hence forms no surface film. Absence of previous O contamination of the C surface was shown by measurements before and after the filament was heated to 2800° K.

490. EDMISTER, WAYNE C.; PERRY, HARRY; COREY, R. C., AND ELLIOTT, M. A. **Thermodynamics of gasification of coal with oxygen and steam. Charts for material and enthalpy balance calculations.** *Trans. Am. Soc. Mech. Engrs.* **74**, 621-36 (1952).—*C.A.* **46**, 7733*a*.

The heat balance and product-gas yield and compn. for the gasification of coal with O_2 and steam were detd. on the assumption that the water-gas shift equil. is attained for the product gases. The charts were of general applicability for any rank of coal; they covered a wide range of operating conditions through the use of multiple parameters and can be used for pressures as high as 30 atm.

491. ELLIOTT, M. A.; PERRY, HARRY; JONAKIN, JAMES; COREY, R. C., AND KHULLAR, M. L. **Gasification of pulverized coal with oxygen and steam in a vortex reactor.** *Ind. Eng. Chem.* **44**, 1074-82 (1952).—*C.A.* **46**, 7733*e*.

Effects of ratio of O_2 to coal and depth of reactor on carbon conversion and production of synthesis gas are discussed. Diffusion is an important factor in these gasification reactions, and one of the most effective means for obtaining controlled relative velocity is to gasify in a vortex reactor equipped with multiple entrant tangential slots.

492. FRANKE, N. W.; KIEBLER, M. W.; RUOF, C. H.; SAVICH, T. R., AND HOWARD, H. C. **Water-soluble polycarboxylic acids by oxidation of coal.** *Ind. Eng. Chem.* **44**, 2784-92 (1952).—*C.A.* **47**, 1917*a*.

A description of lab. and pilot-plant equipment and procedure for oxidations of coals with gaseous O_2 and aq. NaOH up to 270°C and 900 lb/in^2. Humic acid formation reaches a max. when 1.5 *N* NaOH is used and decreases, with increased formation of sol. acids, as the NaOH concn. is increased. Sol. acids up to about 50% of the C in the original coal are isolated by acidification and extn. with MeCOEt; these contain benzene carboxylic acids and aromatic acids with more complex nuclei.

493. GEL'D, P. V.; VLASOV, V. G., AND SEREBRENNIKOV, N. N. **Reactions of oxides and their compounds with solid carbon.** *Zhur. Priklad. Khim.* **25**, 121-33 (1952).—*C.A.* **47**, 4704*h*.

Reduction of oxides (Cr_2O_3, MnO, ZnO, $Ca_3(PO_4)_2$) by carbon was investigated by the loss of wt of pressed mixts. of the oxide with graphite on heating at a const. temp. (~850-1150°C). CO_2 produced proved to be remarkably const. with batches $Cr_2O_3 + 4.5C$ and MnO+ 4C. In the case of $Ca_3(PO_4)_2$, the rate of reduction was slower under 1 atm. than *in vacuo*, and the activation energy fell to 17,000 cal/mole. The contrast between the behavior of $Ca_3(PO_4)_2$ and the other oxides can be explained by accumulation of P_2 vapor, according to $Ca_3(PO_4)_2 + 5\ CO \rightarrow 3\ CaO + 5\ CO_2 + P_2$, as a result of which the partial pressure of CO_2 in the system depended also on the total pressure and on the pressure of P_2.

494. GEORGIADIS, C. **Direct oxygen determination in coal. Improved Spooner method.** *J. usines gaz* **76**, 188-90 (1952).—*C.A.* **47**, 6115*d*.

O_2 is detd. directly in coal by passing purified N_2 through a tube 60 cm long, 20 mm in diam., and heated over 21 cm to 1150°C; 6 cm are required for the boat contg. the coal sample and 16 cm for the 3-5 mm plug of charcoal following the sample. The O of the coal is converted to CO, the gases are passed through Cd acetate to remove the H_2S and through various agents to remove the H_2O and CO_2, the CO is then oxidized over hopcalite catalyst, and the CO_2 is absorbed and detd.

495. GUÉRIN, HENRI AND BASTICK, MARTHE. **Determination of oxygen in coal.** *Compt. rend.* **234**, 218-20 (1952).—*C.A.* **46**, 7935*a*.

Heat 0.5 g of coal *in vacuo* (5 mm) at 1000°C and trap the H_2O, CO_2 and carbides formed at -195°C while CO, CH_4, and N are adsorbed on silica gel. After gasometrically detg. H_2O, CO_2 and CO, calc. the O_2 present in the original coal. Carbonization at successive temp. increments up to 1000°C permits the process of gas liberation to be followed, and the actual compn. of different coals to be investigated.

496. GULBRANSEN, EARL A. AND ANDREW, KENNETH F. **Reactions of artificial graphite. Kinetics of oxidation of artificial graphite at temperatures of 425° to 575° and pressures of 0.15 to 9.8 cm of mercury of oxygen.** *Ind. Eng. Chem.* **44**, 1034-8 (1952).—*C.A.* **46**, 7734*c*.

The oxidation was studied by means of the microbalance method. Rate data can be fitted to the equation $W = Kt + Ct^2$ where K and C are consts. and t is time. The calcd. energy of activation was 36,700 cal/mole. As a function of pressure, K followed the equation $K = A + BP$, where A and B were consts.

497. GULBRANSEN, EARL A. AND ANDREW, KENNETH F. **Surface oxide formation and surface roughness studies in relation to oxidation of artificial graphite at temperatures of 25° and between 425° and 575°C.** *Ind. Eng. Chem.* **44**, 1039-44 (1952).—*C.A.* **46**, 7734*d*.

The effect of pretreatment of graphite with O_2 on the rate of reaction with O_2 was investigated. The formation of the surface oxide at 500°C was a gradual and not an instantaneous process. Surface roughness as detd. by adsorption of Kr at liquid-N_2 temps. can be correlated to the value calcd. from the extent of surface-oxide formation. Heating at 950°C increased surface roughness as does oxidation at 500°C while oxidation at room temp. decreased surface roughness.

498. GULBRANSEN, EARL A. **Mechanism of the oxidation of graphite at temperatures of 425° to 575°C.** *Ind. Eng. Chem.* **44**, 1045-7 (1952).—*C.A.* **46**, 7734*f*.

Theoretical rate expressions for the oxidation of graphite were compared with exptl. rates of reaction. Two adsorption processes, immobile adsorption with dissociations and mobile adsorption, were shown to be possibly the rate-controlling processes for the oxidation of pure graphite.

499. GUMZ, WILHELM. **Gasification of solid fuels at elevated pressures.** *Ind. Eng. Chem.* **44**, 1071-4 (1952).—*C.A.* **46**, 7733*b*.

Gasification of solid fuels under pressures of 20 to 30 atm. offers advantages in high capacity and high fuel rates, low O_2 consumption, and decrease in cost of labor and product gas. The effect of pressure on gas compn., pressure drop in the fuel bed, and terminal velocity of suspended particles is calcd. and compared with exptl. data.

500. HÖNL, H. AND WOLFF, W. T. E. v. **Quantitative analysis of the combustion process in a coal tube. I. Theoretical.** *Z. physik. Chem.* **201**, 278-301 (1952).—*C.A.* **47**, 7188*f*.

The combustion process with O_2 proceed at the surface of the coal: (1) $2C + O_2 = 2CO$; (2) $C + O_2 = CO_2$; (3) $2CO + O_2 = 2CO_2$. The combustion process is discussed and calcd. quantitatively for the case that only reaction 1 takes place, reactions 2 and 3 being inhibited. The further assumption is made that no convection or diffusion of the reacting gases occurs.

501. INGLES, O. G. **Water gas shift reaction in fuel systems. I. Water gas shift on carbon.** *Trans. Faraday Soc.* **48**, 706-12 (1952).—*C.A.* **47**, 2457*e*.

The reaction in the presence of a pure sugar charcoal was studied by means of a flow technique between 750 and 850°C. The experimentally observed characteristics of the reaction were explained on the basis of a chain mechanism: $H + H_2O \rightleftharpoons OH + H_2$, $OH + CO \rightleftharpoons CO_2 + H$. The role of the charcoal was that of a chain initiator. The chain length was estd. to be very short. The extent to which the reaction, $2CO \rightarrow CO_2 + C$, occurred under the exptl. conditions was detd. by passing CO alone over the charcoal. Formation of CO_2 was found to be less than 0.0002 g/min.

502. JOHNSTONE, H. F.; CHEN, C. Y., AND SCOTT, DONALD S. **Kinetics of the steam-carbon reaction in porous graphite tubes.** *Ind. Eng. Chem.* **44**, 1564-9 (1952).—*C.A.* **46**, 8349*h*.

The integral and differential techniques were used. Individual rate coeffs. were detd. for the component reactions at temps. between 862° and 938°C. The mechanism of the reaction consisted of adsorption of water mols. on dual active centers, followed by relatively slow reaction with the carbon to form CO and H_2. The latter was strongly adsorbed and acted as a retardant to the over-all reaction. The water-gas shift reaction rapidly approached equil. in this system.

503. Kinney, C. R. and Friedman, L. D. **Ozonization studies of coal constitution.** *J. Am. Chem. Soc.* 74, 57-61 (1952).—*C.A.* 47, 1353*i*.

Moist O_3 converts a significant fraction of the C of carbon black and lamp black directly to water-sol. products without intermediate formation of humic acids. The results of ozonization of aq. alk. solns. of humic acids depend on the source of the acid and the temp. of prepn. of the soln.

504. Kleier, N. P. and Man'ko, N. M. **Kinetics of the activated adsorption of oxygen and of hydrogen on carbons with different contents of mineral impurities.** *Doklady Akad. Nauk S.S.S.R.* **83**, 713-16 (1952).—*C.A.* **46**, 6911*f*.

Salts of K, Ca, Fe, Ni, Ag, and Pt, in the amt. of 1%, were introduced by impregnation into activated birch charcoal, purified by treatment with NaF in HNO_3. Rates of adsorption were followed over 200 min., with O_2 at 182°C and with H_2 at 485°C. Addn. of Fe decreased whereas Ca, K, and Pt increased the rate of the adsorption. On silica gel, which is a poor adsorbent for H_2, the mineral salts had practically no effect on the rate of adsorption. Addns. of Ca, K, Pt, and Ni increased the no. of sites with low activation energies whereas Fe practically suppressed such sites. The effects of the salts on the adsorptions of O_2 and of H_2 differed; this was attributed to these 2 gases being adsorbed on different parts of the surface.

505. Kuchta, J. M.; Kant, A., and Damon, G. H. **Combustion of carbon in high-temperature high-velocity air streams.** *Ind. Eng. Chem.* **44**, 1559-63 (1952).—*C.A.* **46**, 8351c.

The kinetics of the combustion of spectroscopic-grade electrode carbon was studied for air velocities between 28 and 540 ft/sec and for air temps. between 900° and 1200°C. The reaction could be described by a diffusion-type equation in which the specific reaction rate was proportional to the square root of the air velocity or inversely proportional to a film-resistance parameter and relatively independent of the ambient temp. The exptl. data agreed in general with the Arrhenius-type equation in which the specific reaction rate was primarily dependent on the surface temp. of the reacting C. It appears that the reaction of C and O_2 under these exptl. conditions lay in an intermediate or transition region where both diffusion and chem. reactivity were rate-controlling factors.

506. Lebedev, A. N.; Volkov, I. I., and Efremov, M. A. **The combustion of ASh (anthracite dust) and mixtures of it with low-grade coal.** *Izvest. Vsesoyuz. Teplotekh. Inst. im. Feliksa Dzerzhinskogo* **21**, No. 5, 17-20 (1952).—*C.A.* **46**, 8346*e*.

The exptl. continuous combustion of ASh over a period of 8 hrs and mixts. with low-grade coals over a period of 100 hrs in a two-stage, completely insulated furnace operating at only 65-70% of capacity steam production, occurred smoothly and safely.

507. Mandal, A. K. and Orning, A. A. **A test of a reported effect of pulverization upon the carbonization properties of coal.** *Fuel* **31**, 33-6 (1952).—*C.A.* **46**, 1734*e*.

Pulverized samples formed into 1-g pellets were heated as in the volatile matter test. Swelling was prevented by oxidation, even for a strongly coking coal, but was not eliminated by pulverization alone. As judged by the yield of oxides of C upon thermal decompn. under vacuum at 350°C, the extent of swelling was closely related to the degree of oxidation of the coals. Oxidation rather than pulverization was concluded to be responsible for the observed effects on carbonization properties.

508. Mehta, M. M.; Kini, K. A.; Moitra, A. K., and Lahiri, A. **Absorption of oxygen by Indian coals.** *J. Sci. Ind. Research* (India) **11B**, 418-22 (1952).—*C.A.* **47**, 3543*a*.

Investigations of O_2 absorption by Indian coals of varying stability show low values for stable coals. CO_2:CO ratio in the oxidation products is greater than 1 for the coals tested and increases with humidity. O_2 absorption reaches a max. at 40% relative humidity.

509. Oreshko, V. F. and Tislin, T. S. **Effect of thermal treatment of coal on its oxidation.** *Zhur. Priklad. Khim.* (J. Applied Chem.) **25**, 373-83 (1952).—*C.A.* **46**, 7303*g*.

Coal heated in a N_2 stream to 270-340°C suffers thermal decompn. with loss of the least polymerized components which form part of the lyophilic cover of coal micelles which can react with O_2 forming low-temp. complexes. After removal of these products, the residue shows a sharp rise of formation of high-temp. complexes with O_2, although the ignition temp. remains the same even after treatment at 390-400°C. Thermal treatment at 430-40°C causes a rise of ignition temp. with higher rate of formation of high-temp. O_2 complexes and accelerates crystn. processes in the coal mass.

510. Panchenkov, G. M. and Golovanov, N. V. **Kinetics of the regeneration of aluminosilicate catalysts. Mechanism of the reaction of oxidation of "coke" on aluminosilicate catalysts.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* **1952**, 384-94.—*C.A.* 47, 4717*h*.

In the earliest initial stages of the oxidation of the "coke" deposited on aluminosilicates, there is observed at 270-428°C not a decrease but an increase of the wt. No wt increase is found with a gas rigorously free from O_2; the effect, therefore, must be due to an adsorption of O_2 by the coke. With increasing concn. of O_2 in the gas the kinetic order of the rate of oxidation, at 415°C, passes from 1st to zero order; at 500°C the rate is 1st-order in O_2 up to 30% O_2 in the gas, and becomes self-accelerated at higher O_2 contents as a result of heat evolution. The initial increase of wt, followed by a period of decreasing wt, indicates that the oxidation is a 2-stage process; the 1st stage consists in the formation of a complex C_xO_y; this complex can remain stable in an inert atm., but undergoes further oxidation to CO_2 and CO in the presence of O_2. A certain amt. of the C_xO_y complex is present in the coke before the start of the oxidation.

511. Panchenkov, G. M. and Golovanov, N. V. **Kinetics of the regeneration of aluminosilicate catalysts. Oxidation of the coke on the catalyst in tubes at variable concentration of oxygen along the catalyst layer.** *Izvest. Akad. Nauk S.S.S.R., Otdel, Tekh. Nauk* **1952**, 1031-6.—*C.A.* **47**, 4718*i*.

The general expression of the rate of a heterogeneous chem. reaction in which the reactant occupies a surface area σ per unit surface area of catalyst, and S_o is the surface area of catalyst per unit length of layer in the direction of the flow, is $n_o(dy/dl) = k'S_o\,\sigma$, where n_o is the feed rate at the entrance, and y is the mole fraction of mols. reacting at the distance l from the entrance; S_o is proportional to the vol. v_c of catalyst per unit length of layer. In application to the regeneration of a catalyst in a stream of O_2, under pressure P_o, Langmuir's scheme for a 1st-order surface reaction gives $\sigma = bP_o$; the sp rate of consumption of O_2 per unit length under $P_o = 1$ is $w_l = kb$, and the rate of its consumption if the mole fraction of O_2 in the gas is a, is $w_a = w_1 a$.

512. Parts, A. G. **The water-gas-shift equilibrium in the gasification of lignite with steam.** *Australian J. Appl. Sci.* **3**, 257-61 (1952).—*C.A.* **46**, 10582*b*.

It is shown that the compn. of the exit gases from a lignite-pilot plant always corresponded to the establishment of equil. of the water-gas-shift reaction at a theoretical temp. of 1000°K. At such low temp., establishment of the water-gas-shift equil. is thought to be due to catalysis by the fly-ash. Reactions leading to the formation of methane, ethane, and illuminants do not lead to an equil., but the sum of the formed hydrocarbons is proportional to the fraction of total decompd. steam.

513. Reif, Arnold E. **A study of the reactions of carbon monoxide with coke.** *J. Phys. Chem.* **56**, 778-84 (1952).—*C.A.* **46**, 8828*h*.

The reaction between CO and degassed coke has been investigated between 700-1000°C and 1-63 mm Hg. The initial process was an adsorption of CO on the coke. The adsorbed complex (CO) reacted with another CO: $CO + (CO) \rightarrow CO_2 + C$. Increasing CO_2 concn. causes: $C + CO_2 \rightarrow CO + (CO)$ and $CO_2 \rightarrow (O) + CO$. At 700° and 800°C the amount of CO_2 formed after a 90 min. period was only 2 and 17%, resp., of the equil. values and adsorption had practically ceased; at 900° and 1000°C, however, 44 and 66%, resp., were reached and adsorption was still appreciable.

514. Reif, Arnold E. **The mechanism of the carbon dioxide-carbon reaction.** *J. Phys. Chem.* **56**, 785-8 (1952).—*C.A.* **46**, 8828*g*.

The reaction of degassed coke with CO_2 at 900°C is given by the equations: $CO_2 \rightleftharpoons (O) + CO$ and $C + O \rightleftharpoons CO$, where (O) represents a mol. chemically bonded to the surface. These equations hold for all carbonaceous fuels, but the rate consts. vary widely with compn. and reactivity.

515. Riddiford, A. C. **Temperature coefficient of heterogeneous reactions.** *J. Phys. Chem.* **56**, 745-8 (1952).—*C.A.* **46**, 8940*h*.

The Nernst diffusion theory of heterogeneous reaction rates was extended to the general case of a solid-fluid system wherein the observed rate depends on both the chem. reaction rate at the surface and the transport process rate. These two rates were used to produce a simple, general treatment of the temp. coeff. of heterogeneous reactions. An example of a case where the transition from chem. to transport control occurred with temp. was the combustion of carbon spheres in a flowing gas stream.

516. Sebastian, John J. S. **Powdered-coal gasification. Effect of variables.** *Ind. Eng. Chem.* **44**, 1175-84 (1952).—*C.A.* **46**, 6363*b*.

Young, high-volatile coals yield better results than high-rank, low-volatile coals. High-ash or high-S coals can be gasified in entrainment with equal ease as high-grade coals, whether the coal is strongly coking or non-coking. For a given coal of predetd. particle size gasified in preliminary tests, the O:coal ratio, steam:coal ratio, and steam temp. can be so selected from graphs that, in all probability, good conversion with lowest O_2 and steam requirement will be obtained in large-scale pilot gasifiers.

517. Sevenster, P. G. **The oxygen-absorption characteristics of South African coals.** *J. Chem. Met. Mining Soc. S. Africa* **53**, 163-76 (1952).—*C.A.* **47**, 7189*b*.

The O_2 absorption was 100-700 ml at 30°C and 170-1200 ml at 60°C per 100 g of coal. A rough relationship was found to exist between O_2 adsorption and moisture content, both on the air-dry and inherent bases.

518. Thring, M. W. **Physics of fuel-bed combustion.** *Fuel* **31**, 355-64 (1952).—*C.A.* **46**, 7729*c*.

To evaluate the phys. reaction rates it is assumed, first, that O_2 diffuses through a stagnant layer to the surface where it reacts infinitely quickly to form CO which diffuses back to the turbulent core of the gas flow in the space between the fuel particles where it reacts infinitely quickly to form CO_2 as long as any O_2 remains in this core. Any of the resulting CO_2 that diffuses back to the fuel surfaces reacts with infinite rapidity to produce CO. Second, it is assumed that the diffusion processes obey Stefan's law, and this can be approximated as diffusion through a nonreacting gas present in much greater quantity. From these assumption the partial pressure of O_2 in the voids between the particles is related to the distance through the bed. For a fuel bed of particles 3 cm in size at 1200°, the distance for pO_2 to vanish is then found to be 3 to 4 cm, in good agreement with expt.

519. Traustel, S. **Industrial testing of the reactivity of cokes.** *Metall* **6**, 298-302 (1952).—*C.A.* **46**, 8832*d*.

Methods for detg. the reactivity of various cokes are discussed, based upon their reaction with a mixt. of CO_2 and CO.

520. Weisz, H. L. and Orning, A. A. **Reactivity of cokes.** *Fuel* **31**, 288-301 (1952).—*C.A.* **46**, 7742*b*.

A reactivity test is based on measurements of adibatic self-heating rates of a fuel sample in a stream of air or O_2. Temps. at which the solid fuel attains self-heating rates of 15° and 75°C per min. are reported as reactivity indexes T_{15} and T_{75}, resp. These indexes were detd. for 122 cokes in air and 92 cokes in O_2. The relations show a dominant influence of the chem. nature of the solid as measured by the volatile content, which in turn is detd. primarily by the max. temp. of carbonization. The effect of pore-surface distribution is significant but small as compared to the dominant influence of the nature of the solid.

521. Wicke, E. **Primary processes in the burning of graphitic carbon.** *Z. Elektrochem.* **56**, 414-20 (1952).—*C.A.* **47**, 294*i*.

Exptl. studies of graphite combustion are reviewed, and conclusions drawn from these investigations are summarized.

522. Wynne-Jones, W. F. K.; Blayden, H. E., and Marsh, H. **The reactivity of carbon.** *Brennstoff-Chem.* **33**, 238-41 (1952).—*C.A.* **46**, 10578*d*.

The most important single factor in the reactivity of carbons is the presence of traces of metallic impurities, probably as carbides. The nature of the carbon also has an influence, and different forms show very great differences in reactivity, at least in the presence of impurities. This may not be entirely a surface effect. The formation of gaseous oxides is invariably accompanied by the formation of oxides at the surface, and there is a const. relation between combined O and the pressure of the gaseous C oxides.

523. Zollikofer, H. **Oxygen content of coal and effect on gas production.** *Schweiz. Ver. Gas-u. Wasserfach Monats.-Bull.* **32**, 386-7 (1952).—*C.A.* **47**, 7189*c*.

A discussion and data on the relation between the O in coal and the CO content of resulting carbonization gas.

524. Adam-Gironne, Jean. **The thioreactivity of fuel. II. Study of the catalytic action of certain mineral compounds.** *Bull. soc. chim. France* **1953**, 446-7.—*C.A.* **47**, 7196*g*.

The influence of metallic salts on the reaction of S vapor with wood charcoal to form CS_2 was studied. An optimum concn. of catalyst existed for each salt. Na, K, Ca, Mg, and Pb salts increased the reactivity of the charcoal, while Mo, Ag, Ni, Fe, Co, Th, V, Cu, Mn, and Al did not. The large effect of Na did not appear to diminish appreciably even after 40% of the charcoal has been transformed to CS_2.

525. Busso, R. H. **A study of the production of light and the occurrence of metastable active centers in the combustion of graphite.** *J. chim. phys.* **50**, 53-9 (1953).—*C.A.* **47**, 6258*d*.

Ultraviolet of wave length 1900-2800 A. was produced in the course of the oxidation of graphite at 1500°C in air at pressures of 10^{-2}–15 cm Hg. Above 5 cm Hg, the light was formed by excited metastable CO_2 (mean life of several tenths of a sec) returning to its normal state, while at pressure below 5 cm Hg, excited metastable CO (probably in the $A^3\Pi$ state) with a mean life of about a sec was present as the light source.

526. Godsave, G. A. E. **Rates of combustion of solid-fuel particles.** *Nature* **171**, 86 (1953).—*C.A.* **47**, 4577*i*.

When a carbon sphere was burned in an air stream with a surface temp. greater than about 800°C, the rate-controlling process was the diffusion of O_2 through the gas film to the surface. This rate can be predicted by a semiempirical equation for mass transfer as a function of Reynolds no. (Re) and Schmidt no. (Re between 2 and 800). For spheres between 800 and 1400°C, the equation reduced to $S = 0.347\ (1 + 0.272\ (Re)^{1/2})\ Dp/d$, where S was specific reaction rate (g/cm²-sec), D was diffusion coeff. of O_2 in the gas (cm²/sec), p was gas density (g/cc.), and d is sphere diam. (cm).

527. Guérin, Henri and Adam-Gironne, Jean. **The thioreactivity of combustible solids. I. Test method and comparison of combustibles of various types and of charcoals made from woods of various species.** *Bull. soc. chim. France* **1953**, 302-3.—*C.A.* **47**, 5664*i*.

A test procedure is described in which S vapor flows at a constant rate over a carbonaceous sample at 800°C, and the gaseous products are analyzed. The index of thioreactivity is defined as the percentage of S transformed to CS_2. Results reported for 13 species of wood charcoal show that the index varies between 45.6 (olive wood) and 59.1 (beech wood). The index is 24.7 for anthracite, 2.9 for gas coke, and 0.6 for graphite.

528. Guérin, Henri and Bastick, Marthe. **The direct determination of oxygen in coals. III. Method of pyrolysis in vacuum.** *Bull. soc. chim. France* **1953**, 304-6.—*C.A.* **47**, 6115*e*.

The sample is heated to 1000°C and the gaseous products are passed over a silica cracking column heated to 900°C. The CO, CO_2, and H_2O which are formed are detd. separately and the total-O is calcd. The ratios of these 3 products remain const. for each type of coal and their formation can be studied as a function of temp.

529. Pourbaix, M.; Gottignies, L., and Berger, R. **Method of measuring the reactivity of cokes.** *Chaleur & ind.* **34**, 70-6 (1953).—*C.A.* **47**, 5664*g*.

Exptl. arrangements are described for studying the reaction of CO_2 with coke in the temp. range 800-1100°C. Some typical results are given which show the CO/CO_2 ratio obtained for several metallurgical cokes.

I-6. Hydrogen on Metals

530. Hofsten, Sven von; Kalling, Bo; Johansson, Folke, and Knös, Oof. **Absorption and desorption of hydrogen in the manufacture of steel.** *Jernkontorets Ann.* **123**, 485-526 (1939).—*C.A.* **34**, 2302^2.

A series of measurements were carried out in full-scale furnaces on gas compn. and the H-content of the molten metal. Samples of the molten metal were analyzed for H_2 by vacuum melting, and for carbon. The H-content of the gas dropped as the carbon was burned out. This was attributed to the diffusion of dissolved H_2 into bubbles of CO formed during the decarbonization process. If the furnace gas contained H_2 or any of its compds., the dehydrogenation was incomplete and reached an equil. value. The absorption of H_2 was promoted by a high partial pressure in the gas and partly hindered by a protective surface slag, but the rate of decarbonization seemed to have no influence.

531. Barrer, R. M. **Stationary and nonstationary states of flow and hydrogen-palladium and iron.** *Trans. Faraday Soc.* **36**, 1235-48 (1940).—*C.A.* **35**, 2382^9.

The diffusion consts. and permeability of H_2 were detd. for Pd from room temp. to 350°C and for Fe over the interval 0 to 80°C. The systems studied were: thermal diffusion of H_2 through a Pd disk; H_2 through Fe and Pd cathodes having "inactive surfaces" and "active surface conditions"; H_2 from HCl through rolled Fe sheet and through steel; H_2 by electrolysis through Fe. Phase-boundary reactions and diffusions were the variables, but not adsorption effects.

532. Eilender, W.; Chiu, Y. C., and Willems, F. **The effect of hydrogen in steels of different composition.** *Arch. Eisenhüttenw.* **13**, 309-16 (1940).—*C.A.* **34**, 2307^1.

Plain and alloy steels were melted with different methods of deoxidation, the H-content was artifically increased, and structure, H-content and H_2 escape were detd. The H_2 escape became more difficult in unalloyed steels with increasing C content, and also in low-C steels by addn. of alloying elements, except in Cb steels, in which the velocity of the escape of gas increased with increasing Cb content.

533. Herasymenko, P. and Combroski, P. **Hydrogen equilibria in the production of steel.** *Arch. Eisenhüttenw.* **14**, 109-15 (1940).—*C.A.* **35**, 718^9.

To prevent loss of H_2 that occurs on sampling and cooling in the air, 100 g steel was poured into an iron tube which could be connected to a vacuum app. H_2 was determined by heating in an elec. furnace to 900-950°C. The H-content increased considerably during reduction in the arc furnace; it varied much during oxidation. For open-hearth melts, the H-content was independent of the boiling of the melt. A parallel course was found between Mn-content and H-content.

534. Lepp, Henry. **The oxygen-hydrogen-molten iron system.** *J. Iron Steel Inst. (London)*, Advance copy, May, **1940**, 9 pp.—*C.A.* **34**, 3158^7.

Previous studies of the reaction between H_2 and molten Fe neglected the absorption of H_2. The action of water vapor with molten Fe was represented by $2FeO + 2FeH + H_2 \rightleftarrows 4Fe + 2H_2O$ for which the equil. const. was $\log K = 23585.82/T - 7.5526$. The concn. of H_2 absorbed by molten Fe increased with temp. and decreased with FeO.

535. Newell, W. C. **The estimation of hydrogen in steel and other metals.** *J. Iron Steel Inst. (London)*, Advance copy, May, **1940**, 11 pp.—*C.A.* **34**, 4013^2.

The vacuum-heating method is designed to det. the H-content of a dozen or more metal samples consecutively with a min. of elaborate app. The sample is heated *in vacuo* for one hr at 600°C. No further evolution of H_2 occurs when these samples are melted *in vacuo*. The accuracy of the heating method is ten times that of the fusion method. From 400° to 700°C the rate of H_2 evolution increases with temp. Above 700°C the curves show an irregularity which causes them to cross.

536. Norton, Francis J. **Diffusion of hydrogen from water through steel.** *J. Applied Phys.* **11**, 262-7 (1940).—*C.A.* **34**, 3564^1.

Using a metal radio tube with a steel shell as an ionization gage, the diffusion of H_2 through the steel into the interior was measured. When dipped into water, diffusion rates averaging 0.13 μ/hr at 25°C and 0.80 μ/hr at 100°C were observed for a plain sand-blasted surface; the shell was 0.0635 cm thick, the area exposed to water was 30.7 cm², and the free vol. inside was 15.0 cc. No diffusion occurred when exposed to water vapor alone. The rate of diffusion was less for the regular painted tube, and also for coatings of Ni, Sn, Cd, and Cu, but a porous Cu coating increased the rate to that for water on the bare steel.

537. Balandin, A. A.; Erofeev, B. V.; Pecherskaya, K. A., and Stakhanova, M. S. **The nickel hydrides.** *J. Gen. Chem. (U.S.S.R.)* **11**, 577-89 (1941).—*C.A.* **35**, 7305^9.

Absorption of H_2 considerably exceeding 4 atoms of H indicated other processes which use up H_2: (1) soln. of H_2 in the hydride and (2) catalytic hydrogenation of the benzene nucleus in excess of PhMgBr or in the product of the reactions $NiCl_2 + 2PhMgBr + 2H_2 = NiH_2 + 2C_6H_6 + MgBr_2 + MgCl_2$ or $NiCl_2 + 2PhMgBr + 2H_2 = NiH_4 + Ph_2 + MgBr_2 + MgCl_2$. The existence of NiH_2 and NiH_4 was proved analytically and that of NiH kinetically, The stability of the sols of Ni hydrides depended on the stabilizing effect of the org. Mg compds. adsorbed on their surfaces.

538. Hibbard, Henry D. **Control of hydrogen in steel.** *Steel* **108**, 69-70, 103-4 (June 16, 1941); *Metals and Alloys* **14**, 574 (1941).—*C.A.* **36**, 3134^6.

The most important sources of H_2 in steel is probably the H_2O vapor in the gases in the furnace chamber. The only apparent means of removing H_2 from the molten metal is the boil. The temp. during the working period should be low enough for a vigorous boil to take place. A reduction of the C and Mn contents by a prolonged boil may also decrease the H content, since C and Mn may have some solvent power for H.

539. Holm, V. C. F. and Thompson, G. **Determinations of hydrogen in ferrous materials by vacuum extraction at 800°C and by vacuum fusion.** *J. Research Natl. Bur. Standards* **26**, 245-59 (1941) (RP No. 1373).—*C.A.* **35**, 3555^{6}.

Vacuum fusion was satisfactory for the examn. of steels which often contain H_2 in an unstable form as a result of cathodic charging or heating in H_2. Warm extn. at 800°C was better for such steels. With them about 90% of the H_2 may be lost on standing for a few days. The quantities of H_2 found in most samples approximated the soly. of H_2 in the materials.

540. Houdremont, E. and Schrader, H. **Flake formation and embrittlement by hydrogen absorption of the steel in annealing. I. The combined action of hydrogen and stresses in the creation of flake cracks.** *Tech. Mitt. Krupp Forschungsber.* 4, 67-78 (1941).—*C.A.* **35**, 7334^{1}.

With increased cooling velocity the no. of flake cracks increases, and lower H-contents at higher cooling velocities suffice to cause formation of flake cracks. In a material that is free of H, stresses alone cannot produce flaking. In a H-contg. steel, stresses can essentially affect the orientation of the flakes and even cause flaking in cases where the H-content alone is not sufficient to cause flaking at a definite cooling velocity.

541. Itterbeek, A. van. **The relation between adsorption and the catalytic activity of metals.** *Meded. Kon. Vlaamsche Acad. Wetensch., Letteren Schoone Kunsten België, Klasse Wettensch.* **3**, No. 10, 3-20 (1941); *Chem. Zentr.* **1942**, II, 742.—*C.A.* **37**, 4958^{3}.

On the very pure Ni film the adsorption of H_2 and CO up to 500°C and pressures below 1 mm was studied with the help of a thermal-cond. gage. Comparison of the H_2 and CO isobars showed that at 167° and 329°C the ratio of H_2:CO was 3:1 and at 2 other temps. the ratio was 2:1 corresponding, resp., to the synthesis of CH_4 and benzene. On a copper film, neither H_2 nor CO was adsorbed until a small quantity of thorium was electrodeposited.

542. Kimura, Osamu. **Effect of sorption on the electric conductivity of pulverized metals. I.** *Bull. Chem. Soc. Japan* **16**, 378-81, (1941).—*C.A.* **41**, 4347*i*.

The elec. conds. of pulverized Pt, Au, Ni, Co, Cu, and Ag were measured in H_2. As the pressure increased, the cond. of Pt increased, those of Ni, Co, Cu, and Ag decreased, and that of Au remains unaltered. For Ni, oxidation and reduction velocities, temp. dependence of cond., relation between current and voltage, and the dependence of cond. on pressure of H_2 were studied in detail.

543. Kodama, Shinjiro; Matsumura, Shoichi, and Tarama, Kimio. **Physicochemical investigations on gasoline synthesis. IV. Velocity of adsorbing hydrogen by cobalt.** *J. Soc. Chem. Ind. Japan* **44**, 823-5 (1941).—*C.A.* **42**, 2080*b*.

H_2 at atm. pressure was brought into contact with Co at 14.5-275°C, and the velocity of adsorption measured. With t in min. and x as the cc. H_2 adsorbed per g of Co, this equation held $t = x(t/A + 1/A^2K)$, [which is the integrated form of $dx/dt = K(A - X)^2$], where A and K were consts. characteristic of each temp. There were active adsorbing centers on the surface of Co of various degrees of activity, and at low temp. the centers of greater activity react. When the temp. was raised such centers soon become satd. with H_2 and then the centers of less activity began to exhibit a measurable velocity of adsorption.

544. Kodama, Shinjiro; Matsumura, Soichi, and Ando, Tatsuo. **Physicochemical investigations on gasoline synthesis. V. Velocity of adsorption of hydrogen by a catalyst of cobalt and infusorial earth.** *J. Soc. Chem. Ind. Japan* **44**, 920-4 (1941).—*C.A.* **42**, 8439i.

The mechanism of adsorption of H_2 under atm. pressure by Co pptd. on infusorial earth is the same as in case of pure Co. The equation $t = x(t/A + 1/A^2K)$ holds. The const. A, detd. by the number of active adsorbing centers, is much greater for the supported catalyst. The values of K, measuring the velocity of adsorption, are small, perhaps because the activity of adsorbing centers increases and most of them are instantly satd.

545. Kodama, Shinjiro; Matsumura, Soichi, and Ando, Tatsuo. **Physicochemical investigations on gasoline synthesis. VI. Velocity of adsorption of hydrogen by cobalt-thoria-infusorial earth catalyst.** *J. Soc. Chem. Ind. Japan* **44**, 920-4 (1941).—*C.A.* **42**, 8440i.

With a catalyst of Co, ThO_2, and infusorial earth in the ratio 100: 18: 150, there was no change in the mechanism of adsorption. Addn. of thoria not only increased the number of active adsorbing centers, but also produced centers of greater activity at lower temp., so that it greatly decreased the temp. of activated adsorption of H_2.

546. Newell, W. C. **Third report of the oxygen subcommittee of the committee on the heterogeneity of steel ingots. Section II. The vacuum fusion and vacuum heating methods. Part C. The determination of hydrogen (vacuum-heating).** *J. Iron Steel Inst. (London)*, Advance Copy, May, **1941**, 93 pp. (Paper No. 5/1941 of the Heterogeneity of Steel Ingots Committee (Submitted by the Oxygen Sub-Committee)) 26-7.—*C.A.* **35**, 4703^{3}.

The previously described app. has been improved by replacing the single-stage Hg-vapor pump by a two-stage pump; thus the pumping rate and degree of vacuum were increased.

547. Zapffe, C. A. and Sims, C. E. **Hydrogen embrittlement, internal stress and defects in steel.** *Am. Inst. Mining Met. Engrs., Tech. Pub.* No. **1307**, 37 pp. (1941).—*C.A.* **35**, 7916^{3}.

H-embrittlement entails occlusion of H_2 under high pressure in "interblock disjuctions." These appear to be a fundamental part of the crystal structure and one related to slip and cleavage phenomena. When the occlusion pressure exceeds the elastic strength of the steel, the disjunctions are sprung and slip and cleavage planes operate much as during cold deformation. If H_2 is contained in cavities, not block disjunctions, such as in weld metal, H_2 can dissolve in injurious quantities at temp. somewhat below the transformation temp.

548. Andrew, J. H.; Bose, A. K.; Geach, G. A., and Lee, H. **The formation of hairline cracks. I.** *J. Iron Steel Inst. (London)*, Advance copy, Sept., **1942**, 10 pp. (Paper No. 5/1942 of the Alloy Steels Research Comm.).—*C.A.* **37**, 61^2.

Internal defects similar to hairline cracks were produced by rapid cooling. An aging period after quenching was required. All of the results so far obtained support the view that H_2 was the most important single factor involved in hair-crack formation.

549. Andrew, J. H.; Bose, A. K.; Lee, H., and Quarrell, A. G. **The formation of hairline cracks. II.** *J. Iron Steel Inst. (London)*, Advance Copy, Nov., **1942**, 41 pp. (Paper No. 6/1942 of the Alloy Steels Research Committee).—*C.A.* **37**, 1114^1.

H_2 is the fundamental cause of hairline cracks. It is present as a H-rich constituent formed on rapid cooling through the $\gamma - \alpha$ change. H_2 from the decompn. of this constituent diffuses into voids and builds up disruptive pressure. The cracks also contain methane which is a cause of trouble in preventing hairline cracks. Alloying elements affect the stability of the H-rich constituent and thus the susceptibility to hair cracks. Decompn. at low temp. leads to hairline crack formation.

550. Andrew, J. H.; Lee, H., and Quarrell, A. G. **The determination of solubility of hydrogen in iron and iron alloys.** *J. Iron Steel Inst. (London)*, Advance copy, Sept., **1942**, 12 pp.—*C.A.* **37**, 62^4.

The specimen prepd. in a current of H_2 at 1000° to 1050°C for at least 30 days to remove all traces of C and O_2 was heated in H_2 at a known temp. and pressure until equil. was reached, and the amt. of H_2 dissolved by the metal was measured. An abrupt change in soly. occurred between 950° and 900°C on cooling. The temp. coeff. of soly. was greater in γ Fe than in α Fe. Typical values in cc. per 100 g of Fe were: at 500°, 1.00; 700°, 1.8; 900°, 3.1; 1100°, 7.5.

551. Dingenen, Walter van. **Active adsorption of gases on pure and activated metal surfaces and its relation to the general physical properties of the metals.** *Verhandl. Kon. Vlaamsche Acad. Wetensch., Letteren schoone Kunsten België, Klasse Wetensch.* 4, No. 4, 59 pp. (1942).—*C.A.* **38**, 4849^7.

Measurements of activated adsorption of H_2 on pure Ni surfaces conformed to activated adsorption. Adsorption isotherms and isobars were detd. from room temp. to 500°C. From the velocity of adsorption conclusions were drawn about the energy of activation of the adsorption process. Measurements were made of the adsorption of H_2, D_2 and CO by Carbotox (activated carbon of Lurgi Co., Frankfurt), on electrolytically Cu-plated carbon, and on pro-motor-activated carbon-Cu. Promotors used were ThO_2, BaO, Cs_2O and SrO, for which the "work of emergence" of electrons is small, and Se_8, which has a large potential. The expts. covered the range −183° to 600°C. Adsorption of Ni and Cu at higher temps. was a so-called activated (atomic) adsorption, related to other physical properties of the material such as electron emission and cond.

552. Fast, J. D. **Gas permeability of metals.** *Philips' tech. rundschau.* **7**, 73-81 (1942).—*C.A.* **38**, 2910^9

The penetration of gases through metal walls presents at least 5 successive steps: (1) dissocn. of mols. into atoms or ions at the entrance surface, (2) infiltration of the atoms or ions thus formed into the metal, (3) diffusion in the metal, (4) transition from the dissolved to the adsorbed state at the emergent surface, (5) recombination of adsorbed atoms or ions into mols. There are thus 5 different instances conceivable, for which one or more examples are given: (1) H_2 through Fe, (2) H_2 through Fe with very rough entrance surface, (3) H_2 through Cu, (4) O_2 through Zr, (5) H_2 through Pd and O_2 through Cu or Ni. Selective permeability of walls can be employed to purify and analyze gases.

553. Ishikawa, Yoshioki. **The desorption of the adsorbed hydrogen on a platinum plate by the impact of slow electrons. I.** *Proc. Imp. Acad. (Tokyo)* **18**, 246-50 (1942).—*C.A.* **43**, 5279*e*.

A diode with an oxide-coated filament was used as a reaction chamber. Pure H_2 was passed over the anode of the Pt plate and was adsorbed. After evacuation slow electrons were emitted and the gas desorbed by this impact was measured by a Pirani gage. The electronic current of impact was 100-500 microamp. The atom produced by the dissocn. had kinetic energy of more than 3.55 v. which was obtained by subtracting the dissocn. energy 4.45 v. from the excitation energy 8 v. It easily overcame the adsorptive force of the metal (1 e.v.).

554. Ishikawa, Yoshioki. **The desorption of the adsorbed hydrogen on a platinum plate by the impact of slow electrons. II.** *Proc. Imp. Acad. (Tokyo)* **18**, 390-4 (1942); *Rev. Phys. Chem. Japan* **16**, 117-38 (1942).—*C.A.* **43**, 5280*b*; **46**, 4357*b*.

After heating the diode to about 200°C and immersing in liquid air the range of applied voltage was 7-60 v. Five max. were caused by the interaction between the H_2 mol. and the impinging electron. This indicated: (1) The stable H_2 mol. existed on the surface of Pt in the $1\Sigma_g$ ground state and was not perturbed by adsorption. (2) The desorption of the adsorbed mol. from the Pt surface was caused by an inelastic collison, (3) The adsorbed H_2 may be ionized by the electron impact to H_2^+ and remains stable in this state. (4) Adsorbed atoms and protons were not desorbed by this mechanism but may exist on the surface.

555. Itterbeek, A. van and Borghs, J. **The van der Waals adsorption of gases (H_2, D_2, CH_4, N_2, and Ne) on nickel flakes.** *Z physik. Chem.* **B50**, 128-42 (1942).—*C.A.* **37**, 2242^2.
The measurements were made in the temp. range of liquid N_2 and for Ne, H_2 and D_2 in the range of liquid H_2 also. At 60 to 69°K the van der Waals adsorption of D_2 was about 10% greater than that of H_2. At 18-20° K the difference was 15%. Although at higher temp. activated adsorption predominated, measurements at lower temps. followed the B.E.T. theory. The no. of adsorption layers reached about 6 for H_2 and D_2. The measurements with CH_4, N_2, and Ne can be explained either by the multilayer theory or by Polanyi's potential theory. With H_2 and D_2, however, there was a different potential curve for each temp. in the range of liquid H_2, in which the potential for H_2 was greater than that for D_2.

556. Kodama, Shinjiro; Matsumura, Shoichi; Tarama, Kimio; Ando, Tatsuo, and Yoshimori, Keisuke. **VII. Velocity of adsorption of hydrogen by iron.** *J. Soc. Chem. Ind. Japan* **45**, 254-8 (1942).—*C.A.* **43**, 2412i.
H_2 was adsorbed by Fe in the dissocd. form in the case of Co. The surface of Fe was not homogeneous, and adsorption at the centers of the weaker activity was observed at higher temps. No reason for the irregularity found at 99.6°C was given. Above 150°C the no. of active centers of adsorption suddenly increased.

557. Kodama, Shinjiro; Matsumura, Shoichi; Tarama, Kimio; Ando, Tatsuo, and Yoshimori, Keisuke. **VIII. Velocity of adsorption of hydrogen by iron on infusorial earth.** *J. Soc. Chem. Ind. Japan* **45**, 254-8 (1942).—*C.A.* **43**, 2413a.
Fe hydroxide was pptd. on infusorial earth and dried. Some irregularity was observed in the velocity of H_2 adsorption. Infusorial earth had an effect of increasing the no. of active centers and increasing the activity of those centers.

558. Kodama, Shinjiro; Matsumura, Shoichi; Tarama, Kimio; Ando, Tatsuo, and Yoshimori, Keisuke. **IX. Velocity of adsorption of hydrogen by a composite iron catalyst.** *J. Soc. Chem. Ind. Japan* **45**, 254-8 (1942).—*C.A.* **43**, 2413*b*.
The catalyst contained Fe, Cu, Mn, and infusorial earth in the ratio 100:25 : 2:125, resp. Results similar to the case of pure Fe were obtained, except that the t/x vs. t curve was irregular at 25° and 60°C, and above 100°C it was a broken line, showing that the adsorption of H_2 above 100°C conformed to the 2nd-order reaction velocity equation. There was no marked change in the amt. of H_2 adsorbed at higher temp., but below 100°C the amt. of H_2 adsorbed increased. This increase was considered to be caused by Cu.

559. Moreau, Léon; Chaudron, Georges, and Portevin, Albert. **Single-crystal and polycrystalline iron charged with hydrogen.** *Génie civil* **119**, 246-7 (1942).—*C.A.* **38**, 3179^8.
Comparison of data on single-crystals with existing data for polycryst. Fe indicated that H_2 diffuses through faults.

560. Ogawa, Eijiro; Tada, Masatomi, and Okuno, Toshiro **Studies of catalytic action by conversion between para-hydrogen and ortho-hydrogen. I. (a) Conversion by magnetized nickel wire; (b) Conversion by catalyst for ammonia synthesis.** *J. Soc. Chem. Ind., Japan* **45**, Suppl. binding, 387-9 (1942).—*C.A.* **44**, 7637*a*.
At 73°C the activation energy of the ortho-para-H_2 conversion over Ni was 3000 cal for unmagnetized and 6000 cal for magnetized catalyst. At 112°C the effect of magnetization disappeared, indicating that the conversion changed from a magnetic to activated adsorption mechanism. For the $H_2 + C_2H_4$ reaction at 150-200°C, the magnetic mechanism acted on C_2H_4 but not on H_2.

561. Portevin, Albert; Chaudron, Georges, and Moreau, Léon. **The path of hydrogen in monocrystalline and polycrystalline iron.** *Compt. rend.* **215**, 351-3 (1942).—*C.A.* **38**, 3234^8.
Iron charged with electrolytic H_2 was degassified by annealing in vacuum. Study of the residual gas content, micrography, fragility and Brinell hardness of samples annealed at different temps. and a comparison of the behavior of polycryst. and monocryst. iron showed that the gas freed from the lattice followed the intergranular boundaries. This effect may cause trouble at annealing temps. around 300°C.

562. Portevin, Albert; Chaudron, Georges, and Moreau, Léon. **The two manners of hydrogen evolution by heating iron.** *Métaux corrosion-usure* **17**, 175-7 (1942).—*C.A.* **39**, 4037^5.
The greatest hardness of iron was obtained by electrolytic loading with H_2 for 8 hrs at −10°C. The samples were then heated at different temps. in vacuo and the progress of the evolution of H_2 was observed. After heating polycryst. samples at 250° and 300°C only about one-third of the H_2 remained in the crystal lattice, yet by heating to 900°C the intercryst. H_2 went into the lattice. In samples consisting of a single crystal almost the entire H_2 content was left in the lattice after heating to 300°C. This showed that the escape is through the intercryst boundaries.

563. Rostagni, Antonio and Sandrin, Italo. **Sources of protons with a palladium anode.** *Atti reale ist. Veneto sci.*, Pt. 2, *Sci. mat. e nat.* **101**, 283-7 (1942).—*C.A.* **45**, 4550*f*.
The possibility that H_2 occluded on Pd might be a good source of protons was investigated, with and without electron bombardment. The results were unfavorable.

564. Rostagni, Antonio and Sandrin, Italo. **Nature of ions produced by electronic bombardment of palladium.** *Atti reale ist. Veneto sci.*, Pt. 2, *Sci. mat. e nat.* **101**, 343-8 (1942).—*C.A.* **45**, 4550*f*.
A mass spectrograph was used to analyze the products obtained by bombarding a Pd tube contg. H_2. H_1^+, H_2^+, H_3^+ were present but not in sufficient intensity to provide a source of protons.

565. Widemann, M. **The solubility of hydrogen in iron.** *Anz. Maschinenwes.* **64**, No. 11, Suppl. 17-19 (1942).—*C.A.* **38**, 2603^3.
Absorption of H_2 by liquid Fe, by Fe products during heat-treatment in H_2-contg. atms., and by Fe during pickling is explained. Dissolved and absorbed H_2 are partly lost during hot and cold working or by exposure of metal to the atm. X-ray

examn. shows H_2 is dissolved in the α and γ lattices, produces an increase in lattice const., and acts especially on the intercryst. material.

566. ZAPFFE, C. A. **"Fish-eyes" in steel welds caused by hydrogen.** *Metal Progress* 42, 201-6 (1942).—*C.A.* **36**, 5761⁴.
The major portion of H_2 occluded at ordinary temps., after the welding operation, is "extra-lattice." The shiny, central blowhole in steel welds is the locus to which H_2 diffused during cooling. Gas pressure within the entire "fish-eye" exceeds the elastic, or cohesive, strength of the metal.

567. ZAPFFE, C. A. **Defects in cast and wrought steel caused by hydrogen.** *Metal Progress* 42, 1051-6 (1942).—*C.A.* **37**, 592⁴.
Checks and tears along tensile test specimens are ordinary indications of H_2-embrittled spots known as "snowflakes," "white spots" or "silver streaks." Flakes in forgings, shatter cracks in rail heads and "pin holes" near the surface of steel castings are other manifestations of H_2.

568. ARMBRUSTER, MARION H. **The solubility of hydrogen at low pressure in iron, nickel and certain steels at 400° to 600°C.** *J. Am. Chem. Soc.* **65**, 1043-54 (1943).—*C.A.* **37**, 4283⁷.
The soly. (s) of H_2 was measured over a range of pressure (p) from 0.001 to 1.5 mm in carefully pretreated samples of α-iron (initially carbonyl iron), Ni and certain steels at 400°, 500°, 600°C and at pressures up to 350 mm in the iron at 600°C. The results were reproducible, and were in accord with the linear relation $s = a\ p^{1/2}$. The measurements on Fe and Ni at all 3 temps. were accurately reproduced by the resp. equations: $\log (s/p^{1/2}) = -1454/T + 1.946$ and $\log (s/p^{1/2}) = -645/T + 1.732$, where T was °K.

569. BALANDIN, A. A. AND EROFEEV, B. V. **Progressive poisoning of H_2 sorption in the process of formation of Ni hydrides.** *Acta Physicochim. U.R.S.S.* **18**, 494-8 (1943); *J. Gen. Chem. (U.S.S.R.)* **12**, 168-70 (1942).—*C.A.* **37**, 2675²; **39**, 251⁴.
The progressive poisoning of the catalyst in hydrogenation of aromatic hydrocarbons, the formation of Ni hydrides, and the solution of H_2 in these hydrides are considered predominantly to be localized on certain definite elements of the complex surface of Ni.

570. DOTY, PAUL M. **The attainment of thermal equilibrium between a gas and a hot surface.** *J. Chem. Phys.* **11**, 557-9 (1943).—*C.A.* **38**, 908⁹.
Thermal equil. is complete for the dissocn. $H_2 \rightarrow 2H$ in contact with a hot wire at 1148-1420° K. Complete attainment of thermal equil. is possible only for mols. and surfaces like H_2 and W, where chemi-adsorption occurs.

571. ITTERBEEK, A. VAN; MARIENS, P., AND PAEMEL, O. VAN. **Activated adsorption by nickel foil between 200° and 500°C.** *Ann. Phys.* **18**, 135-44 (1943).—*C.A.* **38**, 5708⁷.
The adsorption of H_2 and D_2 by Ni foil was detd. at temps. of 250-500°C and at pressures of 1-4 mm. Curves of the amt. adsorbed at const. pressure vs. temp. showed at approx. 360°C a definite hump, which was more pronounced the higher the pressure. With D_2, but not with H_2, a second hump also appeared at about 410°C. The hump at 360°C may be due to an increase in surface, as the coeff. of expansion of Ni was known to have a max. at this temp.

572. MURATA, YOSHIO; NAKAGAWA, MASAYUKI; TASHIRO, EIICHI, AND UMEMURA, TADASHI. **LXV. Reduction by hydrogen and heat-treatment of iron catalysts.** *J. Soc. Chem. Ind. Japan* **46**, 52-68 (1943).—*C.A.* **43**, 2401*b*.
Fe catalysts lose their activity when reduced with H_2 depending on the temp. and time; thus, they totally lose their catalytic power when reduced in H_2 4-8 hrs at 450°C while those reduced at 250°C for 4-10 hrs regain their activity in the course of 1-2 days of normal operation. The activity of the catalysts reduced with H_2 is not recovered by oxidation with air at 250-450°C. Fe catalysts slightly increase their activity when heated in an air current at 100-400°C, but above 400°C, the activity is gradually reduced with the elevation of temp. until it is completely lost at 600°C.

573. MURATA, YOSHIO; NAKAGAWA, MASAYUKI; TASHIRO, EIICHI, AND UMEMURA, TADASHI. **LXVI. Reduction of iron catalysts.** *J. Soc. Chem. Ind. Japan* **46**, 52-68 (1943).—*C.A.* **43**, 2401*d*.
The effect on the activity of the catalyst of reducing with various gas mixts. was studied in detail. The activity of the catalyst was increased when it was reduced by H_2 to which a small amt. of CO was added. The effect of adding CO was nearly linear up to $CO : H_2 = 1:2$ and diminished gradually when more CO was added. When the ratio of $CO : H_2$ exceeded that of the gas mixt. used in the synthesis, the activity of catalyst was greatly reduced.

574. ZAPFFE, C. A. **Sources of hydrogen in steel and means for its elimination.** *Metal Progress* **43**, No. 3, 397-401 (1943).—*C.A.* **37**, 1969⁷.
The principal source of H_2 is H_2O—liquid, vapor or chemically combined as Fe rust. Recommended procedures are given for enameling, heat-treatment, electroplating and melting.

575. ZAPFFE, C. A. **Effects of hydrogen in steel.** *Proc. Open Hearth Conf., Am. Inst. Mining Met. Engrs.* **26**, 240-51 (1943).—*C.A.* **38**, 5186⁸.
Absorbed H_2 in steel causes brittleness and cracks by segregation at certain loci within the metal and congesting it so that slip mechanism is unable to operate; the mechanism is a simple aging function. Sources of H_2 preventing it from being absorbed by careful melting practice, and its removal by N_2 and vaporizing solids are discussed.

576. ZAPFFE, A. AND MOORE, GEO. A. **A micrographic study of the cleavage of hydrogenized ferrite.** *Am. Inst. Mining Met. Engrs., Tech. Pub.* No. **1553**, 19 pp. (1943).—*C.A.* **37**, 1967¹.
Ferrites of 3 different origins were rendered ductile in H_2 with subsequent treatment in vacuo and were then embrittled by addn. of H_2 alone. Occlusion of H_2 by Fe at ordinary temps. occurred as the retention of fluid, compressed gas in microscopic openings or rifts into which the gas ppts. form supercooled or supersatd. solid solns. The

failure of H-embrittled Fe occurred by direct cleavage through these gas-filled rifts, which had no ductility.

577. AUSTIN, J. B. **Determination of hydrogen in steel.** *Proc. Conf. Natl. Open Hearth Comm., Iron Steel Div., Am. Inst. Mining Met. Engrs.* **27**, 178-81 (1944).—*C.A.* **39**, 675^7.

Methods for detg. H_2 in steel are adequate and have not shown a definite relationship between H_2 content and mech. properties.

578. FRANKENBURG, WALTER G. **The adsorption of hydrogen on tungsten. I.** *J. Am. Chem. Soc.* **66**, 1827-8 (1944).—*C.A.* **39**, 451^4.

Data were given at equil. pressures between 1×10^{-5} and 30 mm and from -194° to 750°C. W powders were used with B.E.T. surfaces about 7000 to 20,000 cm^2 per g. The W powders were reduced in H_2 at 750°C and outgassed at 750°C in a high vacuum for 35 to 50 hrs. Such powders showed well-reproducible values of H adsorption with negligible gas evolutions. The adsorption was characterized by the uptake of relatively large quantities of the gas at low pressure (about 25% of the satn. value, at 10^{-4} mm and 0°C). Extrapolation of the adsorption isotherms to high pressure led to a satn. value of adsorption corresponding to 1 H_2 per 2 W atoms in the metal surface. The quantities of H_2 adsorbed per cm^2 of the W surface at a given temp. and pressure were identical, within the limits of exptl. error, for 2 different powders the surfaces of which differed by the factor 3.

579. FRANKENBURG, WALTER G. **The adsorption of hydrogen on tungsten. II.** *J. Am. Chem. Soc.* **66**, 1838-47 (1944).—*C.A.* **39**, 452^1.

Langmuir's formula is adapted to the rapid decrease of the differential heats of adsorption with increasing covering of the W surface with H_2. A detailed discussion leads to the evaluation of the satn. value (S) of 1 adsorbed H_2 per 2 W atoms on the surface. The adsorbed H_2 exists on the surface in the form of atoms, at all surface coverings below 0.008 S, and as "mols." at all surface coverings above 0.008 S. Q, the differential heat of adsorption of H_2, is temp.-independent for a given surface covering up to 529°C; a sharp decrease with increasing temp. then takes place.

580. KJERRMAN, H. **Indirect determination of hydrogen in steel.** *Jernkontorets Ann.* **128**, 1-12 (1944).—*C.A.* **39**, 4309^6.

Basic open-hearth steel is higher in H_2 than acid open-hearth steel. Killed basic open-hearth steel contains more H_2 than rimming basic open-hearth steel. Burning damp wood in the gas producer supplying fuel to the steel furnace causes the H-content of the steel to be greater than when coal is used. A moist ladle increases the H-content of the steel, and a leak in the water-cooled mechanism operating and butterfly of the reversing valve increases the H_2 in the steel.

581. OWEN, E. A. **Note on the solubility of hydrogen by palladium.** *Phil. Mag.* **35**, 50-7 (1944).—*C.A.* **38**, 4176^5.

The occlusion of H_2 below 1 atm. by Pd was examd. by X-ray methods between 60°-130°C range. The β-phase, when first formed, was finely dispersed through the α-phase and remained finely divided when the whole material consisted of β-phase. Likewise, the α-phase, when it reappeared, was finely divided through the β-phase and when all the latter had gone the newly formed α-phase remained finely divided unless annealed for some time at a higher temp. than the isothermal. No improvement in line sharpening was detected if the system was kept for 5 days at the temp. of the isothermal. No evidence was obtained that metallic hydrides were formed in the temp. range examd.

582. OWEN. E. A. AND WILLIAMS, E. ST. J. **X-ray study of the hysteresis effect observed in the palladium-hydrogen system.** *Proc. Phil. Soc. (London)* **56**, 52-63 (1944).—*C.A.* **38**, 4176^8.

Pure Pd filings were mounted on a fiber and then charged with H_2. The hysteresis curve was detd. at 100°C and found to be essentially the same as that reported formerly; other curves were detd. (60-130°C). Only those parts of the ascending and descending isothermals where a single component existed could be retraced by altering the pressure. The reversibility disappeared immediately when the 2nd component was formed. The effect of charging the Pd with H_2 for long periods was examd. The behavior of charged Pd under varying conditions in the pressure region of hysteresis was very definite, although the system was not in final equil. Expts. with charging times up to 90 hrs were recorded.

583. ROLLASON, E. C. **The influence of hydrogen on weldability of high-tensile alloy steels.** *Inst. Welding (London) Quart. Trans.* **7**, 74-5 (1944).—*C.A.* **39**, 1615^3.

Normal mild steel welds contain more than enough H_2 to cause embrittlement. The max. appears to be about 4 cc/100 g; decrease to 1-2 cc/100 g greatly extends the weldability. The H-content of austenite welds can be considerably higher than that of ferritic welds without loss of weldability.

584. UHLIG, H. H. **Influence of hydrogen on mechanical properties of some low-C Mn-Fe alloys and on Hadfield Mn steel.** *Am. Inst. Mining Met. Engrs., Tech. Pub.* No. **1701**, 19 pp. (1944).—*C.A.* **38**, 5782^3.

Low-C Mn-Fe alloys contg. 9-22% Mn, H_2 treated at 1000°C and quenched are embrittled. Specimens of electrolytic Fe 0.406 cm in diam. and 3.3% Mn-Fe alloy are not embrittled because H_2 is not retained no matter how rapid the quench. Alloys vacuum treated at 1000°C and quenched in vacuum lose H_2.

585. VILLNER, L. AND NORRÖ, A. **Furnace atmospheres in arc furnaces and their effect on hydrogen and nitrogen contents of steel.** *Jernkontorets Ann.* **128**, 105-34 (1944).—*C.A.* **39**, 3772^9.

There was no marked absorption of N_2 in the period between removing the first slag and prepg. the refining slag in spite of the high N-content of the furnace atm. In the refining period a certain amt. of N_2 was absorbed by the steel, an av. for 12 charges being 0.002%; N_2 in the slag rose steadily in this period and could be as high as 0.15%. The steel took up a considerable quantity of H_2 from the H_2O in the burnt CaO during the building up of the furnace slag and some was still present on tapping. H_2 absorption could be reduced by prepg. the slag first with limestone and then with burnt CaO.

586. Wagner, Carl. **Solubility of hydrogen in palladium alloys.** *Z. physik Chem.* **193**, 407-16 (1944); **194**, 85 (1944).—*C.A.* **41**, 1520^a.

Soly. of H_2 in Pd is changed considerably by alloying with Ag or B. These effects are explained by the assumption that in pure Pd the lattice units are Pd ions, while in the alloys the units are Pd atoms and Ag ions. The chem. potential of electrons in these lattices is detd. by the relative amts. of these two varieties of units.

587. Zapffe, C. A. and Sims, E. **Hydrogen and nitrogen as causes of gassiness in ferrous castings.** *Trans. Am. Foundrymen's Assoc.* **51**, 517-62 (1944).—*C.A.* **38**, 1453^3.

Melts flushed with H_2 yielded porous castings. Steam was more effective than H_2 in promoting porosity. The soot deposited in ingot molds by a C_2H_2 flame was a good H_2 adsorber. There was no porosity in castings poured from metal that had been flushed with N_2 alone. Flushing with H_2 followed by N_2 yielded sound castings, but gassiness occurred when H_2 was passed through the bath after the N_2 flow.

588. Balandin, A. A. **The kinetics of catalytic hydrogenation.** *Bull. acad. sci. U.R.S.S., Classe sci. chim.* **1945**, 339-58 (English summary).—*C.A.* **40**, 4593^8.

Two kinds of active centers are assumed: I, capable of activating the adsorbed H_2, the II, activating only the hydrogenatable org. substance. Both adsorb H_2 and the initial, intermediate, or final products; the establishment of the adsorption equil. is faster than the subsequent reaction. In the case of benzene on Ni, the I centers would be located along the lattice edges with the inter-atom distances of 3.52 A., the II centers are constituted by the sextet in a place with the distance 2.49 A. A simple expression is obtained for the rate of dehydrogenation showing independence of pressure and confirmed by the example methylcyclohexane-toluene, between 200° and 300°C. The rate remains const. for the hydrogenation under high pressure as long as there remains a sufficient amt. of hydrogenatable substance. This is confirmed for toluene at 75°C and 120 atm. and at 120°C and 35 atm.

589. D'yakonov, I. A. and Samarin, A. **Analysis of the process of absorption of gases by metals.** *Bull. acad. sci. U.R.S.S., Classe sci. tech.* **1945**, 813-20 (in Russian).—*C.A.* **41**, 2367^d.

Hydrogen absorption isobars of various metals fall into 2 distinct groups: one with weaker absorption rising with temp. at 400-1600°C (Si, Cu, Ag, Cr, Fe, Co, Ni), the other with stronger absorption falling with rising temp. (Ti, Zr, Th, V, Cb, Ta, La, Ce, Pr, Pd). Isotherms in the first group, corresponding to simple solid soln., are straight lines in terms of the square root of the gas pressure, p. In the second group, this plot is linear only at low pressures; the isotherm then bends upward and attains a horizontal satn. level at high pressures. The generalized isotherm of absorption consists of 3 continuous branches: (1) a first linear portion corresponding to soln. of atoms of the gas in the metal, (2) a second linear portion of steeper rising slope corresponding to soln. in the metal of a gas-metal compd., and (3) a final horizontal 3-phase branch of complete satn.

590. Eborall, R and Ransley, C. E. **The reaction of an aluminum-magnesium alloy with water vapor, and the absorption of hydrogen.** *J. Inst. Metals* **71**, 525-52 (1945) (Paper No. 1004).—*C.A.* **40**, 305^4.

The gas obtained from wrought and cast Al-Mg alloy, contg. 7% of Mg, was almost entirely H_2; at 500°C and atm. pressure, the soly. of H_2 was approx. 0.05 cc. per 100 g. Diffusivity of H_2 in the alloy can be expressed by $D = D_o exp(-E/RT)$ where $D_o = 340$ cm^2/sec and $E = 24{,}600$ cal/g-atom. Annealing in damp air gave the same results as annealing in H_2O vapor. At room temp., diffusivity of H_2 in the alloy was approx. 2×10^{-16} cm^2/sec.

591. Griffin, Carroll W. **The sorption of hydrogen by poisoned copper. Temperature-variation experiments.** *J. Am. Chem. Soc.* **67**, 62-4 (1945).—*C.A.* **39**, 1342^5.

The sorption of H_2 with temp. variation on pure massive Cu was detd. and compared with that of H_2 on the same Cu poisoned with a small quantity of CO. The effect of the poison was largely to prevent the soln. of H_2 in Cu.

592. Hall, M. N. A., Mrs.; Martin, S. L. H., and Rees, A. L. G. **Solubility of hydrogen in zirconium and zirconium-oxygen solid solutions.** *Trans. Faraday Soc.* 41, 306-16 (1945).—*C.A.* 39, 5147^3.

The soly. of H_2 in Zr contg. O_2 in solid soln. from 0 to 50 atom % was detd. isothermally up to 1000°C and at pressures 1 to 760 mm. Special precautions were taken for the elimination of surface contamination of the Zr by oxide or nitride films. Desorption expts. demonstrated the existence of hysteresis, but this was not fully investigated. Degassed powders contg. O in solid soln. were found to be more liable to spontaneous ignition on exposure to air at room temp. than were samples contg. little O.

593. Hasegawa, Shigeo. **Physicochemical studies of copper catalyst. IV. The adsorption of hydrogen by cupric oxide.** *Rev. Phys. Chem. Japan* **19**, 132-9 (1945).—*C.A.* 44, 2356*d*.

CuO (10 g) was reduced in a sealed vessel under H_2 pressure after being heat-treated at various temps. At 120°C, the rate of decrease of H_2 was gradual, and there was no marked inflection point in the rate curve. The rate of the pressure decrease was smaller when the temp. of heat-treatment was higher. Above 160°C, the course of the pressure decrease immediately after the start was similar, but there was a difference after a short time, and a break in the rate curve. In the part before the inflection point, H_2 was not in adsorption equil. with CuO, and after it, the observed decrease in H_2 pressure was the true reaction.

594. Hurst, J. E. **Cast iron. Residual elements and gas contents.** *Iron and Steel (London)* **18**, 635-40 (1945).—*C.A.* **40**, 1125⁷.

An addn. of 0.10% Te to an iron normally solidifying gray brought about complete whitening. The rate of scaling of 2 pieces 6% Si iron was not the same, although their compns. were similar. The difference in machinability between 2 cast iron cylinders was attributed to slight variations in compn., the cylinder having good machinability contained 0.09% Ti and 3.3 ml H_2 per 100 g of metal. The poor-machining casting contained 0.05% Ti and 7.8 ml H_2 per 100 g, all other elements including O_2 and N_2 being almost identical. The greatest single trouble in the production of sound castings arose from the gas content. H_2 in excess of 2 ml per 100 g of metal invariably caused unsoundness.

595. Itterbeek, A. van; Mariëns, P., and Verpoorten, I. **Activated adsorption of hydrogen in the neighborhood of the Curie point.** *Nature* **155**, 668 (1945).—*C.A.* **39**, 3989³.

The adsorption of H_2 (at pressures of 0.2, 0.4, 0.6, and 0.8 mm) on Ni is reported in cc./m² at 250°, 300°, 350°, 360°, 370°, and 400°C. Equil. is attained in 30 sec. Adsorption increases with temp. There is a pronounced discontinuity in the isobars near 358°C (the Curie point). The adsorption is partially reversible.

596. Michel, André; Bénard, Jacques, and Chaudron, Georges. **Mechanism of the diffusion of hydrogen in palladium at ordinary temperatures.** *Bull. soc. chim.* **12**, 336-40 (1945).—*C.A.* **40**, 259⁵.

A Pd wire was hydrogenated by electrolysis at 8 ma./cm² and all the H_2 dissolved in the metal. As electrolysis proceeded, the lattice parameter a of the ordinary Pd α phase increased from 3.882 to 3.885 A., whereas its pattern became diffuse. The hydride phase β appeared right from the start, but the intensity of its pattern did not appreciably increase until a for the α phase had reached its max.; then β began to replace α. A superficial layer of β phase was first formed; H_2 diffused from this layer into the body of the α metal until the phase was satd. with H_2; then further addn. of H_2 transformed α to β.

597. Mravec, J. G. **Determination of hydrogen in molten steel by the gas-tube method.** *Trans. Am. Inst. Mining Met. Engrs.* **162**, 298-403 (1945).—*C.A.* **40**, 7064⁶.

The gas tube is suitable for production control and research work. Results are based on a 3-5 lb sample.

598. Naughton, John J. **Determination of hydrogen by vacuum extraction and tin fusion.** *Trans. Am. Inst. Mining Met. Engrs.* **162**, 385-90 (1945).—*C.A.* **40**, 7064⁸.

In detg. H_2 in Fe-Mn alloys by any heating method, volatile Mn might absorb the H_2. To limit this loss, the samples were stored in a chamber immersed in liquid air. Gas-cooled samples of 3.5, 6, 10, 12, 17, and 22% Mn-Fe alloys contained approx. 0.0001, 0.00015, 0.0004, 0.00046, 0.00055, and 0.0006% H_2 by wt, resp. H_2O-quenched samples contained 0.0002-0.0007% H_2, the increase being due to the high soly. of H_2 and low rate of diffusion in the austenitic phase.

599. Post, C. B. and Schoffstall, D. G. **Determining the hydrogen content of molten steel by vacuum extraction.** *Trans. Am. Inst. Mining Met. Engrs.* **162**, 390-8 (1945).—*C.A.* **40**, 7064⁵.

A sample of liquid steel from the furnace bath was cast in a bomb. A portion of the cast steel sample was heated at 600-800°C under high vacuum, and the gases were collected and measured. The H-content could be detd. within ± 6% by this method.

600. Potter, E. V.; Hayes, E. T., and Lukens, H. C. **Hydrogen content of electrolytic manganese and its removal.** *Trans. Am. Inst. Mining Met. Engr., Inst. Met. Div., Tech. Pub.* No. **1809**, 9 pp. (1945).—*C.A.* **39**, 3735⁹.

Approx. 250 cc. of H_2 was sorbed in 100 g of electrolytic Mn and effectively removed by heating to not over 500°C for longer than 1 hr, in air or in an O_2-free atm. at atm. pressure, or in a partial vacuum. Heating to 500°C for 1 hr in a vacuum will reduce the H_2 content to less than the amt. sol. at 500°C and 650 mm H_2 pressure without increasing the O_2 or N_2 content to over 0.03%. A product free of H_2, and contg. no impurities not present in the original metal, can be obtained by heating in an atm. of some inert gas, or in H_2.

601. Rozental, K. I.; Dolin, P. I., and Ershler, B. V. **Kinetics of ionic discharge and ionization of adsorbed deuterium atoms on a platinum electrode.** *J. Phys. Chem. (U.S.S.R.)* **19**, 601-14 (1945).—*C.A.* **40**, 3323⁵.

A Pt wire contg. adsorbed H_2 was polarized. The capacity was high at low polarization voltages and low frequencies (e.g., 10 cycles per sec) of the polarizing a.c., and low at high frequencies (up to 6000 cycles per sec), when it is almost independent of the voltage; at high frequencies it was chiefly that of the elec. double layer. The capacity values in 0.14 N D_2SO_4 + 2 N Na_2 SO_4 in D_2O were lower than those in H_2O for all voltages and frequencies, and the conductance values were lower except at low frequencies. At a const. potential the adsorbed D_2 was greater than that of H_2; the difference of the energies of adsorption of D_2 and H_2 by Pt was calcd. to be 1.7 cal per mole.

602. Scafe, R. M. **Determination of hydrogen in steel sampling and analysis, by vacuum extraction.** *Trans. Am. Inst. Mining Met. Engrs.* **162**, 375-84 (1945).—*C.A.* **40**, 7064².

By using an evacuated tube and cylinder for sampling, samples were taken from various grades of steel covering a range from low-C rimming to high-C killed and fine-grained steels. The H-content varied from 0.0008% in a 0.08% C rimmed steel to 0.0033% in a fine-grained 0.52% C open-hearth steel.

603. Sloman, H. A. **Application of the vacuum-fusion method to the determination of oxygen, hydrogen, and nitrogen of nonferrous metals, alloys, and powders.** *J. Inst. Metals* **71**, 391-414 (1945) (Paper No. 998).—*C.A.* **39**, 4562⁴.

Data are given for steels, Ni, Co, Cu, Cr, Mn, Si, W, ferro-Cr, ferro-Si, ferro-Mn, Al, and Al-base alloys. Discussion of results includes the effects of d., degassing elements, fluxes, and furnace atms. during the original melting or sintering. The method is not suitable for Mg and Mg-alloys.

604. THOMPSON, J. G. **Determinations of hydrogen in iron and steel by vacuum extraction at 800°C.** *Trans. Am. Inst. Mining Met. Engrs.* **162**, 369-74 (1945).—*C.A.* **40**, 7064^4.

This method was preferred to the vacuum fusion method for the detn. of small amts. of H_2 on the grounds of greater speed and precision. Specimens of plain carbon and low-alloy steels retained approx. 0.00035% H_2 after annealing in H_2 at 1100°C. Remelted electrolytic Fe retained about 0.0005%, and 14-18% Cr steels quenched from 1100°C in H_2 retained more than 0.0007% H_2.

605. VIALLARD, RODOLPHE. **The fixation of hydrogen and deuterium by cerium.** *Compt. rend.* **221**, 144-6 (1945).—*C.A.* **40**, 1715^6.

When 0.1 g of Ce was exposed at room temp. to D_2, 24,200 cc of D_2, measured manometrically and referred to S.T.P., was absorbed per g atom of Ce. The reaction was exothermic.

606. VIALLARD, RODOLPHE. **Equilibriums of hydrogen and of deuterium with cerium and gadolinium.** *Ann. chim.* **20**, 5-72 (1945).—*C.A.* **40**, 4283^4.

D_2 and H_2 are fixed by Ce even at room temp. The product contains less D_2 than required by the formula CeD_3; it is closer to CeD_2. Both H_2 and D_2 react with Gd above 150°C. The absorption of the gases above 250°C proceeds according to the laws of diffusion and dissocn. The products obtained are Gd hydride and deuteride, corresponding to the formula Gd_2H_3 and Gd_2D_3, resp. If these compds. are cooled in the presence of H_2 and D_2, resp., GdH_2 and GdD_2 are obtained. Hydrides and deuterides of the rare earths are real chem. compds., but their compn. does not correspond to the formula MH_3.

607. YAVOĬSKIĬ, V. I. **Determination of hydrogen in steel.** *Zavodskaya Lab.* **11**, 406-15 (1945).—*C.A.* **40**, 3365^5.

The total H_2 content of steel can be divided into 3 fractions: (a) the H_2 liberated in a vacuum at 150-200°C, (b) that oxidized at 900-1000°C which comprises the H_2 dissolved in the steel, and (c) that oxidized close to or above the m.p. of the steel, which comprises the H_2 not liberated from the center of the sample at 900-1000°C and the chemically combined H_2. The fractions (b) and (c) are detd. as water vapor absorbed by P_2O_5. Fraction (c) is detd. after the complete oxidation of the steel.

608. BUSK, R. S. AND BOBALEK, E. G. **Hydrogen in magnesium alloys.** *Am. Inst. Mining Met. Engrs., Inst. Metals Div., Metals Technol.* **13**, No. 7; *Tech. Pub.* No. **2105**, 15 pp. (1946).—*C.A.* **41**, 77*c*.

H_2 forms an interstitial solid soln. with Mg to the extent of 15 to 20 cc. per 100 g of metal. This puts Mg in the same group as Ni, Fe, Co, Cu, or Mn. The soly. is sensitive to both alloy compn. and phase distribution. The addn. of most elements to Mg raises the tolerance for H_2; with the exception of Al, which first increases, then decreases the H_2 soly.

609. D'YAKONOV, A. AND SAMARIN, A. **Analysis of the adsorption process of gases by metals. II. Adsorption of hydrogen and nitrogen by iron.** *Bull. acad. sci. U.R.S.S., Classe sci. tech.* **1946**, 121-6.—*C.A.* **40**, 4932^2.

The neg. heat effect of adsorption and the close adherence of this phenomenon to "square-root rule" at all temps. and pressures indicated soln. of H atoms in Fe. The soly. const. of H_2 was given for α-Fe by $\log K_H = -(1250/T) - 2.51$; γ-Fe, $\log K_H = -(1220/T) - 2.335$; δ-Fe, $\log K_H = -(1340/T) - 2.46$; and liquid Fe, $\log K_H = -(1590/T) - 1.71$. The allotropic form of Fe had a slight effect on the soly. of H_2. N_2 was less metallic than H_2; and, therefore, it had a greater chem. activity toward Fe.

610. ITTERBEEK, A. VAN; MARIËNS, P., AND VERPOORTEN, I. **Van der Waals and activated adsorption on nickel and silver sheets.** *Mededeel. Koninkl. Vlaam. Acad Wetenschap., Belg.* **8**, No. 1, 8-24 (1946).—*C.A.* **41**, 5771b.

The amount and rate of adsorption of H_2 on pure Ni and Ag sheets were detd. between 200° and 500°C, and at 90°K in the case of Ag. A reproducible rate is realized only after repeated cleanings and activations by means of repeated heating in H_2 and evacuation. The adsorption on Ni corresponded to the formation of a unimol. layer. A discontinuity appeared in the isobars between 350° and 400°C. The adsorption on Ag was very slow, and maxima occur in the isobars at 200°C. Langmuir's equation represented the data.

611. KIPERMAN, S. AND TEMKIN, M. **Kinetics of the ammonia synthesis on tungsten.** *J. Phys. Chem. (U.S.S.R.)* **20**, 623-7 (1946).—*C.A.* **41**, 332*i*.

Mixts. of H_2 and N_2 were passed through a W catalyst. The temp. was varied between 582° and 678°C, the ratio H_2 to N_2 between 1 and 3, and the space velocity V of flow between 12,000 and 104,000 hr^{-1}. The yield of NH_3 divided by the yield corresponding to equil. could be expressed by the equation $k = -0.5\, \gamma^{1.5}\, VP^{0.5} \ln (1 - x^2)$, k being a const., $\gamma = P_h/0.75\, P$, P_h the partial pressure of H_2, and P the total pressure. The apparent energy of activation on Fe and Mo catalysts were very similar, the mechanism of the NH_3 synthesis on these 3 catalysts seemed to be identical.

612. LIANG, HUNG; BEVER, MICHAEL B., AND FLOE, CARL F. **The solubility of hydrogen in molten iron-silicon alloys.** *Am. Inst. Mining Met. Engr., Iron and Steel Div., Technol. Pub.* No. **1975**, 9 pp. (1946).—*C.A.* **40**, 2096^9.

The soly. of H_2 in 9 alloys contg. Si (0.08 to 63.7%) was detd. from 1350-1650°C at 50° intervals, under 1 atm. pressure. The soly. decreased rapidly from 32.5 ml per 100 g metal for the 0.08% Si iron at 1650°C to 7.3 for the 31.7% Si alloy. It then increased with further Si addns., being 23.8 ml for the 63.7% Si alloy at 1650°.

613. PORTEVIN, ALBERT. **Hydrogen in metals.** *Metal Progress* **50**, 1206-8 (1946).—*C.A.* **43**, 6553e.

At very low temp., H_2 mols. are superficially fixed according to the ordinary laws of adsorption, but as room temp. is approached the mols. dissociate; the result is a superficial fixation of H atoms, which then diffuses into the metal atom by atom. There is no major transformation of the metal structure.

614. Potter, E. V. and Lukens, H. C. **Solubility of hydrogen in electrolytic manganese and transition points in electrolytic manganese.** *Metals Technol.* **13**, No. 6; *Am. Inst. Mining Met Engrs., Inst. Metals Div., Tech. Pub.* No. **2032**, 12 pp. (1946).—*C.A.* **41**, 18*a*.

The soly. of H_2 in electrolytic Mn was detd. by a method not requiring complete degassing of the metal and checked by direct soly. detns. on degassed, electrolytic, and vacuum-distd. metal. The variation of soly. with temp. was detd. for electrolytic Mn from 25° to 1300°C, and the variation of soly. with pressure was detd. for const. temp. The variation in soly. of vacuum-distd. Mn with temp. was also detd.

615. Tucker, R. C. **Sources of hydrogen in cast iron.** *Foundry Trade J.* **79**, 129-132, 144 (1946).—*C.A.* **40**, 4992^2.

To avoid surface eruptions during the solidification of cast Fe, it was necessary to avoid excessive H_2 in the metal by maintaining the moisture content of the coke used below 2%. To detn. H_2 the sample residue was mixed with a measured vol. of air or O_2 and combustion was carried out by leading through a fused silica tube contg. Pd on asbestos. The use of fused silica was found advisable. After the combustion, the gas can be transferred into the measuring burette. This app. will det. 0.5 ml H_2 in 15 ml of a H_2-N_2 mixt. with an accuracy of ±0.03 ml.

616. Watanabe, Teizo. **The oxygen and hydrogen reaction-potassium chloride effect on the surface of steel.** *Rev. Phys. Chem. Japan, Shinkichi Horiba Commen.* **1946**, 68-72.—*C.A.* **44**, 1309i.

The space between the glass tube and the manometer was heated to 100°C to reduce condensation of the reaction products. Before each expt., the tube was thrice heated to 540°C and exhausted for several hrs, then filled with H_2 and pumped out again. The exhausted tube was brought to the temp. of the expt., and $H_2 + 1/2\ O_2$ by vol. were added. Runs were made (397°, 447° and 396°C and at 250, 500 and 750 mm initial pressure) with the tube coated with KCl, with a bare steel plate in the tube, and with the steel plate coated with KCl. The steel plate retarded reaction and became coated with a yellowish brown deposit. Coating the steel plate with KCl caused increases in pressure which were much greater than those observed in the glass tube alone.

617. Zapffe, C. A. **The behavior of hydrogen in steel during pickling.** *Wire and Wire Products* **21**, 149-57 (1946).—*C.A.* **40**, 2096^4.

Pickling and cathodic electrolysis form H atoms which either enter the grain of the steel or form gaseous H_2. H_2 entering the sheet from pickling travels through the metal and forms bubbles in oil on the opposite side. The embrittled metal breaks through the grain, not through the grain boundary. H_2 embrittlement is regarded the trapment under under high pressure of H gas within the microscopic voids that traverse the interior of each grain.

618. Andrew, J. H. and Lee, Hsun. **Internal stresses and the formation of hairline cracks in steel.** *J. Inst. Metals, Symposium on Internal Stresses in Metals and Alloys*, Preprint No. **1099**, 9 pp. (1947).—*C.A.* **42**, 84c.

Hairline cracks in steels were caused by internal pressures from H_2. H_2 could be accommodated at the mosaic disjunctions or boundaries and the variation in the size of the mosaic blocks might account for the different behaviors in which steels of different chem. compns. and treatments respond to hairline-crack formation.

619. Andrew, J. H.; Lee, H., Lloyd, H. K., and Stephenson, N. **Hydrogen and transformation characteristics in steel.** *J. Iron Steel Inst. (London)* **156**, 208-53, (1947).—*C.A.* **41**, 6860*g*.

H_2 evolution was studied for 22 steel compns. soaked in H_2 and cooled in vacuum. There was an increase in the rate of evolution corresponding to the γ-α change. Nascent H was generated by electrolytic action on the surface. The rate of diffusion and the soly. at room temp. depended upon the structure. The best temp. for isothermal H_2 removal corresponded with a rapid transformation. H_2 was the fundamental cause of hairline cracks.

620. Bénard, Jacques and Albert, Philippe. **Chemical activity of hydrogen desorbed from palladium and its alloys.** *Compt. rend.* **224**, 45-7 (1947); *Bull. soc. chim. France* **1947**, 904-9.—*C.A.* **41**, 2632*a*; **42**, 1102*g*.

Pd foils, 0.1 mm thick, were satd. with H_2 by electrolysis and suspended in solns. of $Fe_2(SO_4)_3$ or $KMnO_4$. The solns. were reduced at a rate which remained const. until the reaction stopped; 160 hrs were required for completion at 20°C. The total amt. of reduction found at 0°C was equiv. to 80cc. H_2 per g Pd, which accounts for nearly all that taken up by the foils. With increasing temp. the reaction rate increased but the total amt. of reaction decreased. With Pd-Au alloys, the total amt. of reaction was about half as great at 0°C, but dropped very little with increasing temp.

621. Bevington, C. F. P.; Martin, S. L., and Mathews, D. H. **The absorption of gases by titanium and zirconium.** *Proc. Intern. Congr. Pure and Applied Chem.* **11**, 3-16 (1947).—*C.A.* **44**, 7617*b*.

Isotherms and isobars are given. The soly. in Zr is 5 at. % for H_2, 30% for O_2, and smaller for N_2. In Ti the absorption is 30 at. % for H_2, 30% for O_2. Nonmetal atoms can take up positions in the octahedral holes of the metal lattice where they assume a slightly neg. change, becoming strongly bound but mobile, and as a result expand the metal lattice, increase the d., and decrease the elec. cond. Presence in the metal lattice of other atoms considerably lowers the H_2-sorbing capacity. The O, N, and C atoms cause a shift in discontinuous regions of the isotherms toward higher temp. and pressures.

622. Cameron, J. **The evolution and absorption of hydrogen by steel in industrial reheating furnaces.** *J. Iron Steel Inst. (London)* **157**, 609-15 (1947).—*C.A.* **42**, 4884i.

The rate of evolution or absorption of H_2 from solid steel is expressed as an exponential function of the time. At 1100°C the values of the const. are such that the limiting concn. is reached in 24 hrs. The local concns. of H_2 occurring due to the action of water vapor are not likely to exceed 2% H. Because of the large masses of steel and the relatively short soaking times the H-content of reheating-furnace atms. has practically no effect on the H-content of the steel ingot. H is usually present in very small concns. (of the order of 10^{-3} to 10^{-4}%).

623. Chufarov, G. I. and Nosyreva, S. S. **Methods of oxidation and hot extraction in determining hydrogen in metals.** *Zavodskaya Lab.* **13**, 287-8 (1947).—*C.A.* **42**, 3283a.

The detn. of H_2 by oxidation of the metal with O_2 at moderate temps. has a limited field of application. The method cannot be used for high-C steels because of the absorption of CO_2 by the plugs in the absorption tubes contg. P_2O_5. It is also impossible to det. H_2 by this method at temps. of 800-1000°C in the case of nichrome, heat-resistant steels, and many other metals and ferrous alloys.

624. Dubovol, V. Ya. and Ramanov, V. A. **Apparatus for the rapid determination of hydrogen in steel.** *Zavodskaya Lab.* **13**, 883-4 (1947).—*C.A.* **43**, 64*d*.

The sample was placed in a reaction tube and evacuated to eliminate all gases adsorbed by the sample and by the app. It was heated to 650-700°C and kept at this temp. for 25-30 min. and then cooled to room temp. The vol. of the gas was detd. The app. was suitable for plant labs.

625. Halsey, G. and Taylor, Hugh S. **The adsorption of hydrogen on tungsten powders.** *J. Chem Phys.* **15**, 624-30 (1947).—*C.A.* **41**, 7200f.

Frankenburg's data from −194° to 750°C were interpreted on the basis of a nonuniform surface without interaction, the heterogeneity of the surface being specified in terms of an exponential distribution of sites given by the distribution function. Such a heterogeneity was especially significant in W metal which hitherto had been treated as an essentially uniform surface.

626. Prettre, Marcel and Goepfert, Olivier. **Activated-adsorption isotherm for a heterogeneous surface.** *Compt. rend.* **225**, 681-2 (1947).—*C.A.* **42**, 1101c.

The adsorption of H_2 by a Ni-kieselguhr catalyst at 438°K does not follow the Langmuir isotherm. It is assumed that the surface of the catalyst is heterogeneous in the sense that different regions have different values of the parameters. The data can be reproduced within exptl. error by the sum of a no. of Langmuir isotherms equal to the no. of regions assumed. In the present instance 3 terms suffice.

627. Ransley, C. E. and Neufeld, H. **Absorption of hydrogen by aluminum attacked in caustic soda solution.** *Nature*, **159**, 709-10 (1947).—*C.A.* **41**, 5358*c*.

Specimens of cast 99.99% Al were immersed in 0.01 *N* NaOH for 49 days, with frequent renewal of the soln. The samples were washed in 1% acetic acid and dried. On degassing 0.47 cc. H_2 per 100 g Al was evolved with a much smaller vol. of other gases, mainly CO_2. The bulk of the gases other than H_2 was assocd. with the oxide film. A H-content of 0.4 cc./100 g was normal for cast Al.

628. Schumb, W. C.; Sewell, E. F., and Eisenstein, A. S. **Observations on the stability of the barium-hydrogen and zirconium-hydrogen systems.** *J. Am. Chem. Soc.* **69**, 2029-33 (1947).—*C.A.* **41**, 7217h.

The equil. gas pressures in the systems Ba-H_2 and Zr-H_2 were measured up to 600° and 650°C, resp. In a finely divided condition or in thin layers, Ba reacted readily with H_2. At 600°C the dissocn. pressure of BaH_2 was not greater that 0.24 mm, which was low in terms of H_2-thyratron requirements. Above this temp. Ba evapd. rapidly; this renders its use as a H_2 reservoir impractical. In the Zr-H_2 system the dissocn. pressure rose from 0.16 to 2.1 mm as the temp. was raised from 150° to 500°C.

629. Sykes, C.; Burton, H. H., and Gegg, C. C. **Hydrogen in steel manufacture.** *J. Iron Steel Inst. (London)* **156**, 155-180 (1947).—*C.A.* **41**, 6853*h*.

H-content is reported for typical heats of carbon and alloy steel made in elec. arc, and open-hearth furnaces and taken from ingots, billets, and forgings. Ductility is reduced if H_2 is in excess of 2 cc. per 100 g. Even under carefully controlled melting conditions H_2 content of 4-6 cc. per 100 g may occur; this amt. will decrease ductility. High H_2 in itself does not cause cracks.

630. Weiss, Joseph. **Some electron-transfer processes in heterogeneous systems. I. Electrodeposition of hydrogen.** *Discussions Faraday Soc.* No. **1**, 68-71 (1947).—*C.A.* **42**, 8667*d*.

Energy states for electrons on the surface can be produced through impurities, through the solvent producing chem. changes, or through adsorbed H atoms. In the last case the mechanism of the discharge is identical with that of the slow electrochem. recombination.

631. Wells, J. E. and Barraclough, K. C. **The determination of hydrogen in liquid steel.** *J. Iron Steel Inst. (London)* **155**, 27-32 (1947).—*C.A.* **41**, 7305*e*.

The best method of sampling the bath is a modified pencil test in which the sample is taken from the mold as soon as possible and then quenched in water.

632. Zhabina, V. A. **Method of hot extraction for determining hydrogen in steel.** *Zavodskaya Lab.* **13**, 275-81 (1947).—*C.A.* **42**, 3283d.

A simple vacuum resistance furnace was constructed to obtain temps. as high as 3000°C for detg. H_2. The service life of the heater can be extended to 8-10 months. The chief components of the furnace were shown. Two app. for detg. H at low temps. (up to 900°C) were described. In one app. the H was detd. by measuring the pressure drop after gases have passed over heated CuO and through P_2O_5 soln.; in the other app. the extd. gases were collected and analyzed for its components.

633. Beeck, Otto. **Surface catalysis.** *Revs Modern Phys.* **20**, 127-30 (1948).—*C.A.* **42**, 4435*b*.

Traces of H_2O and H_2S lowered the decompn. temp. of hydrocarbons. Mol. ray expts. also indicated the decompn. of CH_4 into CH_3 and H_2 and ethane into 2 CH_3 radicals. There was evidence that the CH radical was formed in the decompn. of acetylene. The adsorption step was the crucial step in surface catalysis and the reaction of ethylene and H_2 was cited as an example.

634. Beeck, O.; Ritchie, A. W., and Wheeler, A. **The adsorption of hydrogen on nickel catalysts. I. The effect of sintering.** *J. Colloid Sci.* **3**, 505-10 (1948).—*C.A.* **43**, 2079*f*.

High-vacuum-evapd. Ni films prepd. at 23°C adsorb H_2 practically instantaneously. There is little difference in the amt. adsorbed at −196°C and at room temp. This is in marked contrast to the results obtained with Ni catalysts prepd. from NiO by H_2 reduction. If the vacuum-evapd. films are sintered at 100-400°C, slow sorption of H_2 is observed. The ratio of slowly sorbed H_2 to rapidly adsorbed H_2 increases with increasing sintering temp. The so-called "activated adsorption" of H_2 on Ni is not adsorption on the metal surface, but is slow sorption into the interior of the metal structure.

635. Bernstorff, H. **The course of the sintering process in iron powder.** *Arch. Metalkunde* **2**, 103-6 (1948).—*C.A.* **43**, 2556*h*.

Powder was produced by pouring molten Fe or steel through a H_2O jet against a rotating disk. This material was annealed 1 hr in H_2 at 950°C. A coarse and a fine powder fraction were molded in the form of tensile specimens with approx. 40 tons/in^2. These were sintered at 850°, 1000°, 1150°, and 1300°C for periods ranging from 2 to 10 hrs. The differences observed in these tests were in degree or time of property changes. The differences observed between the fine and coarse powders were also attributed to the higher activation of the former. The finer powder either reached better properties, or if they were merely equal, they were reached with lower temp. or shorter time of sintering.

636. Bianchi, G. **Diffusion of cathodic hydrogen into platinum.** *Atti accad. nazl. Lincei, Classe sci. fis., mat. e nat.* **4**, 206-11 (1948).—*C.A.* **42**, 8557*h*.

Diffusion of H_2 into Pt is greatly influenced by the structure of the metal, as well as its previous history. When an electrode is Pt-plated to reduce the value of the cathode potential, the amt. of H_2 diffusing into the Pt is reduced proportionately.

637. Darken, L. S. and Smith, Rodney P. **Behavior of hydrogen in steel during and after immersion in acid.** *Corrosion* **5**, No. 1, 1-16 (1948).—*C.A.* **43**, 1301*h*.

The quantity of H_2 absorbed by steel during acid-pickling increased approx. linearly with square root of time until a limiting quantity, after which no H_2 was absorbed. This satn. value was very small for hot-rolled steel but increased markedly with cold work, and varied for different steels. The satn. value was decreased slightly by long-time annealing of cold-worked steel, but the rate of absorption was decreased considerably by annealing.

638. Derge, G.; Peifer, W., and Richards, J. H. **The sampling and analysis of steel for hydrogen.** *Am. Inst. Mining Met. Engr., Iron and Steel Div. Metals Technol.* **15**, No. 4 Tech. Pub. No. **2362**, 28 pp. (1948).—*C.A.* **42**, 5816*e*.

When a standard vacuum fusion equipment for the analysis of gases in steel is modified so that samples can be analyzed immediately after introduction to the vacuum, blank corrections are small. The gas reservoirs and pressure measurement are adjusted to the small amts. of H_2 which are present and it is possible to analyze steel for H_2 with a probable error of ±0.00001%.

639. Dialer, K. **The system misch metal-hydrogen.** *Monatsh.* **79**, 296-310 (1948).—*C.A.* **43**, 2840*h*.

The vols. of very pure H_2 absorbed by samples of misch metal (about 48% Ce, 30% La, 20% Nd) were measured. The metal surfaces were cleaned by repeated evacuations and exposures to a stream of N_2. The amt. absorbed was only 0.37% from the theoretical amt. for CeH_3 and did not depend on whether or not the Ce had peen previously heated. The dissocn. pressure of the CeH_3 was 375 mm at 800°C and above 200°C did not depend on the past history of the sample. The absorption energy was calcd. from the isosteres by van't Hoff's relation and was const. to about 160 cc. H_2 per g Ce corresponding to CeH_2. The energy dropped sharply with further absorption. These results and the ease of pumping some H_2 from CeH_2 suggested that the final H_2 was loosely bound.

640. Harashima, Akira; Tanaka, Tomoyasu, and Sakaoku, Kiichiro. **I. Coöperative phenomena in the palladium-hydrogen system.** *J. Phys. Soc. Japan* **3**, 208-13 (1948).—*C.A.* **44**, 5180*g*.

The theoretical calcn. of the H_2-Pd isotherms is improved at high temp. and low concn. by considering the dependence of potentials between protons and sites and between neighboring protons on the vol. of the Pd. The vol. change of Pd on absorption of H_2 and the unsym. isotherms are explained.

641. Hurst, J. E. and Riley, R. V. **A study of the hydrogen, oxygen, and nitrogen content of foundry pig iron.** *J. Iron Steel Inst. (London)* **159**, 130-6 (1948).—*C.A.* **42**, 6288*d*.

A vacuum fusion gas analysis method was used. In pig irons with high O-content, the N-content had a tendency to be above the av. The total oxygen was reported with no possibility of sepg. that due to CO evolved as gaseous form from that due to the reduction of oxide inclusions present in the Fe. The N-content was in the range from 0.001 to 0.006%. A Northamptonshire iron gave a gas vol. of over one-half the vol. of the solid specimen. Other residual elements detd. spectrographically were Ni, Cr, Cu, Mo, V, Ti, Al, As, Sn, and B. With the exception of B and Sn, significant amts. of all of these elements were found in all of the specimens.

642. Hurst, J. E. and Riley, R. V. **Residual gases in cast iron.** *Foundry Trade J.* **85**, 407-14, 429-34 (1948).—*C.A.* **43**, 4199*f*.

H_2, CO, N_2, O_2 can be detd. in cast iron. Samples for estg. the gases are obtained in an evacuated or N_2-purged steel tube sealed at the lower end with a Cu disk and at the upper end with a rubber balloon. The cast iron is further degassified by vacuum fusion at 1800-2000°C and the gases are pumped off by a diffusion pump and stored in inverted test tubes over Hg. The original gas content in the cast iron dets. the effect of remelt on gas content; remelts have reduced H_2 from 16.0 to 2.5 p.p.m., O_2 from 190 to 20 p.p.m., and N_2 from 20 to 10 p.p.m.

643. KODAMA, SHINJIRO; MATSUMURA, SHOICHI; YOSHIMORI, KEISUKE; NISHIBAYASHI, YOSHIBUMI; KADOTA, NORIAKI, AND IWAMURA, EINOSUKE. **Physicochemical studies on gasoline synthesis. XIII-XV. Influence of potassium carbonate and boric acid on the activated adsorption of hydrogen and carbon monoxide on iron catalysts.** *J. Chem. Soc. Japan, Ind. Chem. Sect.*, **51**, 98-100 (1948).—*C.A.* 44, 9136*c*.

By adding K_2CO_3 to the catalyst (100 Fe + 25 Cu + 2 Mn + 125 kieselguhr) the activated adsorption of CO above 200°C increased, while that of H_2 did not, especially when 6% K_2CO_3 was added. By adding H_3BO_3 to the same catalyst, adsorption of CO was decreased and of H_2 increased at 200°C. When 20% H_3BO_3 and 2% K_2CO_3 were added, adsorption of both CO and H_2 at 200°C increased.

644. NOSYREVA, S. S. **Measurement of the diffusion of hydrogen in steel.** *Zavodskaya Lab.* **14**, 307-10 (1948).—*C.A.* 43, 2559*i*.

The rate of diffusion of H atoms through sheets 0.5 mm thick (surface area 7 cm^2) was detd. by the displacement of a Hg column, by the H_2 gas issued from recombination, after diffusion across the sheet. The H atoms were produced by electrolysis of 0.1 *N* H_2SO_4 at 0.014 amp./cm^2, at room temp. Armco iron transmitted a total of 7.78 ml H_2 in 72 hrs, transformer steel a total of 6.37 ml. With austenitic stainless steel, no diffusion was noticed in 72 hrs. The soly. of H_2 after 24 hrs electrolysis was 6.93, 15.9, 46.5, and 25.0 ml/100 g in martensite, troostite, sorbite, and normalized steel, resp.

645. OBRUCHEVA, A. D. AND RUBINSHTEIN, I. L. **Polarization capacity of the iridized electrode.** *Doklady Akad. Nauk S.S.S.R.* **63**, 403-6 (1948).—*C.A.* 43, 2521*i*.

Curves of the potential against the charge (coulomb/g), in 1 *N* HCl, HBr, H_2SO_4, and KOH, resemble the corresponding curves obtained on platinized Pt. The strength of the bond between Ir and H_2 increases in the order HBr < HCl < KOH < H_2SO_4, as against the order HBr < HCl < H_2SO_4 < KOH on Pt. The O_2 arrest in KOH begins immediately and without transition after the H_2 portion, in H_2SO_4 at 0.5, in HCl at 0.73 and in HBr at 0.97 v.; the nearly horizontal arrest in HBr is evidently linked with evolution of Br_2.

646. PERRIN, MARCEL. **Reduction with hydrogen of nickel Fischer catalysts.** *Compt. rend.* **227**, 476-8 (1948).—*C.A.* 43, 26*i*.

The wt loss and amt. of H_2O and CO_2 formed during heating (with or without simultaneous reduction) of a Ni-promoter-kieselguhr Fischer catalyst (pptd. with alkali carbonate) were measured as a function of time and temp. Upon heating in streaming H_2 up to 450°C in 127 min., a wt loss of 24.8% was noted. A similar expt. but in streaming N_2 gave a loss of 24%. Heating in air at 900°C resulted in a loss of 26.4%; this showed that heating up to 450°C had eliminated almost all volatiles.

647. REINEBECK, LIESELOTTE. **Spectroscopic investigations of the surface interchange reactions between hydrogen and a copper cathode.** *Funk u. Ton* **1948**, 223-6.—*C.A.* **45**, 1426h.

The carrier gas was He or A, to which H_2 was added through a Pd tube. The spectroscopically observed CuH mols. must have formed on the cathode surface. The tube temp. was 600-800°K but owing to ionization local hot spots exist on the cathode surface, leading to evapn. In CuD the intensity distribution of the rotation lines corresponds to a temp. of 2000°K. Further work dealt with the exchange in the presence of water of H_2 and D_2 on a metal surface covered with H_2. BiH and AlH can be detected in the spectrum even when no H_2 is added. The hydrides of Pb and Te were not formed. These expts. show the effect of the surface on hydride formation.

648. SAUERWALD, F. **Method for determining hydrogen, particularly in magnesium.** *Z. anorg. Chem.* **256**, 217-25 (1948).—*C.A.* 43, 2119*g*.

The direct detn. of H_2 by a method similar to that used for the detn. of H_2 in steel was not satisfactory in the analysis of Mg because the metal itself had too high a vapor pressure. It was found possible to chlorinate all of the H_2 at 750°C and by passing the HCl together with pure O_2 through a combustion tube (400°C) contg. CuO, H_2O was formed which can be absorbed in weighed $MgCl_2$ and P_2O_5 tubes.

649. SIMPKINSON, T. V. **Melting of quality basic electric steel.** *Can. Mining Met. Bull.* No. **431**, 127-37 (1948).—*C.A.* 42, 4110*b*.

The phys. chemistry of steelmaking is discussed in simple terms, with emphasis on oxidation, deoxidation, and the role of H_2.

650. SIMS, C. E. AND MOORE, G. A. **Apparatus for the hot-extraction for hydrogen in steel.** *Am. Inst. Mining Met. Engrs., Iron and Steel Div., Metals Technol.* **15**, No. 4, Tech. Pub. No. 2369, 10 pp (1948).—*C.A.* 42, 5724*h*.

App. is described for conducting hot extn. of steel in a high vacuum up to 1050°C (1925°F), for periods of 40 hrs or more. The accuracy of the results obtained is entirely controlled by errors in sampling methods and in analysis of the evolved gas, since the evolution app. is currently more precise than available assocd. equipment.

651. SMITH, DONALD P. **Note on some theoretical discussions of palladium-hydrogen and cognate systems.** *Phil. Mag.* **39**, 477-81 (1948).—*C.A.* 43, 4070*h*.

The effect of occulsion in rifts is discussed. Theoretical treatments that assume the existence of simple solid-soln. systems, in which the hydrogen is uniformly distributed, disregard exptl. evidence to the contrary.

652. SUTRA, GENEVIÈVE AND DARMOIS, EUGÈNE. **The passage of hydrogen through iron.** *Compt. rend.* **226**, 177-9 (1948).—*C.A.* **42**, 2842*i*.

One face of a film of Fe (53 μ thick) was exposed to solns. of varying pH and the opposite face to a vacuum. With acid solns., a part of the liberated H_2 diffused through the Fe. The proposed mechanism involved H atoms, formed when adsorbed H^+ were discharged at the surface. The relation between loss in wt of the Fe and H-ion concn. had the same form as the Langmuir adsorption isotherm.

653. TANAKA, TOMOYASU; SAKAOKU, KIICHIRO, AND HARASHIMA, AKIRA. **II. Coöperative phenomena in the palladium-hydrogen system.** *J. Phys. Soc. Japan* **3**, 213-18 (1948).—*C.A.* **44**, 5180*h*.

A further refinement of a previous calcn. to take into consideration D_2 and the variation of the thermal vibration of the proton in its site in the Pd lattice yielded isotherms agreeing more closely with the exptl. curves.

654. ZAPFFE, C. A. AND HASLEM, M. E. **The relationship between cold-working and hydrogen embrittlement.** *Wire & Wire Products* **23**, 475-8, 527, 528, 529 (1948).—*C.A.* **42**, 5396*d*.

Both the mech. movements of the cold-work and the formation of H_2 within steel operate along planes of looseness within the grain of the metal. Cold-working increases the capacity of the metal for absorbing H_2, leaving the metal more liable to embrittlement. Removal of the effects of cold-work by annealing renders the metal more resistant to H_2 embrittlement. Cold-working a metal already contg. H_2 causes removal of much of the gas by opening communications among the individual gas occlusions and allowing them to escape.

655. ZAPFFE, C. A. AND HASLEM, M. E. **Sensitivity of different steels to pickling brittleness.** *Wire & Wire Products* **23**, 563-9, 609-12 (1948).—*C.A.* **42**, 6729*h*.

In cathodic pickling, where surface concn. of the H_2 can be closely controlled by regulation of c.d., factors within the steel are disclosed which affect susceptibility to H_2 embrittlement. In acid pickling, results are modified by the degree of metal attack, because it controls the hydrogenizing conditions.

656. BARTZ, M. H. AND RAWLINS, C. E. **Hydrogen blistering of steel a source of damage to vessels.** *Petroleum Processing* 4, 898-906 (1949).—*C.A.* 44, 1388*h*.

The blistering of vessel walls and other refinery steel equipment results from acid corrosion which liberates at. H. This diffuses through the steel until it encounters a break or discontinuity in the metal, where the reaction $H + H \rightarrow H_2$ takes place. The H_2 is not capable of diffusing further, and the pressure of the trapped gas eventually results in blisters in the metal.

657. BASTIEN, PAUL AND AZOU, PIERRE. **The action of subzero temperatures on the ductility and deformation characteristics of steel which has been charged electrolytically with hydrogen.** *Compt. rend.* **228**, 1337-9 (1949).—*C.A.* **43**, 5717*a*.

Tensile strength and elongation of annealed, 0.15% C steel, charged electrolytically in HCl with H_2, were detd. over the range +15° to −70°C. The effect of H_2 on strength was minor. Localized concn. of H_2 in imperfections in the steel crystals interfered with slip on plastic deformation.

658. BASTIEN, PAUL AND AZOU, PIERRE. **Influence of hydrogen on the cohesion of steel.** *Compt. rend.* **228**, 1651-3 (1949).—*C.A.* **43**, 8331*g*.

The difference between a steel charged in H_2 and the same steel not charged, was in the cohesion, which was 115 kg/mm² for uncharged and 74 for charged steel annealed to 0.15% C. These values were correct to ±5-10%.

659. BASTIEN, PAUL AND AZOU, PIERRE. **The occurrence of a reversible hydrogen embrittlement of iron and steel at low temperature.** *Compt. rend.* **229**, 549-51 (1949).—*C.A.* **44**, 511*h*.

The decrease of tensile strength and elongation, caused by charging with H_2 in acid or electrolytically, disappeared reversibly below −110°C. Below −110°C the feeble activated adsorption of H_2 on the walls of the voids of the metal was changed into stronger phys. adsorption reducing the H_2 pressure and eliminating the embrittlement. On heating above −110°C the processes were reversed.

660. BRUGGEMANN, T. **Penetration of hydrogen into steel.** *Chem. Tech.* **1**, 178-82 (1949).—*C.A.* **44**, 6794*f*.

A review.

661. COUPER, A. AND ELEY, D. D. **Parahydrogen catalysis by transition metals.** *Nature* **164**, 578-9 (1949).—*C.A.* **44**, 2355*a*.

The activation energy E and frequency factor A_o for the catalytic activity of Pd-Au alloys for the para H_2 conversion were measured. Little change was noted as the concn. of Au was increased up to 60 at. %, but at higher concns. there was an abrupt increase in E and decrease in A_o. The catalytic activity of pure Pd fell to zero when H atoms were dissolved in the Pd. The results were attributed to the filling of the *d*-band of Pd with electrons from the added Au or H.

662. DARMOIS, E. **The penetration of hydrogen into iron and several consequences.** *Bull. soc. chim. France* **1949**, D170.—*C.A.* **43**, 7304*h*.

The passage of H_2 through Fe in acid soln. takes place when H^+, as a free proton, is adsorbed on the Fe surface. The protons diffuse into the Fe, and Fe^{++} ions go into soln. The protons diffusing ensemble of electrons and protons is equiv. to H atoms. Values are consistent with and adsorption process based on the Langmuir isotherm

663. DASTUR, M. N. AND CHIPMAN, JOHN. **Equilibrium in the reaction of hydrogen with oxygen in liquid iron.** *J. Metals* **1**, No. 8, Trans. 441-5 (1949).—*C.A.* **43**, 8822*e*.

The reaction was studied between 1563°-1760°C. The exptl. results were represented by: $K_1 = p_{H_2O}/(p_{H_2} \times \%O)$; $\log K_1 = 7050/T - 3.17$.

664. DEDRICK, J. H. AND GERDS, A. **A study of the mechanism of sintering of metallic particles.** *J. Applied Phys.* **20**, 1042-4 (1949).—*C.A.* **44**, 506*b*.

Single layers of spherical Cu particles were sintered under varying conditions of time and temp. in a dry H_2. Analysis of the rate of interface contact between the particles had shown metallic sintering to be a diffusion process. The heat of activation of self-diffusion of Cu had been calcd. and found to be 55,000 cal/mole.

665. EUCKEN, A. **The hydrogenation of unsaturated hydrocarbons on nickel contacts. I. The adsorption of hydrogen on nickel.** *Z. Elektrochem.* **53**, 285-90(1949).—*C.A.* **44**, 3342*h*.

The adsorption of H_2 on Ni powder prepd. by reduction of NiO at 280°C (surface 1.60 cm^2/g) was studied by measuring (1) the adsorption equil. between 318° and 539°K at 0.0009 to 0.25 mm Hg pressure, (2) the heats of adsorption at various coverages of the surface, (3) the adsorption rate. Adsorption isobars detd. with increasing temp. exhibited two max. at 200° and 270°K, resp. The apparent heterogeneity of the adsorbing surface was due to the fact that adsorbed H atoms diminish the surface activity for further adsorption. This also caused a decrease of the heat of adsorption with increasing coverage.

666. GALAKTIONOVA, N. A. **The role of hydrogen in flake formation.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* **1949**, 1666-74.—*C.A.* **46**, 74*f*.

A series of 30-kg Cr-Ni-Mo steel melts was made in a high-frequency furnace, either *in vacuo* or with injection of H_2 into the melt. The H_2 melts contained 0.0057% H_2 as compared to 0.00034% for vacuum melts. X-ray studies made on the various samples to det. lattice parameter and secondary x-ray spectra indicated that H was in the ionized form as protons which penetrated deep into the electron shells and produced more stable atoms.

667. GULBRANSEN, EARL A. AND ANDREW, KENNETH F. **Kinetics of the reactions of zirconium with oxygen, nitrogen, and hydrogen.** *J. Metals* **1**, No. 8, Trans. 515-26 (1949).—*C.A.* **43**, 8817*b*.

The kinetics of the reactions of ductile Zr with O_2N_2, and H_2 were studied as a function of time, temp., pressure, surface prepn., and stability. The oxidation reaction showed an appreciable rate at 200°C. No evidence was found for an unstable oxide. The nitride reaction was found to be very sensitive to traces of O_2 and H_2 in the reacting gas. The rate of reaction of Zr with N_2 was much slower than the reactions with O_2 and H_2. The nitride was found to be stable to at least 900°C. The hydride reaction obeyed the sq. root of pressure law. In this case, a film was not formed and it appeared that H_2 diffused into the Zr lattice as atoms.

668. GULBRANSEN, EARL A. AND ANDREW, KENNETH F. **Reactions of zirconium, titanium, columbium, and tantalum with the gases, oxygen, nitrogen, and hydrogen at elevated temperatures.** *J. Electrochem. Soc.* **96**, 364-76(1949).—*C.A.* **44**, 961*b*.

A systematic study is made of the kinetics of the reactions including a study of the time, temp., and pressure variables. The reaction rates are studied by the vacuum microbalance method and the surface structures by the electron-diffraction method. Diffusion consts. and energies of activation are calcd. where possible and the several reactions for the different metals are compared.

669. HOTOT, G. **Determination of hydrogen in steels.** *Rev. universelle mines* 5, 277-8 (1949).—*C.A.* **43**, 8964*h*.

An app. is described with which H_2 and other gases can be detd. in steel with samples of as little as 10 g and up to 300 g. The method is based on the diffusion of H_2 in a vacuum at 700°C. The sample taken from the ingot is held under Hg during transport to the app. consisting of a quartz tube heated externally.

670. HURST, J. E. AND RILEY, R. V. **Gases in cast iron.** *Foundry Trade, J.* **87**, 393-7 discussion, 397-400 (1949).—*C.A.* **44**, 509*f*.

H_2 had proved to be the major constitutent. Substantial amts. of CO and N_2 were always present and the combined vol. often equaled and sometimes exceeded the H_2. Chill-cast white irons, free from graphite, gave a gas which was 70-90% H_2, whereas phosphoric gray irons yielded only 40-70% H_2. The hot-extn. technique, giving accurate results with steels, did not apparently work so precisely with cast iron., The compn. of the gas evolved at 600-800°C *in vacuo* was not predominantly H_2; it contained appreciable amts. of N_2 and CO. Further amts. of H_2 (and CO and N_2) were obtained on (a) raising the extn. temps., (b) machining off the outer layers of the specimen, (c) allowing the specimen to be exposed to the atm., and (d) melting the iron.

671. JORDAN, CHARLES B. AND DUWEZ, POL. **The densification of copper powder compacts in hydrogen and in a vacuum.** *J. Metals* **1**, No. 2, Trans. 96-9(1949).—*C.A.* **43**, 2556*e*.

The densification of Cu powder compacts in H_2 and in a vacuum can be approx. described as a rate process governed by a heat of activation. Cu powder compacts densify more slowly in a vacuum than in H_2. The oxide film on the surface of the particles influences the rate of densification.

672. KWAN, TAKAO. **Adsorption of hydrogen on nickel, cobalt, and platinum at low pressures.** *J. Research Inst. Catalysis*, **1**, 81-94 (1949).—*C.A.* **44**, 4304*e*.

Adsorption isotherms of H_2 between 10^{-3} and 1 mm Hg on Ni, Pt, and Co powders were detd. between 50° and 300°C with special care as to hysteresis. Surface areas of the samples were detd. by the B.E.T. method. Initial H_2 adsorption occurred at const. differential heat of adsorption equal to 26, 18, and 19 kcal/mole for Ni, Pt, and Co, resp., at 300°C. After about 0.1 of the surface was covered, there was a gradual decrease in the heat of adsorption.

673. KWAN, TAKAO. **Rate of hydrogen adsorption on reduced copper.** *J. Research Inst. Catalysis*, **1**, 95-9(1949).—*C.A.* **44**, 4303*i*.

Adsorption of H_2 at about 0.1 mm Hg pressure and temps. of 300°, 350°, and 400°C, on Cu powder (prepd. by reduction of $CuCO_3$), occurred at a slow rate; the sorption did not reach equil. after 66 hrs. The heat of activation of adsorption was 20 kcal/mole.

674. KWAN, TAKAO. **Research on pure iron and synthetic-ammonia catalyst by means of hydrogen adsorption.** *J. Research Inst. Catalysis*, **1**, 100-9(1949).—*C.A.* **44**, 4304*h*.

Adsorption isotherms of H_2 at pressures between 10^{-4} and 1 mm Hg on pure Fe and synthetic-NH_3 catalyst were detd. at 0°, 25°, 50°, and 100°C. Differential heats of adsorption diminished continuously from 17.5 kcal./mole at the lowest pressure to 5 kcal./mole at the highest pressure. Calcns. from the rate of decrease of the differential heat of adsorption yielded surface areas 70 and 14 times, resp., the B.E.T. areas of the Fe and catalyst and were in contrast to results on Ni and Co powders.

675. McQuillan, A. D. **Effect of small quantities of hydrogen and grain-size on the α-β transformation of titanium.** *Nature* **164**, 537 (1949).—*C.A.* 44, 4320*h*.

An almost isothermal change in the equil. pressure was noted in a coarse-grained sample of Ti contg. 0.02 at. % of H at 882 ± 3°C. Thermal analysis and resistance-temp. curves showed single discontinuities for Ti contg. 0.02 at. % of H, and no change was detected when the H_2 was removed.

676. Roginskii, S. Z.; Tretyakov, I. I., and Shekhter, A. B. **Electron-microscopic study of the surface of working catalysts. II. Change of the surface of palladium during catalytic oxidation of hydrogen.** *Zhur. Fiz. Khim.* **23**, 1152-60 (1949).—*C.A.* 44, 1313*a*.

Electron photomicrographs (shadow replicas method) of Pd plates were not altered by treating Pd with O_2 or H_2O. Heating in H_2 at 175°C caused change in gloss of the Pd plates, but almost no alteration in the electronograph. When Pd was used as catalyst (the conditions of expt. were not given), its surface became pitted, the depressions being of very different dimensions; after long usage, the surface appeared etched.

677. Sauerwald F. **The solubility and retention of hydrogen in liquid and solid magnesium and magnesium alloys.** *Z. anorg. Chem.* **258**, 27-32 (1949).—*C.A.* 43, 5355*i*.

At 760°C 41 cc. of H_2 dissolved in 100 g of tech. Mg. The low soly. of H_2 in Al and Zn caused low soly. in alloys of Mg with these metals. The particularly low soly. of H_2 in the alloy contg. 33.3 at. % Zn was attributed to the stability of the Zn-Mg compd. The change in tenacity and extension was sharpest for H-contents between 19.5 and 21.8 cc./100 g of melt. The H-content of the melt could be decreased by passing Cl_2 through it provided the flow of Cl_2 was rapid so that HCl was not reduced by the Mg.

678. Shaler, A. J. **Seminar on the kinetics of sintering.** *J. Metals* **1**, No. 11, Trans. 796-813 (1949).—*C.A.* 44, 506*c*.

The role of oxide films, of the thickness commonly found on metal powders, needed quant. treatment. In view of the extensive use of a H atm., the kinetics of sintering in the presence of diffusible gases was a field in which more work must be done. In addn. to the changes known to occur during the heat-treatment of massive metals-recrystn., grain-growth, etc.-the presence of a large surface-to-vol. ratio increased the effects of transient phenomena such as the reactions and desorptions that occurred at the surfaces of metals.

679. Shuler, K. E. and Laidler, K. J. **The kinetics of heterogeneous atom and radical reactions. I. The recombination of hydrogen atoms on surfaces.** *J. Chem. Phys.* **17**, 1212-17(1949).—*C.A.* 44, 4760*d*.

The data on the kinetics of the recombination of H atoms on various types of surfaces are analyzed in the light of the theory of abs. reaction rates. For the reaction on dry oxides and dry glass, good agreement is found assuming that reaction occurs between a gas-phase H atom and an adsorbed H atom, the adsorption being of the van der Waals type at low temps. and chemisorption at higher ones. The mechanism of surface poisoning by water vapor is due at high-temp. to an increase in activation energy, the mechanism being $S{-}{-}{-}{-}OH + H \rightarrow S{-}{-}{-}{-}O + H_2$; in the low-temp. region to a decrease in the no. of active centers, the reaction being between a gaseous atom and a van der Waals adsorbed H atom above the water layer.

680. Shuler, K. E. and Laidler, K. J. **The kinetics of heterogeneous atom and radical reactions. II. The recombination of hydroxyl radicals.** *J. Chem. Phys.* **17**, 1356-7 (1949).—*C.A.* 44, 4760*d*.

Considerations show that previous exptl. investigations as to the rate of recombination of OH radicals really gave information as to the rate of the gas-phase reaction. The surface reaction is very much slower.

681. Tarama, Kimio; Miyakawa, Toshio, and Morishima, Naomasa. **Adsorption of hydrogen on palladium.** *Repts. Inst. Chem. Research, Kyoto Univ.* **17**, 108-11(1949).—*C.A.* 45, 9993*c*.

The adsorption of H_2 on Pd black was detd. statically under a const. pressure within the range of 0-180°C and 0.125-1 atm. The results agreed with those calcd. by Fowler-Guggenheim's equation of equil. between Pd and H (which is assumed to be dissolved in Pd as proton) at high temp. under low pressure, but were larger below 90°C under high pressure. The excess satisfied Freundlich's equation $a = p^{1/n}$ when evaluated with $n = 1.8$-2.

682. Wentrup, Hanns; Fucke, Herbert, and Reif, Otto. **Hydrogen contents of liquid steel made by different processes.** *Stahl u. Eisen* **69**, 117-22 (1949).—*C.A.* 43, 8331*h*.

The sampling method by suction was described. Acid open-hearth steel showed lowest H-content, amounting to 6.5 cm^3/100 g. The elec.-arc furnace produced steel with H-content of 9.3 cm^3/100 g.

683. Zapffe, C. A. and Haslem, M. E. **Hydrogen embrittlement in copper electroplating.** *Plating* **36**, 906-13 (1949).—*C.A.* 43, 8903*f*.

Wire bend tests showed serious embrittlement of AISI 440-C stainless steel by plating in acid, CN, and proprietary Cu baths. Since even very high efficiency plating processes caused more embrittlement than cathodic pickling, unexplained surface chemistry rather than the amt. of H_2 discharged must det. cathodic H_2 absorption.

684. Bastien, Paul. **Physics of metals. Diffusion of gases in metals. Fe-H system.** *Métaux & corrosion* **25**, 248-62 (1950).—*C.A.* 45, 9439*h*.

Characteristic phenomena of gas diffusion in metals are expressed for the Fe-H_2 system. The quantity absorbed by Cu, Co, Ni, and Fe increases with temp. Th, Ti, and V can absorb 10^3 to 10^5 times more H_2 at the same temp. than Fe, Ni, or Cu, the amt. decreasing with increasing temp. The brittleness of steel is indicated as due to H_2 absorption.

685. Beeck, O.; Givens, J. W., and Ritchie, A. W. **The adsorption of hydrogen on nickel catalysts. II. Sorption isobars from 20°K to room temperature.** *J. Colloid Sci.* **5**, 141-7(1950).—*C.A.* **44**, 6228*f*.

Sorption isobars were detd. for H_2 at 0.1 mm Hg pressure on evapd. Ni films between −253° to 25°C. Slow activated sorption, interpreted as absorption of H_2 into the interior of the metal structure, was observed in agreement with previous results. The process was exothermic and, after initiation by raising the temp. to approx. −150°C, continued at much lower temps.

686. Bénard, J. and Albert, P. **The chemical activity of hydrogen desorbed from palladium.** *J. chim. phys.* **47**, 449-53(1950).—*C.A.* **44**, 9783c.

Reducing action at a distance was obtained by H_2 desorbed from Pd into a stream of pure water or a stream of pure N_2.

687. Bénard, Jacques and Moreau, Jean. **Kinetics of the reduction of ferrous oxide by hydrogen.** *Compt. rend.* **231**, 904-6 (1950).—*C.A.* **45**, 5051e.

Homogeneous sheets of FeO were obtained by oxidizing plates of pure Fe in air at 850°C. Reduction at const. temp. between 450° and 700°C was followed by measuring the change in mass as a function of time. An initial laten period was explained by the formation of Fe nuclei through thermal decompn. of FeO according to $4FeO \rightarrow Fe_3O_4 + Fe$. Reduced Fe then accumulated concentrically around these centers giving rise to a period of acceleration. The Fe formed gradually recrystallized, however, and formed a less permeable material so that the reduction rate decreased toward the end of the process.

688. Bhat, U. V. **Diffusion of hydrogen in steel.** *Trans. Indian Inst. Metals* **4**, 279-89 (1950).—*C.A.* **46**, 7019*i*.

The effect of grain size, compn., and heat treatment of steel on the H_2 diffusion at room temp. has been studied. Grain size of the steel has no notable effect on H_2 diffusion, so diffusion must take place through the lattice. H_2 diffusion decreases with increasing amts. of C or Cr.

689. Couper, A. and Eley, D. D. **The parahydrogen conversion on palladium-gold alloys.** *Discussions Faraday Soc.* **1950**, No. 8, 172-9, discussion 179-84.—*C.A.* **45**, 9988*a*.

Magnetic measurements indicate that 40 and 30 at.% Pd correspond to the complete filling of the *d*-band, or at. *d*-orbitals, with electrons. Vacant *d*-orbitals are essential for the low-temp. catalysis, and they appear to bond the chemisorbed H atoms M—H. The reaction goes through a H_3 complex formed by entry of H_2 from the van der Waals layer. It is postulated that each site exerts 2 bonds to the activated complex, employing atomic *d* and hybrid $d^{2.56}\ sp^{2.22}$ metallic orbitals.

690. Craxford, S. R. and Poll, A. **The reduction of catalysts with a cobalt and kieselguhr base utilized in the Fischer-Tropsch synthesis.** *J. chim. phys.* **47**, 253-6, discussion, 256-7 (1950).—*C.A.* **44**, 8086*i*.

Catalysts having the compn. Co:-ThO_2:MgO: kieselguhr in the ratio 100:6:12:200 were used. The most active catalyst was obtained by reduction at 400°C in pure, dry H_2 at a flow rate of 6000 vols. per vol. of catalyst per hr. The percentage reduction of Co oxide was 29.8% at 300°, 53.2% at 350°, 71.2% at 400°, 81.3% at 450°, and 91.5% at 500°C. Reduction at 400°C caused the least diminution of the surface area after vacuum treatment at 450°C for 4 hrs. A reduction in surface area from 229 m^2/g of Co to 180 m^2 occurred when the catalyst was used in synthesis.

691. Dunoyer, J. M. **Mechanism of the action of gas on a solid body.** *Le Vide* **5**, 905-11 (1950).—*C.A.* **45**, 2755*h*.

An equation was established for the kinetics of a gas-solid reaction, that takes into account the diffusion of the gas into the solid. The reaction studied was the reduction by H_2 of MoO_3 dust, prepd. by dissocn. of $Mo_7O_{24}(NH_4)_6 \cdot 4H_2O$ at 400°C. The reduction to MoO_2 took place at ~400°C. The reaction rates were measured by weighing the reaction tube at different time intervals. The calcd. activation energy was 48 kcal./mol.

692. Emmett, P. H. and Kummer, J. T. **Physical and chemical adsorption studies on catalysts.** *J. chim. phys.* **47**, 67-73 (1950).—*C.A.* **44**, 6711*i*.

$N_2{}^{28}$ and $N_2{}^{30}$ react rapidly to form $N_2{}^{29}$ over Fe catalysts at 450° to 500°C. Singly-promoted Fe synthetic-ammonia catalysts rapidly catalyze the reaction $H_2 + D_2 \rightleftharpoons 2HD$ at −195°C, even though D_2 does not remove from the surface at −195°C, H_2 adsorbed at 78° or 100°C. Adsorption measurements indicate the existence of a new type of activated adsorption on iron capable of occurring rapidly at −195°C. Chemisorption measurements using normal CO as well as radioactive CO indicate that Fe synthetic ammonia catalysts behave as though half the surface were homogeneous and half were heterogeneous.

693. Freidlin, L. Kh. and Ziminova, N. I. **Differentiated outgassing of nickel. Two forms of binding of hydrogen in a catalyst.** *Doklady Akad. Nauk S.S.S.R.* **74**, 955-8 (1950).—*C.A.* **45**, 1836*h*.

Differentiation between the H_2 adsorbed on and the H_2 dissolved in H_2-satd. Ni was realized, and the nonequivalence of the 2 forms of H was demonstrated by expts. of hydrogenation of org. compds. with the H_2 contained in Ni. The org. compds. were hydrogenated, in a N_2 atm., with Ni satd. with H_2 for 10 min. prior to the expt. The compds. investigated fell into 3 groups: I, represented by Michler's ketone, withdrew from the Ni only a definite fraction of its H_2 content. Thus, 2.33 g Ni gave up a total of 49-50 ml H_2. Group II, represented by styrene, cinnamic acid, or its esters, 2.33 g of Ni gave up 198-200 ml H_2, and, on subsequent satn., took up only 19-21 ml. Compds. of group II withdrew from the Ni, in addn. to the adsorped H_2, also part of the dissolved H_2. Group III, e.g. $PhNO_2$ and vinyl butyl ether, withdrew the total amt. of both the H_2 adsorbed and that dissolved in the Ni. The no. of H atoms dissolved in Ni was about 3.5 times the no. of H atoms adsorbed.

694. FREIDLIN, L. KH. AND ZIMINOVA, N. I. **Promotion of nickel catalyst by hydrogen.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* **1950**, 659-61.—*C.A.* **45**, 6029*i*.

Leaching of Al_3Ni_2 2 hrs at 105°C with NaOH, followed by washing with H_2O, EtOH, and toluene gave the basic catalyst contg. 2.33 g Ni per ml. After satn. with H_2 for 10 min., residual H_2 was displaced with N_2 and the unsatd. compd. was introduced; thus hydrogenation was caused at the expense only of H_2 retained by the catalyst. After washing with toluene the operations were repeated. $PhNO_2$, CH_2:CHOBu, etc., were most satisfactory for the removal of the retained (adsorbed) H_2 from the catalyst. Removal of as much as 210 ml adsorbed H_2 from 2.33 g Ni still left certain activity (hydrogenating) in the catalyst, and the latter was pyrophoric; but removal of 223-4 ml H_2 (24-hr contact of the unsatd. compd.) completely inactivated the catalyst, which was then nonpyrophoric. Thus, skeletal Ni was a catalyst that was promoted by adsorbed H_2; possibly other forms of Ni catalyst were similarly promoted.

695. FRIZ, HANS. **Chemical adsorption of hydrogen and other gases on tungsten disulfide.** *Z. Elektrochem.* **54**, 538-40(1950).—*C.A.* **45**, 4994h.

WS_2 was prepd. by decompn. at 400°C of $(NH_4)_2WS_4$ and by reaction at 600°C of WO_3 and CS_2. The H_2 adsorption was the same on both when referred to the same surface area (a detn. by phys. adsorption of CO_2 and SF_6). Between 20° and 450°C the surface adsorbed the gas; above 200°C it was dissolved in the lattice. Similar effects were noted with C_2H_4, although the adsorption maxima were 50-100°C lower.

696. GELLER, W. AND SUN, TAK-HO. **Influence of alloying additions on the hydrogen diffusion in iron and contribution to the system iron-hydrogen.** *Arch. Eisenhüttenw.* **21**, 423-30 (1950).—*C.A.* **45**, 1933*h*.

From the H_2 permeability at higher temps. the diffusion coeffs. and their dependence on temp. were detd. for ferritic alloys with 1-4% Si or 27% Cr and for an austenitic steel with 18% Cr and 8% Ni. Addn. of Si and Cr reduced the diffusion coeffs. strongly. Between diffusion coeff. and giving off H_2 at room temp. a qual. relation existed; below a value of about 10^{-10} cm^2/sec no evolution of H_2 can be expected.

697. GHOSH, J. C.; SASTRI, M. V. C., AND KINI, K. A. **Mixed adsorption of hydrogen and carbon monoxide of Fischer-Tropsch catalysts.** *Research (London)* **3**, 584(1950).—*C.A.* **45**, 3578*h*.

The catalyst was composed of Co 34, Cr_2O_3 4, Cu 4, ThO_2 2.33, Ce_2O_3 0.24%, and kieselguhr balance. The adsorption of either H_2 or CO was found to be greater from that mixt.(1CO:2H or a 2:1 mixt.) in which its concn. was lower. The adsorption of each constituent was found to increase with temp. at much lower temps. in the presence of the other gas than in its absence. The results suggest the formation of a CO-H complex on the surface of the catalyst.

698. GIBB, T. R. P. JR. AND KRUSCHWITZ, H. W. JR. **The titanium-hydrogen system and titanium hydride. I. Low-pressure studies.** *J. Am. Chem. Soc.* **72**, 5365-9(1950).—*C.A.* **45**, 3744*e*.

Stoichiometric Ti hydride was prepared and density detd. as function of Ti-H ratio. Vol. expansion of 17.2% was observed when Ti reacted to form the hydride. The dissocn. pressure was measured for the Ti-H system from 500° to 800°C. The 600°C isotherm showed hysteresis. Ti contg. small amts. of H reacted rapidly with pure H_2 even at room temp. and atm. pressure.

699. HIGUCHI, IZUMI AND KAWANA, YOSHIO. **Calcium and hydrogen system. III. A theoretical consideration of the mechanism involved in the growth of the nucleus consisting of calcium hydride or deuteride.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 71, 624-7(1950).—*C.A.* **45**, 7461*e*.

The specific rate of absorption of H_2 or D_2 by metallic Ca was computed. A formula for the partition function of the activated complex supposed to be formed around the nucleus on the boundary was derived. The theoretical rate of absorption agreed well with the exptl. values.

700. HIMMLER, WILHELM. **Solubility of hydrogen in copper-zinc and copper-nickel alloys.** *Z. physik. Chem.* **195**, 244-52(1950).—*C.A.* **45**, 8326*i*.

H_2 dissolves in metals as protons and electrons. Since alloying affects the chem. potential of the electrons in the metal, it affects the soly. of H_2. Addn. of Zn (to Cu) decreases, and of Ni increases, the soly. of H. In each case the soly. increases with increasing temp.

701. HIMMLER, WILHELM. **Solubility of gases in some alloys of silver, copper, and iron.** *Z. physik. Chem.* **195**, 253-9(1950).—*C.A.* **45**, 8327*a*.

Addn. of Zn or Sn decreases the soly. of H_2 in Cu to about the same extent; addn. of Al decreases it to a greater extent. Addn. of Pt increases the soly. of H_2 but not so much as the same amt. (mol. %) of Ni. Addn. of Pd increases the soly. of H_2 in Ag. Since O_2 dissolves in metals as neg. ions, its soly. should be affected oppositely to that of H_2. This conclusion is not completely substantiated by expts. with Pd-Ag alloys at 800-900°C.

702. ISHIKAWA, FUSAO AND FUJII, SABURO. **Palladium electrode occluding hydrogen for pH measurement.** *J. Electrochem. Soc. Japan* **18**, 187-9 (1950).—*C.A.* **45**, 3260*c*.

The best conditions for prepg. a pair of Pd-H_2 electrodes to be used for pH measurement were detd. With these electrodes, the measurement of pH was made within a mean error of 0.1 mv. (0.002 pH) and max. error of 0.6 mv. (0.01 pH). For this electrode there was no need to arrange equipment to produce H_2.

703. KAWANA, YOSHIO. **Calcium-hydrogen system. I. The rate of absorption of hydrogen by metallic calcium.** *J. Chem. Soc. Japan*, Pure Chem. Sect., 71, 494-6(1950).—*C.A.* **45**, 6468*h*.

Formation of the nuclei of Ca hydride begins after a certain induction period. The rate of growth of the nuclei, being proportional to the boundary area of the nuclei, is expressed by the equation: $dV/dt = K V^{2/3} = K_a S$, where V denotes the vol. of absorbed H_2, K apparent rate const., K_a the sp rate const. of the reaction, and S the boundary area of the nuclei. The activation energy of the reaction was calcd. to be 13.8 kcal/mole from the data over a range of temp. from 251° to 325°C.

704. Kawana, Yoshio. **Calcium-hydrogen system. Rate of absorption of heavy hydrogen by metallic calcium.** *J. Chem. Soc. Japan, Pure Chem. Sect.*, **71**, 554-5 (1950).—*C.A.* **45**, 6468*i*.

The velocity of absorption D_2 by metallic Ca was measured. The general aspects of the absorption process were similar to that of H_2. The activation energy of 13.9 kcal/mole obtained was nearly identical with that of H_2, whereas the sp rate const. was generally smaller by 18% than the corresponding value of H_2.

705. Keel, C. G. **The hydrogen content of steel to be welded.** *Berg-u. hüttenmänn. Monatsh. montan. Hochschule Leoben* **95**, 318-25(1950).—*C.A.* **45**, 4632*b*.

In unalloyed and alloyed C steels 4 cc. H_2/100 g is apparently an upper admissible limit; higher contents lead to formation of cracks in the weld or transition zone. Much higher amts. are allowable in austenite, but in martensite, not more than 1-2 cc. H_2/100 g. To avoid the unfavorable effects of H_2 on the phys. properties (1) electrodes should be used with a min. of H_2O and H-contg. constituents, (2) austenitic electrodes be used, (3) the basic material should be preheated and slowly cooled, (4) the C content of the steel should be reduced, and (5) the piece should be annealed several hrs at 200-400°C.

706. Klyachko, Yu. A.; Atlasov, A. G., and Chistyakova, E. M. **Determination of gases in ferrous metals. I. Construction of apparatus for vacuum melting methods.** *Zavodskaya Lab.* **16**, 17-23 (1950).—*C.A.* **44**, 6741*b*.

A complete description with diagrams of a high-frequency furnace for vacuum work which permits operation at 1500-1600°C with tubular graphite electrodes in a quartz vacuum-tight envelope. H_2 and O_2 can be satisfactorily detd. in all cases and N_2 in many instances.

707. Klyachko, Yu. A. and Atlasov, A. G. **Determination of gases in ferrous metals. II. Apparatus and microanalytical technique for determining hydrogen by heating in a vacuum.** *Zavodskaya Lab.* **16**, 283-90(1950).—*C.A.* **44**, 6765*a*.

Use of vacuum melting and vacuum heating give satisfactory agreement in detg. H_2 in steel (U-12 grade) without microanalysis of the gases. High Ni and Cr steel require such an analysis, since appreciable amts. of C and N oxides are liberated together with the H_2. It was noted that CuO dissocs. into Cu_2O and O_2 at 300-350°C and at 327°C the equil. pressure is 6.3×10^{-12} mm of O_2.

708. Kühne-Sauter, Eva. **Concentration-dependent hydrogen-deuterium exchange process on the surfaces of aluminum cathodes.** *Z. Naturforsch.* **5a**, 499-501(1950).—*C.A.* **45**, 10037*c*.

The exchange between H_2 adsorbed in Al and D_2 in H_2O was investigated spectroscopically in the silect elec. discharge to an Al cathode. For the ratios of D to H in the H_2O of 1:500, 1:100, and 1:50 the equil. D to H ratios in the Al cathode were smaller than the original H_2O ratios, whereas for D-to-H ratios in H_2O of 1:200, 1:300, and 1:400 the equil. ratios were greater.

709. Kwan, Takao. **Rate of hydrogen adsorption on reduced copper.** *Bull. Chem. Soc. Japan* **23**, No. 3, 73-5 (1950).—*C.A.* **45**, 3221*b*.

710. Kwan, Takao and Kujirai, Masaharu. **Absolute rate of the chemisorption of hydrogen on reduced copper.** *J. Chem. Phys.* **19**, 798-9(1951).—*C.A.* **45**, 7845*b*.

The no. of active sites on Cu for the adsorption of H_2 is calcd. to be $4.2 \times 10^{14}/cm^2$. at 623°K. and 5.4×10^{14} at 673°K. All surface atoms of Cu are equally capable of chemisorbing H_2 and that adsorption is not limited to a few "active spots."

711. Kwan, Takao and Kujirai, Masaharu. **Absolute adsorption rate of hydrogen.** *Kagaku* (Science) **21**, 420-1 (1951).—*C.A.* **46**, 3366*b*.

Every adsorbed H_2 is assumed to have only a vibrational degree of freedom, the partition function of that part being unity. The no. of active sites, G, per unit area available to H_2 was calcd. as 4.2×10^{14} and 5.4×10^{14} at 623°K and 673°K, resp., using observed activation energy 20.5 ± 0.5 kcal./mole. If pairs of Cu atoms at 3.615 A. sepn. on the 110 plane are taken as the available sites, G is estd. 1×10^{15}. The adsorption site is not a specified active center but every lattice point on crystal surfaces.

712. Lanyi, Bela. **The reaction of alumina with hydrogen.** *Magyar Kem. Folyoirat* **56**, 51-4 (1950).—*C.A.* **45**, 5007*c*.

The free energy or the affinity of the chem. reaction between alumina and H_2 was calcd. at room temp. and at 100° and 1200°K. There appeared to be no decrease of free energy during the reaction; thus theoretically no metallic Al could be produced this way. The calcns. were extended to the reaction of at. H. This latter reaction seemed to be a spontaneous one at 1400° and 1600°K with a decrease of free-energy values. Above this temp. the free-energy values again increased.

713. McQuillan, A. D. **The α-β transformation in titanium.** *J. Inst. Metals* **78**, 249-57 (1950).—(Paper No. 1279).—*C.A.* **45**, 1481*f*.

The α-β transformation in Ti was studied by the changes of H_2 equil. pressure with temp. The Ti contained very dil. solns. of H_2. The transformation in one material occurred sharply at 882.5°C, but that in the Mg-reduced material took place gradually over a temp. range of 860° to 960°C.

714. McQuillan, A. D. **An experimental and thermodynamic investigation of the hydrogen-titanium system.** *Proc. Roy. Soc. (London)* A204, 309-23(1950).—*C.A.* 45, 6033*c*.

The temp.-pressure-concn. relations of the H_2Ti system were studied. The values of the latent heat and entropy of the transformation in Ti and Zr were of the same order of magnitude, and in each case were much higher than those for the corresponding quantities for the transformations that occur in Fe and Mn.

715. Meunier, F. and Demarez, A. **Influence of hydrogen on the ductility of steel.** *Mém. centre natl. recherches mét., Sect. Hainaut* Dec. 1950, 5-10.—*C.A.* 45, 7497*c*.

Steel samples were charged with H_2 by immersion in 10% HCl for 24 hrs at room temp. Two types of absorbed H_2 were distinguished: that removed by heating at 250°C, and that removed by heating under high vacuum at 600°C. Thermal treatment restored the steel to its original capacity for absorbing H_2. Samples were charged with H_2, exposed to air for increasing periods of time, and ductility increased with increase in time of exposure to the atm.

716. Mignolet, J. C. P. **Contact potentials. I. Adsorption of some gases on evaporated nickel films.** *Discussions Faraday Soc.* 1950, No. 8, 105-14.—*C.A.* 45, 9986*f*.

The chem. films studied are: Ni-H_2, -0.345 v.; Ni-C_2H_2, 1.0 v.; Ni-C_2H_4, 0.83 v. Contact potential is suitable for studying surface reactions involving hydrogenation of C_2H_2 and C_2H_4 on Ni. Van der Waals films of nonpolar gases exhibit surface potentials: Ni-Xe, 0.85 v.; Ni-N_2, 0.21 v.; Ni-C_2H_6, 0.77 v.

717. Miller, A. R. **Statistical aspects of chemisorption.** *Discussions Faraday Soc.* 1950, No. 8, 69-79.—*C.A.* 45, 9986*c*.

The exptl. data for O_2 and H_2 on W lead to the conclusion that for adsorption on an array of localized sites, the distinction between mobile and immobile films is important.

718. Misch, R. D.; Berstein, R. B., and McDonald, H. J. **Influence of certain surface-active compounds upon the hydrogen permeability of a palladium cathode.** *J. Phys. & Colloid Chem.* 54, 681-4(1950).—*C.A.* 44, 8264*b*.

The effect of various org. addition agents on the electrodeposition of H_2 on a Pd cathode was studied by using an electrolyte of 0.2 N H_2SO_4 and a c.d. of 15 ma./cm^2. The ratio of diffused to evolved H_2 was observed to increase with addn. of thiourea, diisopropylthiourea, BuI, styrene, and benzyl sulfide in concns. up to 10^{-4} M. Further increase in concns. with the exception of thiourea, decreased the ratio.

719. Nikolaeva, M. I. and Shlygin, A. I. **Study of the sintering process of platinized platinum by electrochemical methods. I. Thermal treatment in hydrogen atmosphere.** *Zhur. Fiz. Khim.* 24, 427-31 (1950).—*C.A.* 44, 8263*d*.

A platinized Pt spiral was immersed in 0.1 *N* H_2SO_4, its polarization curve taken, then H_2O_2 added, the electrode rapidly rotated, and the const. *k* of the decompn. of H_2O_2 detd. at 20°C. Then the spiral was heated in H_2 for 1 hr each at 40, 60, 80, 100, 120, 150, 200, and 250°C, and the polarization curve and *k* detd. after each heating. The *k* decreased to about 25% after 60°C heating, rose to about 40% after 80°C, and then gradually decreased to 3% after 300°C. H_2 greatly accelerates sintering rather than to stabilize the surface by adsorption.

720. Nikolaeva, M. I. and Shlygin, A. I. **Sintering platinized platinum by electrochemical methods. II. Heat-treatment in air.** *Zhur. Fiz. Khim.* 24, 534-8 (1950).—*C.A.* 44, 8749*b*.

Platinized Pt was heated for 1 hr, cooled to room temp., and either (a) treated with H_2 in 0.1 *N* H_2SO_4 until complete reduction and electrolytically changed, (b) cathodically polarized to det. the amt., *x*, of O_2 adsorbed during heating, or (c) immersed in a H_2O_2 soln. to det. the const. *k* of the H_2O_2 decompn. The *k* was 100%, 34%, 127%, and 105% at 0°, 100°, 300°, and 400°C, resp. The sintering in air was much smaller than in H_2; *x* was 100%, 210%, and 60% at 20°, 200°, and 400°C, resp. The max. of adsorption at 200°C was due to greater rate of adsorption.

721. Opie, W. R. and Grant, N. J. **Hydrogen solubility in aluminum and some aluminum alloys.** *J. Metals* 188, Trans., 1237-41 (1950).—*C.A.* 44, 10640*c*.

The soly. of H_2 in Al, Al-Cu, and Al-Si alloys followed an equation of the general form $\log_{10} S = -(A/T) + B$, where S is the soly. in cm^3 of H at standard conditions per 100 g of metal. Cu and Si both decreased the soly. of H_2 in Al; Cu was more effective than Si.

722. Opie, W. R. and Grant, N. J. **Effect of hydrogen on mechanical properties of some aluminum alloys.** *Foundry* 78, No. 10, 104-9, 209-10(1950).—*C.A.* 45, 2839*b*.

The amt. of dissolved H_2 which precipitates during solidification causing pinhole porosity arose from reaction of Al with water vapor in the atm. above the molten metal. No evidence was found that dissolved H_2 embrittles Al, probably because of the small amt. that the lattice will hold.

723. Pecherskaya, A. G. and Stender, V. V. **Catalytic properties of electrode surfaces.** *Doklady Akad. Nauk S.S.S.R.* 75, 831-3(1950).—*C.A.* 45, 3261*d*.

Fe cathode potentials for evolution of H_2, in solns. of NaOH 100 + NaCl 190 g/l., at 70°C, at 650 amp./m^2, were shifted by 0.2-0.4 v. to more pos. values by coating with W-Ni. As the coating did not change the surface area of the cathode, the effect was attributed to its greater catalytic action as compared with Fe. Typical catalyst poisons, (Hg salts or surface-active substances) counteracted the lowering of the potential, more so on W-Ni than on Fe.

724. Rideal, E. K. and Trapnell, B. M. W. **The adsorption of hydrogen by tungsten, and the mechanism of para-hydrogen conversion at tungsten surfaces.** *J. chim. phys.* 47, 126-38 (1950).—*C.A.* 44, 7118*h*.

The adsorption of H_2 was measured between -185° to 0°C and pressure range 1.5×10^{-7} to 10^{-2} mm on a film of W formed by evapn. of W atoms from a wire. The equil. adsorption increased only 9% at 0° for a 10^4 pressure increase and only 14% on dropping from 0° to −183°C at 10^{-2} mm. If the surface area of the film is judged from the chemisorption of O_2, the measurements represented coverages in the range 60 to 90%. The heats of adsorption calcd. by the Clausius Clapeyron equation were 14, 11, 7, 3, and 2 kcals. per mole at coverages of 70, 75, 80, 85, and 90%, resp. The data fit a Freundlich isotherm.

725. Rideal, E. K. and Trapnell, B. M. W. **The mechanism and temperature coefficient of the parahydrogen conversion.** *Discussions Faraday Soc.* 1950, No. 8, 114-18.—*C.A.* 45, 9986*g*.

The chemisorption of H_2 by evapd. W films indicates that the probable mechanism of the conversion is the condensation and reevapn. of chemisorbed gas. The significance of the temp. coeff. of velocity is discussed.

726. Sadek, Hussein and Taylor, Hugh S. **The heterogeneity of catalyst surfaces for chemisorption. III. Metallic nickel.** *J. Am. Chem. Soc.* 72, 1168-75 (1950).—*C.A.* 44, 5199*e*.

The adsorptions at −195°C were analyzed to det. the relative amts. of van der Waals adsorption and chemisorption of H_2 and to show that 6 different prepns. adsorbed different relative amts. of the two types. The velocity of the H_2-D_2 exchange reaction on Ni-Cr_2O_3 and Ni-ThO_2 was studied to support these findings. There were marked differences in rates with activation energies of 0.45 and 2 kcal, resp. The data did not support an interpretation based either on soly. of H_2 in the lattice or an exothermic entry of H_2 into the Ni lattice at temps. between −195 and −78°C.

727. Sastri, M. V. C. and Srikant, H. **Adsorption of hydrogen at elevated pressures on a promoted iron-synthetic ammonia catalyst.** *Current Sci.* (India) 19, 313(1950).—*C.A.* 45, 9993*b*.

The adsorption of H_2 on a Fe-K_2O-Al_2O_3-TiO_2 catalyst from 50° to 350°C and at pressures from 15 to 50 atms. was studied. Two distinct types of activated adsorption of H_2 were found, one with a max. at about 150°C, the other with a max. at about 300°C. The results indicated the superposition of adsorption on the chemisorption of the H_2.

728. Shekhter, A. B. and Tret'yakov, I. I. **The "zonal" character of the changes in a palladium catalyst in the course of the oxidation of hydrogen.** *Doklady Akad. Nauk S.S.S.R.* 72, 551-4(1950).—*C.A.* 44, 7638*a*.

A polished Pd plate placed in a stream of undild. $2H_2 + O_2$ attained high catalytic activity much faster than an unpolished plate, and its temp. (measured with the aid of a thermocouple soldered to the plate) attained 700°C at a furnace temp. of 160°C. On diln. of the gas mixt. with 40% N_2, the temp. of the plate did not exceed 450°C and the plate showed distinct structural changes after 3 hrs service. With 70% N_2, the temp. did not rise beyond 350°C and no structural changes were noticeable even after 20 hrs. Heating of the Pd to 500-600°C either in vacuo or in H_2, O_2, or H_2O alone caused no structural changes. Electron-microscopic examn. of a Pd plate operated as catalyst in a gas mixt. dild. with 40% N_2 revealed far-reaching heterogeneity of the surface.

729. Troesch, A. **Application of the kinetic laws of adsorption and desorption to the study of catalysts.** *J. chim. phys.* 47, 148-56(1950).—*C.A.* 44, 8754*d*.

Measurements of the rate of desorption of H_2 indicate 3 types of active centers for which energies of activation of desorption are 9, 12, and 16.8 kcal, resp. The action of adsorbed H_2 and C on the kinetics of CH_4 adsorption on Ni is discussed.

730. Turkevich, John; Bonner, Francis; Schissler, Donald, and Irsa, Peter. **Stable and unstable isotopes in catalytic research.** *Discussions Faraday Soc.* 1950, No. 8, 352-6.—*C.A.* 45, 9990*i*.

Results are reported on the interaction of ethylenes and D_2 on a Ni wire at 90°C as analyzed with a mass spectrometer. With 2 vols. of D_2 the exchange reaction proceeds more rapidly than does the addn. reaction; the concn. of light ethylene decreases exponentially, while the concn. of the substituted ethylenes goes through a max. before it becomes zero. The surprising result is the discovery of completely light ethane from the reaction.

731. Vosskühler, H. **Influence of hydrogen upon the corrosion resistance, anodic resistance, and workability of aluminum-magnesium-alloys.** *Metall* 4, 6-9(1950).—*C.A.* 45, 6562*c*.

Corrosion and stress corrosion resistance decreases with increasing H-content. The presence of H_2 can be recognized in that plates which are H-free or low in H_2 remain bright on aging, while plates with considerable H_2 become light gray in color and lose their metallic appearance.

732. Wilzbach, Kenneth E. and Kaplan, Louis. **Exchange reaction between hydrogen and lithium hydrides; preparation of lithium hydride-t and lithium aluminum hydride-t.** *J. Am. Chem. Soc.* 72, 5795-6(1950).—*C.A.* 45, 3694*g*.

The exchange reaction of H_2 gas with solid LiT was studied between 25° and 200°C. The rate was controlled by a diffusion process within the solid. The equil. const. at 200°C was 3.7. $LiAlT_4$ has been used to prep. T-labelled compds. Ethanol-1-t was obtained in 80% yield by reduction of EtOAc.

733. Wright, P. **The effect of occluded hydrogen on the electrical resistance of palladium.** *Proc. Phys. Soc.* (London) 63A, 727-39(1950).—*C.A.* 45, 1402*h*.

Resistance-pressure isotherms from 75° to 150°C are obtained for pressures increasing and decreasing between zero and atm. A decrease in resistance, which is observed when H_2 is added to the alloy in the β phase, is attributed to completion of the *d* shells of Pd. Hysteresis phenomena are discussed. The general characteristics of the resistance isotherms in the system Pd-H_2 can be satisfactorily explained by assuming that the occluded H_2 is held entirely in solid soln. The incomplete *d* shells of the Pd atoms become filled when the ratio of H to Pd atoms in solid soln. is approx. 0.6.

734. Bernstein, Richard B. and Cubicciotti, Daniel. **The permeability of zirconium to hydrogen.** *J. Phys. & Colloid Chem.* 55, 238-48 (1951).—*C.A.* 45, 4511*b*.

The rate of flow of H_2 through Zr between 375 and 920 °C decreased with time exponentially, varied as the square root of the pressure and had a large temp. coeff. The time decrease of the permeability was partially ascribed to surface contamination and partially to a change of structure of the Zr.

735. Buzzard, R. W. and Cleaves, H. E. **Hydrogen embrittlement of steel. Review of the literature.** *Natl. Bur. Standards Circ. No.* 511, 29 pp. (1951).

A review of the literature (1191 references) established the fact that steel absorbed H_2 on exposure at an elevated temp. or in the environment of a chem. reaction. The H_2 so absorbed tended to cause porosity and blowholes in the cast metal. Defects attributed to H_2 included flaking, pickling embrittlement, shatter cracks, hairline cracks, weldment failures, etc. The published data failed to establish quant. proof that H_2 was the sole cause of these defects, but when procedures for maintaining the H-content at a min. were utilized, certain defects generally ascribed to H_2 could be eliminated.

736. Chatterjee, B. and Ghosh, P. C. **Mechanism of decarburization of cast iron in hydrogen.** *Science and Culture* 17, 258-9(1951).—*C.A.* 46, 6570*b*.

A layer low in C near the surface of cast iron heated to 1000 °C in moist H_2 (1.2% H_2O by vol.) is caused by $CH_4 + 2H_2O \rightarrow CO_2 + 4H_2$, the H_2 from the oxidized CH_4 speeding the decarburizing process, $Fe_3C + 2H_2 \rightarrow 3Fe + CH_4$. The diffusion of the H_2, H_2O vapor, and CH_4 permit these reactions to occur within the metal as well as at the surface. The activity of C in Fe_3C is higher than its activity in nonsatd. austenite and H_2 reacts with Fe_3C more rapidly than with C in solid soln.

737. Cook, R. M. and Hobson, J. D. **Determination of hydrogen in liquid steel.** *Iron Steel Inst.* (London) 169, 24-5 (1951).—*C.A.* 46, 61*c*.

Satisfactory agreement is shown for comparative results of the modified notched-pencil mold method and the sealed-mold method of sampling. For control purposes the notched-pencil mold detn. has the advantage of requiring less time.

738. Eley, D. D. **Molecular hydrogen and metallic surfaces.** *J. Phys. & Colloid Chem.* 55, 1017-33, discussion 1034-6(1951).—*C.A.* 46, 30*d*.

The quant. aspects of H_2 catalysis are reviewed and a working hypothesis outlined.

739. Eucken, A. and Weblus, B. **Adsorption of hydrogen on platinum according to measurements of the capacity of polarization.** *Z. Elektrochem.* 55, 114-19(1951).—*C.A.* 45, 9393*c*.

By measurements of the capacity of polarization with a special cell and superimposed a.c. it is found tha 2 max. occur. This indicates the presence of 2 mechanisms of H_2 adsorption, one independent of the concn. of other ions, the other influenced thereby. It is postulated that the 1st max. is caused by the adsorption of H_2 upon O atoms on the electrode surface, forming reversibly something in the nature of a surface hydroxide, while the 2nd max. is caused by adsorption of H_2 upon the Pt atoms themselves.

740. Freidlin, L. Kh. and Ziminova, N. I. **The active structure of the nickel-hydrogen catalyst.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* **1951**, 145-9.—*C.A.* 45, 6031*a*.

H_{ads} gave a measure of the active centers present at the surface. This was directly related to the amt. of dissolved H_2 as shown by its progressive removal with the aid of increasing amts. of 1-methyl-1-cyclopentene in the absence of free H_2. The amt. of H_2 adsorbed by a given sample of the Ni catalyst (2.33 g, contg. 47.4 ml H_{ads} and 177 ml dissolved H_2) was a linear function of the remaining dissolved H_2. Likewise, the catalytic activity in hydrogenation of allyl alc. was a linear function of the dissolved H_2, and both adsorption of H_2 and catalytic activity fell to zero when it was all removed. CH_2:CHOBu was used as H-remover.

741. Fry, A. **Gases in steel—hydrogen.** *Inst. hierro y acero*, Suppl. to Vol. 3, 24-35(July-Sept., 1950); *J. Iron Steel Inst.* (London) **168**, 330(1951).—*C.A.* 45, 7936c.

H_2 is one of those gases which are sol. in steel and do not form solid compds. Part of the H_2 retained in steel can be extd. by heating *in vacuo*. A test is described to confirm the 2 types of H_2 diffusion (at. and mol.). Krupp tests to prove the "flake theory" include blowing H_2 into the bath, heating a steel free from flakes for a long period at 1150 °C in H_2, and annealing steel in H_2 at high pressure at 550 °C. All these methods produce flakes.

742. Garstens, Martin A. **Internal motion of hydrogen absorbed in tantalum.** *Phys. Rev.* **81**, 288(1951).—*C.A.* 45, 3209*a*.

With powd. Ta contg. 53.5 at. % H, it was found that proton motion was frozen at about 215 °K. Above 235 °K the H atoms were not bound to the metal atoms.

743. Gibb, T. R. P., Jr.; McSharry, J. J., and Bragdon, R. W. **The titanium-hydrogen system and titanium hydride. II. Studies at high pressure.** *J. Am. Chem. Soc.* 73, 1751-5 (1951).—*C.A.* 45, 6914*e*.

The equil. pressure of H_2 over the metallic Ti-H_2 system was measured as a function of H-content of the solid phase. Measurements were made over the range 175° to 100 °C at pressures ranging up to 5000 cm. Plots of log P *vs.* 1/T°K were a series of straight lines whose slope increased with decreasing H-content. From these slopes the differential heats of dissocn. were calcd. A family of isotherms showed plateaus at compns. approaching TiH_2.

744. Halsey, G. D. Jr. **Para-hydrogen conversion on tungsten.** *Trans. Faraday Soc.* 47, 649-56 (1951).—*C.A.* 45, 9993*e*.

Data on the para-H_2 conversion on clean W surfaces were considered from the standpoint of the heterogeneous surface. The mechanism finally adopted was that of exchange between chemisorbed H and mol. H_2 adsorbed on van der Waals sites of varying energy. These sites were located between 2 bare chemisorption sites. An activation energy of adsorption of several kcal was necessary for the success of any mechanism.

745. HAUSNER, HENRY H. **The formation of metal from its compound during sintering.** *Powder Met. Bull.* 6, 41-3(1951).—*C.A.* 46, 5498*h*.

Superior properties were obtained when using ZrH_2 as raw material for sintered Zr. Higher d. at lower sintering temps. was obtained as compared to compacts made from plain Zr powder. ZrH_2 powder was pressed at 25 tons/in^2 and sintered at 1150°C for 3 hrs. The remarkable sintering behavior of ZrH_2 was attributed to the great atomic mobility which was experienced at the decompn. range of the hydride.

746. HOBSON, J. D. AND SYKES, C. **Effect of hydrogen on the properties of low-alloy steels.** *J. Iron Steel Inst.* (London) 169, 209-20 (1951).—*C.A.* 46, 2982*b*.

H_2 was detd. by heating the entire fractured specimen in an evacuated furnace at 650°C. Of the 17 steels studied, 8 contained 3% Cr and 0.5% Mo and the others contained 3.5% Ni, 1% Ni, and 2.5% Ni, 0.4% Cr, and 0.4% Mo. The main effect of H_2 was loss of ductility accompanied by some loss of notched-bar impact strength. H content alone did not decide whether hairline cracks would form. The embrittling effect, particularly in the presence of stress raisers, made low H-desirable in finished steel.

747. KAWAI, MASAYOSHI. **Behavior of hydrogen in steel. II.** *Tetsu to Hagane* 37, 23-9 (1951).—*C.A.* 46, 7961*a*.

The discussion covers the H_2 pressure in cavities and the effect of cavities on diffusion of H_2 in steel. In an ideal case, when the H_2 equil. between metal and cavities is realized without loss of H_2 from the metal, the H_2 pressure reaches a max. at about 150°C, and the max. value increases with the H-content and with the reciprocal of the cavity vol. It takes time to attain the H_2 equil. if phys. conditions are varied and the lower the temp. the longer the time. On the other hand, the greater part of the H_2 in steel ppts. into cavities at the lower temp., and yet, if the total vol. of the cavities is large, the quantity of H_2 in the cavities cannot be neglected up to higher temp., especially in the α-phase.

748. KINJYO, KISEI AND IWATA, SHIGEO. **Preparation of highly pure tungsten. I. Reduction of tungsten trioxide in a current of hydrogen.** *J. Chem. Soc. Japan*, Ind. Chem. Sect. 54, 573-5 (1951).--*C.A.* 47. 6321*b*.

The reduction of WO_3 (calcined at various temps.) by H_2 was studied by means of a thermobalance. The reduction into metallic W took place through various lower oxides according the calcination temp. of WO_3. The reduction temp. was 550°C for the WO_3 calcined at 300-800°C and 670° for 1000°C.

749. KINOSHITA, TOSHIHIRO AND HARA, TORAKICHI. **Determination of hydrogen in cast iron.** *Tetsu to Hagane* 37, 102-7(1951).—*C.A.* 46, 8571*a*.

The test pieces (15 mm) were cast in a Cu mold and quenched rapidly in a Hg bath. By this method test pieces of white iron were obtained with no quenching cracks. The extn. temp. of H_2 should be 900°C. The results were reliable. By this procedure, analyses were made in cast iron samples of almost the same compn. There was less H_2 in cupola-melted cast iron than in elec.-furnace-melted cast iron. The Si contents of the cast iron affected the analysis, and H_2 detd. in high-Si cast iron was less than in low-Si cast iron.

750. KUME, SANSHIRO AND OTOZAI, KIYOTERU. **Activation energy. II. Some applications of the empirical rule. III. Activation energy for the adsorption of hydrogen on reduced copper.** *Bull. Chem. Soc. Japan* 24, 257-64(1951).—*C.A.* 47, 4176i.

The activation energies for the addn. of H_2 or halogen to ethylene, for at. reactions involving Na and halogen, and for the adsorption of H_2 and ethylene on Ni were detd. The calcd. values agreed well with expt. except that those for the addn. of H_2 to ethylene were high. The initial rate of adsorption of ethylene on Ni from the calcd. activation energy were 7.73×10^{13} sec^{-1} cm^{-2}. The [110] and [111] surfaces of Cu adsorbed H_2 more quickly than do the [100] surfaces.

751. KUMMER, J. T. AND EMMETT, P. H. **The amount of hydrogen left on the surface of a reduced and evacuated iron synthetic-ammonia catalyst.** *J. Phys. & Colloid Chem.* 55, 337-46(1951).—*C.A.* 45, 5502*h*.

Tracer expts. with D_2 show that promoted Fe synthetic NH_3 catalysts after thorough reduction retain sufficient H_2 to cover as much as 35% of the metallic surface even after 24 hrs evacuation at 500°C. Unpromoted Fe catalysts do not retain a detectable amt. of H_2. It is not known whether the H_2 retained by the promoted Fe catalyst is held as H_2 on Fe or as either H_2 or H_2O on the Al_2O_3 promoter.

752. LAIDLER, KEITH J. **Mechanisms of surface reactions involving hydrogen.** *J. Phys. & Colloid Chem.* 55, 1067-77, discussion 1077-8 (1951).—*C.A.* 46, 26*e*.

The combination of H atoms involved, under most conditions, interaction between a gaseous atom and an adsorbed atom, gave rise to 1st-order kinetics when the surface was nearly fully covered. The production of atoms involved interaction between a gaseous H atom and a bare surface site, one atom being absorbed and the other passing into the gas phase. The hydrogenation of C_2H_4 involved adsorption of C_2H_4 and H_2 on neighboring sites. The exchange reaction between D_2 and NH_3 perhaps occurred by interaction between an adsorbed D atom and a gaseous NH_3 mol. Usually surface reactions between 2 species involved adsorption of both species, both of which undergo activation by the surface. If, however, the product was strongly adsorbed, reaction might occur more readily by interaction between an adsorbed mol. and a gaseous one.

753. MCQUILLAN, A. D. **The application of hydrogen equilibrium-pressure measurements to the investigation of titanium alloy systems.** *J. Inst. Metals* 79, 73-88(1951)(Paper No. 1298).—*C.A.* 45, 4627*h*.

The method depends on the measurement of H_2 pressures in equil. with a very dil. soln. of H_2 in the alloys. The method is applied to a series of alloys in a limited region of the Ti-Cu and Ti-Fe systems. Both Cu and Fe depress the $\alpha \rightleftarrows \beta$ transformation in Ti. The effect of these addn. elements on the soly. of H_2 in the Ti-rich β solid soln. is described.

754. McQuillan, A. D. **The titanium-hydrogen system for magnesium-reduced titanium.** *J. Inst. Metals* 79, 371-8(1951)(Paper No. 1311).—*C.A.* **45**, 7505*h*.

The constitutional diagram of the Ti-H_2 system was studied by using Mg-reduced Ti. The system Mg-reduced Ti-H_2 could not be treated as a simple binary, but had to be considered as a section through a multi-component system. The results obtained in the study of systems of Mg-reduced Ti with other metals were likely to be affected in the same way.

755. Opie, W. R. and Grant, N. J. **Solubility of hydrogen in molten lead.** *J. Metals* **3**, *Trans.* **191**, 244-5(1951).—*C.A.* **45**, 3223*f*.

The soly. of H_2 in molten Pb can be expressed by the equation: $\log S = (-2450/T) + 2.19$. The heat of soln. of H_2 in Pb is 22,300 cal per mole of H_2.

756. Pavlyuchenko, M. M. and Rubinchik, Ya. S. **Reduction of copper oxide by hydrogen.** *Zhur. Priklad. Khim. (J. Appl. Chem.)* **24**, 666-70 (1951).—*C.A.* **47**, 389*i*.

The rates of reduction were detd., at 201° (±0.5°), in a static system under an initial H_2 pressure of 714 mm Hg, for dark brown CuO made by pptn. with alkali, CuO obtained by calcination of the salt, and gray CuO obtained by oxidation of Cu in air. All curves pass through a max. Samples of partially oxidized Cu, with 20, 30, 40, 60, and 100% CuO, and 80, 70, 60, 40, and 0% Cu, all contg. 0.04 g, were reduced practically at the same speed along a rate curve with a max. Artificial admixing of Cu to CuO had no effect on the rate of reduction. Once the reduction had started, H_2O vapor had no effect on the rate. In the presence of Hg vapor, at 203°C, the rate decreased by a factor of 10, and passed through 2 maxima and one min. Variation of the initial pressure of H_2 (200, 350, 700 mm) had only an insignificant effect on the rate of reduction.

757. Podol'skaya, E. V. and Shumovskiĭ, E. G. **Macroscopic determination of hydrogen in hard pig iron.** *Vestnik Mashinostroeniya* **31**, No. 4, 47-52(1951).—*C.A.* **46**, 1940*f*.

The relative content of H_2 was estd. from the appearance of glazed specimens. There was a relationship between the H-content and the microstructure; the higher the H-content the less was the extent of austenite decompn. This was taken to indicate that H_2 pressure interfered with phase transformation. A high H content was assocd. with an austenite-ledeburite structure while a ferrite-pearlite structure was characterized by absence of H.

758. Saitô, Tsunezô. **Adsorption of diatomic gas by binary alloys. I.** *Science Repts. Research Insts., Tohoku Univ., Ser.* **A**, **3**, 502-12(1951).—*C.A.* **47**, 2106*a*.

Gas atoms, dissolved in the interlattice positions in quasi-crystals of molten alloy, were not distributed uniformly. The distribution depended upon the amt. of reaction energies of gas and metal atoms. N atoms had a tendency to cluster around Cr or Mn atoms where N_2 was absorbed by molten Fe-Cr or Fe-Mn alloys. A formula was derived to be used in connection with the absorption of diatomic gas by binary alloys. It explained the results formerly found for Fe-Cr, Fe-Mn, and Fe-Ni alloys. The theory was also checked for H_2 and O_2.

759. Sastri, M. V. C. and Srikant, H. **Mixed adsorption of hydrogen and nitrogen at elevated pressures on a promoted iron synthetic-ammonia catalyst.** *Current Sci.* **20**, 15-16(1951).—*C.A.* **45**, 10018*d*.

An $Fe-K_2O-Al_2O_3-TiO_2$ catalyst was used. The individual adsorptions of H_2 and N_2 from a 3:1 mixt. were detd. on the same catalyst between 50° and 350°C and at a total gas pressure up to 50 atms. The adsorption of H_2 increased regularly with its partial pressure at all the temps. studied, whereas that of N_2 exhibited this regularity only at the highest temp. In practically every case the adsorption of H_2 at a given partial pressure from the mixt. was considerably higher than that from the pure gas at an equiv. pressure. At 350° when the partial pressure of N_2 exceeded 7 atms., the ratio of N_2 to H_2 adsorption varied successively from 1N:1H, to finally 1N:3H.

760. Schuit, G. C. A. **Adsorption as a method for determining the structure of a catalyst.** *Chem. Weekblad* **47**, 453-65 (1951).—*C.A.* **46**, 2383*i*.

Phys. adsorption gives information about the surface area and the distribution of pore sizes, but not about the nature of the surface. For the latter, chemisorption promises to be valuable. The activated adsorption of H_2 on Ni is due to surface O atoms. Sintering is prevented in these catalysts by the spongy SiO_2 skeleton.

761. Schuit, G. C. A. and Boer, N. H. de. **Activated adsorption of hydrogen on nickel catalysts.** *Nature* **168**, 1040-1 (1951).—*C.A.* **46**, 4338*h*.

The thermodynamics and kinetics of the chemisorption of H_2 on metals were studied on a catalyst consisting of 100 parts Ni to 29 parts SiO_2 by wt. For this type of catalyst reduction was incomplete below 400°C, but substantially complete above 500°C. O_2 was adsorbed at -196°C on a well-reduced catalyst then the O-covered sample was slowly heated to a higher temp., and thereafter the adsorption of H_2 detd. Results indicated that with increasing amts. of O coverage, the amt. of rapidly adsorbed H_2 decreased, whereas the total adsorption remained more or less const. Any procedure that involved heating the catalyst sample at 400°C without the presence of H_2, such as heating under N_2 or *in vacuo*, caused a decrease in H_2 adsorbed.

762. Schuit, G. C. A. and Boer, N. H. de. **Activated adsorption of hydrogen on nickel catalysts.** *Rec. trav. chim.* **70**, 1067-84 (1951) (in English).—*C.A.* **46**, 4881*i*.
The adsorption consisted of a very rapid process followed by a much slower one, the latter increasing in velocity with increased temp. The transition between the 2 was not sharp but gradual. However, some distinction could be made by observing the amts. of H_2 adsorbed at 78°K and very low pressure (type I) and the amts. that could be adsorbed in excess of this quantity (type II). A more thorough reduction of the catalyst resulted in an increase of the type I adsorption at the cost of type II. Adsorption of O_2 on a well-reduced catalyst, on the contrary, decreased the type I and increased the type II adsorption, the change being linear with the amt. of O_2 adsorbed. O_2 adsorption occurred in 2 different manners, depending on the conditions, one adsorption site being occupied by either an O atom or O_2 mol.

763. Shushunov, V. A. and Shafiev, A. I. **Kinetics of the reaction between calcium and hydrogen.** *Doklady Akad. Nauk S.S.S.R.* **78**, 1181-4 (1951).—*C.A.* **45**, 8331*h*.
The reaction $Ca + H_2 = CaH_2$ begins with a significant rate at 150-170°C. The reaction is not self-accelerated. With initial pressures of H_2 of the order of 5-10 mm Hg and at temps. above 200°C, the fall of the H_2 pressure *p* is first-order. At lower temps. or at higher initial *p*, the 1st-order falls with the progress of the reaction, and consecutive expts. with the same film give decreasing rates. However, when the thickness of the layer has attained a few tenths of a mm, the rate can again be described by the 1st-order law; this will occur when the CaH_2 layer has become sufficiently thick for the change of its thickness during the reaction to become negligible.

764. Smith, Donald P. **The widened lattice interval and its essential role in the behavior of crystalline metal.** *Science* **113**, 348-52 (1951).—*C.A.* **45**, 5084*h*.
The widened lattice intervals produced by work hardening of metals are evidently "rifts" in the crystal lattice. These rifts are produced by plastic deformation and are capable of healing or extension as conditions are altered. The existence and nature of the rifted state are demonstrated chiefly by the behavior of metals with H_2. Presumably the ionization of H_2 occurs with facility only in the rifts.

765. Soliman, A. **Formation of metallic hydrides and nitrides and their significance in the synthesis of ammonia.** *J. Applied Chem.* (London) **1**, 98-104 (1951).—*C.A.* **45**, 6911*h*.
The activation energy of adsorption of N_2 on Li was evaluated at 47 kcal/g-mol. Adsorption of H_2 was relatively slow at 500-25°C, and Li sublimed freely at higher temps. and pressures below atm. Metallic promoters increased the adsorption by Li of H_2 markedly but had little appreciable effect with N_2; Mn and Ni (1:1) were most effective for H_2, and Cs for N_2. At 30 atm., pressure equil. was attained in 30 sec in the adsorption of N_2 and H_2 by Ca, as compared with upwards of 1 hr at atm. pressure.

766. Thon, N.; Kelemen, Denis G., and Yang, Ling. **Porosity of electrodeposited metals. X. Hydrogen content of electrodeposited metals.** *Plating* **38**, 1055-8 (1951).—*C.A.* **46**, 1366*a*.
Detns. of H_2 in Ni foils 0.0003 in. thick gave H:Ni atom ratios of about 1:300 for Ni baths without addn. agents, and considerably smaller ratios for baths with disulfonate addn. agents. Increasing pH and temp. decreased the H-content slightly. The H-content decreased with increasing foil thickness. The nature of the base metal was also important, a foil deposited on mech. polished Cu contained 5 times as much H_2 as one deposited on electrolytic Cu.

767. Trapnell, B. M. W. **Adsorption on evaporated tungsten films. II. The chemisorption of hydrogen and the catalytic para-hydrogen conversion.** *Proc. Roy. Soc.* (London) **206A**, 39-50 (1951).—*C.A.* **47**, 5758*a*.
Isotherms for the adsorption of H_2 on W films from 0 to −183°C and up to 10^{-2} mm pressure are given. At each temp. there is an initial fast H_2 adsorption followed by a slow reaching of equil. The Freundlich isotherm is obeyed at all temps., with heats of adsorption falling with increased adsorption from 15.4 to 2.8 kcal./mole. By extrapolation this min. becomes 2.4 kcal./mole; this indicates a true case of chemisorption and an almost complete coverage of surface area with 1 atom of H per surface atom. Calcns. based on these exptl. results would indicate the para-H_2 conversion to proceed as: $2\ W + H_2 \rightleftharpoons 2\ WH$.

768. Tsukagoshi, Osamu. **Cleaning-up of hydrogen by barium getter films.** *Repts. Sci. Research Inst. (Japan)* **27**, 1-5 (1951).—*C.A.* **46**, 1367*i*.
Ba deposited on a glass wall by pyrolysis *in vacuo* of BaN_6 painted over a W wire was found to absorb H_2 until H/Ba in the layer approached 2; that is until BaH_2 was formed almost entirely. The reaction velocity increased with higher temp., was relatively unchanged by the H_2 pressure (within the range of $1\text{-}2.4 \times 10^{-4}$ mm Hg), and remained relatively const. up to H/Ba 0.8 and thereafter decreased at higher values of H/Ba.

769. Wagner, G. and Blaha, F. **Action of dilute sulfuric acid on magnetized iron.** *Nature* **168**, 74 (1951).—*C.A.* **46**, 325*h*.
When spectroscopically pure Fe, first heated in H_2 and then degassed *in vacuo*, was allowed to react in the magnetized state with H_2SO_4, less than 10^{-6} by vol. of O_2 was found in the H_2 formed. Similar results were obtained with unmagnetized Fe.

770. Wahlin, H. B. **The transmission of hydrogen through metals.** *J. Applied Phys.* **22**, 1503 (1951).—*C.A.* **46**, 6569b.
To test the hypothesis that H_2 diffuses into some metals by surface dissocn. followed by diffusion of at. H, a Pd tube was made the cathode in a H_2SO_4 bath. A pressure of 50 atm. was built up in the tube. Fe, Ni, Nb, Ta, and Mo all show slight transmission. Cu transmitted so slowly, if at all, that no pos. results were obtained.

771. Brown, W. G.; Kaplan, L., and Wilzbach, K. E. **The exchange of hydrogen gas with lithium and sodium borohydrides.** *J. Am. Chem. Soc.* **74**, 1343-4 (1952).—*C.A.* **47**, 4686*b*.

The direct exchange of solid borohydrides with H_2 provides a simple route to the isolation of isotopic compds. The exchange occurs at a convenient rate with $LiBH_4$ at 200°C, and with $NaBH_4$ at 350°C. Thermal decompn. is negligible.

772. Chang, P. L. and Bennett, W. D. G. **Diffusion of hydrogen in iron and iron alloys at elevated temperatures.** *J. Iron Steel Inst.* (London) **170**, 205-13 (1952).—*C.A.* **46**, 7974*i*.

The effects of Cr, Ni, and Mo on the rate of H_2 permeation in Fe are expressed in the form of an exponential equation. Cr has little effect on permeation in the gamma range, but greatly reduces the rate in the alpha range. Ni and Mo have little effect. The soly. values calcd. from the data are of the same order of magnitude as those obtained by different methods.

773. Charlton, M. G. **Hydrogen reduction of tungsten trioxide.** *Nature* **169**, 109-10 (1952).—*C.A.* **46**, 6537*b*.

Time curves for the reduction of WO_3 by H_2 were obtained by a continuous weighing technique. They showed well-defined inflections that corresponded to the β- and γ-oxides intermediate in compn. between WO_3 and WO_2. The av. compns. for the β- and γ-oxides were $WO_{2.86}$ and $WO_{2.70}$, resp. It was probable that the formation of these oxides by reduction would tend to give O-deficient compds. The presence of H_2O vapor increased the induction period that occurred before one oxide is reduced to the next lower oxide.

774. Chufarov, G. I., Averbukh, B. D., Tatievskaya, E. P. and Antonov, V. K. **Retarding action of gaseous reaction products on the rate of reduction of manganese oxides by hydrogen and carbon monoxide.** *Zhur. Fiz. Khim.* **26**, 834-41 (1952).—*C.A.* **46**, 10813*d*.

Reduction of Mn_3O_4 by H_2 (50-150 mm Hg, 450°) was retarded by H_2O more than reduction of Mn_2O_3. Adsorption (a in 10^{-6} g mol./m^2) at 100°C and 50 mm Hg was for H_2, CO, and CO_2 on MnO_2 20.50, 3.35, and 1.55; on Mn_2O_3 5.5, 8.1, and 4.9; on Mn_3O_4 0.25, 1.00, and 1.70; and on MnO 0.85, 1.30, and 5.80. Between 20° and 100°C, a of CO and H_2 on Mn_3O_4 and of H_2 on Mn_3O_4 increased with temp., and a of CO_2 on Mn_2O_3 and CO on Mn_3O_4 decreased. At 10 mm Hg and 100°C, a for H and H_2O on Mn_2O_3 was 2.6 and 8.0, on Mn_3O_4 0.1 and 3.8, and on MnO 0.2 and 8.6, resp.

775. Cooper, Charles M. **Steel lining eliminates failure of pressure vessels due to hydrogen.** *Chem. Eng. News* **30**, 2942 (1952).—*C.A.* **46**, 9499*c*.

H_2 greatly reduces the mech. properties of high-strength steels usually used in high-pressure vessels. Some fail in brittle fashion at 2000 atm., the same types withstanding 7000 atm. oil pressure. Type 316 stainless steel withstands H_2 as well as it does oil pressure.

776. Couper, A. and Eley, D. D. **Electronic basis of catalyst activity. II. The reversible dissociation of hydrogen molecules and the para-hydrogen conversion.** *Proc. Roy. Soc.* (London) **A211**, 536-43 (1952).—*C.A.* **46**, 10819*i*.

An examn. of the hypothesis that the rate of the para-H_2 conversion on W is detd. by the rate of condensation of H_2 into an almost full monolayer of chemisorbed atoms. The calcd. values of abs. rate, activation energy, and pressure dependency are in disagreement with those observed experimentally.

777. Couper, A. and Eley, D. D. **Electronic basis of catalyst activity. III. The activation energy of the para-hydrogen conversion on tungsten.** *Proc. Roy. Soc.* **A211**, 544-63 (1952).—*C.A.* **46**, 10820*a*.

A study of the activation energy and frequency factor for the conversion of para-H_2 on W. All expts. were made at around 1 mm pressure. The values were independent of variations in wire length, bath temp. and wall thickness, factors likely to change the temp. distribution along the wire. The values varied somewhat from one wire to another, and may be more markedly modified by exposure to H atoms or Na vapor.

778. Duflot, Jean. **The supersaturation of iron by cathodic hydrogen.** *Pubs. sci. et tech. ministere air* (France) No. **265**, 1-56 (1952).—*C.A.* **47**, 3666*e*.

Quantities of H_2 of the order of 130-140cc./100 g were introduced into Fe by electrolysis in 10 *N* H_2SO_4. After the sample was charged with H_2, the amt. and rapidity with which it could be degassed were unaffected by abrasive treatment. Approx. 80% of the dissolved H_2 could be removed by vacuum treatment at 115°C, whereas 100% of the H_2 could be removed by fusion in Sn at 1150°C under vacuum. Charging with H_2 had the following effects on the mech. properties: (1) The Brinell hardness was increased from 55.6 to 65.7 and was decreased to 61.8 by degassing; (2) Young's modulus was not affected; (3) the tensile properties were related to the duration of charging.

779. Gibb, T. R. P. Jr.; McSharry, J. J., and Kruschwitz, H. W. Jr. **Metal-hydrogen systems. III. The uranium-hydrogen system.** *J. Am. Chem. Soc.* **74**, 6203-7 (1952).—*C.A.* **47**, 3675*i*.

Measurements were made for the range 500-4900 cm at temps. from 357 to 650°C for compns. ranging from $UH_{2.85}$ to $UH_{3.00}$. The equation for the dissocn. pressure (p, cm) of $UH_{3.00}$ is $p = -(1730/T) + 5.78$, where T was the temp., °K. After removal of several tenths of a mode of H_2, the solid phase reverted to normal behavior.

780. Heath, H. R. **Diffusion of electrolytic hydrogen through metals.** *Brit. J. Applied Phys.* **3**, 13-18 (1952).—*C.A.* **46**, 5938*d*.

Fe and Pd were permeable to H_2, but Ni, Co, Cu, Zn, Ag, Pt, and Pb were not. The app. consisted of a cylindrical glass electrolytic cell contg. an anode. The base of the cell was fabricated from the test metal which served as the cathode. For Fe (1 cm^2 by 0.08 mm thick), after about 40 min., when steady state was reached (under given conditions), 1 part in 83 of the H_2 produced passed through the plate. The rate of diffusion was linear with reciprocal of plate thickness only for thicknesses less than 0.7 mm.

781. Higuchi, Izumi; Kawana, Yoshio; Hattori, Shin, and Chiba, Hiroshi. **System of calcium alloy and hydrogen. I. Calcium-aluminum-hydrogen system.** *J. Chem. Soc. Japan, Pure Chem. Sect.*, **73**, 198-200 (1952).—*C.A.* **46**, 5397*h*.

The absorption of H_2 by Ca-Al alloy was detd. and the ternary alloy Ca-Al-H was detd. The Ca-Al alloy contg. a greater proportion of Ca than that of $CaAl_2$ absorbed H_2 above 200°C. The amt. V of the absorbed gas per unit wt of the alloy plotted as a function of time t showed a sigmoid curve without an induction period. In the early stage, V was proportional to t^3. The absorbed H combined with Ca atoms in the Ca phase to form CaH_2 and with a part of Ca atoms in the $CaAl_2$ phase.

782. Higuchi, Izumi and Chiba, Hiroshi. **The system of calcium alloy and hydrogen. II. Calcium-magnesium-hydrogen and calcium-aluminum-magnesium-hydrogen systems.** *J. Chem. Soc. Japan, Pure Chem. Sect.* **73**, 400-2 (1952).—*C.A.* **47**, 4270*d*.

When Ca is present in a greater amt. than that corresponding to the compn. Ca_3Mg_4, a free Ca phase exists in the alloy. It has been observed that both Ca-Mg and Ca-Al-Mg alloys adsorb H_2 at 1 atm. in the presence of free Ca.

783. Higuchi, Izumi and Chiba, Hiroshi. **The system of calcium alloy and hydrogen. III. The absorption rate of hydrogen by calcium-magnesium alloy.** *J. Chem. Soc. Japan, Pure Chem. Sect.* **73**, 420-5 (1952).—*C.A.* **47**, 4270*d*.

The influence of temp. and pressure upon the initial rate of H_2 adsorption of the Ca-Mg alloy contg. 70.61% Ca has been studied. The rate does not depend upon the outer area of alloy. The activation energy is estd. to be 20.59 kcal./mole. The influence of pressure appears in line with the adsorption isotherm.

784. Jackson, J. S. **The problem of hydrogen diffusion in the pickling of spring steel.** *J. Electrodepositors' Tech. Soc.* **29**, 89-101 (1952).—*C.A.* **47**, 3780*e*.

H_2 is believed to be adsorbed and to diffuse through steel in the at. state, then to collect as H_2 in discontinuities in the metal lattice. Both ductility and endurance properties may be permanently impaired, although low temp. heat-treatment brings considerable recovery.

785. Kawai, Masayoshi. **Behavior of hydrogen in steel. III.** *Tetsu-to-Hagane* **38**, 9-17 (1952).—*C.A.* **47**, 4819*f*.

The time necessary to remove H_2 from steel by heating was found to be at an optimum 900°C for 2 hrs instead of heating at 800°C for 1-2 hrs. The problem of H_2 escape from steel at ordinary temp. was studied.

786. Kiperman, S. L.; Rybakova, N. A., and Temkin, M. I. **Catalyst reduction by atomic hydrogen.** *Zhur. Fiz. Khim.* **26**, 621-3 (1952).—*C.A.* **47**, 393*f*.

Reduction of WO_3 during 90 hrs at room temp. and then at 300°C during 82 hrs is attempted by means of at. H from a 5000-v. discharge. The resulting catalyst shows higher activity for NH_3 synthesis at atm. pressure than that investigated before. Similar conversions are now obtained at temps. that are 220-30° lower than are necessary with a catalyst reduced with NH_3.

787. Kivnick, Arnold and Hixson, A. Norman. **The reduction of nickel oxide in a fluidized bed.** *Chem. Eng. Progress* **48**, 394-400 (1952).—*C.A.* **46**, 8941*g*.

The course of the reaction was followed by the change in H_2 of the fluidizing gas mixt. between the inlet and outlet of the reactor. The specific-reaction const. was observed to vary as a function of gas velocity, at const. temp., and as a function of temp. at const. velocity. The energy of activation for the over-all reaction was of the order of magnitude of the energy of activation for the adsorption of H_2 on metal oxides. The kinetic step which is effective may be the adsorption of H_2 on NiO.

788. Kostron, H. **Aluminum and gas. II. Blisters and pores.** *Z. Metallkunde* **43**, 373-87 (1952).—*C.A.* **47**, 5855*c*.

H_2 is the only gas which dissolves in Al and its alloys above and below the m.p. The equil. amt. dissolved increases with the square root of the H_2 partial pressure in the atm. and follows an exponential temp. law. The soly. upon solidification drops to $^1/_{19}$ of the original value. Blister formation in melts are discussed from the viewpoint of chemisorption. H_2 is accepted by Al as H^+ and forms solid solns.

789. McGraw, L. D.; Snavely, C. A.; Moore, H. L.; Woodberry, P. T., and Faust, C. L. **A fundamental study of the mechanism by which hydrogen enters metals during chemical and electrochemical processing.** *Natl. Advisory Comm. Aeronaut. Tech. Note* No. **2696**, 43 pp. (1952).—*C.A.* **46**, 7486*g*.

Reagents were found that increase or decrease the H_2 permeability of steels during pickling or plating. H_2 in metals can reduce CCl_4. Hydride formation of the depositing metal during metal deposition can account for embrittlement, even when there is no apparent discharge of H_2. Citrate and tartrate are effective inhibitors of H_2 entry from basic solns. In acid soln. they are not effective unless converted to complex salts with Al. H_2, by forming alloys during chem. or electrochem. reactions at the metal surface, plates into the metal surface. Soln. or compd. formation is essential to entry. Whether a H atom reacts with the metal or a proton is reduced, an alloy must be formed in the process and the entry accomplished.

790. Mignolet, J. C. P. **Nonstoichiometric chemisorption of hydrogen on tungsten and nickel.** *J. Chem. Phys.* **20**, 341-2 (1952).—*C.A.* **46**, 8928e.

The formation of a pos. rather volatile film following that of the normal neg. one was observed in the low-temp. adsorption of H_2 on Cr, W, and Ni. The surface potentials for W were -0.65 v. for the satd. neg. film and 0.2 v. for the satd. pos. film. The pos. films were of a nonstoichiometric chemisorbed nature rather than mol.

791. Norberg, R. E. **Nuclear magnetic resonance of hydrogen absorbed into palladium wires.** *Phys. Rev.* **86**, 745-52 (1952).—*C.A.* **46**, 7873*h*.

Nuclear magnetic resonance signals were observed for H_2 which was absorbed into Pd wires. Steady-state absorption and pulsed "echo" expts.

were performed. The wires were connected as circuit elements and the resonance signals observed were caused by protons contained in the skin layer of wires. Samples were loaded by means of a glow discharge to concns. of 0.2 to 0.8 (expressed as atom ratios H/Pd). The diffusion of the protons among the interstices of the Pd lattice and on the interaction of the protons with the conduction electrons were discussed.

792. Ogawa, Shiro and Watanabe, Denjiro. **Electron-diffraction study on nickel surfaces tarnished in the course of heat-treatment in hydrogen.** *Science Repts. Research Inst., Tohoku Univ., Ser.* **A**, **4**, 41-7 (1952).—*C.A.* **47**, 2110*f*.

When Ni plates for vacuum tubes are annealed in H_2 at 900-1000°C, their surfaces often tarnish and show milk-white appearance. The milk-white surfaces generally give diffuse rings which are entirely different from the Ni pattern. The rings are shown to be due to $(Mg,Ca)SiO_3$ and NiO. The presence of the silicates, even in small quantities, gradually aggravates the grain boundaries upon heat-treatment and finally causes tarnishing of the surfaces.

793. Papp, E.; Zombory, L., and Magyarossy, I. **Determination of hydrogen in aluminum.** *Acta Tech. Acad. Sci. Hung.* **3**, 335-54 (1952) (in German).—*C.A.* **47**, 2636*h*.

H_2 in Al was detd. in a quartz tube (500-mm long and 60-mm inside diam.), a "hot wire" app., and an elec. measuring device. After flushing the app. with dry N_2 and heating the wire with an accumulator, a microammeter was brought to the null point. An Al sample 11 × 2.5 × 1.5 cm (100 g) was melted *in vacuo* in an alundum boat at 800°C and then allowed to solidify. The liberated H_2 was swept through the hot-wire app. with N_2 and the variations in heat conductivity measured with the microammeter. The melting and solidification was repeated. The vol. of H_2 was linearly proportional to the deflection of the microammeter or to the area under the curve when deflection is plotted as a function of time.

794. Parravano, Giuseppe. **The reduction of nickel oxide by hydrogen.** *J. Am. Chem. Soc.* **74**, 1194-8 (1952).—*C.A.* **46**, 6475*h*.

The reduction of NiO by H_2 was studied in the range of 150-350°C and initial pressures of H_2 from 200 to 500 mm. The addn. of Ag_2O, Al_2O_3, Cr_2O_3, Li_2O, MgO, $NiCl_2$, ThO_2, and WO_3 to NiO affected both the rate and activation energy for reduction. These effects were related to the change in the electronic properties of the oxide.

795. Perminov, P. S.; Orlov, A. A., and Frumkin, A. N. **Effect on the pressure on the solubility of molecular hydrogen in the β-phase of the system palladium-hydrogen.** *Doklady Akad. Nauk S.S.S.R.* **84**, 749-52 (1952).—*C.A.* **46**, 10796*c*.

The soly. is detd. by comparison of the H_2 pressure, P, in 2 identical bombs of equal vol. (20 cc.), one contg. Pd and the other Ag. Three samples of Pd were used. The results can be represented by the formula $\ln P = a + b\,([H]/[Pd])$, with the soly. [H]/[Pd] expressed in atom ratio. Values of a and b can be derived from measurements of also the potential, ϕ, of a Pd electrode as a function of [H]/[Pd]; these measurements give the linear relation $[H]/[Pd] = a - q\phi$, hence $[H]/[Pd] = a + (RTq/2F) \ln P$, and $b = RTq/2F$. Values of a and b thus calcd. are in very good agreement with the values from soly. measurements at 273° and at 290°K; the agreement is poorer at 241° and at 323°K.

796. Permitina, N. G. and Shlygin, A. I. **The reaction ability of hydrogen after activated adsorption.** *Zhur. Fiz. Khim.* **26**, 874-7 (1952).—*C.A.* **46**, 10974*b*.

A platinized Pt electrode in 0.1 *N* KOH or H_2SO_4 was satd. with H_2, the excess displaced by N_2, some MeEtC(OH)C:CH added to the soln., and the electrode rotated. Its potential changed (e.g., by 0.18 v. in 30 min.) showing that H_2 was leaving the electrode. This proved that adsorbed H is active in hydrogenation reactions. The change of potential in time was first rapid and then slow.

797. Sastri, M. V. C. and Ramanathan, K. V. **Chemisorption of hydrogen on zinc oxide-molybdenum oxide catalysts. Evidence of heterogeneity of the surface.** *J. Phys. Chem.* **56**, 220-4 (1952).—*C.A.* **46**, 8459*a*.

The chemisorption was studied at const. pressure between 186° and 375°C. At all temps. up to 250°C the adsorption steadily increased with time with no intervening decrease in the amt. of adsorption as the temp. was suddenly raised. On the other hand, between 250° and 375°C each rise in temp. was accompanied by a sudden decrease in the amt. of adsorption, followed by a slow steady increase. These abnormal variations in the adsorption at the higher temps. were explained on the basis of heterogeneity of the surface. The energies of activation for adsorption below 250°C were about 21 kcals.; between 250-300°C they dropped from 21.4 kcals. as the adsorption increased from 1.2 to 1.8 cc.; between 300° to 350°C it dropped from 26.8 to 17.6 kcals. per mole as the adsorption increased from 1.6 to 2.1 cc.

798. Sloman, H. A.; Harvey, C. A., and Kubaschewski, O. **Fundamental reactions in the vacuum-fusion method and its application to determination of oxygen, nitrogen, and hydrogen in molybdenum, thorium, uranium, vanadium, and zirconium.** *J. Inst. Metals* **80**, 391-407 (1952) (Paper No. 1360).—*C.A.* **46**, 4952*a*.

Optimum conditions for detg. the gases and their effect upon properties of the metals are given.

799. Stanley, James K. **The embrittlement of pure iron in wet and dry hydrogen.** *Trans. Am. Soc. Metals* Preprint No. **15W**, 10 pp. (1952).—*C.A.* **46**, 391*d*.

Bend tests with 0.1-in. thick strip, after annealing at 1290° to 2100°F, showed embrittlement after 10 hrs in dry H_2 (−65° dew point) and after 1 hr in wet H_2 (3% H_2O by vol.). Specimens broke through grain boundaries. Brittleness was not due to O_2 content of Fe which was as low as 0.002% but to dissocn. of H_2 to at. H. This moved rapidly into the Fe and at elevated temps. collected at some internal surface such as a grain boundary, slip plane or inclusion, and formed H_2.

800. Stetsenko, A. I. and Tverdovskii, I. P. **Disperse platinum-palladium alloys for adsorption and absorption of hydrogen.** *Zhur. Fiz. Khim.* **26**, 647-58 (1952).—*C.A.* 47, 5758d.

Sorption isotherms at 20°C were studied by the electrochem. method (charging curves). The curves for alloys contg. less than 34% Pt consisted of 2 parts: one that depended on the electrolyte and one that did not. With alloys contg. more than 34% Pt, the entire charging curve depended on the electrolyte. The effect of the electrolyte in the first case gave the possibility of calcg. the sorption isotherms of H_2 with a precision of ±10 to 15% at p_{H_2} equal or less than 1 atm. Only adsorption of H_2 can be observed on alloys with more than 34% Pt.

801. Tompkins, F. C. **Sorption of gases on metal films.** *Z. Elektrochem.* **56**, 360-3 (1952) (in English).—*C.A.* **47**, 4164*a*.

Study of the thermal accommodation coeffs. of H_2 on Fe wires shows that the usual H_2 reduction techniques used in the prepn. of industrial catalysts do not lead to a clean metal surface. Adsorption of H_2 on evapd. films of Fe, conditioned by alternate raising and lowering of the temp. in a temp. range outside that used in the adsorption, shows that H_2 is adsorbed instantaneously at room temp. in the form of atoms with no measurable slow process. At temps. lower than 150°K, it proceeds at a measurable rate. No evidence was found for a sepn. of this process into a rapid surface adsorption followed by a slow adsorption into the bulk of the film. The net rate of adsorption of H_2 varies as the square root of the pressure.

802. Tverdovskii, I. P. and Stetsenko, A. I. **Absorption and solution of hydrogen in disperse palladium-rhodium alloys.** *Doklady Akad. Nauk S.S.S.R.* **84**, 997-1000 (1952).—*C.A.* **46**, 9388f.

Curves of potentials ϕ as a function of the elec. charge Q, in 1 N KOH, H_2SO_4, or HBr, were detd. at 20°C for Pd-Ph electrodes (compn. in at. %) prepd. by codeposition from solns. of $Na_3RhCl_6.12H_2O$ and $PdCl_2$ in varying proportions. Along the portion corresponding to soln. Q increased, and along the portion corresponding to adsorption Q decreased with decreasing Rh content in the alloy. With increasing Rh content, the range of divergence of the curves widened at the expense of the range of coincidence. Above 40 at. % Rh, the whole curve became dependent on the nature of the electrolyte, as for the case of pure Rh. Consequently, the binding of H_2 by high-Rh alloys, and by Rh, was purely adsorptive. The lowering of the adsorption of H_2 in HBr was due to sp. adsorption of Br_2.

803. Vandael, C. **Raney nickel.** *Ind. chim. belge* 17, 581-5 (1952).—*C.A.* **46**, 9396*f*.

A gasometric analysis was made of the amt. of H_2 absorbed by the catalyst. After correcting for the Fe and Cu impurities, there were 1.06 and 0.99 moles of H_2 assocd. with each Ni atom in 2 series of detns., resp. The Ni-H system was also analyzed by titrating with $KMnO_4$ soln.; 1.965 atoms of O were needed to oxidize the H assocd. with one Ni atom.

804. Yasumori, Iwao; Shida, Shoji, and Nakada, Kazuo. **Treatment of atomic adsorption by use of linear atomic chain model. I. Adsorption of atomic hydrogen on alkali metal surfaces.** *J. Chem. Soc. Japan*, Pure Chem. Sect. **73**, 892-5 (1952).—*C.A.* **47**, 6213*g*.

805. Gutmann, Joel R. **The exchange reaction between deuterium and ammonia on the surface of metal powders.** *J. Phys. Chem.* **57**, 309-12 (1953).—*C.A.* **47**, 6233*h*.

The reaction was studied on Fe and Ni powders between 210° and 319°C. The exptl. rate of exchange on Fe was independent of the NH_3 pressure and was of 1st order with respect to D_2. The activation energy was 17.5 kcal./mole. The runs were not reproducible with Ni, and in some cases the rate of exchange was slow in the beginning but increased as the reaction proceeded.

806. Keeler, J. H. and Davis, H. M. **Density and hydrogen occlusion of some ferrous metals.** *J. Metals* **5**, Trans. 44-8 (1953).—*C.A.* **47**, 1555*d*.

Densities of SAE 1020 and ingot Fe decreased with cold-rolling to minima at 60% reduction, whereas high-purity Fe was unaffected. H_2 occlusion of high-purity Fe or ingot Fe was barely affected by 60% cold reduction, but that of SAE 1020 was increased a hundred-fold.

807. Krylov, O. V. and Roginskii, S. Z. **Oxidation of hydrogen on oxygen-activated platinum.** *Doklady Akad. Nauk S.S.S.R.* **88**, 293-5 (1953).—*C.A.* 47, 5232*g*.

On a smooth Pt foil (~1 cm^2 apparent surface area), outgassed *in vacuo* at 800°C, oxidation of a 2 $H_2 + O_2$ mixt. under low pressures (0.01 – 0.2 mm Hg) begins at a slow rate, the activity of the catalyst increasing gradually as the reaction progresses. In contrast, Pt foil activated 15 min. with 0.1 mm O_2 at 250-500°C, shows full activity from the very start of the reaction; at 0°C, the reaction (in a static system, vol. of vessel ~600 ml, initial pressure 0.1 mm) is complete in 10-30 min. The amt. of O_2 sorbed by the same Pt foil, in 15 min. exposure, increases steadily and ever more rapidly between 290° and 800°C. At 700°C, the catalytic activity, as a function of the amt. of O_2 sorbed, passes through a max. Thus, O_2 sorbed at a high temp. and in an amt. corresponding to 6 monolayers or more, takes no part in the production of active centers.

808. Laidler, Keith J. **Kinetics of surface reactions in the case of interactions between adsorbed molecules.** *J. Phys. Chem.* 57, 318-19 (1953).—*C.A.* **47**, 6234*f*.

The effect of interactions between adsorbed mols. on the abs. rates of surface reactions, with special reference to the para-H_2 conversion, was considered. The interactions affected the no. of dual surface sites and also the partition function for the surface sites. The 2 effects were shown to cancel exactly for a fully covered surface. In calcg. abs. rates it was therefore correct to omit interaction terms.

809. LAIDLER, KEITH J. **Mechanisms of surface-catalyzed reactions. I. The para-hydrogen conversion on tungsten.** *J. Phys. Chem.* **57**, 320-1 (1953).—*C.A.* **47**, 6234*g*.

The rate was controlled by adsorption of H_2 on a bare dual surface site. If the variation of rate const. *k* with *p* was taken into account, the mechanism explained the low reaction orders of close to zero. It was also consistent with the observed abs. rates. The mechanism involving reaction between an adsorbed atom and a gaseous mol. or a van der Waals adsorbed mol. was incapable of explaining either the order or the abs. rate.

810. MALLETT, M. W.; GERDS, A. F., AND GRIFFITH, C. B. **Determination of hydrogen in magnesium, lithium, and magnesium-lithium alloys.** *Anal. Chem.* **25**, 116-19 (1953).—*C.A.* **47**, 2637*a*.

The alloy was heated *in vacuo* at 500°C. Gas was evolved at about 3 ml per min. for nearly 3 hrs and the H_2 was detd. in an Orsat app. The specimen was also sealed in a welded steel capsule and heated 4-5 hrs in a quartz tube at 750°C. Rather high results were obtained. The sample was also dissolved in molten Sn at 450°C and heated in an evacuated borosilicate glass tube. This method was suitable for detg. H_2 in pure Mg and possibly pure Li if care was taken to protect the sample from air while it was being weighed and loaded into the furnace. The samples tested contained 0.008-0.015% H_2.

811. MARKHAM, MARIA C.; WALL, MARY C., AND LAIDLER, KEITH J. **Molecular kinetics and mechanism of methane-deuterium exchange reactions on nickel.** *J. Phys. Chem.* **57**, 321-3 (1953).—*C.A.* **47**, 6234².

CH_3D was considered to be formed from adsorbed CH_3 and D_2 on evapd. Ni and the rate of production of CH_3D was shown to be approx. equal to the rate of adsorption of CH_4 as CH_3 radicals. CH_2D_2, CHD_3, and CD_4 were considered to be formed by reaction between adsorbed CH_2 radicals and adsorbed D atoms, and a treatment was given for the relevant statistical factors. Calcd. rates for all 4 processes were in agreement with the exptl. rates.

812. SHIELDS, BRUCE M.; CHIPMAN, JOHN, AND GRANT, NICHOLAS J. **Thermal conductivity method for analysis of hydrogen in steel.** *Metals* **5**, *Trans.* 180-4 (1953).—*C.A.* **47**, 2635*h*.

The vacuum Sn-fusion method of analysis for H_2 was modified to permit the analysis of the evolved gases for H_2 by means of a thermal cond. cell. A properly prepd. sample could be analyzed in 10 min. with a probable error of ±0.12 p.p.m. A study of various methods for storage of H-samples showed that samples can be safely held in a Dry Ice-acetone bath as long as 6 days. Storage in liquid N_2 was necessary for samples to be held one week or more.

813. SKEI, T.; WACHTER, A.; BONNER, W. A., AND BURNHAM, H. D. **Hydrogen blistering of steel in hydrogen sulfide solutions.** *Corrosion* **9**, 163-72 (1953).—*C.A.* **47**, 5864*a*..

Extensive damage to some refinery equipment has occurred owing to transmission through steel of the H_2 formed during corrosion of steel by H_2S solns. Damage in the form of H_2 blistering, fissuring, and embrittlement of steel has been particularly severe in catalytic cracking gas plants. The lab. method involved measurement of the vol. of H which passed through to the opposite side of a thin wall of C steel. It was shown that the rate of H_2 transmission can be reduced greatly by indicated changes in chem. environment (presence of O, use of alloys, etc.).

814. YAO, Y. L. AND MILLIKEN, K. S. **Storage of solid steel samples for hydrogen analysis.** *Anal. Chem.* **25**, 363-4 (1953).—*C.A.* **47**, 4245*h*.

After the sample is cut to size, clean in ether, dry, and weigh. Then dip in molten Sn for a few sec. Cover the Sn bath with fused $ZnCl_2$. On immersing the sample in the Sn bath with a quick motion, the smudge coalesces to form a light mass partly covering the Sn. Take the sample from the bare and clean surface of Sn. The wt of Sn in the coating is usually 5-10% of the wt of the sample. It can be stored for a few days without diffusion of appreciable quantities of H_2.

I-7. Gases on Metals

815. BOWDEN, F. P. AND HUGHES, T. P. **The friction of clean metals and the influence of adsorbed gases. The temperature coefficient of friction.** *Proc. Roy. Soc.* **A 172**, 263-79 (1939).—*C.A.* **33**, 8465³.

The removal of oxide and surface films increased the kinetic friction between the outgassed metals, in some instances to 20 times the value for the same metals cleaned in air. The addn. of a trace of O_2 to the clean metal caused an immediate reduction in friction.

816. GOLDOVSKIĬ, M. L. **Friction of pure metals and the influence of adsorbed gases. The temperature coefficient of friction.** *Uspekhi Fiz. Nauk* **25**, 373-6 (1941).—*C.A.* **37**, 3314³.
Review.

817. MÜLLER, ERWIN W. **Tearing off adsorbed ions by high electric field strengths.** *Naturwissenschaften* **29**, 533-4 (1941).—*C.A.* **39**, 4002³.

A monocrystal W point electrode with adsorbed Ba film is focused in an electron microscope as cathode with field electron emission. By changing of polarity a high positive field strength of several 10^8 v. per cm can be applied. The pos. field tears off part of the adsorbed Ba film. The loosening starts with 82×10^6 v. per cm on the 110 plane of W, it spreads to other planes with increasing field strength, the 100 plane comes last; at 120 v. per cm the entire film disappears.

818. ALTPETER, WALTER. **The removal and absorption of nitrogen by molten steel in the basic**

arc furnace. *Stahl u. Eisen* 62, 997-1001 (1942).--*C.A.* 37, 5346^7.

Changes in N_2 content of molten steel from melting to tapping were detd. in 102 com. melts from 3 furnaces. Initial N_2 content at the end of melting depended on furnace atm. which may have been abnormal because of leaks. Final N_2 did not depend on furnace atm., although N_2 contents of 0.001% were obtained only in newly rammed furnaces; usual contents were 0.003 to 0.005%. N_2 removal was most rapid with quick decarburization and the use of fine ore. Temp. of steel was not a controlling factor. Ni, Cr and Mo did not retard removal of N_2 during melting or tapping.

819. ARMBRUSTER, MARION H. **The adsorption of gases at low temperature and pressure on smooth silver.** *J. Am. Chem. Soc.* 64, 2545-53 (1942).—*C.A.* 37, 16^3.

The adsorption of H_2, N_2, A, CO, CO_2, and O_2 at pressures up to 0.1 cm on a substantially plane, reduced surface of Ag was measured over the range 195° to 20°C. H_2 was not measurably sorbed at any temperature; A, N_2, and CO were sorbed at -195° and -183°, but not at -78° or 20°C. CO_2 was not sorbed at 20°, but at -78°C was sorbed to the slight extent of 6 ml at a pressure of 0.02 cm. The adsorption was in each case instantaneous and reversible. O_2 was sorbed at -195° and -183°C and some part of it could not be removed by pumping at that temperature. At -78° and 20°C, there was activated adsorption of O_2. All the isotherms were of the type observed in a plane surface of other metals and were satisfactorily represented by the Langmuir equation. The surface coverage varied from about 20 to 90% of a close-packed monolayer.

820. BAUKLOH, WALTER AND EDWIN, BJORN. **The effect of temperature and pressure on the disintegration of CO and the action of the explosive effect of carbon.** *Arch. Eisenhuttenw.* 16, 197-200 (1942).--*C.A.* 37, 5903^3.

The CO disintegration ($2CO \rightleftarrows C + CO_2$) is a special case of a slow adsorption catalysis which assumes technical importance in the presence of suitable catalyzers such as Fe, Ni or Co. The adsorption of CO by the metallic surface is connected with an increase in its activity. There exists a max. of disintegration which depends on temp. The disintegration increases with increasing pressure (at const. temp.) to an asymptotic max. value. The explosive effect is explained by the growth of carbon preferably in the direction of pressure, and if a resistance is offered in this direction (wall or other metal part) C and also the metal (Fe) particles are deformed.

821. DANKOV, P. D.; KOCHETKOV, A. A., AND SHISHAKOV, N. A. **Oxide films on metals. II. Initial oxide films on aluminum.** *Bull. acad. sci. U.R.S.S., Classe sci. chim.* 1942, 274-85 (English summary).—*C.A.* 39, 1582^3.

Very complex relations exist between the metal and the oxide, with possible existence of unstable oxide forms. The primary Al oxide should be classed with the amorphous substances. Much of the earlier work is controversial and conflicting because of different methods of sample prepn.

822. GRAAF, J. E., DE, AND HAMAKER, H. C. **Adsorption of gases by barium.** *Physica* 9, 297-309 (1942).—*C.A.* 37, 4286^5.

The adsorption of H_2, O_2, CO, CO_2 and N_2 was detd. on a series of Ba films vaporized under various conditions. The adsorptive power of Ba was increased by vaporizing it in A with increasing A pressure up to a max. at 5 mm. Similar notable improvements resulted on vaporizing in Xe and Ne, whereas He proved less effective. Ba films vaporized also in CO_2, CO and N_2 at low pressure (optimum 0.4 mm) had better adsorptive power for N_2, e. g., than Ba films prepd. in vacuum. The chemically active gases such as H_2 and O_2, on the other hand, were ineffective. The improvement in the films went hand in hand with an increase in the surface of the Ba layer. A coarsening of the Ba structure and with it a decrease in the adsorptive power resulted from warming the substrate of the film (glass or metal) during the vaporizing of the Ba.

823. GRIFFIN, CARROLL W. **The sorption of carbon monoxide by metals. Temperature variation experiments.** *J. Am. Chem. Soc.* 64, 2610-13 (1942).—*C.A.* 37, 16^6.

Measurements are made for the sorption of CO on supported Cu and on massive and supported Pt. The results are qualitatively similar to like measurements of H_2 on massive and supported metals. The presence of a secondary sorptive force is probably a general characteristic of metallic sorbents and is present only to a small extent with supported sorbents where the metal is largely exposed as surface. With CO on massive metals, the secondary action is over 3 times as great with Pt, and about ten times as great with Cu, when compared with their respective supported forms.

824. GUILLET, LÉON, JR. **Gases and metals. The influence of the gases absorbed in metals on their properties.** *Génie civil* 119, 134-6 (1942).—*C.A.* 38, 319^4.

The kind and quantity of gases in metals were studied. The influence of the gases on the properties of the metal, how it can be overcome, and how they form inclusions in the forged steel were discussed.

825. GULBRANSEN, E. A. **Thin oxide films on iron.** *Trans. Electrochem. Soc.* 81, 11 pp. (1942).—*C.A.* 36, 2824^7.

A vacuum microbalance technique for the study of chem. reactions occurring on metallic surfaces was described. Preliminary curves were presented for the oxidation of pure electrolytic Fe from 25° to 400°C and at various pressures of O_2. Attempts were made to correlate the data with the various mechanisms proposed for oxidation reactions.

826. HUTTIG, GUSTAV F.; THEIMER, HELLMUT, AND BREUER, WALDEMAR. **Reactions of solids. CXXVI. Degassing of solids.** *Z. anorg. allgem Chem.* 249, 134-45 (1942).—*C.A.* 37, 3658^9.

The loss of volatile foreign components of powd. Cu, Fe, Sn and Al_2O_3 was measured with rising temp. Sep. detns. were made of H_2 (burning with CuO), H_2O (absorption in P_2O_5), and N_2 (absorption in molten Li). The regularities found in the release of gas consisted of 2 maxima in the rate of degassing, at $\alpha = 0.29 \pm 0.02$ and $\alpha = 0.42 \pm 0.01$, in which $\alpha = (273 + t°)/T_F$, T_F being a characteristic temp. of the powd. material. The 1st max. corresponded to a loosening of the surface, the 2nd to that of the crystal lattice.

827. IIJIMA, SHUNICHIRO **Dissociation of silver oxide at low temperature.** *Bull. Inst. Phys. Chem. Research (Japan)* **21**, 737-43 (1942).—*C.A.* **41**, 5366*i*.

By use of a thermal balance with which pressure can be detd., the decompn. of Ag_2O according to $Ag_2O = 2Ag + 0.5\ O_2$, was found to begin at 230-70°C. It was affected only slightly by the O_2 pressure. The oxidation of Ag into Ag_2O did not occur at any temp. when the O_2 pressure was below 760 mm, and the reverse reaction velocity of the dissocn. equil. at low temp. was too small to be detected.

828. LAURENT, A. **Dissolved gases in metallurgical products.** *Métaux, corrosion-usure* **17**, 113-23 (1942).—*C.A.* **38**, 2597⁵.

Comparative tests were made with 99.7% Al: (1) heating to 600°C for 1 month under a pressure of 10^{-4} mm Hg, (2) fusion under the same reduced pressure and (3) bombardment in the cold repeated 3 times (4 bombardments) at intervals of 24 hrs. The vols. of gas liberated (cc. per 100 g of metal) were 12.5 for the first method, 20.0 for the 2nd, and 216 for the 3rd.

829. MORITA, NORIYOSHI. **The catalytic exchange reactions of oxygen atoms between gaseous oxygen and water vapor by iron oxide catalyst. I. Experimental.** *J. Chem. Soc. Japan* **63**, 659-64 (1942).—*C.A.* **41**, 2974*h*.

Four catalysts: (1) α-Fe_2O_3, (2) γ-Fe_2O_3, (3) $Fe_2O_3 + Bi_2O_3$(2:1 by wt), (4) Bi_2O_3 were prepd. Their catalytic activities were detd. in the exchange reactions of O atoms in O_2 and water vapor. (1), (2), and (3) showed about the same activity. The activity of (1) and (2) decreased with repeated use. All 4 catalysts lost their catalytic activity when heated above 800°C. The temp. of the exchange reaction was 300-700°C.

830. MORITA, NORIYOSHI. **The catalytic exchange reactions of oxygen atoms between gaseous oxygen and water vapor by iron oxide catalyst. II. Theoretical.** *J. Chem. Soc. Japan* **63**, 665-7 (1942).—*C.A.* **41**, 2974*i*.

The decrease in the catalytic activity of the catalysts caused by heating above 800°C is attributed to the decrease of the active centers and the elevation of the activation energy.

831. SMOLUCHOWSKI, R. **Diffusion rate of carbon in iron-cobalt alloys.** *Phys. Rev.* **62**, 539-44 (1942).—*C.A.* **37**, 819⁵.

Studies of rates of various transformations and reactions in Fe alloys seemed to indicate that certain elements have a definite effect on the rate of diffustion of carbon in γ-Fe. Direct measurement was made of the rate of diffusion of carbon in Fe-Co alloys. An addn. of 4% Co decreased the activation energy from 32,500 to 30,000 cal., corresponding to an almost twofold increase of the diffusion rate at 1 at. % carbon concn. At higher carbon contents the accelerating effect of Co was smaller.

832. THOMAS, LLOYD B. AND OLMER, FRANCOIS G. **The accommodation coefficient of mercury on platinum and the heat of vaporization of mercury.** *J. Am. Chem. Soc.* **64**, 2190-5 (1942).—*C.A.* **36**, 6404⁷.

The accommodation coeff. of Hg on Pt was measured at low Hg pressures. It was found to approach unity as the temp. difference between the filament and wall approached zero and to fall off about 0.08 for each 100°C of this temp. difference. The data obtained in the measurements allowed a calcn. of the heat of vaporization of Hg.

833. BÉNARD, J. **Role of diffusion in surface oxidation of iron.** *Métaux, corrosion, usure* **18**, No. 2, 20-9 (1943).—*C.A.* **44**, 9781*c*.

The rate of oxidation of pure Fe at 250-900°C was investigated. The chem. nature of the films formed and the mechanism of the diffusion of metal through the oxide film were discussed.

834. CHAUDRON, GEORGES. **Gas problem in aluminum.** *Usine* **52**, No. 21, 8 (1943).—*C.A.* **38**, 5765⁸.

Ionic treatment of Al in the elec. field of 100,000 or better 130-140,000 v. and analysis of the liberated gases showed for a total quantity of 85 cc. per 100 g Al: 15 cc. CO, 58 cc. H_2 and 10 cc. N_2. Errors can be caused by fat or grease films on the Al surface or too great thickness of the sheets. In practice, H_2 was absorbed in the Al electrolysis, in pickling and rolling by dissocn. of moisture and was present in ionic form embedded in the crystal lattice. CO was absorbed from combustion gases and together with H_2 liberated by dissocn. of fat. N_2 was absorbed in at. form (dissocn. takes place at 1200°C) and existed as solid soln.

835. DUHN, J. H. v. **The effect of adsorbed layers of molecules of dielectric substances on the contact difference of potential between two metals.** *Ann. Physik* **43**, 37-52 (1943).—*C.A.* **38**, 1939².

Vapors of a series of dielec. liquids, such as members of the paraffin and alc. series, benzene, chlorobenzene, and toluene, and also H_2 were allowed to form adsorptive layers on a series of metallic surfaces, and the potentials were measured with respect to a standard electrode by the Kelvin method. In some cases the contact difference of potential was found to be a function of the pressure of the vapor; this effect was ascribed to change in the thickness of an adsorbed layer, or change of penetration of the foreign mols. in the lattice of the metal. Correlations with the electron structure of the metal were noted, also with the mol. refraction of the adsorbed material. Values of the order of ±0.8 v. were observed.

836. FRENKEL, YA. I. **Theory of the formation of oxide films on the surfaces of metals.** *J. Exptl. Theoret. Phys. (U.S.S.R.)* **13**, 289-94 (1943).—*C.A.* **39**, 1099³.

The formation of thin oxide films on metals in the presence of air takes place via adsorption of O_2, dissocn. of the adsorbed O_2 into O atoms, and diffusion of the latter via the intercryst. spaces involving a deformation of the lattice into a thin surface layer of the metal itself.

837. Goldfeld, Yu. M. and Kobozev, N. I. **Experimental study of the role of the action of forces in the adsorption process. II. Adsorption kinetics.** *J. Phys. Chem. (U.S.S.R.)* **15**, 275-95 (1943).—*C.A.* **38**, 4481⁹.

The kinetics of desorption of CO, H, C_2H_4 and C_4H_6 on Cu is always markedly greater than first-order. With increase in temp. the abs. value of the desorption velocity increases and the order decreases. If the Cu has previously adsorbed CN, the velocity of desorption of CO and the order of the desorption curve are both raised. Moreover the subsequent introduction of CN to CO adsorbed on Cu increases the desorption of CO manyfold. An equation is derived for the velocity of desorption that represents the exptl. findings qualitatively.

838. Gulbransen, E. A. **The transition-state theory of the formation of thin oxide films on metals.** *Trans. Electrochem. Soc.* **83**, 13 pp. (1943).—*C.A.* **37**, 2251³.

The expression involved an entropy of activation as well as the energy of activation. Exptl. results indicated that the oxidation of Fe, stainless steel and Cu followed the parabolic law for certain temp. ranges and pressure ranges after a certain initial period. The parabolic rate law consts. were shown to follow a straight line when log K was plotted against 1/T. Energies of activation of 22,600, 29,600 and 24,900 were found for Fe, stainless steel and Cu, resp.

839. Hirashima, M. **Carbonization of the thoriated tungsten filament.** *J. Inst. Elec. Engrs. Japan* **63**, 867, (1943).—*C.A.* **42**, 44*d*.

A new type of thoriated W has been produced by coating the W with an aq. soln. of Th nitrate and heating this block in an inert gas to diffuse the Th into the W. The emission characteristic of this new-type cathode was almost the same as that of the usual thoriated W cathode. The W crystals became finer.

840. Hurt, David M. **Principles of reactor design—gas-solid interface reactions.** *Ind. Eng. Chem.* **35**, 522-8 (1943).—*C.A.* **37**, 4001².

Over-all reaction rates were shown to be a function of surface reaction rates and diffusional, or mass-transfer, rates, and these component factors were individually correlated with their resp. important variable. The new terms H.R.U. (height of over-all reaction unit) and H.C.U. (height of catalytic unit or surface reaction unit) were introduced as measures of over-all reaction rate and surface reaction rate, and used in conjunction with a conventional gas-film H.T.U. as a measure of mass-transfer rate. Data for the oxidation of SO_2 on Pt catalysts were given to illustrate the method.

841. Hüttig, Gustav F. and Freitag, Tibor. **Reactions in the solid state. CXXXIII. The fritting of aluminum powders in a vacuum and in hydrogen.** *Z. anorg. Chem.* **252**, 95-111 (1943).—*C.A.* **38**, 3888².

The adsorption of CH_3OH vapor by Al powders, subjected to preheating in vacuo and in H_2, was detd. The adsorption isotherms were interpreted on the basis of Langmuir's theory. The surface activity depended on the preheating and other factors. Slight addns. of HCl to H_2 increased the activity noticeably.

842. Ishikawa, Yoshioki. **Desorption of the water molecules adsorbed on a platinum plate by slow-electron impact.** *Proc. Imp. Acad. (Tokyo)* **19**, 380-4 (1943) (in English).—*C.A.* **41**, 5382*i*.

A Pt plate, composing the anode of a diode after a thorough outgassing at 350°C and introduction of a trace of H_2O vapor, was bombarded by slow electrons. The H_2O desorbed from the Pt surface was detd. by the Pirani gage. When the amt. of H_2O desorbed in 3 min. over i (impinging electrons in ma.) was plotted against the accelerating voltage, the resulting desorption curve showed many breaks between 5 and 30 v. The H_2O mol. dissocd. with rising voltage in 5 steps; $H+OH^+$, H_2+O^+, $OH+H^+$, $O+H_2^+$, and $H+H^++O^-$.

843. Ishikawa, Yoshioki. **Determination of the thickness of an adsorbed molecular layer of water.** *Proc. Imp. Acad. (Tokyo)* **19**, 385-92 (1943).—*C.A.* **41**, 5358*a*.

The thickness of an absorbed layer of H_2O on a Pt plate was detd. by desorption of H_2O by slow electron impact. When the amt. of the desorbed H_2O in 3 min. over i (impinging electrons in ma.) was plotted against the voltage, 3 curves for the uni-, bi-, and tri-mol. layer desorptions were obtained.

844. Matuda, Syoiti. **Theory of self-diffusion of metallic crystals.** *Sci. Papers Inst. Phys. Chem. Research (Tokyo)* **40**, 207-27 (1943).—*C.A.* **41**, 6099*g*.

The diffusion coeff. is discussed from the view point that the atoms travel through vacant lattice positions (the Schottky holes) which are formed in several lattice points in the crystal.

845. McBain, J. W. and Glassbrook, Clarence I. **Electrification and luminescence phenomena accompanying desorption of gases from metals.** *J. Am. Chem. Soc.* **65**, 1908-9 (1943).—*C.A.* **38**, 17⁷.

When various gases are passed over a metal that is cooling during sorption and desorption, the gas stream on the outward side becomes electrified. It causes a luminescence on the walls of a silica tube. These effects are ascribed to very fine electrified ultramicroscopic particles released from the metal.

846. Smoluchowski, R. **Diffusion rates of carbon in iron-molybdenum and iron-tungsten alloys.** *Phys. Rev.* **63**, 438-40 (1943).—*C.A.* **37**, 4608⁴.

The effects of W and Mo on the rate of diffusion of carbon in face-centered Fe was studied at 1000°C. Both elements retarded the diffusion of carbon, the effect of W being more than twice that of Mo. There was no connection between the variation in lattice parameter of face-centered Fe and the variation in the diffusion rate of carbon.

847. Suhrmann, R. and Kundt, W. **Influence of adsorbed oxygen on the secondary emission of evaporated metallic layers at 293° and 83°K.** *Z. Physik* **121**, 118-32 (1943).—*C.A.* **37**, 6543³.

The yield of secondary electrons was studied for Cu, Ag, Au, Cd and Be layers evapd. on glass in a vacuum and exposed to O_2 at room temp. for a short time. The yield at room temp. for Cu, Ag and Au was only slightly affected, but when these O_2-treated layers were cooled to 83°K the yield with 100-v. primary electrons increased reversibly by 100%, and the max. yield shifted to smaller primary-electron energy.

848. THOMAS, LLOYD B. AND OLMER, FRANCOIS. **The accommodation coefficients of He, Ne, A, H_2, D_2, O_2, CO_2 and Hg on platinum as a function of temperature.** *J. Am. Chem. Soc.* **65**, 1036-43 (1943).—*C.A.* **37**, 4609².

The desirability of having uniform temp. throughout the length of the filament for accommodation-coeff. measurements were indicated. A tube designed to give this condition was described. Accommodation coeffs. for the above 8 gases were obtained with this tube over a range of temp. and compared with existing values.

849. ARMBRUSTER, MARION H. AND AUSTIN, J. B. **The adsorption of gases on smooth surfaces of steel.** *J. Am. Chem. Soc.* **66**, 159-71 (1944).—*C.A.* **38**, 1412⁹.

The adsorption on cold-rolled steel of A, Ne, H_2, N_2, CO and CO_2 was detd. at 20°, -78°, -183° and -195°C and at pressures up to 0.1 cm. Measurements were made first on a degreased and outgassed surface and subsequently on the same surface after reduction by H_2. Neither H_2 nor Ne was measurably adsorbed on either surface within the range of temp. or pressure investigated. A unimol. layer of physically held N_2, A or CO was sorbed on the unreduced surface at -183°C, but in each case approx. 15% of the total vol. sorbed could not be desorbed by reducing the pressure at that temp. A similar monolayer of physically held N_2 and A on the reduced surface could be entirely desorbed by evacuation of the system at the temp. in question. On this same surface a complete monolayer of physically held CO was adsorbed along with a partial layer of chemisorbed mols. The isotherms were the low-pressure section of the sigmoid-type characteristic of adsorption on Fe catalysts. The B.E.T. equation appeared to be preferable.

850. DEBEAU, DAVID E. **The effect of adsorbed gases on contact electrification.** *Phys. Rev.* **66**, 9-16 (1944).—*C.A.* **38**, 5446³.

The electrification produced on contact of quartz and of NaCl on Ni in atms. of air, O_2 and N_2 was measured. Contact electrification was a surface phenomenon and depended greatly on the nature of the surfaces involved. At least two layers of adsorbed gas played an important part in the phenomenon of contact electrification. In the pressure range from 760 to 30 mm at least one layer of adsorbed gas was removed. At pressures below 0.1 mm at least a second layer of adsorbed gas was removed. In this pressure range the major contribution to the charge sepn. was made by the surface from which the second layer of gas had been removed. A fit of the data to Langmuir adsorption isotherms was obtained. Water vapor and perhaps H_2 acted as surface-poisons.

851. EICHBORN, JOHANN LUDWIG VON. **Mutual adhesion of substances not miscible spatially. II. Evidence of adhesion in condensed moisture and hysteresis of the borderline of water drops on mercury surfaces.** *Kolloid-Z.* **109**, 62-78 (1944).—*C.A.* **41**, 2959*d*.

Moisture from breath or from distd. water vapor condensed on a clean Hg surface and then evapd. leaves a visible mark on the Hg surface at the point of the Hg-H_2O-air interface. The angle of contact of the surfaces affects this phenomenon.

852. ERICKSON, JAMES L. **Degassing aluminum.** *Light Metal Age* **2**, No. 4, 19-22 (1944).—*C.A.* **38**, 4889².

The topics covered were: gases present in Al, the Al-H_2 system (gas-metal alloy), entrance of gases into the metal, soly. of H_2 and N_2 in Al, methods for the removal of H_2 from Al melts, degassing by the use of an inert gas (N_2), methods advocated for the removal of gases from Al and its alloys, chlorination and the use of Cl-evolving compds. These were discussed from the point of view of foundry technique in the prevention of porosity in Al castings.

853. GALLAGHER, CHARLES J. **Adsorption of thorium on tantalum.** *Phys. Rev.* **65**, 46-50 (1944).—*C.A.* **38**, 2253².

Th was evapd. from thoriated W onto a well-outgassed Ta ribbon, and the thermionic emission at 1390°K was studied as a function of the time of evapn. The work function of the ribbon changed from 4.07 volts to 2.52 volts and the emission const. decreased by a factor of 30. The ribbon was then held at 1550°K and the emission from the two sides was studied separately. The emission from the activated side decreased, whereas that of the clean side increased until both reached the same final level after about 20 hrs. This indicated that the adsorbed Th migrated around the edges of the ribbon and distributed itself uniformly over the emitting surface.

854. GILBERT, F. AND SCHEUER, E. **Factors influencing the moisture content of furnace atmospheres.** *Metallurgia* **30**, 187-90 (1944).—*C.A.* **38**, 5697⁷.

The sources of moisture in order of importance are the H-content of the fuel, the H_2O content of the air used for combustion, the H_2O content of the fuel. If the H-content of the fuel is more than 5%, it is the predominating source of moisture and no changes in the H_2O content of the air or fuel are significant. H_2O content of the fuel plays a significant part only if atm. H_2O and H-content of the fuel are low.

855. GULBRANSEN, EARL A. **A vacuum microbalance for the study of chemical reactions on metals.** *Rev. Sci. Instruments* **15**, 201-4 (1944).—*C.A.* **38**, 6135⁸.

The torsion micro balance consists of a frame constructed of fused quartz rods of 1/8 in. diam. and a beam of 0.073 in. quartz rod. Wires for supporting the beam and weights are of 0.001 in. diam. W attached by means of fused AgCl. The sensitivity is 0.3×10^{-6}g, with a 0.6840 g sample. With the balance, enclosed in a glass tube and with suitable auxiliary app. the kinetics of formation of films from -90° to 1000°C and for pressures of gas ranging from 10^{-5} mm of Hg to 1 atm. can be studied.

856. Hedvall, J. A. **Effect of supersonic waves on surface reactions of metals.** *Tek. Tid.* 74, 625-6 (1944).—*C.A.* 39, 5150².

The rate of formation of surface reaction products was studied when Cu was exposed to I_2 vapor or S fumes, and Fe to O_2. The specimens could be subjected to supersonic waves with a quartz oscillator. A marked increase in the reaction rate was produced by supersonic waves.

857. Kochetkov, A. A. **The kinetics of formation of oxide passivating films on iron.** *Bull. acad. sci. U.R.S.S., Classe sci. chim.* 1944, 390-5 (English summary).—*C.A.* 39, 3196¹.

Pyrophoric Fe (particle diam. about 10^{-4} cm) was prepd. by reducing Fe_2O_3 with H_2 at 280-340°C. This burned in air to α-Fe_2O_3, but at pressures of about 1 mm the rate of oxidation could be measured. In dry air, O_2 was absorbed for 15-20 min., and then absorption stopped. If the Fe was then heated to 210°C, more O_2 was absorbed in accordance with the parabolic law. If moist air was used, O_2 absorption stopped as before, but on long standing there was an increase in wt of about 1 mg per day, owing to corrosion of Fe.

858. Kodama, Shinjiro; Matsumura, Shoichi; Tarama, Kimio, and Yoshimori, Keisuke. **IX. Adsorption of carbon monoxide on cobalt, cobalt-kieselguhr, and cobalt-kieselguhr-thoria catalysts.** *J. Soc. Chem. Ind. Japan* 47, 1-5 (1944).—*C.A.* 43, 2413*d*.

The adsorption of CO was measured at 0°-250°C. In all cases adsorption accompanied by decompn. of CO and formation of metallic carbide took place above 110°C, and ordinary activated adsorption took place below 110°C. The addn. of kieselguhr and ThO_2 greatly increased the no. of centers of activity and promoted the formation of carbide.

859. Kodama, Shinjiro; Matsumura, Shoichi; Tarama, Kimio, and Yoshimori, Keisuke. **XII. Adsorption of carbon monoxide on iron, iron-kieselguhr, iron-kieselguhr-copper-manganese catalysts.** *J. Soc. Chem. Ind. Japan* 47, 1-5 (1944).—*C.A.* 43, 2413*e*.

Adsorption of CO at 0-300°C was measured. Formation of carbide took place above 150°C, and the addn. of kieselguhr and (Cu + Mn) greatly increased the velocity. The effectiveness of kieselguhr as carrier and promoter in gasoline synthesis was thought due to the increase in the number of active centers for H_2 and CO, the increase in the amt. of activated adsorption of H_2, and the velocity of carbide formation. The effectiveness of Cu + Mn as promoter lay in the increase in the no. of active centers for carbide formation.

860. Moreau, L. **Absorption of nitrogen into iron during dry machining.** *Métaux, corrosion, usure* 19, 53-4(Mar.-Apr.) (1944).—*C.A.* 46, 2461*e*.

N_2 was detd. in large test-pieces obtained by cutting and then rolling, in milling chips, and in fine milling powder. The temp. at the surface when test-pieces were obtained by dry-machining was sometimes above the m.p. of the metal and resulted in nitriding.

861. Nakata, Shigeo and Chitani, Toshizo. **Catalytic oxidation of carbon monoxide on the surface of silver. III. Experiment at 150-240°C.** *J. Chem. Soc. Japan* 65, 305-9(1944).—*C.A.* 41, 3354*d*.

The reaction velocity is proportional to the partial pressure of O_2 when the oxide fraction is 0-0.85. The catalyst gradually loses its activity. The activity is recovered when the catalyst is heated at 200°C in the presence of H_2.

862. Norton, F. J. and Marshall, A. L. **The degassing of metals.** *Am. Inst. Mining Met. Engr., Inst. Metals Div., Tech. Pub.* No. 1643, 10 pp. (1944).—*C.A.* 38, 1193⁶.

A comprehensive study was made of the degassing of Mo to det. how rigorous a treatment was necessary to remove completely sorbed gases from Mo electrodes in vacuum tubes. The technique, manipulation, analytical procedures, prepn. of samples, were given and the results discussed in terms of the nature of the gas, the permanence of degassing, the degassing of W and Ni, graphite, the absorption of N_2 and CO by Mo and W.

863. Rolf, Pauline. **The accommodation coefficient of He on Pt.** *Phys. Rev.* 65, 185-9 (1944).—*C.A.* 38, 2867⁷.

Detns. were made at 77°, 193°, 273°, and 373°K and the values obtained at these temps. for a clean Pt surface were 0.090, 0.043, 0.071 and 0.072 (±0.004), resp. When the Pt was allowed to remain in contact with the He for 24 hrs or more, the accommodation coeff. increased to 0.43, 0.071, 0.170 and 0.170 (in the same temp. order). Little adsorption occurred at 193°K, but strong van der Waals adsorption appeared at 77°K and activated adsorption at higher temps.

864. Takayasu, Masaaki. **Copper catalyst. I.** *J. Chem. Soc. Japan* 65, 46-9(1944).—*C.A.* 41, 3353*g*.

The amt. of residual oxygen was detd. in various kinds of Cu prepd. by the reduction of various Cu oxides at 200°, 250°, and 300°C. The results were summarized.

865. Takayasu, Masaaki. **The preparation of contact catalysts.** *J. Chem. Soc. Japan* 65, 686-90 (1944).—*C.A.* 41, 3352*h*.

When Cu wire of 1 mm diam. was heated in a current of O_2 above 500°C, a very stable layer of cupric oxide was formed on the surface of the wire. The catalyst was handy for expts.

866. Tanida, Shigeo. **Mixed catalysts. III. Adsorption of hydrogen, benzene, and cyclohexane by nickel-molybdenum catalyst.** *Bull. Chem. Soc. Japan* 19, 8-17 (1944).—*C.A.* 41, 4368*g*.

The adsorption of H_2, C_6H_6 and cyclohexane on a Ni catalyst promoted by Mo was measured between 0° and 300°C under atm. pressure. The adsorption of H_2 was a max. when the atomic ratio of Mo to Ni was 15:100.

867. YAMADA, NOBORU AND CHITANI, TOSHIZO. **Catalytic oxidation of carbon monoxide on the surface of silver. II. Experiment at 250-300°C.** *J. Chem. Soc. Japan* **65**, 224-7(1944).—*C.A.* **41**, 3354*c*.

When the concn. of CO in the mixt. is greater than 30%, the reaction velocity becomes proportional to the 0.8-0.9th power of the partial pressure of O_2. It is suggested that CO and O_2 are separately adsorbed on the surface of Ag and that the reaction takes place at the boundary.

868. BANGHAM, D. H. **Initial stages of the reaction between copper and oxygen.** *J. Sci. Instruments* **22**, 230-1 (1945).—*C.A.* **40**, 1725^2.

"Clean" electrolytic Cu foil was mounted in a glass bulb which could be jacketed at any desired temp. To maintain the pressure of O_2 sensibly const., however, a jacketed gas buret was provided into which Hg was admitted equal in vol. to the O_2 fixed. In expts. at sufficiently low temps. and pressure, the parabolic time-law was no longer valid and the uptake of O_2 followed a sigmoid course. The delay in the start of the reaction resulted from the difficulty of forming the nuclei of a new phase; the Cu_2O phase spread laterally across the surface after starting from point nuceli.

869. BROWN, HIRAM. **Degassing and pouring aluminum.** *Modern Metals* **1**, No. 2, 12-17(1945).—*C.A.* **39**, 2473^2.

Some alloys, such as the Al-Zn-Mg type and the Al-Si alloys without Cu, have much less tendency toward gas absorption than have other common alloys and can be poured without degassing. Other alloys may pick up H_2 during meltings; this results in pinhole porosity and lowered ductility, fatigue resistance, corrosion resistance, etc. The use of Cl_2 or N_2 for degassing is discussed in detail. Degassing should be effected at 685-740°C and the metal should be raised to pouring temps. when degassing is complete.

870. CAPDECOMME, L. **Surface orientation in the phenomena of corrosion.** *Comm. tech. etats et properties surface metaux, Journess etats surface* **Oct. 1945** 247-50.—*C.A.* **42**, 8765*c*.

Anodically polished Cd oxidized at different rates depending upon the orientation of the crystal face at the surface. The rates of oxidation in decreasing order were (1010), (1013), and (0001). The surface film (probably FeS) formed on a crystal of FeS_2 during mech. polishing was shown by optical means to continue the orientation of the substrata.

871. GWATHMEY, A. T.; LEIDHEISER, H. JR., AND SMITH, S. P. **The chemical action of oils on single crystals of metals.** *Natl. Advisory Comm. Aeronautics, Tech. Note* No. **982**, 52 pp. (1945).—*C.A.* **40**, 7582^2.

The chem. action of lubricant components on large single crystals of metals was studied over a range of temps. in the presence of H_2, N_2, O_2, and air. Ag, Cu, Pb, Fe, Zn, and Ni were tested. Surface reactions were easily detected on the electrolytically polished spheres used, which were machined from the single crystals of the metals. The rates of all surface reactions tested, including oxidation, etching, C formation, rearrangements due to gaseous catalysis, crystal growth, and electrolytic reactions, varied considerably with crystal plane.

872. JURA, GEORGE; LOESER, E. H.; BASFORD, P. R., AND HARKINS, WM. D. **A first-order change which involves the vaporization in two dimensions of heptane on the surface of silver.** *J. Chem. Phys.* **13**, 535-6 (1945).—*C.A.* **40**, 511^8.

A reversible 1st-order vaporization-condensation of n-C_7H_{16} was found on Ag. An adsorption isotherm at 14.90°C showed a 1st-order transition at 0.019 mm Hg. A pressure-mol. area isotherm at 14.90° and 25.00°C showed that the crit. temp. lay between these temps. The crit. area was between 310 and 2200 A^2., and the crit. pressure was >0.18 dyne per cm. Other 1st-order changes of this type include water on graphite, triptane on Ag, N_2 on a fluid cracking catalyst, and n-C_7H_{16} on Fe_2O_3.

873. KAMEYAMA, NAOTO. **Sorption equilibrium of moisture on cuprous oxide.** *J. Soc. Chem. Ind. Japan* **48**, 59 (1945).—*C.A.* **42**, 6199*a*.

Sorption equil. of moisture on Cu_2O was studied. The following exptl. relationship was obtained: $\log p = -(4855/4.57)\ (1/T) + 4.15$. The reaction corresponded to the following equation: $(Cu_2O)_m + H_2O\ (vapor) = (Cu_2O)_m.H_2O + 4.86$ kcal.

874. KAMEYAMA, NAOTO. **Sorption equilibrium of moisture on a graphite brush.** *J. Soc. Chem. Ind. Japan* **48**, 61(1945).—*C.A.* **42**, 6199*b*.

An expt. was made to det. whether moisture in the atm. is adsorbed by Cu_2O on the surface of a Cu commutator or by the graphite brush. Cu_2O had a greater hygroscopicity than the graphite brush.

875. KAMEYAMA, NAOTO. **Sorption equilibrium of moisture on cuprous oxide and the coefficient of friction of the surface of a commutator.** *J. Soc. Chem Ind. Japan* **48**, 64(1945).—*C.A.* **42**, 6199*d*.

The coeff. of friction between commutator and brush varied because of the adsorption or desorption of moisture from the atm. by the layer of Cu_2O on the surface of the Cu.

876. MARSH, J. S. **Slag-metal relations in the basic open-hearth and electric processes.** *Trans. Am. Inst. Mining Met. Engrs.* **162**, 672-84 (1945).—*C.A.* **40**, 7111^4.

It is shown graphically that the slag-metal-O_2 relations applicable to the basic open-hearth also apply to the oxidizing period of the basic elec. furnace.

877. McINTYRE, J. B. **Copper castings. Effect of gas absorption on foundry practice.** *Metal Ind. (London)* **66**, 178-9(1945).—*C.A.* **39**, 2473^3.

The belief that unsoundness in Cu castings is due to O_2 has been found to be incorrect for the amts. usually encountered (0.03 to 0.10%). If electrolytic cathode Cu is used, it should be melted and ingotted, then remelted, and presolidified to remove occluded H_2. Recommended melting practice includes the charging of as much as possible of the wt involved, rapid melting, and avoidance of undue exposure to flame action.

878. Nietzsche, Eugene. **The origin of microcavities.** *Light Metal Age* 4, No. 1, 12-13,31 (1945); *Giesserei* **31**, 43-7(1944).—*C.A.* **40**, 3084⁹.

Some of the lesser-known ways are given in which H_2 and other gases, which cause cavities and porosity, can be detected in the light-metal foundry. Methods of preventing and eliminating these causes of porosity are discussed.

879. Riddle, L. E. **Effect of moisture additions to the air delivered to blast furnaces.** *Blast Furnace Steel Plant* **33**, 965-70 (1945).—*C.A.* **39**, 4823³.

A decrease resulted in Fe production of approx. 0.5% per grain of H_2O added, and an increase in coke rate of approx. 1.2% per grain of H_2O added. Negligible difference in blast-furnace regularity and flue-dust production and no significant difference in Fe quality resulted. Controlled H_2O addns. cannot be justified from an economic standpoint.

880. Washburn, T. S. **Deoxidation of basic open-hearth steel.** *Trans. Am. Inst. Mining Met. Engrs.* **162**, 658-71 (1945).—*C.A.* **40**, 7110⁴.

Some of the considerations that det. the selection of any specific deoxidation practice are reviewed.

881. Amdur, I. **Pressure dependence of accommodation coefficients.** *J. Chem. Phys.* **14**, 339-42 (1946).—*C.A.* **40**, 4274⁸.

It was assumed that the accommodation coeff. varied linearly with the fraction of the surface covered by the adsorbed gas and that the accommodation coeff. had a negligibly small value on a gas-free surface and an asymptotic value on a satd. surface. The assumptions lead to an accommodation coeff. isotherm that reproduced the pressure dependence of 119 accommodation coeff. values for He, Ne, A, Kr, Xe, H, D, N, Co, and O on Pt with an av. abs. deviation of 1.5%.

882. Armbruster, Marion H. **The sorption of water vapor at low pressure on the surface of some cold-rolled steels at 20°C.** *J. Am. Chem. Soc.* **68**, 1342-7(1946).—*C.A.* **40**, 5976¹.

The sorption up to 0.15 cm Hg was measured on two surfaces of cold-rolled, mild carbon steel and on a stainless alloy contg. 18% Cr and 8% Ni. At the highest pressures the steels sorbed a complete layer held physically and a partial layer by chemisorption. The stainless alloy adsorbed 3-4 times as much as the steel and of this amt. 1/3 was chemisorbed. The effective surface area of the two steels was significantly different. About 90% of the total sorption occurred within 3 to 4 hrs,. the remainder in an addnl. 15 hrs.

883. Armbruster, Marion H. and Austin, J. B. **The adsorption of oxygen at low temperature and pressure on smooth iron.** *J. Am. Chem. Soc.* **68**, 1347-54 (1946).—*C.A.* **40**, 5976⁴.

The sorption of O_2 on 3 smooth surfaces of cold-rolled steel was measured at 20°, -78°, and -183°C and at pressures up to 0.1 cm. At -183°C the unreduced surface sorbed a monolayer of O_2 physically, also a small amt. held so strongly that it could not be pumped off at temp.; the amt. of this strongly held O_2 was about that of A, N_2, or CO likewise strongly sorbed. The reduced surface (with H_2) at -183°C chemisorbed O_2 equiv. to a film several mols. thick, but there was evidence that this O_2 penetrated the surface; it also sorbed a monolayer of O_2 physically. At -78°C the O_2 chemisorbed on the unreduced surface was equiv. to less than half a monolayer. At 20°C both unreduced and reduced surfaces chemisorbed an amt. almost twice that sorbed at -78°C. The isotherms deviated from the Langmuir equation at the lowest pressures, but were there represented accurately by the Freundlich relation, the exponent ranging from 3 to 5. The heat of adsorption of O_2 physically sorbed on the unreduced surfaces was about 3.5 kg-cal, in agreement with about 4 kg-cal for O_2 physically sorbed on Fe catalysts as detd. calorimetrically.

884. Bardeen, J.; Brattain, W. H., and Shockley, W. **Investigation of oxidation of copper by use of radio-active-Cu tracer.** *J. Chem. Phys.* **14**, 714-21 (1946).—*C.A.* **41**, 2295*g*.

A very thin layer of Rd-Cu was electrolytically deposited on a Cu blank. The surface was then oxidized in air at 1000°C for 18 min. to give an oxide layer 0.0125 cm thick. After quenching, successive layers of the oxide were removed chemically, and the Cu activity in each layer was measured. The observed self-diffusion of Rd-Cu in the oxide agreed quantitatively with a theory based on the assumptions: (a) The oxide grew by diffusion of vacant Cu^+ sites from the outer surface of the oxide inward to the metal. (b) The concn. of vacant sites at the O-oxide interface was independent of the oxide thickness, and dropped linearly from this const. value to zero at the metal boundary. (c) Accompanying the inward flow of vacant sites, there was a flow of pos. electron holes such as to maintain elec. neutrality. (d) Self-diffusion of Cu ions took place only by motion into vacant sites.

885. Beiler, S. Ya.; Rebinder, P. A., and Gol'denberg, N. L. **Condensation of water vapor on hydrophobized cooling surfaces.** *Bull. acad. sci. U.R.S.S., Classe sci. tech.* **1946**, 1491-5 (in Russian).—*C.A.* **41**, 2626*b*.

Adsorptive hydrophobization of the metallic cooling surface in steam turbines might substantially improve the exchange of heat. Effective and stable hydrophobization could be obtained with chemisorbed substances of the type of flotation collectors. Expts. were made with an app. of 4 Cu tubes 180 mm long, 25 mm in diam., wall thickness 1 mm, with electrically heated outer glass jackets for the water vapor, 9 thermocouples at various levels, stationary water circulation. Emulsol of spindle oil and naphthene soap, and mercaptobenzothiazole proved to be the best hydrophobizing agents. K amylxanthate was of medium efficiency (t = 75 hrs); turbine oil was weak (10 hrs). On brass, spontaneous emulsions of mineral oils with acid soaps gave effects lasting 100 hrs.

886. Bénard, Jacques and Coquelle, Odile. **Recent micrographic investigations of the high-temperature oxidation of iron.** *Compt. rend.* **222**, 796-7 (1946).—*C.A.* **40**, 4011⁷.

Polished sections of Fe oxidized at 900°C showed, outermost, a very thin layer of Fe_2O_3, then a thicker continuous layer of Fe_3O_4, then a still thicker region of Fe_3O_4 dispersed in FeO, gradually fading into pure FeO. The regions contg. FeO comprised 9/10 of the thickness of the oxide layer. On Fe oxidized above 900°C, the Fe_2O_3 and Fe_3O_4 layers became thicker at the expense of the FeO layer. Below 710°C, the Fe_3O_4 layer grew at the expense of the FeO layer. Both phenomena were explained by a decrease in diffusion of Fe atoms into the FeO layer.

887. Bénard, Jacques and Coquelle, Odile. **Kinetic study of the formation of oxides on iron surfaces at high temperatures.** *Compt. rend.* 222, 884-5 (1946).—*C.A.* 40, 5985^2.

The rate of development of Fe_2O_3 layer on fresh Fe surface is linear at 900°, 950°, and 1000°C as measured micrographically by the thickness of the layer formed. The rate for Fe_3O_4 is linear at 700°, 800°, and 900°C, but diminishes as time progresses at 950°C. The rate of production of FeO is parabolic at 650°, 700°, 800°, 900°, and 950°C. Two factors are involved—the diffusion of reactants across the oxide layer, and the rate of interaction of the reactants.

888. Bénard, J. and Coquelle, Odile. **Oxidation of iron at high temperatures determined metallographically.** *Rev. met.* 43, 113-24 (1946).—*C.A.* 41, 3418*b*.

Oxidic film produced on heating iron was a result of Fe diffusion outwards and of O_2 inwards into the metal. These rates of diffusion, which varied with temp., specified the character of the scale. The formation of the scale as a whole followed a parabolic function. Individual constituents of it formed according to other curves, Fe_2O_3 and Fe_3O_4 following a straight line and FeO following a parabolic function. The influence of temp. on total scaling up to 900°C can be presented by the well-known exponential equation.

889. Bosworth, R. C. L. **Contact potential difference as a tool in the study of adsorption.** *J. Proc. Roy. Soc. N. S. Wales* 79, 53-62 (1946).—*C.A.* 40, 4932^1.

The contact potential of a metal catalyst as a function of the amt. and nature of gas chemisorbed is described. For O_2 on W it is shown that the condensation coeff. is 0.4 and that the dipole moment of the adsorbed O_2 is nearly independent of the fraction of the surface covered, being -0.78 Debye units for slight covering and -0.66 for a monolayer.

890. Bosworth, R. C. L. **Properties of films of nitrogen on tungsten.** *J. Proc. Roy. Soc. N. S. Wales* 79, 166-71 (1946) (Reprint).—*C.A.* 41 897^i.

The contact potential method is used to study properties of adsorbed films of N_2 on W. If 1 N atom occupies the same space as 3 H atoms, the condensation coeff. is 1 in 100. The heat of desorption is calcd. as a function of the fraction of the surface covered, with data obtained between 740° and 1180°K, where the N_2 film is shown to be mobile.

891. Bosworth, R. C. L. **Evaporation of oxygen from a tungsten surface.** *J. Proc. Roy. Soc. N. S. Wales* 79, 190-5 (1946) (Reprint).—*C.A.* 41, 898^a.

The heat of evapn. of O_2 from W was calcd. from measurements of the contact potential of a W surface, covered with an oxide film and heated between 1270° and 1930°K. The surface spreading forces were derived, amounting to 2880 dynes per cm for a complete film. The surface structure for a surface concn. of $\theta = 1.0$ should be that of a peroxide, changing to a surface oxide for $\theta = 0.5$. Under the conditions studied, O_2 evapd. from the surface and not atoms.

892. Burshtein, R.; Shumilova, N., and Gol'bert, K. **Adsorption of oxygen on iron and the effect of adsorbed oxygen on the properties of iron electrodes.** *J. Phys. Chem. (U.S.S.R.)* 20, 789-801 (1946) (In Russian); *Acta Physicochim. U.S.S.R.* 21, 785-802 (1946).—*C.A.* 41, 2298d; 6454*b*.

Fe (band, wire, or powder) prepd. by reduction with H_2 of $Fe(NO_3)_3$ or $Fe(CO)_5$ was heated in H_2 and degassed at 500-850°C. When O_2 in small amts. was admitted to this Fe at 20°C, the rate of adsorption was high (0.12 cc./min.) until the adsorbed vol. reached the value V; after this the rate rapidly decreased. For smooth Fe, V was 0.023 cc. per 100 cm^2 (geometric surface area). For Fe powder $V = 0.045$ cc. per g. One g of this powder adsorbed 0.015 cc. of N_2 in conditions corresponding to unimol. adsorption. The volume adsorbed slightly increased from -183° to -138°C, remained const. until -73°C, and rapidly increased at higher temps. At 200°C it was 2.4 cc. per g of Fe. Pure, fully reduced Fe was not pyrophoric and readily sintered at 550-560°C. Admixt. of O_2 or S raised the sintering temp. and made Fe pyrophoric.

893. Cabanes, Ch. **Mechanism of corrosion of iron by water as a function of pH. Role of dissolved oxygen. Degasification by heat, vacuum, or chemical means.** *Chaleur et ind.* 27, 261-70 (1946).—*C.A.* 41, 1194^e.

It may be necessary to remove the last traces of dissolved O_2 by chem. means, but the detn. of small quantities of dissolved O_2 is difficult. With such low O-contents, the pH of the H_2O may be of importance, as a suitably alk. H_2O may be less corrosive than distd. water with the content of dissolved O_2. Air leakage into the condenser, etc., may play a more important role in accounting for dissolved O_2 in boiler H_2O.

894. Davis, Raymond T., Jr. **The activated adsorption of nitrogen on a finely divided tungsten powder.** *J. Am. Chem. Soc.* 68, 1395-1402 (1946).—*C.A.* 40, 5975^8.

The adsorption was detd. over the range 10^{-6} to 35 mm Hg and between 400° and 750°C. The adsorption isotherms on a log-log plot consisted of a curved portion in the low-covering region and of straight lines in the high-covering range. At satn. one mol. of N_2 was adsorbed for every 4 W atoms. The heat of adsorption was const. at about

75.0 kg-cal/mole in the low-covering range and decreased according to the relation $Q = 139.0 \log s/A$ kg-cal/mole in the higher-covering range. The activation energy involved in the adsorption was approx. 10.0 to 25.0 kg-cal/mole and varied with the surface covered.

895. FINE, LESLIE AND MAAK, CHARLES H. **Some observations on the effect of oxygen on carbon in steel.** *Welding J. (N. Y.)* 25, 283s-7s (1946).—*C.A.* 40, 4013^{2}.

Metallographic examn. was made of an $O_2—C_2H_2$ pressure weld deliberately prepd. with a large amt. of dissolved-O_2 along the plane of the weld. The hardness at the weld plane was lowered, which caused "auto-decarburization" (the transport of C from one internal region to another). The consequent lowering in C-content caused the reduction in hardness.

896. GARNER, W. E. AND STONE, F. S. **Activation of metallic copper by oxidation and reduction.** *Nature* 158, 909(1946).—*C.A.* 41, 1920^{g}.

Activation of Cu by repeated oxidation and reduction is due to an increase in surface area, as shown by measurements of the interference color during oxidation. Reduction of CuO films by H_2 at 300°C is not simply a reversal of the oxidation process, but during the reduction oxide particles are enclosed within the metal being formed. After reduction by CO, the metallic film formed is much more compact, so that on repeated oxidation, an oxide film is formed which is more perfect than in the case where H_2 is used as the reducing agent. A second reduction by CO following oxidation is very slow and erratic.

897. GEL'D, P. V. AND ESIN, O. A. **The mechanism of the corrosion of iron by sulfur.** *J. Applied Chem. (U.S.S.R.)* 19, 678-83 (1946) (in Russian).—*C.A.* 41, 4430*a*.

A parallel is drawn between the corrosion of Fe by S and the oxidation by gases (O_2, CO_2, H_2O). The inner layer of the sulfide scale is assumed to be close to pyrrhotite, the outer layer to pyrite; the essential role in the corrosion mechanism is ascribed to solid solns. of S in troilite, the hexagonal lattice of which exhibited a hole structure, corresponding to missing Fe atoms. In corrosion, Fe ions diffuse in the direction from the innermost layer where the "hole concn." is lowest towards the zone of higher hole concn. facing the pyrite layer; the "satd. soln. of holes" corresponds to $FeS_{1.12}$ (at 650°) to $FeS_{1.06}$ (at 1100°). The sulfide layer grows in thickness in both directions.

898. GHOSH, J. C.; SASTRI, M. V. C., AND KINI, K. A. **Adsorption of hydrogen and carbon monoxide and their mixtures on Fischer-Tropsch catalysts. I.** *Current Sci.* 15, 282-3(1946).—*C.A.* 41, 1907^{c}.

The adsorption of H_2 and CO as pure gases and as mixts. was studied up to 178°C on a catalyst whose compn. was: Co 34.2, Cu 4.08, ThO_2 2.33, Ce_2O_3 0.24%, on kieselguhr. In mixts. the presence of one gas promoted the adsorption of the other even at temps. considerably below those where the velocity of reaction became perceptible. The increase of adsorption with H_2 was conspicuous even at 25°C.

899. GHOSH, J. C.; SASTRI, M. V. C., AND KINI, K. A. **Adsorption of hydrogen and carbon monoxide and their mixtures on Fisher-Tropsch catalysts. II.** *Current Sci.* 15, 283 (1946).—*C.A.* 41, 1907*d*.

The logs of the rates of adsorption at const. pressure versus the logs of the corresponding vols. adsorbed gave straight lines which were parallel for different pressures at a given temp. The results suggested $u = k\ P/V^{n}$ as the empirical relation, where u = rate of adsorption in cc/min., P = pressure, V = vol. adsorbed, and n and k consts.

900. GRILLY, EDWARD R.; TAYLOR, WM. J., AND JOHNSTON, HERRICK L. **Accommodation coefficients for heat conduction between gas and bright platinum, for nine gases between 80°K (or their boiling points) and 380°K.** *J. Chem. Phys.* 14, 435-40(1946).—*C.A.* 40, 5316^{3}.

Accommodation coeffs. were calcd. for air, O_2, NO, CO, CO_2, N_2O, CH_4, H_2, and He from thermal-cond. data at frequent intervals (80-380°K). The coeff. for H_2 approached 1, but for other gases it dropped steeply below room temp. The accommodation coeffs. that were derived from 1/K vs. 1/P plots differed slightly from Knudsen accommodation coeffs.

901. HALLOWES, A. P. C. AND VOCE, E. **Attack of various atmospheres on copper and some copper alloys at elevated temperatures.** *Metallurgia* 34, 95-100, 119-22 (1946).—*C.A.* 40, 6391^{4}.

Eighteen metals were tested at 400°C [3 high-concd. and 2 arsenical Cu, 6 Al bronzes (2-12% Al), a group of alloys contg. small amts. of common elements added individually to Cu, and several industrial high-temp. alloys]. Except Ag, all addns. to Cu produced an improvement in its resistance to dry air. Si conferred protection, but the Al bronzes were the most resistant materials. Introduction of 10% H_2O vapor into the air stream made little difference to the scaling rates, but some of the materials showed a slightly decreased attack. The attack upon the Sn bronzes, however, was increased. Approx. 0.1% SO_2 in the air generally increased the attack. The most resistant materials were the Al bronzes contg. 5% or more Al and Everdur.

902. ITTERBEEK, A. VAN AND GREVE, L. DE. **Measurements on thin nickel films.** *Physica* 11, 470-4 (1946) (in French).—*C.A.* 40, 6923^{2}.

Ni films 30 to 700 mμ thick were formed on glass by cathodic sputtering. The elec. resistance was measured at various temps. between 37°K and 650°K before and after standing at the temp. for 24 hrs.

903. JONES, F. LLEWELLYN. **Electric properties of tungsten oxide films.** *Nature* 157, 371-2 (1946).—*C.A.* 40, 3679^{1}.

When the surface was covered with thin oxide layers or dust particles, strong electron currents occurred with fields as low as 100,000 v./cm. The time lag of sparking was inversely proportional to the intensity of cold-cathode emission. With W, the most effective film was a mixt. of the yellow and blue oxides, which together appeared as a white deposit. With the oxidized and a clean electrode, in air and N_2 at atm. pressure, the spark time-lag was low only when the clean electrode was the anode.

904. KEMBALL, C. AND RIDEAL, E. K. **The adsorption of vapors on mercury. I. Nonpolar substances.** *Proc. Roy. Soc. (London)* **A187**, 53-73 (1946).—*C.A.* 41, 1523^{a}.

Reversible results for the adsorption of benzene, toluene, and heptane vapors on Hg were obtained. The films were found to be gaseous and obeyed the equation $F(A-b)=kT$, where F = spreading pressure, A = area per mol., and b = co-area. The possibility that the films might be immobile was considered and the Langmuir equation was applied but found unsatisfactory. A standard state for the surface phase was defined and the free energy, total energy, and entropy of adsorption were evaluated. The heat of adsorption increased with the amt. on the surface. A no. of phase changes were found to occur after the completion of monolayer adsorption, the most striking being interpreted as the changeover from flat to vertical adsorption of the toluene.

905. KEMBALL, C. **II. The entropy and heat of adsorption of nonpolar substances.** *Proc. Roy. Soc. (London)* **A187**, 73-87 (1946).—*C.A.* 41, 1523^{e}.

By denying all rotations of benzene on Hg except in the plane of the ring and denying the 3rd degree of translational freedom, the calcd. entropy of adsorption agreed closely with the exptl. value. The surface mobility of toluene was found to be considerably hindered, and the entropy of adsorption of heptane confirmed the view that the mols. were partially rolled up. An attempt was made to derive the theoretical heat of adsorption of benzene from various relations for the attractive and repulsive potentials for the van der Waals forces near a metal surface. The values obtained were of the same magnitude as the exptl. value. The calcns. for the adsorption of benzene were sufficient to indicate that the values for the heats of adsorption of the nonpolar substances adsorbed on Hg were due to the van der Waals dispersive forces.

906. KHVATOV, A. D. **Changes of catalyst in poisoning.** *J. Gen. Chem. (U.S.S.R.)* **16**, 407-14 (1946).—*C.A.* 41, 904^{f}.

In poisoning a Ni catalyst by CO, there occurred not only an intensive topochem. change of the surface but also the change of structure of the components of the catalyst which changed the basic course of the reaction. Ni was apparently the detg. factor in the changes of the other catalyst components. The greatest drop of activity corresponded to the greatest change of disperse nature of the catalyst and a min. amt. of removed metal. The control reaction was the dehydrogenation of cyclohexane.

907. KONIG, HANS. **The lattice constants of films of aluminum formed from the vaporized metal.** *Naturwissenchaften* 33, 367-8 (1946).—*C.A.* 43, 5653c.

Ag and Cu films produced by vaporization and condensation gave values of lattice consts. in agreement with X-ray. Similarly produced films of Al, however, frequently gave lower values, 4.025 and 4.030 A. instead of 4.041 A. The lower value was due to the water vaporizing along with the metal, which reduced the lattice const. It was known that water was sol. in the Al lattice up to 3%.

908. LEHOVEC, KURT. **Thallium diffusion in crystalline hexagonal selenium.** *Z. Naturforsch.* **1**, 508-11(1946).—*C.A.* 41, 4988c.

Tl diffused in the cryst. hexagonal Se with considerable speed in the region of the Se m.p. Tl ions migrate. The diffusion could be observed spectroscopically, but more conveniently, however, by following the change in cond. No other metals with similar properties had been found.

909. MÜLLER, HERMANN. **The protective inactivation of pyrophoric substances.** *Z. Naturforsch.* **1**, 324 (1946).--*C.A.* 41, 5355*i*.

Pyrophoric substances could be made inactive by opening the container under a substance such as acetylcellulose in acetone, 96% EtOH, and in the case of pyrophoric Co, by hydrocarbons. On evapn. of the solvent the pyrophor was protected against spontaneous ignition. This was attributed to a layer of surface oxidation which took place during the slow evapn. of the solvent.

910. SAYAMA, YOSHIHIRO. **Vapor pressure of the cesium oxide photocathode.** *J. Phys. Soc. Japan* **1**, 13-17 (1946).—*C.A.* 43, 7767*f*.

The photosensitive Cs_2O layer was formed on a Ag base by reducing Ag_2O with Cs vapor. Deposition of metallic Cs on the Cs_2O surface caused a decrease in photoelec. and thermionic emission and a sudden increase in vapor pressure when $Cs/O=2$. When $Cs/O<2$, the Cs atoms were oxidized rapidly and the vapor pressure was very low.

911. SCHWAB, GEORGE-MARIA. **Metal electrons and catalysis.** *Trans. Faraday Soc.* 42, 689-97 (1946).—*C.A.* 41, 1921*b*.

The measurement of reproducible and reliable temp. coeffs. of HCOOH dehydrogenation with alloy catalysts was described. It was applied to homogeneous and heterogenous alloys of Ag, Au, and Cu with other metals. All the described results can be expressed in terms of the wave-mech. theory of the Hume-Rothery phases by a dependence of the activation energy on the degree of electron satn. of the first Brillouin zone of the metal. This led to the concept that catalytic activation consisted in a transition of electrons from the substrate to the metallic catalyst.

912. TIAPKINA, V. V. AND DANKOV, P. D. **Structure of primary films of oxide and bromide on silver.** *Compt. rend. acad. sci. U.R.S.S.* **54**, 415-18(1946) (in English).—*C.A.* 41, 4348*b*.

A Ag_2O film, prepd. by treating Ag on the anode of a gas-discharge tube, had a cuprite-type structure with $a=4.69$A., the same as massive Ag_2O. The x-ray diffraction pattern, however, was weak and strongly fogged owing to the deformation of the crystal lattice, which was more than 12% for Ag-Ag_2O. AgBr film, obtained by immersing Ag in Br_2, had a NaCl structure with $a=5.74$A., similar to massive AgBr. The diffraction pattern was sharp.

913. TWIGG, G. H. **Chemisorption of oxygen and its effect on the electrical resistance of a silver catalyst.** *Trans. Faraday Soc.* **42**, 657-63(1946).--*C.A.* 41, 1920^{1}.

The elec. resistance of a tightly packed Ag-plated glass-wool catalyst increased when O_2 was admitted to the previously cleaned catalyst at 240°-360°C. It decreased to a const. value when the O_2 was pumped out or was removed by chem. reaction with ethylene. The adsorption of O_2 caused an irreversible increase in resistance, but H_2O and CO_2 produced no effect. The relation between the quantity of O_2 adsorbed and the percentage change in resistance was used to study the rates of adsorption and desorption and the adsorption isotherm of O_2 on the Ag.

914. YARNOLD, G. D. **The hysteresis of the angle of contact of mercury.** *Proc. Phys. Soc. (London)* **58**, 120-5 (1946).—*C.A.* **40**, 3953³.

The method involved measurement of the force exerted by a rising or falling Hg surface on a partly immersed suspended sphere. Data were given for spheres of glass and steel, having various radii. The approx. constancy of the receding angle, together with the remarkable adhesion of the Hg to the solid surface, suggested that a solid-liquid interface of more or less const. energy was formed in all cases. On the other hand, the wide variation in the advancing angle suggested that the irreversible work involved in the destruction of the solid-air interface and its replacement by the solid-liquid interface may be extremely variable.

915. ALEXANDER, LEROY; MURRAY, W. M., AND ASHLEY, S. E. Q. **Determination of oxygen in steel by the vacuum-fusion method.** *Analyst* **19**, 417-22 (1947).—*C.A.* **41**, 5053*c*.

Special precautions are taken to avoid surface contamination and superficial oxidation during the prepn. of the sample. The gases evolved by heating in a graphite crucible in a low vacuum are collected, analyzed by conventional methods of gas analysis, and the O calcd. from the quantity of CO formed. A complete analysis requires about 1.5 hrs. Data obtained in the analysis of 354 steel samples give value between 0.003 and 0.1% of a 2-g sample.

916. BASTIEN, PAUL; MISCHONSNIKY, SIMON, AND SENNEVILLE, CHANTEL DE. **The phenomena of adsorption and desorption produced on the surface of iron after etching with acid or after electrolytic etching.** *Compt. rend.* **224**, 126-7 (1947).—*C.A.* **41**, 4351*c*.

Steel wire (2 mm diam.) made from 0.06% C Martin basic steel annealed at 950°C, was charged with H_2 by etching for 48 hrs in 10% HCl, or by cathodic attack in the same medium at a c.d. of 5.25 ma. per sq. cm. for the same period. Samples then exposed to the air after drying, increased in wt rapidly during the first few hrs, then more slowly. In vacuum no such increase was found. In 100 hrs exposure to air after etching, a 100 g sample adsorbed 65.1 cc. N_2 and 17.1 cc. O_2. To study the gases released on desorption a 100 g sample was etched 72 hrs, dried, exposed to the air 2 hrs, then immersed in Hg for 72 hrs. The gas evolved amounted to 39.5 cc. and analyzed 94.7 H_2, 0.3 O_2, and 5.0% N_2.

917. BÉNARD, J. **The mechanism of the surface oxidation of iron at high temperatures.** *J. chim. phys.* **44**, 266-8(1947).—*C.A.* **42**, 5748*d*.

Microscopic and x-ray examn. of Fe pellets heated in O_2 for the same time at different temps. show that below 910° FeO predominates, but above 910°, the proportions of Fe_3O_4 and of Fe_2O_3 increase rapidly. This change is related to the phase change occurring in Fe at 910°C. Curves for the isothermal increase in thickness of the various oxide films show that for thin coatings of FeO, the oxidation step is rate-controlling.

918. BÉNARD, JACQUES AND TALBOT, JEAN. **Effect of crystallite orientation on the thermal oxidation of iron and copper.** *Compt. rend.* **225**, 411-13 (1947).—*C.A.* **42**, 440*c*.

Rolling of sheets produced an increase in the oxidation rate which was proportional to the reduction of cross section for both metals. These changes were paralleled by the appearance of oriented structures. The effect of deformation was due to the anisotropy of the rate of oxidation. It seemed probable that this was caused by inequalities in the rates of diffusion of metal and O_2 through the oxide layers already formed. The oxidation-time curves started out as straight lines and continued as parabolas.

919. BROCKWAY, L. O. AND KARLE, J. **Electron-diffraction study of oleophobic films on copper, iron, and aluminum.** *J. Colloid Sci.* **2**, 277-87 (1947).—*C.A.* **41**, 4693*e*.

Metallographically polished Cu, Fe, Al, and Pt showed adsorbed mols. of actadecylamine, cerotic acid, or stearic acid in oleophobic films to have an av. tilt of 5° from the surface normal. On thin-rolled Pt whose surface had been cleaned by flaming, the mols. of oleophobic films had tilts as high as 30°. The difference was attributed to submicroscopic unevenness of the rolled Pt surface. Roughening the metal surface with emery paper did not prevent the formation of oleophobic films on Cu or Fe, but considerably more time was required for the film to form. Roughening prevented the formation of oleophobic films on Al.

920. BURWELL, ROBERT L., JR.; SMUDSKI, P. ALLEN, AND MAY, THOMAS P. **Ethylene adsorption isotherms at -183°C.** *J. Am. Chem. Soc.* **69**, 1525-9 (1947).—*C.A.* **41**, 5771*g*.

The adsorption of C_2H_4 was used to detn. surface areas on Al foil subjected to various etching and anodic treatments. Sheets of 99.5% pure Al, 28 μ thick, carefully solvent-cleaned, were subjected to one or more of six different treatments with variable time. One- to two-hundred-mesh porous glass was employed as a reference substance. Some of the isotherms were S-shaped; in some the linear portions continued to the exptl. satn. pressure. The results accorded with the hypothesis of porous structure of anodic coatings.

921. DAVIS, R. T., JR.; DEWITT, T. W., AND EMMETT, P. H. **Adsorption of gases on surfaces of powders and metal foils.** *J. Phys. & Colloid Chem.* **51**, 1232-48 (1947).—*C.A.* **42**, 1102*b*.

The adsorption isotherms for N_2, Kr, n-C_4H_{10}, 1-C_4H_8, and $CHCl_2F$ were measured at or below their b.ps. and found to be S-shaped on Ag foil, monel ribbon, glass spheres, W powder, ZnO pigments, Al_2O_3, and silica gel. Mol. cross-sectional areas to bring the calcd. surface into agreement with those obtained for N_2 (16.2 A.²) were: Kr, 20.8 A.² at -195°C; C_4H_{10}, 43.4 A.² at -78°C and 46.9 A.² at 0°C; $CHCl_2F$, 37.5 A.² at -78°C and 40.1 A.² at 0°C; and 1-C_4H_8, 42.7 A.² at 0°C. When $CHCl_2F$, n-C_4H_{10}, and Kr were used and the mol.-area calcd.

from liquid d., the surface areas of the Ag foil and monel ribbon were smaller than the geometric area by as much as 25%.

922. Dobretsov, L. N.; Starodubtsev, S. V., and Timokhina, Ya. I. **Surface ionization of thin layers of calcium and magnesium oxides.** *Compt. rend. acad. sci. U.R.S.S.* **55**, 303-6 (1947) (in English).—*C.A.* **41**, 5355*f*.

The ionization of Ca and Mg on W filaments was found to be many times greater than it should be due to coatings of the alk. earth oxides. Expts. showed that surface ionization was substantially different on oxide films than it was on pure metals.

923. Emmett, P. H. and Cines, Martin. **Surface-area measurements on metal spheres and carbon blacks.** *J. Phys. & Colloid Chem.* **51**, 1329-41 (1947).—*C.A.* **42**, 1104*h*.

A comparison of areas obtained by adsorption isotherms for N_2 at −195°C on metal powders with those calcd. from photomicrographs yields roughness factors in the range 1.1 to 1.8. Areas detd. by the adsorption of CS_2 and C_4H_{10} are 20 to 50% lower than those obtained by using N_2. Pelletizing carbon black produces no appreciable changes in its surface area per g.

924. Evans, U. R. **The mechanism of oxidation and tarnishing.** *Trans. Electrochem. Soc.* **91**, 24 pp. (1947) (Preprint).—*C.A.* **41**, 2376^{b}.

Outward migration of cations and electrons, normally by lattice defects, gives parabolic film growth, but mech. breakdowns due to compressional stresses (of which good evidence exists) may lead to other equations. Blistering should lead to rectilinear or logarithmic thickening according as the rifts in the blister walls do or do not admit O_2(s). Flaking (which is rare but catastrophic) should lead to periodical recommencement of rapid oxidation. Shear-cracking (likely if cohesion is poor and adhesion good) may produce parabolic, rectilinear, or intermediate forms. The theory is applied to explain why conditions prevailing at the time of exposure decide the corrosion-rate.

925. Faĭnshteĭn, S. M. **The mechanism of oxidation of the simplest gases by oxygen on thin silver layers.** *J. Phys. Chem. (U.S.S.R.)* **21**, 37-50 (1947).—*C.A.* **41**, 6121*c*.

Thin Ag layers produced by sublimation on glass adsorb, at −183°C and 0.01 mm Hg, about 5 mol. layers of O_2, assuming geometric areas equals real area. About 0.25-0.5 of this O_2 cannot be removed by evacuation between −183° and 300°C. After evacuation at −183°C less O_2 is adsorbed in a second and subsequent expt. Ag layers prepd. at −183°C and brought to 0°C have no adsorption capacity. Oxygen which cannot be removed by evacuating reacts with H_2 or CO at 7-40°C, the reaction being more rapid (less than 1 hr) with CO. O_2 adsorbed at −183°C loses the capacity of reacting with H_2 after heating to 200°. H_2 reacts also with O atoms on Ag crystals. Neither H_2 nor CO is adsorbed by Ag layers at −183°C.

926. Fontana, M. G. and Beck, F. H. **Nature and mechanism of passivity of 18-8S stainless steel.** *Metal Progress* **51**, 939-44 (1947).—*C.A.* **41**, 4752*b*.

Expts. with type 304 stainless steel of normal compn. from several sources of supply shows that a passivated surface becomes active after exposure to vacuum and again becomes passive by exposure to air; the action is reversible. The effect is due to a physically adsorbed layer of weakly held gas mols.

927. Gulbransen, Earl A. **The kinetics of oxide-film formation on metals and alloys.** *Trans. Electrochem. Soc.*, **91**, 31pp. (1947).—*C.A.* **41**, 4083*a*.

The fundamental factors are: (1) time; (2) temp.; (3) pressure; (4) surface prepn. and passivation treatments; (5) gas in the metal lattice; (6) surface area; (7) crystal orientation; (8) gas flow; (9) cycle oxidation; (10) vacuum effect; and (11) stability of the oxide film. Rate expts. on the metals Al, Mg, W, Mo, Fe, and 18/8 stainless steel are used to illustrate the effect of the various variables. The metals and alloys follow the parabolic rate law over a certain time and temp. range. Deviations are found for higher temps. The deviations are found to be independent of film thickness, surface prepn., and pressure. The energies of activation vary from 22,600 cal/mol. for Fe to 45,650 cal/mol. for W. The entropies of activation vary from −28.7 for 18/8 to 11.2 for W.

928. Gulbransen, Earl A. and Wysong, W. S. **Thin oxide films on aluminum.** *J. Phys. & Colloid Chem.* **51**, 1087-1103(1947).—*C.A.* **42**, 13*d*.

The oxidation of Al of various purities and degrees of polishing was followed by actual gain in wt. Al was not unique in its oxidation behavior. The oxidation followed the parabolic rate law at 350-450° and a linear law at 500-550°. Whereas O_2 pressure had little effect on the oxidation rate, the nature of the Al was important. Chem. and phys. processing treatment, as well as kind and amt. of impurities, played a part in detg. oxidation rates. The type of rate law depended only on temp., not on film thickness or other factors mentioned. Electron-diffraction patterns showed that the oxide film was amorphous.

929. Karnaukhov, M. M. and Morozov, A. N. **Kinetics of solution of nitrogen in liquid iron and in its alloys with silicon.** *Bull. acad. sci. U.R.S.S., Classe sci. tech.* **1947**, 735-47 (in Russian).—*C.A.* **42**, 1482*d*.

Absorption of N_2 by molten carbonyl Fe, outgassed to 0.001 mm Hg at a temp. regulated within 10-15°C and under low pressures, was detd. with an accuracy of 0.03 cc./100 g. The equil. soly. of N_2 in Fe was strictly proportional to $(p)^{1/2}$. The rate of soln. was greater with a smaller amt. of metal and greater relative surface. The final soly. (v) changed but little with the temp. between 1550° and 1750°C: at $p = 22$ mm Hg, $v = 7.03$ and 7.37 cc./100 g; the temp. coeff. was 0.0017 cc./degree. In Fe-Si, prepd. from carbonyl Fe and Si(SiO_2 1.46, Al 0.78, Fe 0.20), the soly. of N_2 was proportional to $(p)^{1/2}$ in all alloys (1.07-12.9% Si). N_2 was dissocd. into N and formed the nitrides Fe_xN and Si_yN, in equil. with N adsorbed at the surface [$Fe_xN \rightleftarrows x\text{Fe} + \text{N}$ and $Si_yN \rightleftarrows y\text{Si} + \text{N}$].

930. Kauki, Yrjo. **A theory of rust formation on iron.** *Trans. Chalmers Univ. Technol. Gothenburg* No. 61, 15pp. (1947).—*C.A.* **42**, 7224*c*.

The potential of Fe in O-satd. water gradually falls to a const. value, dependent on the O_2 pressure over the soln. The passive state of Fe is not dependent on this pressure, however, and is due to the formation of more or less stable compds. O_2 alone cannot lead to heavy corrosion at ordinary temps. The role of H-overvoltage in corrosion is discussed, and the effect of mech. treatment and pressure of O_2 on corrosion cells. The exact conditions for zero corrosion are difficult to calc. because of inaccurate values of the soly. product for $FeCO_3$. Fe $(OH)_2$, and $Fe(OH)_3$, the latter being the least important.

931. KEMBALL, C. **The adsorption of vapors on mercury. III. Polar substances.** *Proc. Roy. Soc. (London)* **A 190**, 117-37 (1947).--*C.A.* 42, 1476*e*.

Water, acetone, and alcs. (Me to hexyl) were adsorbed on Hg. All substances gave reversible adsorption and, except water, gaseous films were formed at low pressures. MeOH and EtOH showed the adsorption of second layer at higher pressures, the double layer having half the co-area of the original monolayer. Acetone gave rise to a double layer and finally a triple layer (with 1/3 of the original co-area). For the gaseous films of butyl, amyl, and hexyl alcs. the co-areas and the thermodynamic data indicated that the mols. were lying flat on the surface. The large entropy and heat of adsorption of water were taken as evidence of the assocn. of the adsorbed water mols., and this probably occurred, to some extent with MeOH as well. The heat of adsorption of acetone was smaller than expected for a substance with a large dipole moment. The co-areas of water and MeOH were much larger than might have been expected. Water vapor was found to be adsorbed on Hg, although not strongly at 50°C.

932. KIPERMAN, S. **Kinetics of the ammonia synthesis on ruthenium.** *Phys. Chem. (U.S.S.R.)* **21**, 1435-48 (1947).—*C.A.* 42, 5320*h*.

Mixts. of N_2 and H_2 were passed through a Ru catalyst deposited on SiO_2 gel at 552, 650, 665, 709, and 736°C. The mol. ratio H_2:N_2 was varied between 0.5 and 16, and the rate of gas flow between 19,000 and 125,000/hr. An equation for reaction rate was derived by assuming that the adsorption of H_2 is important and that there exists a particular relation between the mol. forces within the adsorbed film. The H_2 adsorption was important for understanding the value of activation energy which, on Ru, was 59,250 cal instead of 46,500 cal for other catalysts.

933. KORNILOV, I. I.; DURNOV, A. T., AND PRYAKHINA, L. I. **Rate of oxidation of quaternary alloys of iron-chromium-nickel and manganese.** *Doklady Akad. Nauk S.S.S.R.* **58**, 1665-8 (1947).—*C.A.* **46**, 3934*b*.

Oxidation rates of alloys contg. 17.3-20.5% Cr, 7.8-9.2% Ni, 16.7-2.85% Mn, and 58.2-68.5% Fe were detd. The results, indicated that at 1000°C alloys contg. Mn and Fe oxidize more rapidly than those contg. Cr or Ni. In order of rate of oxidation the series was Mn, Fe, Cr, and Ni. Most of the oxidation fell to Mn and it detns. the general rate of reaction.

934. LAKHTIN, YU. M. **The diffusion of nitrogen into iron.** *Vestnik Inzhenerov i Tekh.* **1947**, 48-55.—*C.A.* 44, 8299*a*.

In the formation of the nitrided layer, N_2 diffused most easily into the α phase of the iron, since less energy was required for the act of diffusion itself in this case. Diffusion of the N_2 into the γ phase was essentially more difficult. On the assumption of a uniform diffusion of N_2, a temp.- time relation was developed for the depth of penetration of the hexagonal ϵ phase.

935. MAMET, A. P. **The corrosion of brass under the influence of ammonia.** *Izvest. Vsesoyuz. Teplotekh. Inst. im. Felix Dzerzhinskogo* **16**, No. 10, 26-32(1947).—*C.A.* 46, 7506*b*.

The corrosion of brass by NH_3 in aq. soln. and in mixts. of water vapor, CO_2, O_2, etc. was studied. In the complete absence of O_2 there was practically no corrosion except at high concns. At very low NH_3 concns. the rate of corrosion was very slight, even in the presence of O_2. The max. attainable rate of corrosion depended exclusively on the rate of diffusion of the O_2 onto the metal surface. This max. rate was reached at about 60°C. Cooled surfaces were corroded at concns. as low as 3 mg NH_3/kg.

936. McCARTNEY, J. T. AND ANDERSON, R. B. **Crystalline aggregation of cobalt powder.** *J. Applied Phys.* 18, 902-3 (1947).—*C.A.* 42, 805*g*.

CoO was pptd. from $Co(NO_3)_2$ by NH_4OH, reduced by H_2 at 250°C, and stabilized by exposure to CO_2 at liquid-air temp. Electron micrographs were shown demonstrating the aggregation of Co metal particles into hexagonal platelets 7-25 μ in diam. The N_2 adsorption method gave 67 m^2/g for the oxide and 2 m^2/g for the metal; this indicated a sintering of the particles during reduction into large smooth droplets of metal.

937. MOTT, N. F. **Theory of the formation of protective oxide films on metals. III.** *Trans. Faraday Soc.* 43, 429-34(1947).—*C.A.* 42, 1471*d*.

It is assumed that the work function is small enough to allow the thermionic emission of electrons from the metal into the conduction levels of the oxide. If O_2 is adsorbed onto the surface of the oxide and oxide ions are formed, a strong elec. field will be set up in the oxide. The soly. of metal ions in the oxide is at the temps. considered too small for any passage of metal by diffusion. Under these very strong fields, migration of ions can take place. A theory based on these assumptions gives a limiting thickness which increases rapidly with temp. up to a certain crit. temp., which should be about 600°K for Al, above which the parabolic law should hold.

938. MOTT, N. F. **The oxidation of metals.** *J. chim. phys.* 44, 172-80(1947).—*C.A.* 42, 5317*e*.

A theory of formation of oxide films on metals in contact with air considered the solubilities and mobilities of ions and electrons from the metals in the oxide film and the resultant fields.

939. POSPEKHOV, D. A. **Oxide films on copper.** *J. Applied Chem.* **20**, 462-4(1947).—*C.A.* 42, 3302*i*.

CuO obtained by calcination of $Cu(NO_3)_2$ and reduction in H_2 at 200°C, gave nonpyrophoric Cu which, in air at room temp., underwent gradual oxidation forming violet and blue oxide films. Metallic Cu obtained from $CuCO_3$ by decompn. at

300°C, reduction in (N_2+3H_2) at 300-330°C, and cooling under the same gas, was oxidized in open air at room temp. within a few hrs to a black film. With limited access of air, dark-red, violet, and blue films were obtained which did not change any further in open air.

940. SHALER, A. J. AND WULFF, J. **Rate of sintering of copper powder.** *Phys. Rev.* **72**, 79-80 (1947).—*C.A.* **41**, 5356*e*.

Exptl. results on the sintering of uniform spherical Cu particles regularly packed and sintered in A, at 1 atm. and in a vacuum, are given. From the value of 1200 dynes/cm for the surface tension of solid Cu, the viscosity coeffs. of 2.4×10^{10} and 5×10^{9} sec/cc. at 850 and 900°C, resp., are calcd. corresponding to a heat of activation of self-diffusion of Cu of greater than 85,000 cal. In the absence of entrapped gas, the small pores disappear first, and all pores eventually disappear; with entrapped gas, the small pores shrink and the large pores expand.

941. SHIRAI, SHUNJI. **Oxidation of a thin single-crystal film of copper.** *J. Phys. Soc. Japan* **2**, 81-3 (1947).—*C.A.* **43**, 6880*f*.

The structures of pure and oxidized Cu films were studied by the transmission method of cathode-ray diffraction. A film, approx. 40 μ thick, was prepd. on the cleavage surface of NaCl at 300°C by evapn. The films were then oxidized by heating 10 min. in an elec. furnace in air between 220° and 280°C (Cu_2O), exposing to air while floating on water for several hrs (Cu_2O), and by heating at 280°C or higher in an elec. furnace for 10 min. (CuO). Films oxidized while attached to the substrate gave less perfect orientations.

942. SHVARTSMAN, L. A.; SAMARIN, A. M., AND TEMKIN, M. I. **The kinetics of consumption of carbon in a steel bath.** *J. Phys. Chem. (U.S.R.R.)* **21**, 1027-32 (1947) (in Russian).—*C.A.* **42**, 2496*d*.

About 2% electrode carbon was dissolved in Armco Fe in a large magnesite crucible, the melt heated and stirred in contact with air, and its C content detd. in samples withdrawn at intervals. If the reduction of the C-content was due to its combustion at the boundary between Fe and air, the rate of the reduction should be that of diffusion of C toward this boundary. The small temp. coeff. between 1520 and 1650°C agrees with this hypothesis. Older observations on combustion of carbon in a Bessemer hearth also agreed with the theory that the rate of combustion was detd. by phys. factors.

943. SOMERS, E. V. AND GUNTHER, D. W. **Adsorbed gases in cast iron.** *Foundry* **75**, No. 3, 66-9, 218, 220, 222, 224, 226, 228, (1947).—*C.A.* **41**, 2676*d*.

The variable amts. of dissolved O_2 and H_2 were related to changes in the phys. properties of gray-Fe castings. Cast Fe (%C plus 1/3 of the % Si) showed a higher tensile strength and a higher chill depth. A correlation of the phys. properties of the Fe with tapping temp. showed the change in chem. compn. could be attributed to oxidation of the Si and combination of oxidation and reduced soly. of the carbon. Indications are that dissolved O_2 is a carbide stabilizer. The lower chill depth, assumed to accompany a lower O_2 content, would indicate a higher H_2 content.

944. STAGER, H.; BRANDENBERGER, E., AND KOBEL, E. **The carburization of steel as reaction in the solid state.** *Schweiz. Arch. angew. Wiss. u. Tech.* **13**, 97-113 (1947).—*C.A.* **41**, 5425*f*.

Under some conditions steel may absorb carbon in the solid state. This reaction depends on the formation of primary particles. Suitable treatments at higher temps. produce secondary cryst. particles (graphitization), which change the conditions of carbon absorption.

945. STRANSKI, I. N. AND SUHRMANN, R. **Electron emission from crystalline metal surfaces and its relation to the crystal structure. I. Pure metal surfaces.** *Ann. Physik.* [6] **1**, 153-68, 169-80 (1947).—*C.A.* **43**, 6492*e*.

The relation between the emission from the faces of W crystals is discussed in relation to the crystal consts. Low surface energy goes with high work function, which explains the phenomenon in which the work function of a surface can be lowered by deposition of a partial layer of the same substance.

946. STRANSKI, I. N. AND SUHRMANN, R. **II. Single-crystal surfaces with impurity atoms.** *Ann. Physik.* [6] **1**, 153-68, 169-80 (1947).—*C.A.* **43**, 6492*e*.

Cs was first adsorbed on the 112 face of cryst. W and next on the 011 face. The covered spots spread and emission increased when the adsorbed film was thick enough, again first on the 112 face. On the 001 face of W only atoms of diams. (given in A.) 3.1, 4.5, 6.3, 8.9, etc. could form films. On the 111 face the values were 4.5, 8.9, etc.

947. TACONIS, K. W. **Properties of the liquid helium film.** *Symposium Grenslaagverschijnselen, Verhandel. Koninkl Vlaam. Acad. Wetenschap., Belg.* **1947**, 64-75 (discussion 76-7).—*C.A.* **43**, 3254*e*.

Layers of adsorbed He grow in proportion to the pressure up to thicknesses of 30 atoms. For supersurface heat transfer as well as subsurface transfer through narrow slots there is a crit. flow below which there is almost no friction.

948. TOKUMITSU, TADASHI AND OKAMOTO, HIROAKI. **Electron-diffraction study of sealing alloys for glass and metals, with special reference to Fernico.** *Proc. Phys. Soc. Japan* **2**, 76-8 (1947).—*C.A.* **44**, 10424*a*.

Oxide films covering the surface of Fe-Cr alloys, Fernico (Ni 28%, Co 15%, Cr 3%, Mn 0.65%, and Fe), and other Fe-Ni alloys are observed by means of electron diffraction. The production of lower oxides $(Cu_2O, NiCr_2O_4)$ improves the nature of metals for metal-to-glass seals and that Co atoms in Fernico produce a kind of spinel. When Fernico is oxidized in air, oxide mols. covering the surface of the metal yield strong orientation, although its nature is different according to the temp. of oxidation.

949. WELLER, SOL. **Kinetics of carbiding and hydrocarbon synthesis with cobalt Fischer-Tropsch catalysts.** *J. Am. Chem. Soc.* **69**, 2432-6(1947).—*C.A.* **42**, 1483*i*.

Rates of formation (carbiding) and hydrogenation of Co_2C and of hydrocarbon synthesis were detd. on a Co-thoria-kieselguhr catalyst by using a flowing system with observation of vol. decrease after freezing out reaction products with liquid N_2. Rapid CO consumption occurred initially diminishing to a fairly steady but much lower rate. Hydrogenation of the Co_2C proceeded at a much higher rate than formation; the diffusion of carbon through the interior was probably not the rate-detg. step for carbiding.

950. WIRTH, J. K. **Corrosion of iron under protective coatings.** *Arch. Metalkunde* **1**, 445-8 (1947).—*C.A.* **42**, 7224*b*.

Depending upon the pH value of the electrolyte, rusting might take place either below a paint layer on the Fe surface (under-coat corrosion) or on top of the coating surface (rust diffusion). Blister formation was usually assocd. with local imperfection in the coat. In addn. to the chem. compn. of the coating, its capillary properties were of great importance.

951. WYLLIE, G. **The hole theory of diffusion.** *Proc. Phys. Soc. (London)* **59**, 694-9(1947).--*C.A.* **42**, 1471*b*.

The diffusion of the solute atoms is detd. by the compd. activation energy which is the sum of the energy necessary for the formation of a hole next to a dissolved atom and the energy of activation for the hole to make one jump around that atom. It applies to cases where diffusion of a foreign metal atom in a lattice has a lower activation energy than self-diffusion in the same lattice, Au in Pb being a conspicuous example. The calcn. of the actual energies involved becomes a very difficult problem in quantum mechanics that has not yet been solved.

952. AGLIARDI, NINO AND MARELLI, SANDRO. **Activated adsorption of hydrogen and of carbon monoxide on cobalt.** *Gazz. chim. ital* **78**, 707-17(1948).—*C.A.* **43**, 3686*e*.

With "cleaved" Co, adsorption of CO was at first more rapid than that of H_2, but subsequently adsorption of CO became less than that of H_2. When the Co was poisoned with CO, the adsorption of H_2 was smaller; nevertheless the adsorption was even then more rapid than by Co not poisoned by CO. Mixts. of CO and H_2 were adsorbed more rapidly than was pure H_2. CoC_2, traces of which were formed in the surface reactions with CO, tended to stabilize the adsorbing surface, and even with successive adsorptions of H_2, the surface did not revert to its original condition.

953. ARIZUMI, TETSUYA AND NARITA, SHIN-ICHIRO. **The effect of oxygen on the oxide-coated cathode.** *J. Phys. Soc. Japan* **3**, 356-60 (1948).—*C.A.* **44**, 5696*i*.

Log of the thermionic emission current from an oxide-coated cathode was inversely proportional to the log pressure of O_2 present in the tube and directly proportional to the temp. of the cathode. If the partial pressure of the O_2 was less than 10^{-7} mm Hg, the latter relationship was linear, and the work function was equal to about 1.0 e.v.

954. ARMBRUSTER, MARION H. **The sorption of gases on a plane surface of two stainless iron-chromium-nickel alloys at 20°, -78°, and -183°C.** *J. Am. Chem. Soc.* **70**, 1734-42 (1948).—*C.A.* **42**, 5398*b*.

The surface of stainless alloy (approx. 18% Cr and 8% Ni) may differ considerably from ordinary steels. H_2, Ne, A, N_2, CO, and O_2 was sorbed at pressures up to 0.1 cm Hg. The sorption of CO_2 was detd. at -78° and -183°C. Ne and H_2 were not measurably sorbed in the range of temp. and pressure studied. A was very slightly sorbed at -183°C and could not be removed by pumping; the magnitude of the sorption was about the same as that of strongly held CO_2 at -78°. CO was the only gas that was physically adsorbed to as great an extent as a complete monolayer.

955. BARANOV, S. M. **Effect of high-silicon silicates on the properties of steel.** *Stal* **8**, 346-52 (1948).—*C.A.* 44, 512*g*.

The silicates referred to were formed when Si was added to molten steel for the purpose of deoxidation. These silicates accumulated on grain boundaries where they acted like surface-active substances during the crystn. of the melt. It was quite possible to control the quantity of surface-active components in steel by deoxidizing the molten metal with C, Al, or other deoxidizers prior to adding FeSi.

956. BARRER, R. M. **Gas-metal equilibria, interstital solutions, and diffusion.** *Discussions Faraday Soc.* **1948**, No. 4, 68-81.—*C.A.* **43**, 4917*e*.

The elements H_2, B, C, N_2, and O_2 sometimes form zeolitic solid solns. in the metals of the transition series. The kinetics and nonequil. processes for H_2 diffusion were discussed, to rate equations for phase-boundary processes and derivations of the conc. dependence of the interstitial diffision coeff.

957. BÉNARD, JACQUES AND TALBOT, JEAN. **The kinetics of the reaction of oxidation of iron in its initial phase.** *Compt. rend.* **226**, 912-14 (1948).—*C.A.* 42, 4430*d*.

The rates of oxidation of Fe specimens, 14 cm^2, were detd. at 850-1050°C. The reaction rate-time curves consisted of a portion (approx. 20 sec) during which the specimen reached thermal equil. with the furnace, a linear segment, and a parabolic segment. The transition from a linear relation to a parabolic relation occurred when the oxide was 1.3μ thick at 850°C and 7μ at 950°C. The heat of activation for the oxidation of α-Fe was calcd. to be 59,000 cal, which is very close to the heat of reaction for the oxidation of Fe to FeO, 63,000 cal. With Cu the linear segment was very short.

958. BÉNARD, JACQUES AND TALBOT, JEAN. **Influence of structure and crystalline orientation on thermal oxidation of copper and iron.** *Rev. met.* 45, 78-85(1948).—*C.A.* 42, 7687*d*.

Flat specimens of cond. Cu were deformed 25, 40, 60, and 80% by cold rolling and by tensioning, were electrolytically polished, and were heated in air at 900° ± 2°C. The oxide layer thus produced was quite adherent and was composed of a thin film of CuO adjoining the metal and columnar crystals of Cu_2O. The percentage of oxidation was detd. by weighing. Singly crystals of Cu were grown and studied for the oxidation characteristic of their crystallographic planes. Oxidation rate increased in the order (123), (100), (111), (211-110), (210-221).

959. Braunbek, Werner. **Resistance of platinum foil as a function of atmosphere.** *Z. Naturforsch.* 3a, 216-20 (1948).—*C.A.* 43, 6481*h*.

A Pt foil 2μ thick had a lower resistance in gaseous atm. than in vacuo. The difference was about 0.5% for O_2, 0.3% for A, and 0.1% for He. The differences corresponded to addnl. metal of approx. 1 monolayer thick which were explained by the setting free at the surface of conducting electrons which had been hindered in vacuo by surface potential deformations.

960. Burshtein, R. Kh. and Surova, M. D. **Effect of oxygen adsorbed on iron on the contact potential difference.** *Doklady Akad. Nauk. S.S.S.R.* **61**, 75-8(1948).—*C.A.* **42**, 8585*d*.

Thermionic current-voltage characteristics were detd. with a W cathode and a pure Fe-wire anode of 0.2 mm diam., surface area 50 cm², without and with known amts. of O_2 adsorbed on the Fe, preliminarily reduced in H_2 at 600°C and heated to 750°C. Adsorption of 2×10^{15} mols. O_2/cm^2, at 100°C, shifted the characteristic curve to higher current intensities by an amt. corresponding to a decrease of the electron-extn. work function by 0.6 v. The decrease as a function of the amt. of O_2 adsorbed passed through a max. at this point; it diminished with further increasing amt. of O_2. The curve at 150°C had a max. at about 3.6×10^{15} mols.

961. Cabrera, N. **Oxidation of aluminum at low temperatures.** *Rev. Met.* **45**, 86-92 (1948).—*C.A.* **42**, 7687*a*.

Metallic ions passed through interstitial positions in the oxide film and diffused until the air-oxide interface was reached. These ions could diffuse through the oxide by means of reticulated metallic voids called ionic openings. Free electrons passed into the cond. layer of the oxide and diffused to the air-oxide interface. In case of Al, only two described mechanisms of migration took place. They were discussed at length. A series of expts. showed that dry O_2 or O_3 did not oxidize Al in the dark, but caused the formation of an oxide layer when subjected to the action of ultraviolet light or in the presence of humidity.

962. Chaudron, Georges. **Micrographic study of the oxidation of iron and of the transformations of ferrous oxide.** *Pittsburgh Intern. Conf. on Surface Reactions* **1948**, 165-7.—*C.A.* **42**, 8133*a*.

The oxide layers formed from 650° to 1000°C had widely different structures. Under 900°C 4 consecutive crystal layers were formed: (1) crystals of FeO oriented by epitaxy on the surface crystals of Fe, (2) crystals of Fe_3O_4 pptd. in this first layer, (3) a regular layer of Fe_3O_4 crystals, and (4) an extremely thin layer of Fe_2O_3. Above 900°C one observed rapid development of magnetite the thickness of which increased rapidly.

963. Chevenard, Pierre and Wache, Xavier. **Selective surface oxidation of alloys and the effect of metallic structure on the process of thermal oxidation.** *Rev. met.* **45**, 121-8 (1948).—*C.A.* 43, 541*f*.

The effect of surface oxidation can be shown by magnetic analysis or by the use of a thermobalance. The thickness of the oxidic film produced for a 92% Ni alloy increased with time. Specimens of Ni-Al and of Ni-Cr alloys were heated to a high temp. in air, then their oxide layer was carefully removed, and cleaned specimens were heated at 1000°C for 3 hrs in vacuum, which showed that no outward diffusion of either Al or Cr took place.

964. Czerski, Lucjan. **Oxidation of copper at high temperatures and low pressures.** *Roczniki Chem.* 2, 83-92 (1948).—*C.A.* 43, 2851*a*.

The oxidation of Cu at 950°C and 20 mm O_2 occurred both at the surface of the Cu_2O layer (87%) and at the surface of the Cu (13%). The Cu_2O layer contained an excess of 0.035% Cu. The av.d. of the 1.55-mm Cu_2O layer was 6.101 ± 0.006 g/cc., whereas the d. of portions of the layer (measured from the external surface) was as follows: 0.30 mm 6.144, 0.25 mm 6.039, 0.40 mm 6.110, and 0.60 mm 6.102.

965. Dankov, P. D. and Ignatov, D. V. **Oxide films on metals. III. Electronographic investigation of oxide films produced on aluminum in gaseous discharge.** *Bull. Acad. sci. U.R.S.S., Classe sci. Chim.* **1948**, 29-39 (in Russian).—*C.A.* 42, 5294*h*.

Al surfaces (prepd. by vacuum condensation of Al vapor on polished Al foils, and by condensation on mica or NaCl and stripping by immersion in H_2O) were exposed to silent discharge in 0.5-0.8 mm Hg of O_2, under 500-600 v., 2-3 milliamp. On massive foils subjected to prolonged discharge at either the anode or the cathode, a visible oxide film formed. Thin Al films, originally translucent and appearing blue in transmitted light, became more translucent and less intensely colored after 10 min. exposure to discharge at the anode.

966. Dontsova, E. I. **Clarification of the oxidation (rusting) process of iron by means of oxygen isotopes.** *Doklady Akad. Nauk S.S.S.R.* 63, 305-6 (1948).—*C.A.* 43, 2564*f*.

Expts. using normal river water and normal air, or water enriched with H_2O^{18} with normal air, or normal water with air enriched by O^{18}, showed that the principal source of O_2 in the compn. of iron oxide (rust) is that in the water in contact with the metal. The atm. O_2 participates in rusting to the extent of about 10 % only.

967. Emmett, Paul H. **Studies of metal surfaces by low-temperature gas adsorption.** *Pittsburgh Intern. Conf. on Surface Reactions* **1948**, 82-90.—*C.A.* **42**, 8057*f*.

Theoretical and exptl. results show that by measuring the low-temp. adsorption isotherms of suitable inert gas (N_2 for example) near the b.p. of this gas, it is possible to obtain a reliable estimate of the abs. surface area of the solid being measured. The results obtained coincide with those obtained by use of the micrographs and electron microscope. Total areas ranging from 100 cm² to 2000 cm² per sample can be measured either on plane or on spherical smooth and nonporous samples. It is possible to det. the av. thickness of corrosion of the protective layer.

968. Evans, U. R. **Mechanism of the formation of films on metals.** *Pittsburgh Intern. Conf. on Surface Reactions* **1948**, 71-6.—*C.A.* 42, 8040*d*.

The growth of films on metals proceeds in four successive stages: (1) Attachment of O_2 to the surface by chemisorption with formation of a two-dimensional layer of a solid soln. (2) lateral growth during which the film (oxide) is in lateral compression. (3) Thickening of the film originating after the entire surface is covered. The thickening of the film, translated by a parabolic law, is believed to result from the outward movement of cations and electrons. (4) Periodic crack-heal growth, due to sudden cracking or blistering resulting from internal stress existing in the film. At lower temps. cracks may occur in the outer layer overlying the inner compact layer. According to the relative resistance of the two layers, the growth will obey either the parabolic or the rectilnear law.

969. FRAUENFELDER, H.; HUBER, O.; PREISWERK, P., AND STEFFEN, R. **Condensation of radioactive cadmium and silver on metallic surfaces.** *Helv. Phys. Acta* **21**, 197-8 (1948).—*C.A.* 42, 8624*c*.

Samples of Cd^{107}, made by the (p,n)-process with Ag, were deposited on a Mo wire. When heated in an evacuated space, it was found that less than 0.5% of the evapd. Cd condensed on a metallic surface placed over the wire, but nearly all of the radioactive Ag (the decay product of Cd^{107}) condensed. If the receiving surface was first plated with Ag, about 50% of the radioactive Cd also condensed.

970. GRAND, M. **Degassing aluminum alloys. Experiments with chlorine and hexachlorethane.** *Metal Ind. (London)* 72, 29-30(1948).—*C.A.* 42, 2215*c*.

Cl_2 constitutes an excellent degassing agent, but is limited because of its toxicity. C_2Cl_6, a solid, suffers partial decompn. to C_2Cl_4 and Cl_2 at 700-800°C. Thus, where 40-60 g of Cl_2 are enough to degas 55-65 lbs of Al-Mg alloy, it is necessary to employ 280g of C_2Cl_6. It is possible to slow down the evolution of Cl_2 and at the same time achieve complete breakdown of the C_2Cl_6 into its elements; in this way C_2Cl_6 consumption is reduced by about 50%. Degassing is not always instantaneous and it is therefore advisable to wait 10-15 min. before proceeding to check the effect of the treatment by means of the vacuum test. KBF_4 has been found particularly suitable in the case of the Al-Mg alloy with 7% Mg.

971. GULBRANSEN, E. A. AND ANDREW, K. **Reactions of metals in high vacuums.** *Pittsburgh Intern. Conf. on Surface Reactions* **1948**, 222-36.—*C.A.* 43, 29*d*.

Basic types of reactions between metals and various gases, found in high vacuums (pressures below 10^{-6} mm Hg) and at 1200°C, were studied. Gas-metal reactions could be classified into three groups: (1) those in which a gas was formed as the result of the reaction, (2) those in which the metal combined with the gases of the vacuum, (3) those in which one gas was exchanged for another. The exptl. investigation concerned the oxidation in vacuo of Zr, W, Mo, and 12% Cr-Fe alloy, the formation of CO as the result of the reaction between the carbon in the metal (Nichrome) and its surface oxide film, the volatilization of MoO_3 and the oxidation and evapn. of Mg.

972. GWATHMEY, ALLAN T. **Preparation of single crystals for the study of surface reactions.** *Pittsburgh Intern. Conf. on Surface Reactions* **1948**, 66-70.—*C.A.* 42, 8057*i*.

Four techniques of growth of single crystals are described. Growth from molten metal is particularly suitable for Al, Cu, Au, and Ag (in Mo-wound vacuum furnace), for Ni (in alundum crucibles) and for Bi, Cd, In, Pb, Sn, and Zn (by sealing the metals under vacuum in glass tubes). Growth of crystals in solid states can be applied to Fe after decarburizing and to Al, with the strain-anneal method. Growth by deposition from vapor is particularly suitable for Zn and W. Growth by electrodeposition is especially practical for Cu. The investigation of gas-metal systems shows that many gaseous catalytic reactions produce definite facets, the nature of which depends on the metal, the reacting gases, and the plane to which the original surface is made parallel.

973. GWATHMEY, ALLAN T.; LEIDHEISER, HENRY, JR., AND SMITH, PEDRO G. **Influence of crystal plane and surrounding atmosphere on chemical activities of single crystals of metals.** *Natl. Advisory Comm. Aeronaut. Tech Note No.* **1460**, 67 pp. (1948).—*C.A.* 42, 8040*i*.

Single crystals of Al, Cu, Au, Pb, Ni, Ag, Cr, Fe, Cd, Zn, Sn, Bi, and In were prepd. and formed into spheres 1/2 in. diam.; the surfaces were prepd. in a smooth and strain-free condition by electrolytic or chem. polishing methods. The processes studied were: oxidation in air at elevated temps., rate of corrosion by hot oils, the extent of roughness produced by corrosion, wetting by stearic acid of Cu, Ni, and Fe, rearrangement and roughening of the surface due to the action of hot gases, electrochem. processes including deposition, etching, metal replacement, and in a few cases, galvanic action.

974. HAASE, L. W. **Corrosion of refined zinc and its alloys.** *Chimie & industrie* 59, 53(1948).—*C.A.* 42, 7224*f*.

Very definite conclusions were drawn from studies regarding the dry or electrolytic coating of Fe and Zn and the use of Zn or its alloys in place of colored metals, more particularly as regards the action of water. No improvement can be expected from increasing the purity of the Zn, and the latter is not suitable as a substitute for colored metals.

975. HICKMAN, J. W. **Metal oxide films at elevated temperatures.** *Iron Age* **162**, No. 7, 90-4, No. 8, 90-4 (1948).—*C.A.* 42, 7693*h*.

Various Al alloys, Nichrome, Inconel, Stellite, Refractaloy, Kovar, Hypernik, mild steel, Hastelloy, and Z-nickel were investigated. It was not possible to predict which oxides would form on the surface of an alloy by considering the thermodynamic stability of the oxides, nor by considering the relative sizes of the metallic ions. The most important factors were the relative rates of formation and diffusion of the metallic ions, and how they were influenced by temp. An analytical method was desirable for analyzing the films while still present on the metal.

976. Kawamura, Hajimu; Shinohara, Akira, and Takahasi, Katsuya. **The active centers of the oxide-coated cathode.** *J. Phys. Soc. Japan* **3**, 301-4(1948).—*C.A.* **44**, 5696*g*.

The difference between the d. of free Ba atoms in the ordinary fine-grained oxide and that in the coarse-grained one having very low emission was investigated. The energy required to produce one active center free Ba could be calcd.: $\epsilon = H + L - E$, where E was the heat of evapn. of the free Ba, $-L$ was the energy required to condense the evapd. Ba atom to Ba metal, and H was the heat of formation of BaO. For coarse-grained crystals $E = 2.3$ e.v., $L = 1.9$ e.v., $H = 5.8$ e.v., and $\epsilon = 5.4$ e.v.; for fine-grained crystals, $H = 4.8$ e.v. and $\epsilon = 4.4$ e.v.

977. Keii, Tominaga. **Adsorption of ethylene by elements.** *Repts. Sci. Research Inst.* (Japan) **24**, 171-6(Chem. Sect., 97-102)(1948).—*C.A.* **45**, 4112*g*.

Assuming that in the adsorption reaction H_2C: $CH_2 + 2Ni \rightarrow H_2C(Ni)C(Ni)H_2$ the Ni-Ni distance (2 adjacent Ni atoms on fixed positions on the carrier) was const. and the C-C distance variable, the potential curve surfaces for the adsorption heat 60 and 38.2 kcal. and the Ni-Ni distance 3.52 and 2.49 A. were calcd. by London's approximation formula. The energy change was not much affected by the activation heat, but was greater with larger adsorption heat; with adsorption heat 38.2 kcal., the energy change was greater by about 4 kcal. when the Ni-Ni distance was 3.52 than when it was 2.49 A.

978. Korovskii, Sh. Ya. **Effect of surface-active substances on the fatigue of steel.** *Doklady Akad. Nauk S.S.S.R.* **59**, 1449-51 (1948).—*C.A.* **42**, 8748*d*.

Specimens of steel were subjected to fatigue tests in (1) air, (2) redistd. petrolatum, (3) petrolatum + 0.2% oleic acid, and (4) petrolatum + 0.3% cetyl alc. The no. of cycles required for destruction at a given load was less for (3) and (4) than for (1) and (2), the decrease being greater for quenched and tempered steel than for normalized steel. The decrease in fatigue strength in certain media was an adsorption rather than a corrosion phenomenon.

979. Krupkowski, A. **The oxidation of metals.** *Hutnicke Listy* **3**, 357-61(1948).—*C.A.* **43**, 4991*a*.

Free-energy values were calcd. for a number of metals and the affinity of individual metals to O_2 at various temps. detd. Classification of metals according to the free energy of oxidation reactions indicated the ease of impurity removal from molten metals at temps. above 1000°C by introducing O_2 or H_2O, particularly if the oxide layer which covered the metal was in a liquid state. At normal temps. and up to nearly 1000°C, a solid and dense oxide layer was formed on solid and also on liquid metals in most cases.

980. Kubaschewski, Oswald and Goldbeck, Ortrun Von. **The rate of oxidation of nickel.** *Z. Metallkunde* **39**, 158-60(1948).—*C.A.* **44**, 8209*g*.

The rate of absorption of O_2 from air by specimens of Ni from various sources was measured at various temps. The abs. value of the rate of oxidation depended upon the purity of the Ni. The purer the Ni the lower was the rate of oxidation. Oxidation was essentially a parabolic function of the time.

981. Lankford, W. T. **Hydraulic bulge testing of sheet metals.** *Symposium on Deformation of Metals as Related to Forming and Service, Am. Soc. Testing Materials, Spec. Tech. Pub.* No. 87, 66-82 (1948).—*C.A.* **44**, 91*g*.

The use of O_2 as an oxidizing agent is discussed in metallurgical high-temp. furnaces, with special reference to reactions in the bath of the open-hearth steel furnace, the purification of Cu in a reverberatory furnace, the production of alloy steels in the elec. furnace, the operation of converters both in the steel industry and in the conversion of Cu mat to blister Cu.

982. Leibu, H. J. **The reduction of iron oxides with hydrogen and carbon monoxide.** *Schweiz. Arch. Angew. Wiss. u. Tech.* **14**, 1-19. 49-59, 76-85(1948).—*C.A.* **42**, 4881*h*.

H_2 is superior to CO as reducing agent. Although below 800° CO is a relatively better reducing agent, at these temps. it tends to decomp. to CO_2 and carbon, and thus gives a reaction product of undesirably high C-content. This decompn. is hastened greatly by reduced Fe. H_2 also removes S from the iron ores in the reduction process.

983. McGinnies, Rosemary T. and Siegel, Benjamin M. **The preparation and optical properties of gold blacks.** *J. Optical Soc. Am.* **38**, 582-9 (1948).—*C.A.* **42**, 6603*i*.

Au smokes deposited on cellulose nitrate films were studied. The conditions of pressure of the inert atm., purity of the gas, rate of evapn. and the distance between source and deposition surface giving the highest infrared absorption per unit mass were found. The Au "blacks" turned yellow and had lower infrared absorption when heated above 110°C. Gold "blacks" with very high infrared transmission (3-15μ) and low transmission at shorter wave lengths were prepd. when oxygen was present in the "inert" atm.

984. Metlay, Max. and Kimball, George E. **Ionization processes on tungsten filaments. I. The electron affinity of the oxygen atom.** *J. Chem. Phys.* **16**, 774-8(1948).—*C.A.* **42**, 7156*g*.

The electron affinity of the O atom was found to be 53.8 ± 0.8 kcal./mole. The detn. was made by measuring the ratio of ions to electrons leaving a hot W filament in contact with N_2O gas at low pressure.

985. Metlay, Max. and Kimball, George E. **II. The adsorption of fluorine on tungsten.** *J. Chem. Phys.* **16**, 779-81 (1948).—*C.A.* **42**, 7156*h*.

F formed a very stable at. layer on the surface of W, which did not desorb below 2600°K. A less-stable layer was believed to adsorb over the first layer. The fraction of the F dissocd. on the W surface was exponential in temp., and the rate of loss of W from the surface was independent of temp. and of pressure, at 2000-2400° K and 1-6μ of Hg. The adsorption caused a low accommodation for the thermal dissocn. of F.

986. Shumilova, N. A. and Burstein, R. Kh. **Passivation of iron by gaseous oxygen.** *Doklady Akad. Nauk S.S.S.R.* 61, 475-8 (1948).—*C.A.* 42, 8585*g*.

Fe was reduced with H_2 at 600°C (in a vacuum-jacketed quartz tube), then out-gassed at 800°C, loaded with a known amt. of O_2, and polarized anodically in 0.1 *N* KOH, with 5.3×10^{-7} amp./cm^2 of true surface area. By detns. of the potential E as a function of the quantity Q of electricity passed, the "electrochem. yield" Q' (i.e. passivity) was detd. as a function of A = no. of O_2 mols./cm^2 of true surface area. The results invalidated the previously made assumption of a removal of the passivating oxide film anodic soln.; a quantity of electricity of 0.11 millicoulombs/cm^2 can dissolve not more than 3×10^{14} atoms Fe, hence, cannot remove an oxide film corresponding to 2×10^{15} mols. O_2/cm^2. Passivation by gaseous O_2 and by anodically evolved O_2 were basically different. Thus, in dil. alkali, Fe was passivated anodically by a fraction of a monolayer of O_2, whereas under the same conditions several mol. layers were required for passivation with gaseous O_2.

987. Terem, Haldun N. **The kinetics of the oxidation of magnesium.** *Compt. rend.* 226, 905-6 (1948).—*C.A.* 42, 4430*g*.

Mg ribbons (2.75 × 0.15 mm) were oxidized in air at 470°, 490°, 510°, and 530°C. All samples oxidized linearly with time. Samples of Mg powder (250-300 mesh) oxidized in a similar linear fashion between 420° and 480°C. When the temp. was increased at a rate of 120° per hr in the case of the ribbon and 240° per hr in the case of the powder, combustion occurred at 540°C and 470-500°C, resp. The rate of reaction was decreased to 1/3 – 1/2 when pure or moist O_2 was used in place of air.

988. Tolley, G. **Catalytic oxidation of sulfur dioxide on metal surfaces. II. Reaction of sulfur dioxide and oxygen at a mild steel surface.** *J. Soc. Chem. Ind. (London)* 67, 401-4 (1948).—*C.A.* 43, 8325*d*.

Sulfide and sulfate formation occurs simultaneously, the sulfide being concd. near the surface of the steel. The rate of sulfate formation is greatest between 580° and 635°C corresponding to the max. catalytic activity of Fe_2O_3. Water vapor inhibits sulfide and sulfate formation, but increases the rate of oxidation.

989. Triche, H. **The application of spectrographic analysis of surfaces to the study of impurities.** *Congr. groupe. avance. methodes anal. spectrograph. produits metal.* 10, 77-8 (1948).—*C.A.* 43, 5694*c*.

Samples of Zn and Sn-Cd alloy are dipped in acid. The impurities (such as Ag) not attacked by the acid become concd. on the surface. Analysis is then accomplished by passing a Tesla spark between the prepd. surface and a counter-electrode of the pure metal (Zn or Sn-Cd alloy).

990. Tyapkina, V. V. and Dankov, P. D. **Kinetics of the oxidation of silver by molecular oxygen in the gaseous electric discharge.** *Doklady Akad. Nauk S.S.S.R.* 59, 1313-15 (1948).—*C.A.* 42, 7156*i*.

Oxidation of Ag, freshly condensed *in vacuo* and unexposed to gases, by dry O_2 under low pressure (initial ~0.3 mm Hg), at 18°C, reaches 5 mol. layers of Ag_2O relative to the macroscopic surface area, and to 1 unimol. layer if the actual surface is assumed to be about 5 times the apparent area. If the oxidation is carried out in a silent elec. discharge (18°C, 700 v., 2 milliamp.) between the Ag film, deposited on the inner wall of a glass tube of 10 – 16 mm diam., and an axial Ag wire serving as cathode, no satn. is reached but oxidation (detd. from the decrease of pressure of the O_2) progresses with time along a parabolic curve, much faster and deeper than in the absence of an elec. discharge.

991. Tyapkina, V. V. and Dankov, P. D. **Electron-diffraction study of primary sulfide films on silver.** *Doklady Akad. Nauk. S.S.S.R.* 59, 1461-3 (1948).—*C.A.* 43, 32*e*.

Thin polycryst. sheet Ag was obtained by condensation of the vapor in a vacuum on celluloid. This Ag was tarnished by exposure for several hrs at 20°C to wet H_2S, with air as an impurity. The layer of sulfide (approx. 100A. thick) was studied by electron diffraction. It was concluded that the small crystallites that formed were acanthite, the rhombic modification of Ag_2S.

992. Wagner, Carl. **Reactions of metals and alloys with oxygen, sulfur, and halogens at high temperatures.** *Pittsburgh Intern. Conf. on Surface Reactions* 1948, 77-82.—*C.A.* 42, 8137*a*.

For oxides contg. an excess of O_2 as compared to the formula, oxidation is detd. by exchange of electrons between monovalent and divalent Cu ions and by motion of Cu ions which takes place by jumping of Cu ions from normal positions to adjacent vacant positions. This is the case in the formation of Ni, Fe, Co oxides, and Cu oxides and halides. The oxidation of Zn (an antithesis of the oxidation of Cu) proceeds by migration of interstitial Zn ions and quasi-free electrons and is nearly independent of the O_2 pressure. The rate of the reaction between Ag and S is controlled by the diffusion potential rather than by the concn. gradient.

993. Wiemer, H. and Fischer, W. A. **Sintered iron and carbon articles.** *Arch Eisenhuttenw.* 19, 125-35(1948).—*C.A.* 43, 1297*g*.

Sintering mixts. of Fe and C in vacuo produces ferritic-graphitic, ferritic-graphitic-pearlitic, and pearlitic structures. The mech. strength (1-60 kg/mm^2) depends on C content and sintering time and temp. The sintering atm. (N_2, H_2, CO) has no appreciable influence.

994. Akamatsu, Hideo and Satô, Kazutoshi. **Catalytic decomposition of carbon monoxide by iron.** *Bull. Chem. Soc. Japan* 22, 127-31 (1949).—*C.A.* 44, 7637*f*.

CO was passed through a quartz reaction tube contg. Kahlbaum's electrolytic Fe as catalyst. The exit gases passed through $Ba(OH)_2$ soln. to follow the reaction: $2CO \rightarrow C + CO_2$. Five to ten hrs were necessary for decompn. to begin at 500°C and CO flow of 400 cc. per hr. Once started, the reaction proceeded smoothly. Electron diffraction patterns of the catalyst were taken just as decompn. had begun and after 15 hrs of decompn.

In the 1st case no free carbon was found, but the Fe lost its metallic luster. The pattern obtained was that of cementite. When the surface was black or gray in parts, the pattern was principally carbon but some cementite spacings also appeared. Prolonged decompn. yielded only carbon spacings.

995. ANTONIOLI, A. **Statistical observations on the oxygen content in steel making.** *Met. ital.* **41**, 71-9 (1949).—*C.A.* **43**, 8331*i*.

Existing data on O-content agree with the hypothesis of reaction between heterogeneous phases, but not between homogeneous phases.

996. BAKER, W. A. **Estimation of oxygen in metals by hydrogen reduction.** *Metallurgia* **40**, 188-9 (1949).—*C.A.* **43**, 8963*f*.

A pot-type Pt-sound furnace heated the inclined part of the SiO_2 combustion tube. The app. was calibrated either by reduction of known wts of an oxide of known compn. (e.g., PbO) or by introducing a known vol. of gas into the exhausted system. Fused Al_2O_3 crucibles should be used in the combustion tube. The method is applicable to Cu, Sn, Pb, and to alloys of these elements. Errors due to volatile constituents (P or Zn in Cu-base alloys) may be minimized by using a relatively large bath of a suitable metal, such as Sn, in the combustion tube, deoxidizing the bath during the initial purification of the H_2, and then adding the sample to be examd. to the molten bath.

997. BISCHOFF, F. **Nitrogen absorption in electric-arc welding.** *Schweisstech. Appendix to Die Technik* **4**, 229-34 (1949).—*C.A.* **43**, 9017*c*.

Mn increases N_2 absorption for both bare and coated electrodes, that of the latter being somewhat weaker. Cr increases N_2 absorption noticeably for both types of electrodes though slag and coating weaken it slightly. Ni reduces N_2 absorption, independently of Ni content. Mn + Cr alloyed wires gave an approx. additive absorption of each single element. With bare Mn-Ni wires higher Ni contents affected the absorption so unfavorably that the N_2 contents of bare electrode welds of Mn wires was not reached.

998. BOSWORTH, R. C. L. **The formation of mobile and immobile films of oxygen on tungsten.** *J. Proc. Roy. Soc. N. S.* **83**, 31-8 (1949).—*C.A.* **45**, 6005*d*.

The condensation of O_2 on W was studied by application of the contact-potential method. Values of the fraction of the surface covered, θ, were detd. as a function of time at fixed O_2 pressures and temps. At values of $\theta = 0.5$, or a little less, the condensation proceeded more slowly the higher the temp. at any fixed pressure, and more than proportionally slowly the lower the pressure at any fixed temp. This is attributed to the activation of some of the absorbed O_2 atoms to a mobile state which proceeded the more rapidly the higher was the temp. and the more completely the lower was the pressure. The surface diffusion coeff. (D) at 830°K and $\theta = 0.5$ was 2.5×10^{-16} cm²/sec., D increased as θ increased. At 830°K and $\theta = 0.7$, $D = 4.8 \times 10^{-16}$ cm²/sec, at 830°K and $\theta = 0.8$.

999. CABRERA, N. **The oxidation of metals at low temperatures and the influence of light.** *Phil. Mag.* **40**, 175-88 (1949).—*C.A.* **44**, 507*c*.

The theory of Mott was extended to oxides, such as Cu_2O for which the metal diffuses through the oxide by the mechanism of vacant lattice points. The logarithmic law would be valid down to very low temps. and for O_2 above $\sim 10^{-4}$ mm Hg independently of the temp. and the oxide considered. The model also explained the influence of light on the oxidation of Al.

1000. CASTRO, R. AND ARMAND, M. **Gases in aluminum and its alloys.** *Rev. met.* **46**, 594-616 (1949).—*C.A.* **44**, 516*i*.

The only gas which appeared to dissolve in liquid Al was H_2, and its soly. of a few cc. per 1000 g rapidly diminished with lowering temp. At the fusion point of Al, H_2 soly. was negligible. Nitrides and oxides could usually be found in H-bearing Al. The gases entered Al through the reaction with the atm. in contact with the metal. H_2O adsorbed on the surface of solid Al eventually caused blisters, and appeared to be the most detrimental substance in metallurgy of Al.

1001. CORDIANO, JOSEPH J. **Some effects of oxygen on the performance of iron powder.** *Proc. Ann. Meeting Metal Powder Assoc.* **5**, 21-35(1949).—*C.A.* **45**, 4184*c*.

Fe mill scale was ball milled to a minus 100-mesh powder and reduced in dry H_2 to produce 7 powders varying in oxide content. An addnl. high apparent d. powder was also included in the group. Zn stearate (1% by wt) was mixed in each powder for lubricating purposes. These were sintered at 2050°F for 20 min. at temp., in dry H_2, followed by cooling in the H_2O-jacketed cooling section of the furnace. After sintering the specimens were of a silver-gray color and no traces of lubricant remained. Internal oxides in Fe powders did not materially affect the mech. properties of sintered Fe compacts, but did have a strong effect on decreasing the d. of green and sintered compacts.

1002. CZERSKI, LUCJAN. **Oxidation of copper with air at high temperatures.** *Roczniki Chem.* **23**, 19-28 (1949).—*C.A.* **43**, 8930*h*.

Cu_2O obtained from Cu and O_2 at 950°C contained 0.07-0.35% Cu (23 analyses) in excess of the stoichiometric amt. In Cu_2O prepd. under reduced pressure of O_2 the excess Cu dropped to 0.035%. The excess Cu was irregularly dispersed throughout the oxide; it did not diffuse toward the CuO layer, and did not oxidize even at 950°C (40 hrs). It might be a result of a reaction at the CuO/Cu_2O surface.

1003. DANKOV, P. D. AND SHISHAKOV, N. A. **The crystallochemical mechanism of formation of oxide film on iron at room temperature.** *Zhr. Fiz. Khim* **23**, 1031-5(1949).—*C.A.* **44**, 893*i*.

Electron-diffraction patterns of Fe films condensed from vapor at 2×10^{-4} mm Hg show lines of expanded Fe lattice (spacing up to 3.00 A.), broad lines apparently due to wuestite FeO, and lines of magnetite and $\gamma-Fe_2O_3$. The intensity of wuestite lines indicates that there are 2 ⅔ atoms of Fe for 4 atoms of O. Presumably, the external layer of Fe ions in the metal is expanded to the spacing of wuestite in the (100) face so that O ions can readily enter it.

1004. DEINUM, H. W. AND DAM, J. W. **Determination of small quantities of oxygen.** *Anal. Chim. Acta* 3, 353-9 (1949).—*C.A.* 43, 8963*d*.
The O_2 reacts with metallic Cu in an ammoniacal NH_4Cl soln., and the dissolved Cu^{++} is detd. iodometrically. SO_2, H_2S, C_2H_2, and mercaptans interfere and must be eliminated. As little as 0.001% O_2 in gaseous mixts. contg. high proportions of C_2H_2 can be detd.

1005. DERGE, GERHARD. **Oxygen in titanium.** *J. Metals* 1, No. 10, 31-3 (1949).—*C.A.* 43, 8963*h*.
Proper modification of the vacuum-fusion analytical procedure as ordinarily applied to steels resulted in the satisfactory analysis of carefully prepd. Ti-O_2 alloys contg. up to 0.5% O_2.

1006. DOCKAR, J. **The influence of some additions on the speed of carburization of steels by charcoal.** *Hutnicke Listy* 4, 345-51, 389-91 (1949).—*C.A.* 44, 3862*d*.
Na_2CO_3 was dissolved in distd. water, the soln. was absorbed by the charcoal which was then dried. Mixts. contg. 10, 8.5, and 6% Na_2CO_3 had a corrossive effect on the steel surfaces. A 3% Na_2CO_3 mixt. gave uniform carburization without loss in intensity and had no corrosive effect on the parts to be carburized during the process. The specimens were all from the same melt for each type of steel and the charcoal taken from the same sack. Charcoal impregnated with "stabilizers" combined with Ba compds. form high grade carburization mixt., and a mixture contg. 5% of Ba compds. combined with Na salts can be used. A mixt. of Be and Na compds. was very effective.

1007. ELLIOTT, K. A. C. **Removal of traces of oxygen from gases.** *Can J. Research* 27F, 299-300 (1949).—*C.A.* 43, 7758*e*.
A furnace for heating metallic Cu in a current of the gas consists of a Pyrex tube which is wrapped with asbestos paper, and wound with Nichrome wire. The wire is covered with a second layer of asbestos paper and with asbestos cord. The tube is packed with CuO wire fragments held in place with rolls of Cu gauze. Windows are provided for observing the condition of the Cu. To reduce the CuO, H_2 mixed with a carrier stream of N_2, or other inert gas, is passed through the hot tube.

1008. ESELGROTH, T. W. **Nitrogen degassing of nonferrous metals.** *Metal Progress* 55, 817-20 (1949).—*C.A.* 43, 5715*d*.
Degassing Al, Cu, 95 Cu-5 Mn, and 89.5 Cu-10.5 Sn with N_2 gave improved mech., elec., and thermal properties, cleaner metal, and freedom from porosity. N_2 was less expensive than A and He, easier to use than Cl_2, and did not form undesirable inclusions.

1009. GILDE, WERNER. **Nitrogen in Thomas low-carbon steel.** *Chem. Tech.* 1, 183-5 (1949).—*C.A.* 44, 6795*b*.
N_2 strongly affected the mech. properties of steel; it especially caused brittleness. To compensate for the effect in Thomas steel, most of the absorbed N_2 was eliminated in the mixer. The oxide-film theory explained the influence of the charging rate to the mixer on the N_2 absorption. The elimination of the N_2 in the pan and in the pig was described.

1010. GRAY, T. J. **The application of semi-conductivity measurements in the study of catalysis on copper oxide.** *Proc. Roy. Soc. (London)* A197, 314-20 (1949).—*C.A.* 44, 2355*g*.
The elec. cond. of thin films of oxides was used to study the effects of adsorbed gases and reactions between them. This was applied to the Cu_2O-CuO system.

1011. GULBRANSEN, EARL A. **Kinetic and structural factors involved in oxidation of metals.** *Ind. Eng. Chem.* 41, 1385-91 (1949).—*C.A.* 43, 7309*d*.
By a sensitive wt-gain method the oxidation of Fe, Mo, W, Al, and Mg was studied as a function of time, temp., pressure, and surface area. At 400°C the order of increasing rate of reaction was Mg, Al, W, Fe, and Mo. After a rapid initial period the parabolic law may be fitted to the data for many metals. The rate law followed an exponential behavior, whereas the effect of pressure was small for most metals in the pressure range studied. An electron-microscope study of stripped oxide films showed the film to consist of crystals of the order of 50 to 2000 A., depending on the temp. and time of reaction. The free energy of activation for the rate-limiting process varied from 36,040 cals per mole at 375°C for Mo to 56,100 for 18-8 stainless steel at 650°C.

1012. GULBRANSEN, EARL A. AND ANDREW, KENNETH F. **Kinetics of the reactions of titanium with oxygen, nitrogen, and hydrogen.** *J. Metals* 1, No. 10, Trans. 741-8 (1949).—*C.A.* 43, 9006*i*.
TiO_2, TiN, and TiC were stable at all temps. up to the transition temp. From a thermodynamic point of view, Ti will remove O_2, N_2, CO, and CO_2 at the lowest pressures used in high-vacuum technique. The reactions of water and CO_2 to form the oxide and H_2 and CO, resp. were possible up to 800°C and perhaps higher in vacuums of the order of 10^{-7} mm of Hg. An energy of activation of 26,000 cal per mol. was calcd. from the temp. dependence of the parabolic rate law consts. The O_2 reaction was found to be insensitive to pressure.

1013. HAYES, E. T. AND ROBERSON, A. H. **Effects of heating zirconium in air, oxygen and nitrogen.** *J. Electrochem. Soc.* 96, 142-51 (1949).—*C.A.* 43, 8910*f*.
Zr metal was heated in N_2, O_2, and air at from 425° to 1300°C. Observations were made on the gain in weight, micro- and macro-hardness, and metallographic structures. N_2 diffused into Zr at a much slower rate than O_2. A marked increase in penetration of both gases was found near 900°C. Practical limits for the heating of Zr in air, O_2, and N_2 were given and the posibilities of producing hard-surface coatings were discussed.

1014. HERRMANN, G. AND KRIEG, O. **The influence of gases and vapors on the emission of oxide cathodes.** *Ann. Physik (6)* 4, 441-64 (1949).—*C.A.* 46, 9968*g*.
The emission E_s of a SrO-BaO cathode (on indirectly heated Ni tubes) was detd. at cathode temps.

T_s of 300-1500 °K. Only after the removal of the whole oxide film did a decrease in E_s occur. Purely chem. influences were observed in the cases of O_2, CO_2, CO, and the hydrocarbons; O_2 combined with the free Ba in the activated cathode. CO_2 and CO reacted both with Ba ($Ba + CO_2 \rightleftarrows BaO + CO$ and $Ba + CO \rightleftarrows BaO + C$) and with the oxide itself ($MO + CO \rightleftarrows MCO_3$ and $MO + 2CO \rightleftarrows MCO_3 + C$). These reactions caused E_s to drop. CH_4, C_2H_6, C_3H_8, C_2H_2, benzene, toluene, and naphthalene poisoned the emission as a result of their decompn.

1015. Huttig, G. F. **The relations between adsorptivity and corrosion.** *Berg-u hutten-mann, Monatsh. montan. Hochschule Leoben* 94, 282-4 (1949).—*C.A.* 44, 1389*b*.

The corrosion of sintered bodies and powders depended in the first place on a quality of the surface since that determined the beginning of corrosion. The quality of the crystal lattice determined only secondarily the velocity of propagation of the corrosion into the interior. There was a definite relationship between corrodability and the adsorptive properties of a metal powder.

1016. Imada, Fusao. **The hydrogenation catalysts for oils. I. The constituents of the spent catalyzers. II. The preparation of catalyzers from the spent catalyzers and the hydrogenation study. III. Chemisorption and catalytic activity.** *Kôgaku Ihô, Kyushu Univ.* 20, 105-9; 21, 1-3, 14-27 (1949).—*C.A.* 47, 1408*i*.

Adhering matter on the spent hydrogenation catalyzers is analyzed. Adsorption of unsaponifiable oil matter to the active centers of the catalyzer is thought primarily to be the reason for aging. Since the sol. metal oxide components in diatomaceous earth play a role as promoters, the addition of new earth is found to be advantageous. The recommended procedure for the prepn. of recovered catalyzers is described. The sorption ability for H_2 and C_2H_4, and hydrogenation properties of catalyzers of Ni, Al-Ni, Cu-Ni, Fe-Ni, Ni-Fe-Al, with or without diatomaceous earth and activated carbon are compared.

1017. Itterbeek, A. van and Greve, L. de. **Measurements on the electrical resistivity of thin metallic films.** *Physica* 15, 80-2 (1949)(in English).—*C.A.* 43, 8771*e*.

The temp. coeff. of resistance for a thin metal film as a function of film thickness became zero at a crit. resistance, R_c, and then became neg. with thinner films. Values of R_c were measured for Ni films, cathodically sputtered in the presence of He, H_2, A, Ne, and N_2. The smallest values of R_c were found with H_2 and A, corresponding to a film thickness of ± 40 mμ. In the other cases, the thickness decreased by about 5 mμ.

1018. Itterbeek, A. van; Greve, L. de., and Celis, R. **The negative temperature coefficent of nickel films.** *Physica* 15, 433-6(1949).—*C.A.* 44, 3324*c*.

New values of the crit. elec. resistance (ohms) of Ni films deposited on Pyrex glass by cathodic sputtering were (gas and film thickness in parentheses): 25,000 (N_2, 20mμ); 4500 (H_2,40mμ); 7500 (Ne,30mμ); 25,000(He, 20mμ); 3000 (A, 40mμ). Voltage changes in the range of 3000 to 4000 had little effect.

1019. Itterbeek, A. van; Greve, L. de.; Lambeir, R., and Celis, R. **Nickel films used as thermometers at low temperatures and superconductivity of lead films.** *Physica* 15, 962-70 (1949).—*C.A.* 44, 5174*h*.

Ni films cathodically sputtered in A, Ne, and H_2 had neg. temp. coeffs. of cond. and could measure temps. in the region of liquid H_2 and liquid He. Films prepd. in Ne were the most stable. Pb films, prepd. by sputtering in N_2 were used in the transition region (range of 1°K) for supercond. The residual resistance of the Pb films was initially very high and disappeared completely at the transition point, for Pb wires, 7.20°K.

1020. Knauer, Friedrich. **The residence time of adsorbed alkalies on heated tungsten.** *Z. Physik.* 125, 278-89 (1949).—*C.A.* 43, 4942*c*.

A mol. beam of alkali atoms (K, Na, Cs) passed through a rotating sector to an incandescent W wire and the resulting ionic current recorded. In each cycle, an appreciable length of time (longer for lower wire temps.) was required for the current to reach its max. value. This was evidence for an adsorbed layer of atoms on the wire. The observed residence times were in the range 10^{-2} to 10^{-5} sec.

1021. Koga, Shozo and Wakabayashi. **Application of surface potential. II. Low-temperature oxidation of metals.** *Repts. Sci. Research Inst.* 25, 306-11 (1949).—*C.A.* 45, 4583*b*.

The potential curves of Cu, Zn, and Al, being oxidized below 200°C, and obtained with an improved oscillatory volumetric surface potentiometer, rose with temp., but not necessarily linearly with the thickness of the oxide layers. The Cu curves showed initial inhibition owing to decreased O_2 partial pressure, the oxide formed being a semiconductor of deficient type, whereas the Zn and Al curves were not so affected.

1022. Kopelman, Bernard and Gregg, C. C. **Particle agglomeration in tungsten metal powder.** *J. Phys. & Colloid Chem.* 55, 557-63(1951).—*C.A.* 45, 6010*c*.

Particle-size distribution of W powder in 11 liquids of different dielec. consts. as detd. by turbidimetric analysis showed the apparent av. particle size (μ) to decrease with increasing dielec. const. (D) up to a max. at $D = 25$. The surface bonds in the metal powder resulting from elec. attraction were completely broken in assocd. liquids for which D exceeds 25. Essentially complete agglomeration of the powder occurs in liquids for which D was less than 2.

1023. Kwan, Takao. **Adsorption of carbon monoxide on platinum catalyst.** *J. Research Inst. Catalysis* 1, 110-16 (1949); *Bull. Chem. Soc. Japan* 23, No. 3, 70-2 (1950).—*C.A.* 44, 4304*d*; 45, 3221*a*.

CO adsorption isotherms were measured at pressures between 0.001 and 1 mm Hg at 180°, 200°, 280°, and 300°C. Data were expressed by $x = CP^{1/n}$, where x was adsorbed quantity, P was the equil. pressure, and $n = 2.7$. The differential heat of adsorption was const. for all quantities adsorbed and equals 11 kcal/mole. An expression was derived for the change in heat of adsorption with fraction of surface covered with best agreement assuming that CO was dissocd. to C and O.

1024. Likhtman, V. I. and Venstrem, E. K. **Effect of the dimensions of metal single crystals on the shape of the strain-stress diagram and on the strength-lowering influence of adsorption.** *Doklady Akad. Nauk S.S.S.R.* 66, 881-3 (1949).—*C.A.* 43, 7768*h*.

The effect is attributed to increased shear due to the presence of numerous micro cracks in the surface layer. The effect of surface-active substances, e.g. 0.2% oleic acid in liquid petrolatum, in the direction of increasing the plasticity, is more pronounced at small ratios of length to diameter, owing to the predominant concn. of micro cracks in the surface layer. Under the action of surface-active substances, the preferential accumulation of stress in the surface layer is smoothed out; this accounts for the observed disappearance of the shift of the yield point in the presence of such substances.

1025. Makolkin, I. A. **Adsorption balance for investigation of metal corrosion at high temperatures.** *Zavodskaya Lab.* 15, 1209-12(1949).—*C.A.* 44, 996*h*.

It consists of a Mo spring, placed in a protective jacket (vertical) with a suitable pointer-scale arrangement; the lower end of the spring terminates in a glass fiber carrying the sample which is located in an upright furnace tube. The fiber passes through a tiny opening in latter and thus eliminates the effect of heat on the measuring spring.

1026. McGeary, R. L.; Stanley, J. K., and Yensen, T. D. **Determination of oxygen in metals by the vacuum fusion method.** *Trans. Am. Soc. Metals, Preprint* No. **10**, 14 pp (1949); *Steel* **126**, No. 10, 81-2 (1950).—*C.A.* 43, 8215*g*; 44, 3841*a*.

The metal was melted in a graphite crucible in an evacuated system to convert oxides to CO which was passed over hot CuO to form CO_2. A part of the system was cooled by liquid N_2 which collected CO_2 and removed other gases by vacuum pumps. The CO_2 was expanded and its vol. measured. Accuracy was ±0.001% in 15 to 20 min. with 0.1-2.0 g samples.

1027. Moreau, L. **Determination of oxygen in steels.** *Rev. universelle mines* 5, 279-83 (1949).—*C.A.* 43, 8962*i*.

The steel sample is melted in a graphite crucible in vacuum under a reducing atm. in a high-frequency furnace consisting of a cylindrical tube of fused silica. With a vacuum of 10^{-3} mm Hg and the temp. necessary for complete and rapid reduction are for FeO and MnO 1050-1150°C, silicates 1150-1300°C, SiO_2 1300-1350°C, Al_2O_3 1575-1600°C. The reaction taking place is FeO (dissolved) + $C \rightarrow CO + Fe$, and the O_2 is detd. from the CO.

1028. Mostovetch, Nicolas. **Reversible effects of the adsorption of gas on the electrical conductivity of metallic films.** *Compt. rend*, **228**, 1702-4 (1949).—*C.A.* 44, 403*c*.

The elec. resistances of thin films of Mo, Pt, Rh, Ni, and Au have neg. temp. coeffs. diminished by the adsorption of gases and reversibly increased by outgassing. The elec. resistance of thicker films of these metals has a pos. temp. coeff. increased by adsorption of gas and decreased by outgassing. The resistance of these films is related to the pressure of the gas by the expression: $\log R = -n \log p + \log b$, where n and b are exptl. consts.

1029. Müller, Erwin W. **Surface migration of tungsten on its own crystal lattice.** *Z. Physik* **126**, 642-65(1949).—*C.A.* 44, 2836*b*.

A very fine W point, sharpened in molten $NaNO_2$ and heated in the highest obtainable vacuum, became a smooth cone with a hemispherical apex whose radius increases with time. The electron emission from individual crystal surfaces can be identified in the resulting images. The condensation of W vapor on these surfaces and the migration of W atoms along them are studied by means of photographs. The activation energy for surface migration is 106,500 ± 8000 cal/mol The presence of foreign adsorbed atoms on the W surface appears to accelerate the surface migration, but the amt. of W that migrates is decreased.

1030. Naeser, Gerhard. **A new method for determining oxygen in soft iron, steel, and some other metal powders.** *Stahl u. Eisen* 69, 19-21 (1949).—*C.A.* 43, 6108*f*.

Formation of CO from the O_2 by reaction with C was done in a stream of N_2. The vol. of CO was detd. by using a buret in an arrangement similar to the one used for steam vol. detn. The CO_2 was found to be between 3 and 12% resulting in an error of ±25% in the O_2 found. It is essential, therefore, to transform all the CO_2 into CO. The app. was operated at 1300°C. The accuracy of the method was checked by treating pure oxides. For pure Fe, the error was ±2.3% av.

1031. Nagasako, Noboru and Miyazaki, Shozo. **The catalytic decomposition of ammonia. I. The decomposition on tungsten.** *J. Chem. Soc. Japan* **70**, 134-6 (1949).—*C.A.* 45, 4124*g*.

Studies were made on the catalytic decompn. of NH_3 on W in the form of filament heated electrically to 700-70°C. When the decompn. products were absent, the reaction was of the zero order. H_2 repressed the reaction below the zero order, whereas N_2 had no effect. This showed that the adsorption of N_2 from the gaseous phase was negligible, but the active surface remained entirely covered with H_2 and NH_3 within the temp. range.

1032. Noga, Ken-ici and Okada, Yoshitaro. **The mechanism of grid emission,** *J. Phys. Soc. Japan* 4, 360-1(1949).—*C.A.* 44, 5696*f*.

BaO mols. were evapd. from a hot oxide-coated cathode and deposited on heated wires of W, Ni, and Au. The emission property of the W wire, as a result of this coating, was found to be of the same order of magnitude as that of the usual oxide-coated cathode. The Ni and Au, however, were lower by factors of 10^{-2} and 10^{-5}.

1033. Novokreshchenov, P. D.; Markova, N. E., and Rebinder, P. A. **The adsorption effect in alternating torsion, in connection with the problem of fatigue of metals.** *Doklady Akad. Nauk S.S.S.R.* **68**, 549-52 (1949).—*C.A.* 44, 507*f*.

In unidirectional torsion of Sn wires (diam. 1 mm, length 10 mm), with simultaneous application of a tensile load, the torque was substantially lower in a surface-active medium (0.2% soln. of oleic acid in nonpolar liquid petrolatum). The effect increased with the deformation, attaining a 94% lowering near rupture. In alternating sinusoidal torsion, with simultaneous static tension, adsorption effects appeared clearly at relatively low periods of 4-8.5 min. The effect was explained by a fine dispersion of the surface layer, owing to which the metal became more plastic and withstood a greater no. of torsions before failure.

1034. Perrot, Marcel and Arcaix, Suzanne. **Effect of the adsorption of gas on the evolution of thin films.** *Compt. rend.* **229**, 1139-42 (1949).—*C.A.* 44, 4302*e*.

Two thin films of Ag of comparable thicknesses were prepd. The reflection (R') for a wave length of 5461 A. and the resistance (R) were measured simultaneously under low pressure. Variations of R' with time (after the end of sputtering) were low and comparable; variations of R differed considerably for the two. The min. in resistance was attributed to adsorption at a pressure of 10^{-5} mm of Hg. With dry air, resistance became const. after rising with pressure to about 50 mm. With lab. air, resistance continued to increase with gas pressure. Satd. air behaved similarly except that the magnitude was greater. Thus, water vapor had a great effect in building up the resistance.

1035. Robertson, A. J. B. **The pyrolysis of methane, ethane, and butane on a platinum filament.** *Proc. Roy. Soc. (London)* **A199**, 394-411 (1949).—*C.A.* 44, 2354*b*.

A mass spectrometer was used to examine the reactions on an incandescent Pt filament at pressures of about 10^{-5}mm. Free radicals were directly detected by ionizing them with low-energy electrons. The primary dissocn. of CH_4 on Pt at about 1000°C gave Me radicals, but no methylene radicals could be detected. About one in 300 of the collisions of the CH_4 on Pt led to reaction. No free Me or Et radicals could be detected in the dehydrogenation of ethane to ethylene at 950°C. The presence of Me radicals from methane in the ethane did not bring about any further dehydrogenation of ethane. Et radicals were detected from the pyrolysis of butane at 1050°C which underwent a selective fission at the central C-C bond.

1036. Rowland, P. R. **Reactivities of different faces of a copper single crystal.** *Nature* **164**, 1091-2(1949).—*C.A.* 44, 3327*c*.

Single-crystal spheres of Cu are exposed to halogen vapors at 1 mm and 444°C. The cuprous halides are sublimed away, leaving a clean Cu surface contg. etch pits. The reflecting surfaces of the etch pits are parallel to certain crystallographic planes and are examd. with parallel light. The facets exposed and the intensities of their reflected beams are: (111) and (011) strong, (001) very weak, (012) strong for I_2 and Br_2 but weak for Cl_2.

1037. Saitô, Tunezô. **Absorption of nitrogen by molten iron alloys. I. Study on pure iron.** *Science Repts. Research Insts. Tôhoku Univ.* **Ser. A, 1**, 411-17(1949)(in English).—*C.A.* 45, 4626*e*.

The absorption was measured between 1530 and 1750°C. The satn. value of pure Fe at 1600°C was 0.039 wt % N_2. The temp. coeff. was 1.4×10^{-5} wt % N_2 per degree. The addn. of small amts. of C, Si, Mn, and Cr increased the velocity and Ni decreased the velocity.

1038. Saitô, Tunezô. **Absorption of nitrogen by molten iron alloys. II. Study on iron-nickel, iron-chromium, and iron-manganese alloys.** *Science Repts. Research Insts. Tôhoku Univ.* **Ser. A, 1**, 419-24 (1949).—*C.A.* 45, 4626*e*.

With Cr alloys the satn. value increased from 0.039% N_2 for pure Fe at 1600°C up to 4% N_2 for Cr at about its m.p. Pure Mn at its m.p. absorbed 1% N_2. In the Fe-Ni alloys the absorption decreased with increase in Ni concn. to a value of approx. 0% at 80% Ni.

1039. Samarin, A. M. and Shvartsman, L. A. **Activities of carbon and of oxygen dissolved in liquid iron.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* **1949**, 1231-4.—*C.A.* **45**, 4187*e*.

The deviations from ideality for the equil. between C and O_2 dissolved and gaseous CO can be accounted for without assuming significant soly. of CO in Fe. The deviation of the actual O content is explained by the expansion of the free vol. v as a result of the interstitial soln. of C. This is taken to be $v = V - \omega$, where V = sp. vol., and ω is a const. close to the sp. vol. of the solid phase at the m.temp. Increase of the C content decreases the O content as a result of the chem. reaction; on the other hand, the substitutional soly. is increased somewhat as a result of the increase of the free vol.

1040. Shinohara, Shozo. **Oxide layer on the surface of metals.** *Busseiron Kenkyu*, No. **13**, 7-14 (1949).—*C.A.* 47, 3070*i*.

The theory of the rate of growth of protective oxide layer on metals is improved by taking into account the image force in the case in which the logarithmic law holds.

1041. Shushunov, V. A. and Aurov, A. P. **Kinetics of the reaction of lithium with ethyl chloride vapor.** *Zhur. Fiz. Khim.* **23**, 1197-202 (1949).—*C.A.* 44, 1312*g*.

Li was condensed from vapor on the inside of a glass bulb (4 cc.). EtCl was introduced, and the pressure P detd. with a membrane manometer. Below 30°C, P decreased in time, and eventually LiEt (m 95°) formed. After a latent period the decrease of P was proportional to t^n, t being time and $n = 1.4$ at -25°C and 1.1 at +20°C. Up to 3%, O_2 in EtCl did not affect the rate of reaction, but 10% O_2 lowered it because of formation of Li_2O.

1042. Shushunov, V. A. **Kinetics of the reactions of potassium with carbon monoxide.** *Zhur. Fiz. Khim.* **23**, 1322-7 (1949).—*C.A.* 44, 2833*d*.

K was condensed in a vacuum on a Cu foil suspended on a spring balance, and the vessel was filled with CO. The wt gain corresponded to uptake of 1 mol. CO. Then H_2O vapor was admitted and 1 mol. H_2O taken up. The reaction between K and CO started after a latent period r which at a CO pressure of 3 mm Hg was 22 sec at -183°, 37 sec at -90°, 2 sec at -50°, 25 sec at -20°, and 100 sec at -10°C. If p was the CO pressure after time t, $p_o - p = at^n$, a and n were const. which in different expts. varied between 1.4 and 3.

1043. SHUSHUNOV, V. A. **Effect of additions to the gas phase on the rate of reaction between potassium and carbon monoxide.** *Zhur. Fiz. Khim.* 23, 1328-31(1949).—*C.A.* 44, 2833*g*.

The reaction was not affected by H_2 (up to 50 vol. %) and greatly retarded by 5 vol. % AcOEt, presumably because of formation of a K deriv. of AcOEt. It was accelerated by O_2 between 30° and 60°C the initial rate was proportional to the O_2 concn. (0-10 vol. %) and its temp. coeff. was −2. The effect of O_2 might be due to roughening of the K surface.

1044. STARK, B. V. AND FILIPPOV, S. I. **Adsorption phenomena on the surface of liquid steel.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* **1949**, 413-20.—*C.A.* 45, 5590*f*.

Surface tension of steel melts was detd. in an 8-kg induction furnace by passing N_2 through a capillary inserted in the melt. An increase in the C or O-content of the melt decreased the surface tension. Adsorption of C and O on the phase boundaries was calcd. from the surface tension data. When C and O were in equil. in the melt, the surface tension curve passed a max. which corresponded to equal adsorption of C and O.

1045. STARODURTSEV, S. V. **Investigation of adsorption phenomena by the method of modulated molecular beams.** *Zhur. Eksptl. Teoret. Fiz.* 19, 215-24 (1949).—*C.A.* 44, 6699*b*.

An at. or mol. beam produced by evapn. and collimated through slits was aimed at an incandescent filament. Mech. modulation of the beam gave rise to a modulation of the current due to ionization of the particles adsorbed on the filament. Each adsorbed atom had a definite probability, *w*, of evapg. from the surface either as a neutral atom or as a pos. ion. Exptl. detns. were made with beams of K and of Na on a W filament.

1046. THONON, CL. AND JUNGERS, J. C. **Dehydrogenation of secondary alcohols in the liquid phase with nickel as a catalyst.** *Bull. soc. chim. Belges* 58, 331-49 (1949).—*C.A.* 44, 3876*i*.

The ketone produced during the dehydrogenation of secondary alcs. had a strong inhibitory action on the further reaction. It had a markedly higher adsorption coeff. than the alc. The factors influencing the ratio of the adsorption coeffs. of the ketone and alc. were examd. Different samples of Ni and Cu were used as catalysts. Cu was less active than Ni, but it changed the ratio slightly in favor of the alc.

1047. TROESCH, ANDRÉ. **Inhibition by carbon and hydrogen of the activated adsorption of methane by nickel Fischer catalysts.** *Compt. rend.* 228, 1013-15 (1949).—*C.A.* 43, 6064*a*.

Adsorption of CH_4 at const. vol. on a Ni catalyst contg. Al_2O_3 and SiO_2 was studied at 170°C. The adsorption of CH_4 was inhibited by the deposition of carbon on the active surface, $CH_4 = C + 2H_2$. The rate of adsorption on the available surface remained const. with carbon on the surface although the total amt. of adsorption decreased. The presence of H_2 and C on the surface decreased the amt. of CH_4 adsorbed and decreased the rate of adsorption on the available surface.

1048. TSUKAGOSHI, OSAMU. **Getters—general conditions of making adsorbing vapor films having abnormally large clean-up ability and a search for the method.** *Repts. Sci. Research Inst.* (Japan) 25, Phys. Sect., 1-13(1949).—*C.A.* 45, 4996*g*.

Curves were obtained for O_2 adsorbed under 0.25-0.5 $\times 10^{-3}$ mm pressure on Mg and Ca getter films (from the metals evapd. under 1.5×10^{-3} mm Hg) plotted against the equil. pressure. The gas was adsorbed onto the surface of the gradually crystg. metals; thus the gas was prevented from infiltrating into the crystals or impeding their growth. BaN_6 evapd. at 850°K under the residual N_2 pressure above 4×10^{-3} mm Hg to form a film on the wall at 300°K showed an abnormally large clean-up effect. A Mg getter film with similar ability was also produced.

1049. VEĬS, A. L. AND ROZLOVSKIĬ. **The mechanism of combustion of iron.** *Zhur. Fiz. Khim.* 23, 1305-10(1949).—*C.A.* 44, 2832*f*.

Cutting Fe by burning in O_2 was considered from the view-point of chem. kinetics. Presumably, the rate of reaction was detd. by the diffusion through the oxide film coating the Fe and the flow of this film. The surface temp. of burning Fe was 1550-1600°C (optical pyrometer). There was no "ignition temp." of Fe.

1050. WENTRUP, H. AND REIF, O. **The solubility of nitrogen in iron melts with chromium, manganese and nickel additions.** *Arch Eisenhüttenw.* 20, 359-62(1949).—*C.A.* 44, 4386*d*.

The absorption of N_2 was detd. at 1600 and 1700°C and at the solidification points. Cr and Mn increased the soly. of N_2 in Fe, while Ni decreased it. Increasing the temp. decreased the N_2 soly., and at the solidification point N_2 was evolved. Addn. of Mn to Fe-Cr melts increased N_2 absorption greatly, while addn. of Ni and higher temps. reduced N_2 soly. Solidification of Fe-Cr-Mn and Fe-Cr-Ni melts was also accompanied by N_2 evolution.

1051. WIEMER, H. AND HANEBUTH, R. **Improvement of the mechanical properties of sintered iron by oxygen treatment.** *Arch. Metallkunde* 3, 129-32 (1949).—*C.A.* 43, 9000*i*.

The tensile strength, elongation, and impact strength of sintered plain Fe can be improved by preheating in an oxidizing atm. Hardness and d. are not affected. The optimum oxidation temp. lies between 400° and 500°C. Best results are obtained when between 1 and 3% oxide is formed. The oxidizing treatment is more effective on porous pieces. It is definitely present, but not as marked on reduced spongy powder as on materials having solid particles.

1052. ZAGAR, L. **The activated state of desorbed gas molecules. II.** *Monatsh.* 80, 702-7 (1949).—*C.A.* 44, 7131*i*.

Pt, but not Hopcalite II, activated O_2 for subsequent reaction with CO. Neither back-diffusion of CO nor entrainment of Pt particles can account for the results. The amt. of CO_2 formed increased from 150° to 350°C; it decreased exponentially as the velocity of the O_2 stream increased. It decreased with increasing distance of the catalyst from the point of mixing of the O_2 with CO. The half-life of the active state was about 0.25 sec. Pt also activated H_2 for subsequent reaction with S vapor.

1053. ALLEN, J. A. AND MITCHELL, J. W. **The adsorption of gases on copper films.** *Discussions Faraday Soc.* **1950**, No. 8, 309-12, discussion 312-14.—*C.A.* 45, 9990*g*.

Troublesome dead-space corrections were eliminated and an uncontaminated film of uniform thickness obtained by evapg. Cu from a thoroughly outgassed bead mounted on a W filament at the center of a glass bulb. The results with O_2 in the range − 183° to 74°C indicated that the adsorptive properties of the films at low temps. and their behavior at the higher temps. were stongly dependent on the thermal history of the films.

1054. ARIZUMI, TETSUYA AND KOTANI, SEIICHI. **Oxidation of the evaporated barium films.** *J. Phys. Soc. Japan* 5, 70-5(1950).—*C.A.* 45, 5544*i*.

Typical pressure-cond. curves are given for a "getter" during the introduction of O_2. The "getter" film is granular in most cases. Oxidation proceeds uniformly from the surface at first and then along crystal boundaries. As the thickness of the oxide layer grows, many cracks are induced, recovering the absorption ability.

1055. ARIZUMI, TETSUYA AND IMAEDA, KUNINOSUKE. **Absorption of nitrogen by evaporated film of barium.** *J. Phys. Soc. Japan* 5, 169-73(1950).—*C.A.* 45, 2724*f*.

Pressure changes for const. flow and const. vol. were measured for absorption of N_2 by a Ba getter in an exptl. cathode tube. Effects of temp., of adsorption, and of diffusion are treated.

1056. AVERY, D. G. **Some optical properties of evaporated layers of silver, copper, and tin.** *Phil. Mag.* 41, 1018-31(1950).—*C.A.* 45, 2737*i*.

Multiple-beam interference measurements of the relative phase changes on reflection at a no. of layers of Ag, Cu, and Sn were made, together with measurements of the ellipticity of the light reflected at these layers. The variation of these quantities with the thickness of some layers of Ag was discussed.

1057. BAILEY, G. L. J. AND WATKINS, H. C. **Surface tensions in the system solid copper-molten lead.** *Proc. Phys. Soc.* **63B**, 350-8 (1950).—*C.A.* 44, 7607*h*.

Around 850°C the surface tension between Cu grains was 640 dynes/cm and between Cu and the equil. Pb-Cu liquid-phase 340 dynes/cm. The surface tension of a Cu-gas surface in H_2 or A was 1800 dynes/cm. When Pb vapor was present in the gas atm. at a partial pressure of the order of 0.1 mm Hg the surface tension of the Cu-gas surface had the much lower value of 780 dynes/cm. The reduction was due to the adsorption of Pb at the Cu-gas surface. The failure of Pb to spread readily on Cu appeared to be a feature of the Pb-Cu system, and was not due to contamination of the surface.

1058. BEVAN, D. J. M. AND ANDERSON, J. S. **Electronic conductivity and surface equilibria of zinc oxide.** *Discussions Faraday Soc.* **1950**, No. 8, 238-41, discussion 241-6.—*C.A.* 45, 9989b.

The electronic cond. in air at 500-1000°C varied widely according to prepn. of the oxide. At low O_2 pressures the cond. was quasi-metallic, and fairly reproducible for samples irrespective of their origin. It was suggested that this involves a diffusion process, which promoted a heterogeneous surface. The bulk-phase cond. of zinc oxide was probably high, but electrons were trapped by chemisorption of O_2 on the surface.

1059. BIGUENET, CH. **Photoadsorption in a thin layer of barium.** *Le Vide* 5, 831-6(1950).—*C.A.* 45, 31*i*.

Diode characteristics were affected by illumination. This was attributed to Ba adsorption in thin layers on the W anode. A calcn. of energy data, showed that a part of the Ba was adsorbed as Ba^{++}. Light transformed adsorbed Ba atoms to Ba^+, thus modifying the contact potential between cathode and anode.

1060. BLANC-LAPIERRE, ANDRÉ AND PERROT, MARCEL. **Current-voltage characteristic of very thin silver films for elevated values of the electric field.** *Compt. rend.* **230**, 1641-3(1950).—*C.A.* 44, 10423*f*.

Films of Ag less than 10 mμ thick were studied under elec. fields up to 10,000 v./cm. A considerable departure from Ohm's law was obtained probably through a mechanism of conductibility due to the lacunar structure.

1061. BOORSE, H. A. AND DASH, J. G. **Transport rates of the liquid He II film over various surfaces.** *Phys. Rev.* 79, 1008(1950).—*C.A.* 44, 10419*g*.

The rate of transport was reported at 1.3, 1.5, 1.8, and 2.0°K for Pyrex glass, lucite, stainless steel, Pb, cold-rolled steel machined Cu, polished Cu, etched Cu, and oxidized etched Cu. It was uncertain whether effects obtained with metals in the superconducting state and with magnetized metals were real.

1062. BOSE, B. N. AND HAWKES, M. F. **Kinetics of the eutectoid transformation in alloys of iron and nitrogen.** *J. Metals* 188, No. 2, Trans., 307-16 (1950).—*C.A.* 44, 3423*h*.

The alloy of 2.35 wt-% N, balance Fe, was analogous to the eutectoid Fe-C alloy with respect to transformation to "pearlitic" and "martensitic" structures. Isothermal transformation at all temps. was slower in the N_2 alloy, and the N-austenite was far more stable with respect to transformation to martensite.

1063. BURSHTEĬN, R. KH.; SUROVA, M. D., AND ZAĬDENMAN, I. A. **Effect of oxygen adsorbed on iron upon the contact potential difference.** *Zhur. Fiz. Khim.* 24, 214-23 (1950).—*C.A.* 44, 6743*f*.

A W cathode was kept in a vacuum while an Fe anode adsorbed O_2. After a definite vol., a, of O_2 was adsorbed at temp. T, Fe was cooled to room temp., the vessel was evacuated, W introduced into it, and the potential measured. The temp. of Fe rose to 95°C during this measurement. The true surface S of Fe (wire coil) was detd. from the adsorption of O_2. At T = 100°, 150°, and 270°C the potential increased with a/S to a max. at 0.63 v. and 22 × 10^{14} mol./cm^2, 0.49 v. and 35 × 10^{14}, and 0.19 v. and 72 × 10^{14}, resp., and then decreased. Increase in the potential meant decrease in the work function; this decrease was unexpected and presumably showed that O_2 was adsorbed under the top layer of Fe.

1064. Carli, F. de and Collari, N. **Thermogravimetric study of the oxidation of metals.** *Ann. chim.* (Rome) **40**, 117-31 (1950).—*C.A.* **45**, 5006*c*.

The oxidation at elevated temp. of Armco steel contg.: C 0.019, Mn 0.017, S 0.02, P 0.008, Cu 0.05%, trace Si, and balance Fe (%) is followed by recording wt changes. The temps. were 445°, 480°, 590°, 600°, 700°, 800°C. The activation energies are in cal/mole, for various temp. intervals: (718-753°) 14,090; (753-863°) 19,029; (863-873°) 106,200; (873-973°) 49,210; (973-1073°) 33,475.

1065. Chufarov, G. I.; Zhuravleva, M. G., and Tatievskaya, E. P. **Reduction and dissociation of oxides of cobalt and of nickel.** *Doklady Akad. Nauk S.S.S.R.* **73**, 1209-12(1950).—*C.A.* **45**, 426*i*.

The kinetic curves of the reduction of CoO, prepd. by dissocn. of 98% Co_3O_4 in a N_2 stream at 950° (resulting in a product 99% pure, surface area 0.45 m²/g by the N_2 adsorption isotherm), plotted in terms of the rate (g O_2 taken off the oxide/min.) as a function of the degree of reduction, at 200, 250, 300, and 350°C, in a closed system with circulating H_2 gas under 300 mm Hg, show initial autocatalysis and a max. of the rate at about 25% reduction. The apparent activation energy is 13.0 kcal./mole. Under the same conditions, the curves for Co_3O_4 (98%) show a max., corresponding to reduction of Co_3O_4 to CoO, followed, at least at 350°, by a min. and a 2nd, lower max.; the part of the curve beyond the max. corresponds to reduction of CoO to Co.

1066. Cornuault, P. **The adsorbed phase on catalysts.** *J. Chim. Phys.* **47**, 157-64(1950).—*C.A.* **44**, 8213*h*.

The kinetics of desorption of H_2, CO, CO_2, and CH_4 from a Ni-Al-Mn-kieselguhr Fischer-Tropsch catalyst (reduced in H_2 at 475°C) was measured on samples: (I) sealed off at 450°C immediately after reduction, (II) cooled from 475° to 175°C and maintained 4 hrs in H_2 at this temp., and (III) kept 113 hrs in H_2 at 175°C. The evolution of gas from II as the temp. increased was very similar to that from III. The energy of activation of desorption up to 200°C was about 19 kcal. On both samples II and I, the energy of activation of desorption is about 29 kcal. at 450°. Evolved gas contd. 73 to 100% H_2; the other components were small amts. of CO_2, CO, and CH_4 coming from undecompd. carbonates of the original catalyst.

1067. Cubicciotti, Daniel D. **The oxidation of zirconium at high temperatures.** *J. Am. Chem. Soc.* **72**, 4138-41(1950).—*C.A.* **45**, 1412*e*.

The rate of consumption of O_2 by ductile Zr metal was studied from 600 to 920°C. The oxidation curves were parabolic at all temps. except 920°, where a small deviation toward linear was observed. The oxidation rates were not affected by changing the O_2 pressure from 0.1 to 20 cm.

1068. Dankov, P. D. and Churaev, P. V. **The deformation effect of the surface layer of a metal upon oxidation.** *Doklady Akad. Nauk S.S.S.R.* **73**, 1221-4(1950).—*C.A.* **45**, 1479*g*.

The stresses produced on the surface of a metal as a result of the formation of an oxide film were detd. by measurements of the curvature of a thin mica foil coated on one side with a film of metal deposited by evapn., upon admission of O_2. The curvature was detd. with the aid of a pointer attached to the foil. On oxidation with 10-12 mm Hg of O_2, at room temp., films of Fe and of Ni bended in such a way that the metal-oxide layer was on the convex side, whereas Mg films bended in the opposite direction. The rate of the deformation was greater in the beginning, and then either became const. or slowed down considerably. The oxide films were actually cracked long before the max. stress and strain were reached, and that further oxidation took place at the spots bared.

1069. Devaux, Henri. **Thin layers of acetic, formic, and carbonic acids.** *Compt. rend.* **230**, 1122-4 1950.—*C.A.* **44**, 7120*e*.

A unimol. layer of acetic or formic acid on Hg is indissolubly tied as shown by its complete loss of volatility, even after compression to a small surface area. Further compression causes a rigid state, in which the acid is completely insol. in water. When returned to the liquid state by expansion, the unimol. layer absorbs water, but only in a tangetial sense, expelling it on recompression.

1070. Dravnieks, Andrew. **The kinetics of the zirconium-nitrogen reaction. The oxidation of several metals in activated oxygen at high temperatures.** *J. Am. Chem. Soc.* **72**, 3568-71; 3761-7 (1950).—*C.A.* **44**, 10470*e*; 10470*f*.

The initial rate of the Zr-N_2 reaction between 862° to 1043°C obeyed the parabolic law with an activation energy of 52 kcal. independent of pressure. For reactions of long duration the rate increased as compared with the initial parabolic rate. The rate consts. were sensitive to the origin of the Zr samples. The oxidation of Cu, Ta, Zr, Mo, and Ni in ordinary and in activated oxygen were compared. Only in the case of Cu were reproducible differences caused by the presence of an excess of free O atoms in O_2. Gases in which the monatomic O accelerated, retarded, or did not affect the rate of oxidation were described.

1071. Druyvesteyn, M. J. **The phenomenon of internal oxidation.** *Métaux & corrosion* **25**, 277-82(1950).—*C.A.* **45**, 9448*e*.

In a 1% Mg-Ag alloy the stable MgO which is formed, limits the internal oxidation. In Ag alloys with Cu the surface layer consists of CuO. Cu-Ag alloys have greater hardness than those alloys heated *in vacuo*. Microscopic researches revealed that MgO is very stable while CdO is much less stable in Ag (after oxidation no pptn. is observed in Mg-Ag alloys whereas in Cd-Ag alloys globular ppt. is noted). Application of thermodynamics to internal oxidation is considered in explaining this phenomenon.

1072. Duval, Xavier and Niclause, Michel. **Coefficients of accomodation of acetaldehyde at 273°K on platinum between 1000 and 1300°K.** *Compt. rend.* **231**, 518-19(1950).—*C.A.* **45**, 3226*i*.

The power dissipated by the gaseous heat cond. and the variation of C_v with temp. permitted the detn. of max. and min. values of the coeffs. of accomodation α_i for the internal energy of rotation and vibration. For CH_3CHO these are: 1000°K 0.21-0.37, 1100° 0.19-0.35, 1205° 0.17-0.33, 1310° 0.15-0.31. Since α_i is much less than 1, the mols. of CH_3CHO which leave the Pt filament have an av. internal energy which corresponds to temps. much lower than that of the filament.

1073. Ebert, H. and Trommsdorf, G. **Diffusion of silver in gold.** *Z. Elektrochem.* **54**, 294-6 (1950).—*C.A.* **45**, 1835*c*.

The diffusion of Ag in Au was detd. at several temps. from 806 to 1017°C. The temp. dependence of the diffusion rate obeyed an Arrhenius formula: $D = 2095 \exp. (-37{,}000/RT)$ ($D = cm^2/day$, $R = 1.987$ cal/degree mole and $T = °K$).

1074. Erbacher, Otto. **Active centers on metals.** *Angew. Chem.* **62A**, 403-4 (1950).—*C.A.* **45**, 413*c*.

It is assumed that active center, being disturbed surface areas at at. extent, can be annealed by surface temps. close to about 2/3 of the m.p. of the metal. Migration of atoms can take place, resulting in the smoothing out of the surface defects.

1075. Evans, U. R. **Some aspects of the protection of iron and steel against corrosion.** *J. Oil & Colour Chemists' Assoc.* **33**, 452-8(1950).—*C.A.* **46**, 9856*i*.

Fe oxidizes in dry air, but very slowly, and with no visible change. In H_2O contg. O_2, visible rusting may occur to Fe, even in the absence of acid. If O_2 is supplied to the Fe surface at a slow rate, the $Fe(OH)_2$ formed is converted into the less-sol. FeOOH (rust) at a distance from the metal, and this rust cannot prevent further attack which continues indefinitely. If the O_2 supply is higher, conversion to the ferric condition occurs at the metal-liquid interface, and the reaction soon stifles itself. The inference is that O_2 can sometimes act as a deterrent to corrosion.

1076. Fekete, L. **The theory of the degassing of molten metals by means of vacuum.** *Acta Tech. Acad. Sci. Hung.* **1**, No. 1, 33-49 (1950).—*C.A.* **45**, 4186*h*.

It was possible to calc. the amt. of H_2 escaping in the form of bubbles and the amt. remaining in the melt, in terms of the initial H_2 content. Different pressures and different depths of bath were assumed.

1077. Fischer, W. A. and Ende, H. vom. **The oxygen content of soft iron melts and the solubility of oxygen in solid iron.** *Arch. Eisenhüttenw.* **21**, 297-304 (1950).—*C.A.* **45**, 1480*h*.

Expts. with FeO slags satd. with FeO and SiO_2 in a high-frequency furnace were reported. The reduced O-activity of CaO-satd. FeO slags was ascribed to the presence of Ca ferrite in molten slag in which as much Fe oxide was present as corresponded to binding the CaO as $3CaO.Fe_2O_3$. The soly. of O in solid Fe was found to be 0.05-0.06%.

1078. Fujiwara, Shizuo. **Absorption of nitrogen by zirconium and iron.** *Bull. Chem. Soc. Japan* **23**, 20-2(1950).—*C.A.* **45**, 18*e*.

The wt-increase of Zr and Fe powders due to absorption of N_2 at increasing temps. started at 265° and 650°C, resp. A 1st equil. at 600° and 730°C, and a 2nd at 900-50° and 945°C, resp. was found. Zr-Fe powders contg. 28.1 and 29.9% Zr exhibited starting and equil. temps. similar to the pure Fe powders.

1079. Fukagawa, Shukichi. **Activation of a thoria emitter by zirconium.** *Mem. Coll. Sci., Univ. Kyoto Ser.* **A**, **26**, 45-62(1950).—*C.A.* **47**, 6759*g*.

The work functions of the "ThO_2-Zr-W" emitters were consistently lower than comparable "ThO_2-W" emitters. "ThO_2-Zr-W" emitters gave a large emission without the preliminary heat-treatment necessary in the case of "ThO_2-W" emitters. The activation energy for evapn. of Th atoms from the "ThO_2-W"-type emitter was found to be 5.48-4.02 e.v. as compared with a mean value of 3.0 e.v. for the activation energy for evapn. of Th atoms from "ThO_2-Zr-W"-type emitters. The mechanism of activation by Zr was due to the strong affinity of Zr for O.

1080. Gray, T. J. **Semiconductivity and catalysis.** *Discussions Faraday Soc.* **1950**, No. 8, 331-7:—*C.A.* **45**, 9991*b*.

A technique is described for studying the adsorption of very small quantities of gases by measuring the variation in semicond. of evapd. metal films.

1081. Gulbransen, Earl A. and Andrew, Kenneth F. **Kinetics of the reactions of columbium and tantalum with oxygen, nitrogen, and hydrogen.** *J. Metals* **188**, No. 3, Trans. 586-99 (1950).—*C.A.* **44**, 4359*h*.

At 10^{-6} mm or lower, Cb lost wt below 464°C and Ta lost wt below 605°C, whereas at higher temps. the metals acted as getters. The reaction data of Cb with O_2 (200-375°C) and that of Ta (250-450°C) fitted a parabolic rate law and energies of activation of 22,800 cal/mol., and 27,400 cal/mol. were calcd. from the temp. dependence of the rate-law consts. At 350°C the order of increasing rates of reaction was Ti, Zr, Ta, and Cb. The reactions of Cb and Ta with N_2 were studied between 500-850°C. The H_2 reaction product on Cb was stable under 10^{-6} mm of Hg to a temp. of 250°C. Above this temp. the reaction product decomposed.

1082. Gulbransen, Earl A. and Andrew, Kenneth F. **The kinetics of the reactions of beryllium with oxygen and nitrogen and the effect of oxide and nitride films on its vapor pressure.** *J. Electrochem. Soc.* **97**, 383-95 (1950).—*C.A.* **45**, 1411*i*.

The exptl. data between 350-950°C can be fitted by the parabolic rate law except for the initial period of the reaction. A plot of log K/T vs. 1/T gave an energy of activation of 50,300 cal per mole. Vacuum-treated Be had the smallest parabolic reaction-rate const. at 900°C of any metal or alloy that was studied. The reaction with N_2 was studied over the temp. range of 600° to 925°C.

The data was fitted by the parabolic rate law. A comparison with the O reaction showed that the rate of reaction was somewhat smaller. A plot of log K/T vs. 1/T gave an energy of activation of 75,000 cal per mole. No reaction was observed with H_2 over the temp. range of 300° to 882°C.

1083. Gulbransen, Earl A. and Andrew, Kenneth F. **The kinetics of the reactions of vanadium with oxygen and nitrogen.** *J. Electrochem. Soc.* **97**, 396-404(1950).—*C.A.* **45**, 1412*c*.

The reaction of rolled V sheet with O_2 was studied between 400° to 600°C with specimens weighing 0.1264 g and having a surface area of 1.4 cm^2. The data could be fitted to the parabolic rate law except for the initial period of the reaction. A plot of *log K/T* vs. *1/T* gave an energy of activation of 30,700 cal per mole. The oxidation of V could be compared with the corresponding reactions on Nb and Ta, since the oxide was sol. at high temps. and the extent of reaction was of the same order of magnitude. The rate of reaction with N_2 was much less at a given temp. than the corresponding oxidation reaction.

1084. Harkins, W. D. and Loeser, E. H. **Surfaces of solids. XIX. Molecular interaction between metals and hydrocarbons.** *J. Chem. Phys.* **18**, 556-60(1950).—*C.A.* **44**, 9211*i*.

The energy of interaction between a hydrocarbon and a metal increases rapidly in the order Cu, Ag, Pb, and Fe. The values of the work of adhesion at 25°C for the clean metals are Cu 69, Ag 77, Pb 89, and Fe 93. For the oxide-coated metals the values are only slightly higher. These increase with decrease of temp. For hexane they are essentially the same at 0° as to heptane at 25°C. Isotherms for heptane are given for both 25° and 15°C. The use of adhesion tension should be abandoned, since it is one of the most prolific sources of error in surface science.

1085. Harris, Louis; Jeffries, David, and Siegel, Benjamin M. **The thermal stabilization and sintering of gold smoke deposits.** *J. Chem. Phys.* **18**, 261-5(1950).—*C.A.* **44**, 9211*g*.

Gold smokes made by evapn. in an inert-gas atm. are initially in a thermodynamically unstable state. Measurement at different temps. of the change of resistance assocd. with the loss of vacant sites gave a value of 23.5 kcal./g atom for the activation energy of this process. When heated above 100°C the deposits sintered rapidly and underwent pronounced changes in optical properties. However, a gold smoke deposit could be stabilized, by heat-treatment at 70°C, so that sintering proceeded at an appreciably slower rate.

1086. Heusler, Otto. **Intercrystalline corrosion of coppersilicon alloys by atmospheric oxygen.** *Z. Metalkunde* **41**, 261-4 (1950).—*C.A.* **45**, 102*h*.

Oxidation of Cu-Si alloys in air at 20° to 450°C was increased by small amts. of As, Bi, Ge, Pb, Sb, Sn, and Tl, and decreased by small amts. of Be and Zn. No appreciable effect was produced by Ag, Al, Ca, Cd, Co, Cr, Fe, Hg, Mg, Mn, Mo, Ni, P, Se, Ti, V, and W.

1087. Hüttig, G. F.; Schreiner, H., and Klein, R. **Change of the binding strength between adsorbents and adsorptives.** *Monatsh.* **81**, 101-10 (1950).—*C.A.* **47**, 378*d*.

Exptl. work on Cu/CH_3OH, Fe/CH_3OH, α-Al_2O_5/CH_3OH, and $BaSO_4/CH_3OH$ were tabulated. Known principles were discussed.

1088. Imai, Yunoshin and Ishizaki, Tetsuro. **Nitrogen as alloying element in steel. II. Effect of nitrogen on the temper brittleness of steels.** *Nippon Kinzoku Gakkaishi* **14B**, No. 2, 52-6 (1950).—*C.A.* **45**, 5591*d*.

The effect of 0.1% Al, 0.15% Ti, and 0.3% Ti (as the deoxidizer and denitrifier) on the temper brittleness of steels was studied by means of the impact test. The denitrifying capacity of Ti was higher than that of Al, although more Ti and Al should be added for complete denitrification. The P (0.056-0.057%) in steels promote the effect of N_2 on the temper brittleness. In shortage of N_2, temper brittleness due to C occurred which showed that N_2 had great effect on the behavior of the C in α-Fe.

1089. Imai, Yunoshin and Ishizaki, Tetsuro. **Nitrogen as the alloying element in steels. I. Effect of nitrogen on the temper-brittleness in steels.** *Science Repts. Research Insts. Tohoku Univ. Ser.* **A,2**, 890-908 (1950).—*C.A.* **46**, 4979*c*.

On tempering steels at temps. below 580°C, a brittleness not explained by a carbide soly. theory was correlated with N_2 content of the steel and its heat-treatment. Quenched specimens contg. more than 0.010% N_2 reheated to 400-650°C and slowly cooled gave curves showing increased brittleness when tempering was done at 550-80°C. C, Cr, and Ni did not affect this property, but nitride formers, as Al, Ti, Mo caused its disappearance.

1090. Iwamura, Harero; Shiota, Noburo, and Onozaki, Choei. **Effects of gases on properties of aluminum and its alloys. II.** *Nippon Kinzoku Gakkai-si* **14B**, No. 3, 65-8 (1950).—*C.A.* **46**, 7505*g*.

The effect on torsional properties of gases in Al and its alloys contg. about 4-5% each of Si, Cu, Mg, Zn, or Ni was detd. by impact and corrosion tests. Addn. of a small amt. of H_2 had considerable effect on properties. It improved the impact value but was unfavorable in the corrosion tests in 10% NaOH soln. when compared to ordinary Al and its alloys.

1091. Jungers, J. C. and Coussemant, F. **The effect of adsorption on the course of catalytic reaction.** *J. chim. phys.* **47**, 139-44 (1950).—*C.A.* **44**, 10441*e*.

The kinetics of gas-phase and liquid-phase catalytic reactions are interpreted in terms of the relative adsorptions of reactants and products. Reactions discussed include the hydrogenation of CO and CO_2 to CH_4 over Ni of C_6H_6 to cyclohexane in the presence of CO_2 of acetone to isopropyl alc. acetylene to ethylene and the dehydrogenation of a secondary alc. to a ketone. The hydrogenation of phenol to cyclohexanone takes place through the intermediate formation of cyclohexanone. A quant. evaluation of the adsorption coeffs. and the several reaction velocity consts. is made.

1092. Keier, N. P. **The heterogeneity of the surface of catalytically active nickel oxide.** *Doklady Akad. Nauk S.S.S.R.* 72, 1071-4 (1950).— *C.A.* 44, 9223*i*.

The kinetics of adsorption of C_2H_2 gas by NiO (prepd. by decompn. of $NiCO_3$ at 300°C under not over 10^{-4} mm Hg, and subsequent treatment in vacuo at 400°C) are representable by the equation $q = At^{1/n}$, where q = amt. adsorbed in cc. S.T.P. on 0.75 g NiO, initial C_2H_2 pressure 2.23 mm Hg, T = time in min. Plots of log q against log t are perfectly linear, with the slopes increasing with rising temp. (- 19.6 and 0°C). There is strong evidence for the surface-heterogeneity theory, and against attempts at interpretation on the basis of repulsive interactions between adsorbed mols.

1093, Keidr, N. P. and Roginskii, S. Z. **Investigation of the heterogeneity of active surfaces by the differential isotopic method. I. The active surface of metallic nickel and of zinc oxide.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* **1950**, 27-38.—*C.A.* 44, 5690*g*.

The heterogeneity of the surface of an active Ni catalyst (surface area 1.5-2m^2/g) was demonstrated by expts. of consecutive adsorption, at room temp., of H_2 and of D_2, or D_2 and then of H_2. Prior to the adsorption expts. 1.05-g samples of the catalyst were outgassed at up to 450°C under 10^{-5}mm Hg reduced once more with H_2 at 450°C, and again outgassed at 530°C. Data for a typical run were: 1st adsorption, 0.095 cc. D_2 S.T.P. under 1.48 mm Hg in 9 min. at room temp.; after short evacuation, 2nd adsorption, 0.04 cc. H_2 under 3.08 mm Hg in 9 min. at room temp. followed by 1.5 min. evacuation the % of D_2 and of H_2, resp., in the gas desorbed was: at room temp., 5 and 95; at 2-65°C, 0 and 100; at 170-220°C, 0 and 100; at 300-20°C, 40 and 60; at 420-70°C, 95 and 5; at 520°C, 100 and 0; at 530°C, 100 and 0. Consequently, the isotope adsorbed first was desorbed last.

1094. Kemball, C. **The absorption of vapors on mercury. IV. Surface potentials and chemisorption.** *Proc. Roy. Soc.* **A201**, 377-91 (1950).— *C.A.* 44, 8194*d*.

An app. was constructed to measure the surface potential of adsorbed vapors on Hg. There was a change in potential of 0.055 v. at the phase change assocd. with the alteration in the orientation of toluene mols. adsorbed on the surface of the Hg. CCl_4, hexachlorethane, and $CHCl_3$ vapors reacted with Hg, and the rate of the reaction was detd. The kinetics indicated that the substances dimerize under the action of the Hg surface with negligible activation energy. The rate of reaction with CCl_4 was in agreement with the calcd. rate, assuming that the activated complex consisted of two physically adsorbed mols. loosely held together and able to move over the surface. MeI vapor reacted with Hg only when illuminated with light from a Hg lamp.

1095. Krause, A. **Catalytic properties of rust.** *Przemysl Chem.* **6(29)**, 318-23(1950).—*C.A.* **45**, 10179*c*.

Fe rust formed in moist air at moderate temps. is mainly composed of γ-FeOOH. The catalytic activity of Fe rust is based on the presence of free HO and HO_2 radicals taking part in a chain reaction accompanied by electronic resonance in a complicated oxidation-reduction system.

1096. Kruger, H. O. and Robinson, M. L. **Corrosion of copper by trace constituents of natural gas.** *Gas* **26**, No. 4, 31-5 (1950).—*C.A.* **46**, 2781*e*.

At room temp. the mercaptans were noncorrosive, but H_2S at relatively low concns. caused localized corrosion (black clumps) on Cu surfaces in the field; these clumps grew closer together, finally forming a continuous but lumpy surface. (Uniform corrosion is noted on clean Cu surfaces with H_2S.) These corrosion products had a greater specific vol. than the parent metal and spalled off, and were carried with the gas stream.

1097. Kwan, Takao. **Adsorption of carbon dioxide on reduced nickel.** *J. Chem. Phys.* **18**, 1309-10 (1950).—*C.A.* **45**, 18*f*.

Adsorption isotherms were derived for the adsorption of CO_2 as CO_2, CO + O, and C + 2O. Exptl. evaluation was accomplished at 150° and 200°C, with equil. pressures from 0.0001 to 0.1 mm Hg. The differential heat of adsorption was almost const. at 22 kcal./mole. The exptl. values for fraction of surface covered agreed best with the isotherms for complete dissocn.

1098. Legenchenko, I. A. **Nitrides and kinetics of decomposition of ammonia on iron catalysts.** *Zhur. Fiz. Khim.* **24**, 311-20 (1950).—*C.A.* **44**, 6713*d*.

Dry NH_3 was passed through an Fe catalyst at 400-450°C. The exit NH_3 was sepd. and detd., and the ratio N:H in the residual gas was detd. interferometrically. If this ratio R was less than 1:3, Fe nitride formation took place, and the amt. of it could be calcd. from R. During one expt., the rate of decompn. simultaneously, the rate of nitride formation decreased and became almost zero in 10-20 min. (when the rate of gas flow as 6-19 liter/hr). The decompn. of NH_3 and the formation of iron nitride took place on different surface patches. Decompn. of NH_3 could occur either directly or as a sequence: formation of iron nitride on inactive spots → migration of iron nitride to active spots → decompn. of iron nitride; poisons stopped the migration.

1099. Mallett, M. W. **Purification of argon.** *Ind. Eng. Chem.* 42, 2095-6 (1950).—*C.A.* 45, 1309*h*.

Argon was purified by passing through a bed of Ti heated to 850°C at a rate of 15 liters/hr. The O_2 and N_2 impurities of commercial grade A were gettered by Ti at 850°C. The treated A was sufficiently free of active gases to prevent tarnishing of U heated at 600°C.

1100. McGeary, R. K.; Stanley, J. K., and Yensen, T. D. **How to determine oxygen in metals by a fast vacuum fusion method.** *Steel* **126**, No. 10, 81-2(1950).—*C.A.* 44, 3841*a*.

The metal is melted in a graphite crucible in an evacuated system to convert oxides to CO which is passed over hot CuO to form CO_2. A part of the system is cooled by liquid N_2 which collects CO_2 and removes other gases by vacuum pumps. The CO_2 is expanded and its vol. measured. Accuracy is ±0.001% in 15 to 20 min. with 0.1-2.0 g samples.

1101. Mendelssohn K. and White, G. K. **Helium II transfer on metal surfaces.** *Nature* **166**, 27-8 (1950).—*C.A.* **44**, 8719*e*.

The rate of transfer of He II over different surfaces was investigated. Pt, Ni, and glass beakers were cleaned, polished, and baked *in vacuo* to remove any surface films. The rate of transfer was strongly dependent upon the nature of the surface of the beaker. At 1.2°K, the following rates (in units of 10^{-5} $cm^3/cm/sec$) are given: Pt (cleaned): 15.9; Pt (cleaned and baked) 21.4; Pt (polished and baked); 22.4; Ni (cleaned and baked): 24.3; glass (cleaned: 7.3).

1102. Mertens, E. **Fluidized heterogeneous catalysis by the method of currents.** *J. chim. phys.* **47**, 286-8, discussion, 288-9 (1950).—*C.A.* **44**, 7637*d*.

Results were reported on the hydrogenation of benzene at 200°C with a $Ni\text{-}Al_2O_3$ catalyst with grains 100 μ in diam., and on the oxidation of SO_2 on a Pt-silica gel catalyst with grains 150 μ in diam. In the former case the rate of reaction was approx. 12 times greater with the fluid catalyst than with a similar quantity of stationary catalyst. In the 2nd case the rate of the reation was negligible at very high rates of flow, increased with still slower rates of flow.

1103. Mitani, Kazuo. **The comparison of the exchange of the translational energy with that of the internal energy of gas molecules on solid surfaces. II. Measurement by means of molecular beams. 2.** *J. Chem. Soc. Japan, Pure Chem. Sect.*, **71**, 9-11 (1950).—*C.A.* **45**, 4507*b*.

The relation between accommodation coeff. for the internal energy and the total loss of heat from the heated filament was discussed. By the kinetic theory of gases, the accommodation coeff. was found to be calcd. from the heat loss and the accommodation coeff. for the translational energy. Only the principles of the expt. were given.

1104. Miyazaki, Shozo. **Catalytic decomposition of ammonia gas.** *J. Chem. Soc. Japan, Pure Chem. Sect.*, **71**, 424-6 (1950).—*C.A.* **45**, 6473*a*.

The catalytic decompn. of NH_3 gas in the presence of W was observed at the temp. 730-810°C, under the pressure 15 mm Hg. The theoretical equations explain the observed relations between the reaction velocities and the NH_3 and H_2 gas pressures. The heat of activation and the heat of adsorption of NH_3 gas on W are calcd. They are 46.4 kcal./mol. and 26.6 kcal./mol., resp.

1105. Moore, Walter J. **Parabolic oxidation rates of metals.** *J. Chem. Phys.* **18**, 231 (1950).—*C.A.* **44**, 5686*e*.

Thermodynamic consts. of the transition-state theory for the oxidation of Al, Fe, Zr, Ti, Ni, Cu, Co, Zn, and Be were compared. A schematic diagram of the potential-energy barriers for vacancy formation and diffusion showed that, for equal diffusion barriers, the higher the heat of adsorption, the lower the effective $\Delta H^{\ddagger}$. Since a high heat of adsorption implied an immobile adsorbed film, it may also be assocd. with a large neg. ΔS of adsorption.

1106. Mozgovoĭ, V. S. and Samarin, A. M. **Solubility of nitrogen in liquid chromium and in melts of chromium and silicon.** *Doklady Akad. Nauk S.S.S.R.* **74**, 729-32 (1950).—*C.A.* **45**, 7503*a*.

The equil. concns. of N_2 in wt % in liquid Cr were 1600°C, 4.08; 1650°C, 3.90; 1700°C, 3.84; 1725°C, 3.76; 1750°C, 3.54. The interaction of liquid Cr and N_2 occurred: $2\ Cr + \frac{1}{2}\ N_2 \rightleftarrows Cr_2N$ which $\Delta F = -7594.5 + 1.2727\ T$. The soly. of N_2 in Cr contg. 1.5, 7.25, 10.00, and 20.00% Si was 3.83, 1.98, 0.84, 0.33, at 1600°C; 3.68, 1.89, 0.74, 0.30 at 1650°C; 3.54, 1.72, 0.69, 0.28 at 1700°C; 3.08, 1.68, 0.62, 0.26 at 1750°C. At all Si contents ΔH was about −10,980 cal. At 1600°C the soly. of N_2 decreased with increasing Si content up to 40% Si and no special effect near CrSi was observed.

1107. Myers, Rupert H. **Some properties of tantalum** *Metallurgia* **41**, 301-4 (1950).—*C.A.* **44**, 5776*i*.

Ta absorbs gases strongly at about 1800°C, but they can be removed by heating above 2200°C. The best gettering temps. would be 1700-1900°C. The absorption of gas is accompanied by increases in hardness, elec. resistivity, and lattice parameter. Gas-hardened Ta retains its hardness and chem. resistance to attack by many reagents after heating in a high vacuum up to about 1800°C.

1108. Nickerson, Richard A. and Parker, Earl R. **Surface diffusion of radioactive silver on silver.** *Trans. Am. Soc. Metals* **42**, 376-86 (1950).—*C.A.* **44**, 6224*f*.

Diffusivity values for self-surface-diffusion of Ag, detd. in a vacuum of 10^{-6} mm of Hg, are 0.018, 0.03, and 0.147 cm^2 per hr at 225°, 250°, and 350°C, resp. The activation energy is approx. 10,300 cal per g at. wt.

1109. Parznjpe, V. G.; Cohen, Morris; Bever, M. B., and Floe, C. F. **The iron-nitrogen system.** *J. Metals* **188**, No. 2, Trans., 261-7 (1950).—*C.A.* **44**, 3423*i*.

The Fe-N system was investigated by x-ray diffraction measurements and a controlled nitrogenizing method. The latter was an innovation and depended on the relation between the nitrogenizing power of an $NH_3\text{-}H_2$ mixt. and the N-content of the Fe-N alloy produced. Several heretofore controversial features of the Fe-N phase diagram are clarified.

1110. Rhodin, T. N., Jr. **Single-crystal copper surfaces.** *J. Applied Phys.* **21**, 971-3(1950).—*C.A.* **45**, 16*i*.

Some surface-structure characteristics of single-crystal plates of Cu were detd. By use of phys. microadsorption isotherms of N_2 at 78.1°K, electron diffraction, and x-ray diffraction methods, it was tentatively concluded that the surfaces were essentially planar on a mol. scale, and that the surface atoms were arranged in an approx. undistorted lattice.

1111. RHODIN, T. N., JR. **Studies of copper surfaces by low-temperature adsorption isotherms.** *J. Am. Chem. Soc.* 72, 4343-8(1950).—*C.A.* 45, 3682*b*.

The true surface areas of metal surfaces as small as 10 cm were measured with an error of 6% from low-temp. adsorption isotherms using a specially designed vacuum microbalance technique. The isosteric heats of adsorption corresponding to an adsorption of one monolayer of N_2 were 3500 cal/mole on the (100) face of Cu and 2500 cal/mole on the polycrystal face for the particular surfaces studied. The effect of the progressive oxidation of a rough polycryst. surface of Cu was to decrease the surface area to a point where the roughness factor approached unity.

1112. RHODIN, T. N., JR. **Low-temperature oxidation of copper. I. Physical mechanism.** *J. Am. Chem. Soc.* 72, 5102-6(1950).—*C.A.* 45, 2755*i*.

By use of a sensitive quartz vacuum microbalance, surface areas were detd. from microadsorption isotherms, and the growth of very thin oxide films was followed with an error of 2%. The rate equation was found valid, with some limitations, for film thicknesses in the range of 5-50 A. and temps. from 78 to 300°K: $dx/dt = A$ exp. $(x_1/x - W/kT)$ where x was film thickness at time t, x_1 was a crit. film thickness, W was the energy of activation, and A is a temp.-independent const.

1113. RHODIN, T. N., JR. **The anisotroph of nitrogen adsorption on single-crystal copper surfaces.** *J. Am. Chem. Soc.* 72, 5691-9 (1950).—*C.A.* 45, 3681*h*.

Adsorption isotherms of N_2 at 78.1°, 83.5°, and 89.2°K and pressures of 0.160 cm were detd. on single-crystal and polycrystal surfaces, electropolished and H_2-reduced, with a sensitive quartz-beam vacuum microbalance. The vol. of gas, expressed in 10^{-6} g, required to form a monolayer (calcd. by the B.E.T. equation) decreased from 0.54 to 0.45 for the (110) face, from 0.47 to 0.45 for the (100) face, and remained const. at 0.44 for the (111) face over the measured temp. range. The apparent no. of surface Cu atoms per N_2 was calcd. as 1.8-2.2, 2.7-2.8, and 3.3, for the (110), (100), and (111) faces, resp. The differential heats of adsorption were calcd. and expressed as a function of the fraction of surface covered up to 2.0. The curves showed a max. at monolayer coverage.

1114. RIBAUD, GUSTAVE AND DEVIENNE, MARCEL. **Effect of the nature of the surfaces on the condensation of molecular jets of antimony.** *Compt. rend.* 231, 740-2(1950).—*C.A.* 45, 1842*f*.

Both photographically and by means of Geiger-Muller counters it was found that the ratios of Sb deposited on glass and on Al to that on Cu are 0.52 and 0.44, resp.

1115. SAITÔ, TSUNEZÔ. **Absorption of nitrogen by molten iron alloys. III. Study of iron-carbon and iron-silicon alloys.** *Science Repts. Research Insts. Tôhoku Univ.* Ser. A, 2, 909-16 (1950).—*C.A.* 46, 5508*c*

In the case of Fe-C alloys the satn. value of N_2 decreased with increase in C concn. In Fe-Si alloys the satn. value increased at first and reached a max. at approx. 0.5 wt % Si. It then decreased reaching a min. at a compn. corresponding to Fe_3Si and then increased to the compn. corresponding to FeSi. The effect of alloying elements on the rate of absorption of N_2 was also discussed. The rate was decreased by the addn. of Ni to the Fe and was increased by the addn. of C, Si, Mn, and Cr. The absorption of N_2 was a reaction of the 1st order.

1116. SASTRI, M. V. C. AND SRIKANT, H. **Adsorption of nitrogen at elevated pressures on a promoted iron synthetic-ammonia catalyst.** *Current Sci. (India)* 19, 343(1950).—*C.A.* 45, 7406*h*.

Adsorption isotherms were detd. for N_2 on an $Fe\text{-}K_2O\text{-}Al_2O_3\text{-}TiO_2$ catalyst at 7 temps. between 50 and 350°C, and from 15 to 50 atm. Adsorption at lower pressures (20 and 30 atm.) exhibited only 2 max. at 150° and 300°C, resp.; however, at 50 atm. 3 max. were observed, 100, 200, and 300°C. For an adsorption of 0.05 to 0.15 cc./g at 20 atm. a value of 23 kcal. was obtained for the isobaric head of adsorption.

1117. SHINOHARA, SHÔZÔ AND HOSHINO, RYÔSUKE. **The rectifying mechanism of an electrolytic condenser.** *Busseiron Kenkyû* (Researches on Chem. Phys.) No. 23, 28-34(1950).—*C.A.* 47, 2062*g*.

The thickness of the Al_2O_3 layer on the Al is calcd. from the measurement of the elec. capacity, the dielec. const. of the Al_2O_3 layer being assumed to be 10. It is 1.31, 0.705, and 0.502×10^{-5} cm for films anodized at 95 v. (1 hr), 49 v. (1 hr), and 24.5 v. (3 hrs), resp. The elec. charges are carried by Al ions which diffuse through the oxide layer forming thicker film as well as contributing the elec. current. The diffusion of Al ions is subjected to an elec. double layer of adsorbed anions and pos. charges induced on the surface of the Al anode.

1118. STANLEY, J. K.; HOENE, J. V., AND HUNTOON, R. T. **The oxidation of pure iron.** *Trans. Am. Soc. Metals.* preprint No. 5, 21 pp. (1950).—*C.A.* 44, 9886*h*.

The oxidation of high-purity electrolytic Fe (Puron) in air from 500° to 900°C proceeded by the common parabolic rate law, $W^2 = Kt + C$. The oxidation process as a function of temp. followed the usual exponential law. A Geiger counter x-ray spectrometer showed only one oxide, Fe_3O_4, at 500°C, but 3 oxides $\alpha\text{-}Fe_2O_3$, Fe_3O_4, and FeO at the higher temps.; metallographic examn. resolved the various oxide strata. FeO could be cooled to room temp. without decompn. to Fe and Fe_3O_4.

1119. TANAKA, YOSHIO AND SAKAI, MASATOSHI. **Structure of zinc black.** *Repts Sci. Research Inst.* (Japan) 26, 123-9(1950).—*C.A.* 45, 1835*h*.

Zn black condensed on the inner wall of a glass bell when metallic Zn placed within was vaporized by heating electrically under 1 mm Hg was composed of Zn and O_2 (7-8:1), not chemically combined but Zn microgranules adsorbing O_2. With excessive supply of O_2, ZnO, instead of Zn black, was formed. Zn black could adsorb a large amt. of O_2. This adsorption occurred rapidly in air and is facilitated by moisture if present.

1120. Trambouze, Yves. **Study of Fischer catalysts by differential thermal analysis.** *Compt. rend.* **230**, 1169-71(1950).—*C.A.* 44, 7132*a*.

Ni hydroxide and the gel formed by pptg. Ni with K_2CO_3 were heated to 500°C during 1.5 hrs. Both showed the dehydration of the hydroxide at 360-80°C by a strong endothermic reaction; the 2nd also showed the loss of adsorbed water at 100°C and the decompn. of the basic carbonates into CO_2, H_2O, and NiO at 220-40°C. Four other studies, one with a 1:1 mixt. of kieselguhr and Ni hydroxide heated variously to produce a silicate content of 15%, 8%, and 0% did not show the dehydration curve, but showed the carbonate decompn.

1121. Tsugakoshi, Osamu. **Clean-up of oxygen by barium-getter films.** *Repts. Sci. Research Inst. (Japan)* 26, 73-7 (1950).—*C.A.* 45, 2795*b*.

The Ba-getter film (800 A. thick adsorbed on a piece of mica from BaN_6 pyrolyzed under 2.5-3.5 × 10^{-3} mm Hg) increased its elec. resistance (*r*) parabolically under 10^{-5} mm Hg within a few min. of the end of heating, owing apparently to the growth of BaO on the surface. Ba films 500-4400 A. thick gave a rate of 6-20 cc/sec/cm^2.

1122. Turnbull, D. **Isothermal rate of solidification of small droplets of mercury and tin.** *J. Chem. Phys.* **18**, 768-9(1950).—*C.A.* 44, 7620*f*.

Hg droplets with a mean diam. of 3.8 μ were dispersed in methylcyclopentane; the mixt. was cooled and the vol. changes with time were followed dilatometrically. Most of the droplets solidified between −98 and − 102°C. At const. percentage solidification, the log of the nucleation frequency was a linear function of $1/T(\Delta T)^2$, where ΔT was the super-cooling.

1123. Turnbull, D. **Correlation of liquid-solid interfacial energies calculated from supercooling of small droplets.** *J. Chem. Phys.* **18**, 769(1950).—*C.A.* 44, 7620*h*.

The liquid-solid interfacial energy, σ, can be calcd. from the nucleation frequency at one temp.; the frequency was obtained from the max. supercooling. Values for σ thus obtained, in ergs/cm^2 were: Hg 24.4, Ga 56, Sn 54.5, Bi 54, Pb 33, Sb 101, Ge 181, Ag 126, Au 132, Cu 177, Mn 206, Ni 255, CO 234, Fe 204, Pd 209, Pt 240.

1124. Tylecote, R. F. **The adherence of oxide scales on copper.** *J. Inst. Metals* **78**, 301-26 (1950) (Paper No. 1281).--*C.A.* 45, 2836*d*.

Oxide scales on P-bearing Cu flake off more readily in lab. oxidation tests and in com. hot working than scales on pure or tough-pitch Cu (P-free). Scales on Cu are largely Cu_2O; P-contg. Cu_2O cannot accommodate plastic strains imposed by hot working or by differential contraction during heating and cooling in oxidation tests.

1125. Tylecote, R. F. **The oxidation of copper at 350°-900° in air.** *J. Inst. Metals* **78**, 327-50 (1950)(Paper No. 1282).—*C.A.* 45, 2836*b*.

Oxidation rates of P-free and P-deoxidized Cu were detd. from 350° to 900°C by the continuous weighing method. At 615°C and higher, both oxidize according to the parabolic law, and the rate consts. were similar for the 2 types. At lower temps., the initial stages of oxidation departed significantly from the parabolic mode and the oxidation probably followed a logarithmic law, the rates again being similar for the 2 types of Cu; as the scale thickens, the oxidation conformed more nearly to the parabolic law. At about 450° to 500°C, there was a change of slope in the plot of the parabolic rate const. against the reciprocal of the abs. temp., and at this temp. there was a similar change of slope in the analogous plot of the elec. cond. of the oxide film.

1126. Valensi, Gabriel. **Oxidation of cobalt at high temperatures.** *Métaux & corrosion* 25, 283-91(1950).—*C.A.* 45, 10028*e*.

Intervals of thermodynamic stability of oxides Co_2O_3, Co_3O_4, CoO are, resp., below 300°, between 300 and 900°, and above 900°C. Freshly cut Co forms an invisible film in air, which film reduces the rate of oxide diffusion. Statistical thermodynamics is used in interpreting phys. phenomenon of oxidations.

1127. Veith, W. **The quality and the mechanism of photoelectric emission of cesium-antimony layers.** *J. phys. radium* **11**, 507-13(1950).—*C.A.* 45, 2768*h*.

Photoelec. layers of Cs-Sb produced by evapn. first of a certain thickness of Sb and then Cs are particularly suitable for study since they are extremely sensitive photoelectrically and have a small no. of constituents. At max. sensitivity, the various layers can be considered as semiconductors. The influence of the addn. of O_2 is also studied and discussed. A comparison of these layers with Cs_2O, Ag, Cs, and others indicates that the most sensitive photoelec. layers are the semiconductors.

1128. Vero, J. A. **Theory of the degassing of molten metals.** *Acta Tech. Acad. Sci. Hung.* **1**, No. 1, 130-55(1950) (in Russian).—*C.A.* 45, 4186*i*.

The occlusion of gases in metals is discussed; also methods of removal, such as chilling the melt in the furnace, leaving the melt in a furnace free of the gas, displacement by insol. gases, and fusing under vacuum. Data are given for the various cases, using H_2 in contact with Fe, Ni, and Cu.

1129. Waché, X. **Oxidation of steels and alloys.** *Métaux & corrosion* 25, 267-76(1950).—*C.A.* 45, 9446*h*.

Special consideration is given to oxidation of iron base Fe alloys with Cu and Ni. The oxide in air at 1000°C on Fe, carbon steel, or alloy steels consists of 3 layers: (*a*) outside layers representing 10% of total thickness consisting of Fe_2O_3 and Fe_3O_4, (*b*) intermediate layer, representing 50% of total thickness, a mixt. of FeO and Fe_3O_4, (*c*) internal layer, in contact with the nonoxidized metal, representing 40% of the total, consists essentially of FeO.

1130. Wagener, S. **Method for measuring the efficiency of getters at low pressures.** *Brit. J. Applied Phys.* **1**, 225-31 (1950).--*C.A.* 45, 1836*g*.

A method was described for measuring the rate at which low-pressure air is taken up by a getter. Use was made of a special ionization gage to det. the efficiencies of uptake by Ba, Mg, Th, and Zr.

1131. Walter, Dean I. **Determination of oxygen in titanium.** *Anal. Chem.* 22, 297-303(1950).—*C.A.* 44, 3403*d*.

The vacuum fusion method seems necessary for detg. O_2 in Ti metal. The sample to be analyzed reacts with powd. graphite in the presence of Sn, to form stable Ti carbide and to reduce the various oxides to CO. The gases evolved are collected and analyzed. At a temp. of 1900°C, complete reduction is obtained in 30 min. Analysis of synthetic standards prepd. by diffusing O_2 gas into hot Ti metal indicated practically complete recovery of all O_2.

1132. Weber, Joseph and Laidler, Keith J. **The variation of rate of desorption with extent of surface coverage.** *J. Chem. Phys.* 18, 1418 (1950).—*C.A.* 44, 10412*i*.

Rates of desorption were increased markedly as the surface became more fully covered. This was demonstrated by use of a microwave technique with NH_3 and NH_3 contg. D on a singly-promoted Fe catalyst at 122°C. For example, a pressure of 0.4 mm of Hg increased the rate of desorption of NH_3 by a factor of at least 100. The results were interpreted in terms of repulsive forces between the adsorbed mols.

1133. Wert, C. A. **Measurements on the diffusion of interstitial atoms in body-centered cubic lattices.** *J. Applied Phys.* 21, 1196-7 (1950).—*C.A.* 45, 1835*c*.

The rate of diffusion of carbon in Ta and Nb and of N_2 in α-Fe was measured by effects on internal friction and anelastic after-effect. Data covering a range of 10^4 in rate were reported.

1134. Whitton, W. I. **Corrosion of iron covered by a thin film of neutral salt solution.** *Trans. Faraday Soc.* 46, 927-38 (1950).—*C.A.* 45, 4194*c*.

The corrosion of Fe covered by 0.5 *N* NaCl solns. and O_2 is examd. Owing to the combined effect of the high elec. cond. of the liquid film and the unrestricted supply of O_2 reaching the metal surface, the results are dependent almost entirely on the corrosion properties of the metal itself. Acceleration of corrosion of the "O_2 absorption" type may be caused by the catalytic effect of certain impurities themselves, and not necessarily of oxide films on the O_2 depolarization action.

1135. Wickert, K. and Kroll, J. **Metallic corrosion and absorption.** *Werkstoffe u. Korrosion* 1, 105(1950).—*C.A.* 44, 5785*d*.

Through 3 glass tubes, each contg. a sheet of Fe, water contg. definite amts. of CO_2 or of O_2 was passed. One Fe sheet was covered with $Fe(OH)_3$, one with activated carbon, and the third was bare. The loss in wt of the Fe sheets was used as a measure of the corrosion. If the active constituents of the water (O_2 or CO_2) were physically absorbed by the deposit on the metal, the corrosion rate increased in comparison to that on a deposit-free metal surface. If the active constituents of the water were chemically absorbed, the corrosion rate decreased.

1136. Wilkinson, P. G. and Birks, L. S. **Particle size of evaporated gold.** *J. Applied Phys.* 21, 60 (1950).—*C.A.* 44, 3768*c*.

Evapd. Au formed discrete granules invariably unless a contamination of tungstic oxide was present during evapn.

1137. Worner, H. W. **Surface hardening of titanium.** *Trans. Australian Inst. Metals* 3, 49-51 (1950); *Australasian Engr.* Nov. 7, 1950, 52-5.—*C.A.* 46, 7959*i*.

Ti is surface hardened by heating to 850-1000°C in air or O_2 at 10^{-3} to 10^{-2} mm Hg, or in He or A at atm. pressure with a similar concn. of O_2 and cooling slowly. Brief heating at the lower temp. with higher O_2 gives high surface hardness of shallow depth, while prolonged heating at the higher temp. with low O_2 gives deeper hardening but lower surface hardness.

1138. Zapffe, C. A. and Phebus, R. L. **Embrittlement of stainless steel by steam in heat treating atmospheres.** *Trans. Am. Soc. Metals*, Preprint No. 25, 11 pp. (1950).—*C.A.* 44, 9895*d*.

Bend-tests demonstrated a powerful and unrecognized effect of steam in embrittling the steel through the hydrogenizing effect of the metal-steam reaction. Steels which sustained a full bend of 180° when hardened from a dry atm. failed at angles as low as 20° when steam was admitted to the furnace atm. during heat treating; and steels which fractured at a given angle when quenched from normal air can be markedly improved by drying the furnace atm.

1139. Ziliani, Giuseppe. **Microscopic method for the determination of oxygen in steels.** *Met. ital.* 42, 225-9(1950).—*C.A.* 45, 497*b*.

A method for detg. O_2 in steels is based on the examn. of oxidized inclusions under the microscope (100 ×): $\% O = I_o D_o\, 205n/AP_o$, where I_o is the total area of oxide inclusion, D_o its sp.gr., A, the total area examd., n the no. of O atoms/mol., and P_o the mol. wt of the oxide. In an analogous manner the S content is given by $\% S = I_S D_S 410m/AP_S$, where m is the no. of S atoms and where subscript s refers to the sulfide inclusion. Comparison with data published by the U.S. Bureau of Standards shows good agreement.

1140. Aldrich, L. T. **The evaporation products of barium oxide from various base metals and of strontium oxide from platinum.** *J. Applied Phys.* 22, 1168-74 (1951).—*C.A.* 46, 1345*h*.

The evapn. products of BaO heated on ribbon filaments of Pt, Ta, Ni, Mo, and W, and of SrO on Pt were studied with a high-resolution mass spectrometer for pos.-ion analyses. Only on systems BaO on Pt, and BaO on Ni, and SrO on Pt were the evapn. processes reproducible without particular attention to procedure. BaO on Pt and SrO on Pt differed markedly in evapn. mechanism. At high temps. peaks were found due to Ba_2O^{++}, Ba_2O^{+}, $Ba_2O_2{}^{+}$, and other Ba compds. depending on the base metals used. A measurable ion current was found due to Sr^{+} ions evapd. from Pt.

1141. Arkharov, V. I.; Somova, E. V., and Chukina, T. P. **Internal adsorption of silver in platinum.** *Doklady Akad. Nauk S.S.S.R.* 76, 209-10 (1951).—*C.A.* 45, 6893*i*.

Pt with 0.5% Ag (10 × 15 × 1 mm) was heated 2 hrs to 1180°C (temp. of max. soly. of Ag) and quenched in H_2O. Upon immersion (5 min.) in 250 cc. aqua regia at 20-25°C a layer of about 2.5×10^{-6} cm, corresponding to a loss of wt of about 0.6 mg (for the total surface area of 11.2 cm^2), was etched away. Repeating this 80 times resulted in soln. of 50.5 mg metal. In parallel expts., an identical sample, also heat-treated at 1180°C, was etched in one single operation until wt loss was 50 mg. In a 3rd expt., 50 mg pure Pt and 0.25 mg Ag were dissolved in aqua regia. Comparison of the 3 spectrograms of the 3 solns. showed that the Ag lines were markedly more intense in the first expt. This indicated that in a thin surface layer of the alloy quenched from the temp. of max. soly., the Ag content was substantially higher than its mean bulk concn., i.e. there was pos. internal adsorption.

1142. Bénard, Jacques and Bardolle, Jean. **The oriented growth of iron(II) oxide by the controlled oxidation of iron at high temperatures.** *Compt. rend.* 232, 2217-18(1951).—*C.A.* 46, 1326*e*.

The oxidation of Fe at 850°C and low pressure of O_2 produces iron (II) oxide. The no. and form of the oxide particles depends on the crystallographic orientation of the Fe crystals at the surface, since the rate of growth is different for different crystal faces.

1143. Bowden, F. P. and Throssell, W. R. **Adsorption of water vapor on solid surfaces.** *Nature* **167**, 601-2 (1951).—*C.A.* 45, 8319*g*.

The adsorption of water vapor on Pt foil was detd. by heating the foil to a red heat, allowing it to cool to 20°C *in vacuo* while suspended on a microbalance, and measuring the increase in wt of the foil when water vapor was admitted at different pressures. Confirmatory expts. were made with elliptically polarized light to measure the thickness of the adsorbed water films on metal, diamond, and Zn blende surfaces. The adsorbed layer was at most a few mol. layers in thickness.

1144. Bowden, F. P.; Throssell, F. R. S., and Throssell, W. R. **Adsorption of water vapor on solid surfaces.** *Proc. Roy. Soc. (London)*, **A209**, 297-308 (1951).

The adsorption on Au, Ag, Pt, Al, and ZnS was followed by a direct weighing of the adsorbed film on a microbalance and an examination of polarized light reflected from the surface. Both methods showed that the adsorption of water at vapor pressures near saturation corresponded only to about two molecular layers. Greater adsorption, previously quoted as evidence for long-range surface effects, was due to contamination.

1145. Bowden, F. P. and Young, J. E. **Friction of clean metals and the influence of adsorbed films.** *Proc. Roy. Soc.* **A208**, 311-25 (1951).—*C.A.* 46, 5398*h*.

When sufficiently clean metals were allowed to touch, even at room temp., complete seizure occurred. Various gases and vapors were adsorbed on the clean specimens, and their influences on friction detd. These sp contaminants were most effective as lubricants where they could react with the metal to form a solid and chemically attached film which is several mol. layers thick. Otherwise the friction remained very high, although seizure was prevented. Phys. adsorption might occur in addn., with a significant reduction in the friction. The friction of metals was due mainly to adhesion at the points of real contact. Adsorbed monolayers, or even multilayers of the permanent gases, did not reduce the friction to the low values commonly observed.

1146. Brandt, Werner. **Determination by a flow method of adsorption times of gas molecules on metal surfaces.** *Z. Elektrochem.* 55, 652-4 (1951).—*C.A.* 46, 4317*e*.

Measurements for diffusion through a glass capillary contg. a central metal wire, and through the empty capillary, were used to calc. the adsorption time τ on the metal surface. For C_2H_4 and C_2H_6 τ was about 10^{-7} sec and was $< 10^{-8}$ sec for H. Measurements with C_2H_6 and a series of Pt-Cu alloys were also made.

1147. Carli, F. de and Collari, N. **Thermal oxidation of copper.** *Chimica e industria* 33, 77-80 (1951).—*C.A.* 45, 6021*i*.

At 400°C the wt-increase isotherm was given by $1/P = A - B \ln t$, where t was the time; from 500 to 900°C a parabolic course $P^2 = Kt$ was found. Two curves intersected in the 500-900°C range at about 650°C. This discontinuity was ascribed to the reaction $CuO + Cu \rightleftarrows Cu_2O + 3.5$ kcal. rather than $2CuO \rightleftarrows Cu_2O + \frac{1}{2} O_2 - 34$ kcal.

1148. Chizhikov, D. M.; Khazanov, E. I., and Nikonov, A. G. **Reactions between cadmium and carbon oxides.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* **1951**, 68-73.—*C.A.* 45, 6949*f*.

Cd vapor above 768°C is not oxidized by either CO or CO_2. Solid Cd is oxidized by CO only below 350°C, according to $Cd + CO = CdO + C$. The oxidation is very slow, even with a fine powder. The velocity of evapn. and of condensation is markedly higher than the rate of oxidation. The gain of wt of Cd powder in 2.5 hrs at 300° in CO_2 was 0.0016%.

1149. Corbett, J. A. **Estimation of oxygen in titanium by chlorination.** *Analyst* 76, 652-7 (1951).—*C.A.* 46, 855*a*.

Ti and metallic impurities were converted into volatile chlorides by treatment with Cl_2 at 400°C. The vacuum fusion method was more expensive and took more time. A careful study with pure Ti and 10 alloys contg. 0.5-1.50% Ti showed that the chlorination procedure gave results which were within 5% of the actual O content.

1150. Crowell, A. D. and Farnsworth, H. E. **Adsorption of carbon dioxide on a nickel single crystal with a radioactive tracer.** *J. Chem. Phys.* **19**, 1206-7 (1951).—*C.A.* 46, 3366*a*.

CO_2 labeled with C^{14} was absorbed on the (111) face of a Ni crystal under pressures of 0.1 to 0.01 mm Hg and at temps. from room to 200°C. Measurable amts. were adsorbed but, owing to exptl. difficulties, the results were not reproducible.

1151. Darken, L. S.; Smith, R. P., and Filer, E. W. **Solubility of gaseous nitrogen in gamma iron and the effect of alloying constituents—aluminum nitride precipitation.** *J. Metals* 3, *Trans.* 1174-9 (1951).—*C.A.* 46, 391*b*.

The soly. of N_2 in purified Fe and low-alloy steels was detd. for the γ-region (930 to 1350°C). The diffusivity of N_2 was estd. from the rate of approach to equil. The investigation of Al-killed steels, held in N_2, disclosed pptn. of AlN, the soly. of which was detd.

1152. Davies, M. H. and Birchenall, D. E. **Oxidation of titanium.** *J. Metals* 3, *Trans.* 877-80 (1951).—*C.A.* 45, 10161*b*.

The rate of oxidation of Ti between 650-950°C was measured. The linear-rate law obtained was explained by interface reaction control of the process. Tracer expts. indicated that O_2 diffuses in at least one phase of the scale.

1153. Deb, S. **Emission decay in oxide-coated cathode due to gaseous adsorption.** *J. Sci. Ind. Research* (India) **10B**, No. 3, 77-8(1951).—*C.A.* 46, 3389*b*.

The adsorption of gases, as O_2, Cl_2, and CO_2, adversely affect the emission from the cathode. By assuming that the concn. of the poisoning particles in front of the cathode is proportional to the c.d. an expression is developed for the rate of decay of current from statistical and thermodynamical considerations. The time required for the current to fall to $1/e$ of its initial value is taken as the time const. of the decay. This const. is calcd. to be about 10^{-3} sec. If the energy of activation is negligible, about 0.1 of the cathode surface is available for adsorption, and the current diminishes from 10 to 0.1 amp.

1154. Dravnieks, Andrew. **Action of hot ionized gases on zirconium and copper.** *J. Phys. & Colloid Chem.* 55, 540-9 (1951).—*C.A.* 45, 6021*h*.

The reaction at 986°C was followed by measuring the change in elec. cond. of Zr strips. The cond. loss (an index of oxidation) was measured as a function of time for 8 different gases that in order from most to least oxidative, were: O_2, air, H_2O, N_2 + 0.5% O_2, com. (O_2-contg.) He, CO_2, CO, C_2H_4. Ionization increased the oxidation rate in CO_2, decreased the rate in CO, H_2O, com. He, and N_2 + 0.5% O_2. The retardation of oxidation by ionization is attributed to a clean-up of the metal surface by the nonreacting components of the gas phase.

1155. Eichborn, J. L. v. **Wetting of metals by water.** *Werkstoffe u. Korrosion* 2, 212-21 (1951).—*C.A.* 45, 9334*d*.

Exptl. results of investigations on the equil. of wetting of air, water, and metal are discussed, including original expts. with Hg. A survey of values for surface tension of solid metals and heats of adsorption of metal catalysts gives a comparative measure of the adsorptive power of various metal surfaces. The competition between the wetting by water and the adsorption of air are compared with the results of others on the adsorption of gases or aq. solns. on metal surfaces.

1156. Eischens, R. P. **Isotopic exchange rates as criteria of surface heterogeneity.** *J. Chem. Phys.* 19, 377 (1951).—*C.A.* 45, 6898*c*.

A monolayer of $C^{14}O$ was chemisorbed on reduced Fe, and the exchange with normal CO in the gas phase at 1 atm. was detd. at −78°C. If X was the fraction of the $C^{14}O$ in the gas phase at time t, the curve of $-\ln[1-(X/X_\infty)]$ *vs.* t consisted of a few linear sections. These sections corresponded to different exchange rates on various portions of the surface, within each of which the Fe-CO bonds were equiv. If, however, the surface were "completely heterogeneous" the exptl. data would plot as a smooth curve.

1157. Eremeev, M. A. **Emission of electrons and reflection of ions from metal surfaces.** *Doklady Akad. Nauk S.S.S.R.* 79, 775-7(1951).—*C.A.* 46, 1346*f*.

The no. of electrons emitted by targets of Ta or W under the impact of pos. ions of alkali metals increases linearly with the energy of the ions. With increasing temp. of the target, the no. of electrons emitted decreases, and so does the no. of ions adsorbed on the target (detd. from the ballistic deflection on sudden desorption). Up to 800°K, the reflection coeff. of the ions is independent of the nature of the target and of the energy of the ions. Above 1000°K, the reflection coeff. for K^+ ions is different for Ta and W. The fact that a perfectly pure Sn surface emits no electrons, indicates that the electron emission is due to adsorption of the pos. ions on the target.

1158. Fisher, J. C. **Calculation of diffusion penetration curves for surface and grain-boundary diffusion.** *J. Applied Phys.* **22**, 74-7 (1951).—*C.A.* 45, 3215*g*.

Diffusion in solids is known to occur along grain boundaries and over free surfaces more rapidly than through the interiors of crystals. In order to facilitate quant. investigation of grain-boundary and surface diffusion, a math. analysis of the problem was made, assuming that grain-boundary diffusion was analogous to the diffusion of heat along a thin Cu foil imbedded in cork.

1159. Fry, A. **Gases in steel—nitrogen and nitriding.** *Inst. hierro y acero*, Suppl. to Vol. 3, 36-47 (July-Sept., 1950); *J. Iron Steel Inst.* (London) **168**, 315(1951).—*C.A.* 45, 7936*b*.

N_2 produced solid, stable compds. in steel at low temps. The laws governing the absorption of N_2 and O_2 by steel were somewhat analogous. The soly. of N_2 in Fe at atm. pressure and in relation to temp. was illustrated. N_2 penetration curves for C steels were given. Advantages and applications of nitriding were described and, finally, the influence of alloying elements on the hardness obtained by nitriding was examd.

1160. Funston, E. S. and Reed, Shermán A. **Determining traces of oxygen in bismuth metal.** *Anal. Chem.* 23, 190-1 (1951).—*C.A.* 45, 3289*i*.

Oxygen is detd. from the quantity of H_2 consumed during reduction of trace oxides in a simple gasometric app. (described and illustrated). From 1 to 10 g, depending on O-content, of the Bi sample is held for 30 min. at 850-900°C in H_2. H_2

consumption is measured with a built-in 5-ml microburet. Accuracy and precision were checked by adding known amts., 2-11 mg, of Bi_2O_3 to 10-g samples of O-free Bi. The method and app. were applied to the *detn. of O in Cu and Fe* and checked by the addn. of CuO and Fe_2O_3, resp., to the pure metals.

1161. GEEL, W. CH. VAN AND SCHOLTE, J. W. A. **Capacity and dielectric loss in a layer of oxide deposited by anodic oxidation on aluminum.** *Philips Research Repts.* **6**, 54-74(1951)(in French)·—*C.A.* **45**, 9395*c*.

The equiv. impedance of the system $Al-Al_2O_3$—electrolyte as a function of frequency was detd. The capacity of different thicknesses of oxide films was measured with an a.-c. bridge and by a ballistic method. At the $Al-Al_2O_3$ boundary, it was assumed that there was a layer contg. excess Al atoms. They resulted in good cond. of electronic character. In a direction toward the electrolyte, the concn. of the excess atom decreased and the cond., therefore, decreased in that direction.

1162. GOLDSZTAUB, STANISLAS AND MICHEL, PIERRE. **Preparation of silver-magnesium alloys in thin layers by the simultaneous evaporation of these constituents in vacuum.** *Compt. rend.* **232**, 1843-5 (1951).—*C.A.* **46**, 2467*i*.

Mg was heated in a helix of W wire and Ag in a helix of Mo. The metals were distd. in vacuo and collected on a grid of brass covered by a collodion film some hundreds of microns thick. The condensed metallic vapors were then studied by electron diffraction.

1163. GULBRANSEN, EARL A. AND ANDREW, KENNETH F. **The kinetics of the oxidation of cobalt.** *J. Electrochem. Soc.* **98**, 241-51 (1951).—*C.A.* **45**, 6469*c*.

In the hexagonal crystal form (cold-rolled), Co had a higher oxidation rate than in the cubic form (annealed) up to 550°C. Reaction rates markedly increased at about 700°C. Below 700° the rate was controlled by the diffusion rate of Co cations through the Co_3O_4 layer, whereas above 700° the rate was controlled by the diffusion of Co cations through the CoO layer, both oxides being capable of coexistence.

1164. HADLEY, C. P. **Thermionic emission from oxide-coated tungsten filaments.** *Mass. Inst. Technol., Research Lab. Electronics Tech. Rept.* No. **218**, 25 pp. (1951).—*C.A.* **47**, 4187*i*.

Single-crystal W filaments were coated cataphoretically with oxides of Ba, Sr, Ca, and Mg. The emission from the oxides was not influenced by variation of work function with crystallographic direction of the W.

1165. HECK, CARL. **Structure of evaporated iron layers.** *Metallkunde* **42**, 10-13 (1951).—*C.A.* **45**, 4986*g*.

Thin Fe layers crystallize, not in a body-centered, but in a face-centered cubic lattice, at room temp. At higher temp. and thicker layers transition into the body-centered type takes place.

1166. HINTENBERGER, HEINRICH. **Thermal ion sources for negative ions.** *Helv. Phys. Acta* **24**, 307-9 (1951).—*C.A.* **46**, 2393*e*.

A directly heated W foil is covered with $ZrOCl_2$ or operated at a low pressure of HI, CCl_4, SnI_4, or AgBr to give neg. ions. An indirectly heated metallic powder of W or Th mixed with a halide is more satisfactory. Measurement of the ion current for such a source which contained 5×10^{-6} g NaCl showed that for W powder, Na-ion emission reached a max. in about 30 min. and Cl-ion about 20 min. later, the intensity of Na-ion emission being greater.

1167. HOGARTH, C. A. AND GRANVILLE, J. W. **Rectification effects at surfaces of germanium and lead sulfide.** *Proc. Phys. Soc.* **64B**, 992-8 (1951).—*C.A.* **46**, 10751*d*.

The effects of vacuum heat-treatment were investigated. Temps. between 500° and 900°C could improve the rectification characteristics considerably. The treatment did not spoil the optical quality of a polished surface. Similar effects were obtained with deficit-conducting PbS. Modifications to the surface structures of the crystals by various treatments were investigated by electron diffraction.

1168. IOFFE, E. SH. AND ROTINYAN, A. L. **Gases in electrolytic nickel.** *Doklady Akad. Nauk S.S.S.R.* **77**, 91-2 (1951).—*C.A.* **45**, 6089*b*.

H_2 found occluded in electrodeposited Ni is attributed solely to adsorption of org. matter from the electrolyte in the course of the deposition. Proof is supplied by simultaneous analyses for C, H_2, and O_2, in various electrolytic Ni deposits. Both the H- and the O-contents are directly proportional to the carbon content of the metal. There is, however, a certain H content even at C = 0 (at 20°C, about 2 vol. H_2/vol. Ni) which is evidently of inorg. origin.

1169. JONES, F. LLEWELLYN AND DAVIES, D. E. **Influence of cathode surface layers on minimum sparking potential of air and hydrogen.** *Proc. Phys. Soc.* (London) **64B**, 397-404 (1951).—*C.A.* **46**, 9409*g*.

Oxide layers on the cathode produced marked irregularities in the Paschen curves for air and H_2. Removal of the oxide layer produced smooth Paschen curves, while a thin film of one metal on a different metal as base gave values which were not characteristic of either metal in bulk. The deposition of thin metallic films had considerable effect on cathode emission.

1170. JOY, A. S. AND DORLING, T. A. **Influence of a chemisorbed film on subsequent physical adsorption processes.** *Nature* **168**, 433-4 (1951).—*C.A.* **46**, 3366*e*.

An alkali-promoted Fe catalyst adsorbed the same amt. of N_2 whether or not first exposed to CO and desorbed at −78°C. Differences in chemisorption of CO in 2 successive cycles (adsorption at −195° and desorption at −78°C at 10^{-4} mm for 0.5 hr) corresponded to 6.5, 11.6, and 21.5% of the surface for 3 samples of catalyst.

1171. KAINUMA, YOSHIRO. **Structure of thin metallic films formed by evaporation on molybdenite.** *J. Phys. Soc. Japan* 6, 135-8 (1951).—*C.A.* 45, 9331*g*.

Au, Cu, Ni, Pt, and Al were evapd. on the cleavage surface of molybdenite to a thickness of 20-100 A. at 25-500°C and a pressure of 10^{-4} mm. Electron-diffraction examns. were made at room temp. When the (111) plane of the metal was parallel to the cleavage surface and the [110] axis of the metal was parallel to the [100] axis of molybdenite, 2 types of arrangements, which were mirror images, were possible. Cu exhibited random orientation at 25° and sym. orientation from 50° to 500°C; Pt exhibited sym. orientation from 250° to 430°C; and Al exhibited random orientation from 75° to 375°C.

1172. KALISH, T. V. AND BURSHTEIN, R. KH. **Effect of oxygen adsorbed on platinum on the contact potential difference.** *Doklady Akad. Nauk S.S.S.R.* **81**, 1093-6 (1951).—*C.A.* 46, 3829*d*.

The contact potential difference was detd. by the current-voltage curve of a diode in which Pt is anode, and W cathode. From measurements with the Pt reduced with H_2 at 400°C, outgassed at 1100-200°C and evacuated to 10^{-6} mm Hg and with Pt exposed to O_2, and then evacuated to remove unadsorbed gas, it followed that at room temp., under 0.1 mm Hg of O, only a fraction of a monolayer was adsorbed. Both the rate of adsorption and the amt. adsorbed increased with the temp.; at 800°C, the amt. O_2 taken up by the Pt corresponds to some 300 layers. The work function ψ of Pt having adsorbed 17.5×10^{15} mols. O/cm^2 at 200° was increased by about 0.2v.; however this increase of ψ disappeared after 11 hrs, and ψ went back to practically the original value for a pure Pt surface. Desorption of O_2 cannot account for these phenomena.

1173. KEMBALL, C. **The reaction of methane and deuterium on evaporated nickel catalysts.** *Proc. Roy. Soc.* (London) **A 207**, 539-54 (1951).—*C.A.* 46, 331*b*.

The production of all 4 deuteriomethanes from the reaction of CH_4 and D on evapd. Ni films in the temp. range 206 to 255°C was followed with a mass spectrometer. The adsorption of D_2 was stronger than the adsorption of CH_4. The surface films were shown by electron diffraction to be unorientated. An activation energy of about 11 kcal./mole was required for the adsorption of CH_4.

1174. KIEHL, JEAN P. **Effect of the adsorption of gases on the velocity of reduction of nickel oxide by tungsten.** *Compt. rend.* **232**, 1666-8 (1951).—*C.A.* 45, 7417*b*.

The reaction $2NiO + W = 2Ni + WO_2$ was studied by magnetic susceptibility measurements for the analysis for metallic Ni. The rate of reaction at temps. below 780°C varied according to the gas surrounding and adsorbed upon the reactants; above 780°C there was little effect.

1175. KIMOTO, SHIZUO. **Orientations of crystallites of metal films evaporated on single crystals of copper.** *Science of Light* (Japan) **1**, No. 2, 106-16 (1951).—*C.A.* 46, 10777*a*.

Thin films 100-400 A. thick of Ag, Au, Ni, Pb, Fe, Sn, and Zn were evapd. onto the etched surfaces of Cu single crystals cut out to have (001), (110), and (111) faces. The evapn. was performed *in vacuo* at various temps., and the orientations of crystallites and diffusion of the evapd. metal layers were studied by the electron-diffraction method. The atoms of evapd. metal were mobile at the moment of arrival at the surface of substrate crystal and came close to each other to form a characteristic atomic plane contg. a few atoms in it. The "expected positions" were the ones where the atoms of substrate crystal should be when the crystal undergoes further growth.

1176. KINOSHITA, TOSHIHIRO AND NAKASHIMA, MASUO. **Oxygen in cast iron.** *Tetsuto-Hagane* **37**, 420-6 (1951).—*C.A.* 46, 1558*i*.

The cupola metal melted from inferior pig iron contained much FeO and the gross casting cracks were liable to appear. When the FeO was 0.04%, the repeated impact value decreased very much. When the FeO was 0.05%, the graphite structure was abnormal.

1177. KNAUER, FRIEDRICH AND KÜHL, WALTER. **Adsorption of potassium on tungsten.** *Naturwissenschaften* **38**, 432 (1951).—*C.A.* 46, 3366*c*.

Depending on temp. of the filament and beam intensity the coverage of the filament varied and the current between filament and auxiliary surrounding electrode showed changing characteristics. With little coverage (less than 0.3% of monatomic layer) all K left the filament each period as ions. With increased coverage the emission of the filament will be more and more at. K.

1178. KOBAYASHI, AKIO AND FURUYA, SABURO. **Reactions of barium films with oxygen. I.** *J. Phys. Soc. Japan* 6, 238-43 (1951).—*C.A.* 46, 5462*i*.

Two kinds of Ba getter were used to obtain Ba metal films; Fe tubes contg. Ba metal, and Ba berylliate mixed with Zr powder. In the range of pressure and temp. measured, the coexistence of BaO and BaO_2 was possible but, even if present, BaO_2 scarcely contributed to the reaction.

1179. KOKHANENKE, P. N. **Absorption bands of excess metal atoms in evaporated films.** *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* **15**, 685-9 (1951).—*C.A.* 46, 8976*d*.

The films were prepd.: (1) by multiple vacuum sublimation, (2) by heating an evapd. metal film in O_2, Cl_2, or I_2. Narrow absorption bands in the near ultraviolet selective reflectivity and luminescence were observed in ZnI_2, $ZnCl_2$, ZnO, AgI, AgCl, AgBr, CdI_2, $CdBr_2$, CuI, CuBr, $AuCl_3$, and PbI_2. Cooling with liquid air narrowed the bands and shifted most of them to shorter wave lengths. The absorption was attributed to excess metal atoms.

1180. KÖSTER, WERNER AND RAFFELSIEPER, JOSEF. **The behavior of sintered iron in nitriding.** *Arch. Eisenhüttenw.* **22**, 337-41 (1951).—*C.A.* 46, 1941*i*.

Since sintered bodies were porous, reactions could start not only at the surface but also in the interior, especially if the reactant was a gas. Sintered bodies of different ds. were made of 4 Fe powders (carbonyl Fe, Hametag, sponge Fe, and RZ powder) and nitrided in NH at 500° for 2½-15 hrs. The absorbed N_2 amounted up to 8% depending on the d. The action was much stronger than in ordinary Fe. An almost uniform nitriding through the whole sinter body was obtained in short time except in the carbonyl sample where the nitration at the edges was stronger.

1181. KUMMER, J. T. AND EMMETT, P. H. **Chemisorption of carbon monoxide and the heterogeneity of the surface of iron catalysts.** *J. Am. Chem. Soc.* 73, 2886-9 (1951).—*C.A.* 45, 8335*i*.

Radioactive and nonradioactive samples of CO were added in succession as two separate fractions to a reduced Fe synthetic-NH_3 catalyst at −195° and −78°C. The layer of chemisorbed CO was removed by pumping and analyzed for radioactivity. Although the second fraction of added CO tended to come off first, a partial exchange equiv. to the coverage of about 50% of the Fe surface occurred very rapidly between the two fractions of added CO even if both fractions were added at −195°C.

1182. KUMMER, J. T. AND EMMETT, P. H. **Exchange between $N_2{}^{30}$ and $N_2{}^{28}$ over iron catalysts.** *J. Chem. Phys.* 19, 289-92 (1951).—*C.A.* 45, 9346*d*.

The rates of exchange between $N_2{}^{30}$ and $N_2{}^{28}$ obtained on doubly and singly promoted Fe catalysts was of the right order to be accounted for by assuming that all N_2 evapg. from the surface of the catalyst was completely equilibrated with respect to the N_2 isotope exchange. Large concns. of H_2 (50% H_2in N_2) markedly accelerated the reaction. Small traces of surface oxides poisoned the Fe catalysts severely for the isotope exchange.

1183. KWAN, TAKAO AND FUJITA, YUZABRO. **Adsorption of carbon dioxide on metal catalysts.** *Bull. Chem. Soc. Japan* 24, 46-50 (1951).—*C.A.* 47, 6214*e*.

The adsorption of CO_2 on reduced Ni, Co, and Fe, resp. was studied. Adsorption isotherms were detd. on reduced Ni at 150° and 200°C under pressures ranging from 0.0001 to 0.1 mm Hg. CO_2 adsorption occurred with completely dissociative adsorption at least in the lower pressure region. Adsorption isotherms of CO_2 on reduced Co were detd. at 0° and 40°C below 0.1 mm Hg. The isotherms appeared to be nearly of the Freundlich type in this case. Adsorption isotherms on reduced Fe were detd. at 0° and 25°C under pressures from 0.0001 to 1 mm Hg.

1184. LEVESQUE, PASCAL AND CUBICCIOTTI, DANIEL. **The reaction between oxygen and thorium.** *J. Am. Chem. Soc.* 73, 2028-31 (1951).—*C.A.* 45, 6949*c*.

The reaction of Th with O_2 was studied in the range 250 to 700°C. Above 450°C, the temp. of the sample rose considerably above the temp. of the furnace; below 450°, the oxidations were essentially isothermal. The rate consts. for the linear oxidation between 350°-450°C were measured and the energy of activation was calcd. to be 22 kcal. per mole. From 250 to 350°C, the oxidation proceeded according to the parabolic law. The calcd. energy of activation for the reaction was 31 kcal. per mole.

1185. LIHL, F. **Ferromagnetic properties of half-oxidized iron and iron-cobalt powder.** *Acta Phys. Austriaca* 4, 360-79 (1951).—*C.A.* 46, 1314*d*.

Thermal decompn. of Fe(II) formate or oxalate gave ferromagnetic FeO crystd. in the Fe_3O_4 lattice, unlike ordinary FeO, and contg. C. Reduction of Fe(II) formate or oxalate with H_2 at 300 or 350°C gave mixts. of this oxide, ordinary FeO, and Fe metal, proportions depending on time and temp. of reduction. The pyrophoric properties of the powder could be removed by washing off the adsorbed H_2 with C_6H_6. The powder was pressed into solid form by the methods of powder metallurgy. Mixed crystals of Fe and Co formates were similarly reduced, and the properties of the pressed powder detd.

1186. LILLIE, A. B. AND CONNER, J. P. **Preparation of thin tritium targets.** *Rev. Sci. Instruments* 22, 210-11 (1951).—*C.A.* 45, 7439*f*.

Thin T targets are prepd. by absorbing T gas in Zr metal deposited by evapn. onto a W disk. This is placed in a system at pressures less than 10^{-5} mm Hg, and UT_3, held in a stainless steel trap, is heated to decompd. it into U metal and T gas. The target is heated, then slowly cooled. When the target is cold, the U trap is cooled to take up the remaining T.

1187. MALAGUTI, AMEDEO. **The determination of active oxygen in the higher oxides of silver.** *Ann. chim.* (Rome) 41, 241-6(1951).—*C.A.* 45, 10131*g*.

The active O_2 of the higher oxides of Ag can be detd. by either $FeSO_4$ or $H_2C_2O_4$ in H_2SO_4 soln.; the results obtained are comparable to those obtained by the H_2O_2 or the iodometric method. The reaction between $K_2S_2O_7$ and Ag_2SO_4 results not in the sesquioxide, but in a mixt. corresponding to the formula $Ag_2O_2.Ag_2O_3$.

1188. MASSINON, J.; STOLL, N., AND URBAIN, M. **Determination of oxygen in steels by the method of Gotta.** *Rev. universelle mines* 7, 265-81 (1951).—*C.A.* 46, 4425*f*.

The method is based on the high-temp. reduction of O-contg. constituents (FeO, MnO, SiO_2) by Al. The Al diffuses into the sample which is heated to 1300°C in a mixt. of 1 part Al with 3 parts of special Al_2O_3. This method is compared with the usual methods of detg. O_2 by reduction *in vacuo* in a graphite crucible. The results of all the methods are in good agreement.

1189. McCLELLAN, A. L. AND HACKERMAN, NORMAN. **The sorption of gases on metals at room temperature.** *J. Phys. & Colloid Chem.* 55, 374-82 (1951).—*C.A.* 45, 5483*e*.

Isotherms for the sorption of O_2, NO, NO_2, and Cl_2 at 30°C were measured at 0 to 10-mm pressure on reduced and unreduced samples of S.A.E. 1020 steel, 18-8 stainless steel, and pure Cr powders. Sorption decreased in the order steel, stainless steel, and Cr; reduction increased the sorption of O_2 and Cl_2 on steel. The gas pickup was apparently due largely to chem. reaction and was equiv. to 2 to 66 layers of adsorbate; no phys. adsorption was detected.

1190. METSON, G. H. **Activation of high-vacuum oxide-cathode valves.** *Vacuum* **1,** 283-93 (1951).—*C.A.* **46,** 8952*g*.

Successive doses cause a permanent lowering of the level of total emission and, therefore, a permanent decrease of excess Ba content regardless of the coulombs spent for recovery. The destruction is, at const. cathode temp., proportional of O_2 up to a crit. temp. at which each Ba atom diffused to the surface is destroyed. Above that the attack is independent of pressure. At const. O_2 the attack is proportional to the cathode temp. O_2 poisoning does not lead to complete destruction. An instantaneous and irreversible Ba-matrix formation is assumed during the transition from carbonate to oxide and removal of O_2 at that moment by pumping and by core Mg and Si internal gettering action.

1191. MEYER, LOTHAR AND LONG, EARL. **The thermomechanical effect in adsorbed layers of helium II.** *Phys. Rev.* **84,** 551-2 (1951).—*C.A.* **46,** 1839*f*.

An expression is derived for the thermomech. effect in adsorbed films, by use of the methods of quasithermodynamics. The results are discussed in comparison with the fountain effect in bulk liquid He II, and with the existing qual. measurements on adsorbed He II films.

1192. MITCHELL, E. W. J. AND MITCHELL, J. W. **The work functions of copper, silver, and aluminum.** *Proc. Roy. Soc.* (London) **A210,** 70-84 (1951).—*C.A.* **46,** 10854*c*.

Thin films of the metals were deposited onto aged surfaces of W and the work functions measured on the basis of contact p.ds. with W.

1193. MOORE, WALTER J. AND LEE, JAMES K. **Kinetics of the formation of oxide films on zinc foil.** *Trans. Faraday Soc.* **47,** 501-8 (1951).—*C.A.* **45,** 10017*i*.

The study was made between 300 and 400 °C and from 1.0 to 40.0 cm Hg. Below 350 °C the rate followed $dy/dt = ae^{-by}$, where y was the oxide-film thickness. Above 370°C, the rate followed $dy/dt = k/y$. The rate const. of the latter was markedly pressure dependent, following an expression $k = k_0 bP/(1 + bP)$, and was explained in terms of an activated adsorption of O_2 at the ZnO surface. The activation energy of k_0 was 28.5 kcal./mole, and $b = b_0$ exp $(-42.2$ (kcal.)$/RT)$.

1194. MOORE, WALTER J. AND LEE, JAMES K. **Oxidation kinetics of nickel and cobalt.** *J. Chem. Phys.* **19,** 255(1951).—*C.A.* **45,** 3695*f*.

The rate const. for the oxidation of Ni is $k = 3.09 \times 10^{-5}$ exp. $(-38,400/RT)$ cm^2/sec; for Co, $k = 7.60 \times 10^{-4}$ exp. $(-38,400/RT)$ cm^2/sec. The activation energies for cationic diffusion, by a vacancy mechanism, are the same in both NiO and CoO, but that CoO contains about 25 times as many vacancies as does NiO.

1195. MOORE, WALTER J. AND SELIKSON, BERNARD. **The diffusion of copper in cuprous oxide.** *J. Chem. Phys.* **19,** 1539-43 (1951).—*C.A.* **46,** 5923*f*.

Cu_2O strips were prepd. by the oxidation of Cu at 1000 °C. The diffusion of radiocopper in this material at 800° to 1050 °C gave a self-diffusion coeff., $D = 0.0436$ exp. $(-36,100/RT)$, where R was the gas const. and T the abs. temp. Virtually the same D was obtained from expts. in which radiocopper plated on Cu strips. It was suggested that parabolic rate consts. with large neg. entropies of activation and low heats of activation may be due to grain-boundary diffusion.

1196. MORGULIS, N. D. AND ZINGERMAN, YA. P. **Experimental investigation of the oxide cathode.** *Doklady Akad. Nauk S.S.S.R.* **81,** 783-5 (1951).—*C.A.* **46,** 3880*b*.

The potential distribution across the thickness of an oxide cathode layer (on Ni) was detd. with the aid of fine Pt probes at different c.ds. The total potential drop was composed of 3 portions, the contact, the vol., and the surface-potential drop. The outer surface layer, of a thickness of the order of 40μ, had an increased elec. resistance as compared with the bulk of the film. The resistance of the surface layer fell with rising temp. somewhat faster than that of the body. The surface layer was the seat of a strong elec. field which may exceed 10^5 v./cm.

1197. NASINI, ANTONIO G. AND SAINI, GUIDO. **Accommodation coefficients of gases on metals.** *Chimica e industria* (Milan) **33,** 67-70 (1951).—*C.A.* **45,** 6003*i*.

Gas-adsorption expts. on metal surfaces up to 2500 °K were reported. The systems comprise He on Pt, W, and Ni; A on Pt; Ne on W. McLeod-type manometers must be avoided, since they introduce another metallic surface in the system, and glass-fiber manometers are employed.

1198. NOGA, KIN'ICHI AND OKADA, YOSHITARO. **Prevention of grid emission of electron tubes. I. The structure of an evaporated barium oxide film.** *Oyo Butsuri (J. Applied Phys.)* **20,** 21-5 (1951).—*C.A.* **46,** 2425*f*.

The emission current I_ρ and the work function A were measured for a W filament on which BaO had been evapd. BaO mols. were adsorbed on W at 800 °K and $\theta < 1$ with a definite orientation as regards their dipoles to form elec. double layers and they caused the depression of A and an increase of thermoelectronic emission. BaO was oriented on the W surface in such a manner that the electroneg. O atom was directed towards the metal and the electropos. Ba atoms away from the surface. As θ was increased, BaO mols. tend to gather to form crystallites with increasing intermol. interaction, and the proportionality between log I_ρ and the amt. of BaO was no longer fulfilled. BaO mols. were adsorbed at room temp. with random orientation before they were allowed to rearrange at elevated temp. The thick BaO layer adsorbed on Ni was also examd. and the thick layer $(\theta \approx 20)$ on Ni below 700 °K was the aggregate of BaO crystallites in which many free Ba atoms were dispersed.

1199. ŌYA, SHIGEO. **Absorption of gases by aluminum castings.** *Repts. Casting Research Lab.* No. 2, 33-7 (1951).—*C.A.* **46,** 3471*g*.

Aluminum contg. Si 0.34, Fe 0.29, Cu 0.01% was melted electrically in different amts., and the amt. of gas absorbed was detd. by measuring the sp.gr. of the metal. The oxide film covering the metal prevented gas absorption, and its continuous removal increased the vol. of absorbed gas. Moisture in the atm. led to the greatest gas absorption, while dry air caused comparatively few blowholes.

1200. PAIDASSI, JEAN. **High-temperature oxidation of pure iron.** *Ing. Quim.* **10**, No. 10, 5-17 (1951).—*C.A.* **46**, 9486*h*.

A study of the oxidation of Fe in air between 700 and 950°, from 3 min. to 16 hrs. The constant was verified as $K = 3.8e\ (-39{,}000/RT)$. Careful measurements of the 3 layers (FeO, Fe_3O_4, and Fe_2O_3) suggested that the outside layers Fe_3O_4 and Fe_2O_3 follow the parabolic laws of growth.

1201. POMOSOV, A. V.; ROGATKINA, T. N., AND LEVIN, A. I. **The effect of ammonium salts upon the corrosion of copper powder.** *J. Appl. Chem. U.S.S.R.* **24**, 817-19 (1951) (Engl. translation); *Zhur. Priklad. Khim.* **24**, 720-1 (1951).—*C.A.* **47**, 4271*f*.

Corrosion is enhanced by all the compds. tested at 40° for 12 hrs, but the intensity depends upon the nature of the acid involved in the salt. The rate of corrosion depends upon the quantity and nature of the vapors and gases dissolved in the liquid adsorption layer. The volatility of the acid which constitutes the anion of the ammonium salt is the principal factor controlling the corrosive action on Cu powder.

1202. POMOSOV, A. V. AND LEVIN, A. I. **The atmospheric corrosion of copper powder.** *J. Appl. Chem., U.S.S.R.* **24**, 821-4 (1951) (Engl. translation); *Zhur. Priklad. Khim.* **24**, 723-6 (1951).—*C.A.* **47**, 4271*h*.

Corrosion expts. were conducted in H_2S, HCl, NH_3, and CO_2. In each case, the powder treated with a nonwetting agent was more resistant and in H_2S and CO_2 there was no marked change when H_2O was admitted. After prolonged exposure to dry and moist H_2S it developed that the hydrophobized powder corroded more slowly but that attack eventually progressed. Atm. corrosion did take place even in the absence of moisture films. Plain copper was corroded more severely in anhyd. H_2S than in the presence of water.

1203. REDDEN, THOMAS AND FIELD, MARY JANE. **Metallography of alloys of titanium with oxygen, carbon, and nitrogen.** *Steel* **129**, No. 21, 88-90 (1951).—*C.A.* **46**, 398*h*.

Photomicrographs illustrated typical structures of the alloying effect of 0.25% carbon, N_2, and O_2. Increases in hardness were greatest from N_2 and least from carbon.

1204. RIDEAL, E. K. AND TRAPNELL, B. M. W. **Adsorption on evaporated tungsten films. I. Oxygen and carbon monoxide chemisorption and the determination of film surface areas.** *Proc. Roy. Soc.* (London) **A205**, 409-21 (1951).—*C.A.* **46**, 317*d*.

The chemisorption of O_2 and of CO by evapd. W films was studied between 20 and −195°C and at pressures up to 10^{-2} mm. The film areas were detd. within an error of about 5%. Chemisorption of O_2 was followed by probably an oxidation which slowed very rapidly as gas was taken up, and for which an activation energy of 7000 cal was evaluated. The heat of CO chemisorption was so low in densely packed layers that measurable equil. gas pressures were required even at liquid-air temps. for completion of chemisorption. For CO the fraction of the surface covered varied very slowly with temp. and pressure. This was to be attributed to the rapid fall in heat of adsorption with increasing adsorbed amt. When the heat of adsorption had fallen to values typical of a van der Waals adsorption, the fraction of the surface covered exceeded 100% by an amt. greater than the exptl. error; this showed commencement of 2nd-layer formation.

1205. SAITO, TAIICHI. **Influence of oxygen on properties of iron and steel. II.** *Tetsu-to-Hagane* **37**, 282-90 (1951). **III.** *Ibid.* **38**, 18-25 (1952).—*C.A.* **47**, 4816*c*.

O_2 is one of the greatest influences on grain size and hardenability of iron and steel. Al steel contg. little Al_2O_3 had a greater tendency for large and uniform grain size, but that contg. much Al_2O_3 was apt to form fine grain size and overheated structure. The abnormal structure was apt to appear in Al steel contg. little Al and much Al_2O_3, but in steel contg. much Al_2O_3 and more than 0.4% Al the abnormal structure was not observed.

1206. SASAKI, NOBUJI; UEDA, RYUZO, AND OZASA, MINORU. **Physicochemical properties of tungsten metal powder.** *Bull. Inst. Chem. Research, Kyoto Univ.* **25**, 66-7 (1951) (in English).—*C.A.* **46**, 8463*c*.

The effect of pressing on the structure of W powder produced 2 different sorts of oxide. The pressing greatly decreased the particle size of the original powder and halved the sedimentation vol., but the surface area or the mean particle diam. remained almost unchanged. This indicates that pressing disintegrated almost completely the secondary and tertiary particles to the primary ones without producing any fresh surface by deforming or crushing the primary particles themselves.

1207. SCHNEIDER, ARMIN AND SCHMIDT, WERNER. **Surface reaction between aluminum fluoride and iron at higher temperatures.** *Z. Metallkunde* **42**, 73-5 (1951).—*C.A.* **45**, 5586*h*.

Gaseous AlF stable at higher temp. can be made to react with Fe at 720 to 980°C to form a diffusion layer consisting of $AlFe_3$. This results in considerable increase of hardness and corrosion resistance.

1208. SCHOPPER, HERWIG. **Examination of "thick" metal films and their surface layers by means of the absolute phase.** *Z. Physik* **130**, 427-44 (1951).—*C.A.* **46**, 1322*c*.

Layers can be observed with normal incidence of light; thereby avoiding errors due to possible anisotropy. Equations and procedures were developed for the detn. of n within metal films (for Ag $n = 0.11$ at $\gamma = 546$ mμ) and for the detn. of the thicknesses of transition layers between metal and support and between metal and air (tarnishing layers).

1209. SCHREINER, H. AND MAYR, H. H. **Diffusion of silver in copper.** *Monatsh.* **82**, 748-51 (1951).—*C.A.* **46**, 3420*i*.

Metallographically polished plates of the Cu and of Ag contg. Ag^{110} were placed in intimate contact in a vacuum chamber. After 30 min., A gas at 20°C was flushed through the chamber. The expts. were conducted for 630 min. at 460°C, 288 min. at 500°C, and 144 min. each at 550° and 600°C. The plates were then sepd. and the Ag activity in the Cu plates were measured. The diffusion const. $D = Ae^{-Q/RT}$ was detd. to be 1.10×10^{-20} cm^2/sec at 460°C, 3.72×10^{-19} cm^2/sec at 500°C, 1.023×10^{-17} cm^2/sec at 550°C, and 7.72×10^{-15} cm^2/sec at 600°C.

1210. SHEKHTER, A. B.; ECHEISTOVA, A. I., AND TRET'YAKOV, I. I. **Structure of thin metal layers sputtered on asbestos and on lampblack.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* **1951**, 42-6.—*C.A.* **45**, 4986*h*.

Electron-microscopic examn. of Ag or Au sputtered on asbestos fibers shows discrete grains which change to coarser aggregates on heating to above 220°C in the case of Ag, and to above 320°C in the case of Au. The same phenomena of recrystn. and coarsening, due to mobility of atoms of the metal, are observed after wet impregnation of the asbestos, e.g. with a colloidal Ag soln. On spherical particles of lampblack, sputtered Ag aggregates on heating to 230°C, in the form of parallepipedons growing perpendicularly to the surface of the spheres. Above 350°C, the lampblack particles become increasingly transparent and finally disappear, owing evidently to combustion catalyzed by Au; without Au, combustion takes place only on heating to above 600°C.

1211. SHIMOKAWA, YOSHIO AND TANOUE, TOYOSUKE. **Evolution of gases from rimming-steel ingots.** *Tetsu-to-Hagane* **37**, 555-6 (1951).—*C.A.* **47**, 1560*f*.

The rate of gas evolution from the rimming-steel ingots (0.12-0.18% C) came to a max. at 1-5 min. after filling the mold and then decreased gradually towards the end of solidification. The max. rate of gas evolution was 100-300 cc/min. The total gas (60 to 150 liters) contained CO, 80 to 92; CO_2, 1-4; H_2, 4-11; and N_2, 0.5-4%. As the solidification proceeded, the CO and CO_2 percentage decreased gradually, but the H_2 and N_2 percentage increased.

1212. SINGLETON, J. H.; ROBERTS, E. R., AND WINTER, E. R. S. **Reaction between deuterium and ammonia on evaporated metal catalysts.** *Trans. Faraday Soc.* **47**, 1318-31 (1951).—*C.A.* **46**, 6475*i*.

The exchange reaction was examd. on evapd. films of Fe, W, and Ni above 500°K Fe and Ni catalysts after sintering can be used for long periods without change in activity. The activity of W increased slowly on heating to 700°K *in vacuo* or in the presence of reactants. The energies of activation of exchange were: Fe, 21.0, 20.9, 19.1; W, 16.0, 16.4, 15.4, 11.7; Ni, 14.8, 14.7, 16.1, 15.0 kcal./mole.

1213. STANLEY, J. K.; HOENE, J. VON, AND WIENER, GEORGE. **Determination of oxygen in zirconium metal by the vacuum-fusion method.** *Anal. Chem.* **23**, 377-9 (1951).—*C.A.* **45**, 3752*e*.

The addn. of Zr to molten Fe must give a dil. soln. of Zr in Fe. This can be obtained by using 50-100 mg of Zr and 15-20 g of Fe. Thereafter, about 1.5 g Fe should be added before another sample is analyzed. The temp. should be 1850-1950°C although temp. as low as 1650° is sometimes successful. The addn. of 25% Sn helps the reduction of ZrO by carbon. It is best to introduce the Zr wrapped in annealed Fe foil. Good results can be obtained in about 10 min.

1214. STRANSKI, I. N. **Reactions on crystal surfaces.** *Trans. Chalmers Univ. Technol. Gothenburg, Sweden* No. **114**, 21 pp. (1951) (in German).—*C.A.* **47**, 373*c*.

The use of the electrostatic field microscope was demonstrated by the effects of absorbed Ba and Cu_2O. The adsorption layer of Cu_2O was oriented with the O atoms pointing outward. The W atoms on the surface were homopolarly bound, their activation energy of mobilization was identical with that observed for the migration of single W atoms over (011). The direct observation of single absorbed mols., viz., of Cu phthalocyanine, on W with a microscopic resolution power of 2.8×10^6 was particularly impressive. The effects of enforce condensation and evapn. rate of crystals was shown for As_2O_3.

1215. SUNDEN, O. AND BOHM, E. **Corrosion resistance of alloy steels to pure and sulfur-containing carbon monoxide.** *Chem.-Ing.-Tech.* **23**, 3-4 (1951).—*C.A.* **45**, 3312*b*.

Comparative corrosion data were presented for six types of alloy steel at initial CO pressures of about 500 atm. All steels were completely resistant to pure CO, but even small amts. of S resulted in considerable attack. Only very high Cr-Ni contents, as, e.g. 18-8 and 26-5, gave protection.

1216. TANAKA, YOSHIO AND SAKAI, MASATOSHI. **Adsorption of gas on the metal blacks.** *Science of Light* (Japan) **1**, No. 2, 93-7 (1951).—*C.A.* **46**, 10774*e*.

The adsorbed gas in metal blacks prepd. by evapn. at a pressure of 1 mm Hg was found to be O_2. The adsorbed gas desorbed if the metal black was heated in vacuum, and the amt. of the desorbing gas was measured at various temps. for Zn, Cd, Pb, and Bi blacks.

1217. TEREM, HALDUN N. **Dry corrosion studies. The oxidation of powdered zinc.** *Rev. faculté sci. univ. Istanbul* **16A**, 226-40 (1951) (in French).—*C.A.* **46**, 11079*c*.

When an increase in the rate of oxidation of Zn is expected because of increasing temps. or favorable media, this increase is very slow or even zero. The initial course of Zn oxidation obeys the parabolic law perfectly. The activation energy of the reaction $Zn + 5\ O_2 \rightarrow ZnO$ is about 23,500 cal per g.

1218. TICHENOR, ROBERT L. **Role of oxide composition in oxidation of nickel and cobalt.** *J. Chem. Phys.* **19**, 796-7 (1951).—*C.A.* **45**, 7416*i*.

It is assumed that only a fraction of the oxide surface is effective in ionizing O. The difference in the no. of cation vacancies is attributed to the higher O-content of Co oxide (Co_3O_4, nearly, although retaining the CoO structure) under equil. conditions, rather than to differences in the rates of ionization of O. This increase in O content leads to higher rates of cation diffusion, in spite of smaller values of the cation diffusion coeff.

1219. Torrisi, A. F. and Kernahan, Jean L. **Modified vacuum fusion apparatus for determination of oxygen, hydrogen, and nitrogen in certain metals.** *Anal. Chem.* **23**, 928-9 (1951).—*C.A.* **45**, 7829*e*.

Assembling, cleaning, and repairing are facilitated by use of ground joints. Two measuring systems are attached to one melting furnace and pumping system which enables one operator to analyze twice as many samples per day as with a single unit system.

1220. Varetto, Mme. J. and Lacombe, L. **Oxygen determination in steel by reduction melting in vacuum and by the Gotta process.** *Rev. universelle mines* **7**, 70-3 (1951).—*C.A.* **45**, 4623*c*.

An investigation of the occasional great differences in results of the detn. of O_2 in steel melts showed that the manner of sampling and the shape of the specimens had a great influence.

1221. Vernon, W. H. J. **Adsorption of water vapor on solid surfaces.** *Nature* **167**, 1037-8 (1951).—*C.A.* **45**, 9334*b*.

The adsorption of water vapor by metal surfaces is negligible provided that both metal surface and the atm. are free from contamination. Fe was particularly susceptible to the presence of disperse solid particles, e.g., traces of $(NH_4)_2SO_4$. Ni provided an extreme case of susceptibility to gaseous pollution, e.g., traces of SO_2.

1222. Wagener, S. **Efficiency and mechanism of barium getters at low pressures.** *Brit. J. Applied Phys.* **2**, 132-8 (1951).—*C.A.* **45**, 7406*i*.

The gettering rates of Ba getters for O_2, N_2, H_2, CO, CO_2, and water vapor were measured in the pressure range 5×10^{-8} to 5×10^{-5} mm of Hg. The gettering effect at these low pressures was due almost entirely to the take-up of atoms or metastable mols. produced by the impact of electrons on the stable gas mols. Ions played a very small part in the gettering process. All the gases contg. O (CO, CO_2, H_2O) were found to belong to the same class as O. Their gettering rates were high ($\geq$700 cc./sec), were almost independent of pressure, and remained fairly const. over several min.

1223. Weber, J. and Laidler, Keith J. **Microwave spectroscopic investigation of the kinetics of the heterogeneous ammonia-deuterium exchange.** *J. Chem. Phys.* **19**, 1089-96 (1951).—*C.A.* **46**, 828*f*.

The technique was applied to detg. the mole fraction of NH_3 in mixts. of deuteriated ammonias, and to a study of the kinetics of the NH_3-D_2 isotopic-exchange reaction on a singly promoted Fe catalyst. Rates of desorption of mols. from surfaces were markedly increased on adsorption of other mols. The rate of the exchange reaction was proportional to the square root of the D_2 pressure. With increasing NH_3 pressure the rate passed through a max., showing that the mechanism involved reaction between adsorbed NH_3 and adsorbed D atoms. The activation energy diminished significantly with increasing NH_3 pressure, providing additional evidence for the existence of strong interactions between adsorbed mols.

1224. Weck, H. I.; Meyerson, S., and Seelig, H. S. **Hydrocarbon synthesis catalyst studies. Use of deuteriochloric acid.** *J. Am. Chem. Soc.* **73**, 2331-3 (1951).—*C.A.* **45**, 7333*i*.

Fe catalysts that had been used in hydrocarbon-synthesis studies liberate H_2 and hydrocarbons when dissolved in HCl soln. By the use of DCl instead of HCl, it was proved that these hydrocarbons were derived from iron carbide and the acid and were not adsorbed synthesis products that were liberated when the catalyst dissolved. No exchange was observed between the H in a sample of n-C_5H_{12} adsorbed on metallic Fe and the D in the DCl used to dissolve the Fe.

1225. Wilkinson, P. G. **The properties of evaporated gold and tungsten oxides.** *J. Applied Phys.* **22**, 226-32 (1951).—*C.A.* **45**, 3676*h*.

Au blacks, prepd. by evapg. Au from a tungsten filament in tank N at several mm pressure, contained W oxides which greatly affected the optical and elec. properties. Deposits contg. more than 0.5 mole % of W oxides were black and showed resistivities 10^3 to 10^8 times that of bulk Au. The resistivities of Au blacks increased on exposure to O_2. On the other hand, oxide-free deposits were yellow and possessed a low stable resistivity, unaffected by exposure to O. So-called Au blacks were black because of the presence of W oxides, since Au evapd. in pressures of several mm of O-free N_2 formed bright reflecting films rather than black absorbing deposits.

1226. Winfield, M. E. **Adsorption and hydrogenation of gases on transition metals.** *Australian J. Sci. Research* **A4**, 385-405 (1951).—*C.A.* **46**, 1939*c*.

The behavior of gases chemisorbed at the surface of face-centered cubic crystals of transition metals is discussed by considering simple models of the surface and the possible arrangements of the gas mols. on them. Models are suggested for the structures of the adsorbates of O_2, H_2, C_2H_4, C_2H_2, and CO on Cu, Ni, and Fischer-Tropsch catalysts. From the properties of these models, mechanisms are suggested for the hydrogenation of C_2H_4 on Ni and for the Fischer-Tropsch hydrocarbon synthesis.

1227. Yanagisawa, Masaaki. **Orientation of products on rolled metal surface.** *Bull. Inst. Chem. Research, Kyoto Univ.* **24**, 75-6 (1951) (in English).—*C.A.* **47**, 1019*c*.

The orientations of several compds. produced on the surface of Cu and Ag foils were studied. The Cu foils were reduced from 2.5 mm to 27-30 μ in thickness and had a fiber structure whose axis [111] was parallel to the direction of rolling. The Ag foils, reduced from 1 mm to 30μ, had also a fiber structure whose [112] was parallel to the direction of rolling. A CuI film produced by making I_2 contact with the Cu foil avoiding sublimation and by heating at 70° for 1 hr showed continuous Debye ring (111) indicating absence of special orientation.

1228. Zwicker, Ulrich. **The system Mn-N.** *Z. Metallkunde* 42, 277-8 (1951).—*C.A.* **46**, 393*c*.

Electrolytic Mn is nitrided with NH_3, N_2, and air Microscopic, röntgenographic, and magnetic investigations are reported and the phase diagram of the system Mn-N_2 from 400 to 1400° is developed. The quenched γ-Mn phase is a solid soln. appearing in the concn. range of the ductile tetragonal form.

1229. Antropoff, A. V.; Propfe, H. A.; Weil, K.; Steinberg, F.; Schaeben, L.; Kalthoff, F.; Schroder, H. J.; Schmitz, L.; Junger, R., and Jungerich, W. **Adsorption of gases at very small to very high pressures.** *Kolloid-Z.* **125**, 40-3 (1952).—*C.A.* **46**, 10774*d*.

Differential adsorption (A_d) of N_2 and A, measured at −76°, −25°, 0°, and 20°C at pressures up to 384 atms., gives isotherms which are like theoritical curves based on the equation $A_d = [qVd/(1 + B(q-1)d)] - Vd$, where q is the distribution coeff., V the adsorption vol., d the molar d. of gas in the gas space, and B of vol. of the gas mols. A_d increases with pressure and then falls off. Some irregularities exist in the adsorption isotherm for N_2 at −25° and −76°.

1230. Arkharov, V. I. and Luchkin, G. P. **Participation of nitrogen in the high-temperature oxidation of titanium in air.** *Doklady Akad. Nauk S.S.S.R.* **83**, 837-9 (1952).—*C.A.* **46**, 8559*h*.

In air, Ti is oxidized less than in O_2 in the range 700-1000°C but from 840°C up, the rate of oxidation in air rises with the temp. faster than in O_2. At still higher temps., Ti is oxidized in air more strongly than in pure O_2. The scale formed by oxidation is in all cases rutile, TiO_2, with some TiO in the thin inner layer close to the metal. In the scale formed by oxidation in air at 1100-1200°C, there is also some Ti_2O_3 in the middle layer. On oxidation in air, or on heating in N_2, some N_2 enters the lattice of rutile, most probably in the form of N^{---} ions which replace O^{--} ions in the ratio 2:3.

1231. Balluffi, R. W. and Alexander, B. H. **Dimensional changes normal to the direction of diffusion.** *J. Applied Phys.* **23**, 953-6 (1952).—*C.A.* **46**, 10749*i*.

Ag from the vapor phase was diffused into thin Au wires and foils at 940°C. Measurements were made of the resulting dimensional changes which occurred normal and parallel to the direction of diffusion. The linear percentage expansion normal to the diffusion direction was slightly less than the corresponding expansion parallel to the diffusion stream.

1232. Barteld, Klaus and Hofmann, Wilhelm. **Oxygen determination in lead.** *Z. Erzbergbau u. Metallhüttenw.* **5**, 102-5 (1952).—*C.A.* **46**, 6033*f*.

A very low O-content was obtained in crude Pb. Only after removal of Sn and Sb was a large quantity of O_2 taken up. The soly. of O_2 in Pb rose from about 1 g per ton at 350°C to about 51 g per ton at 800°C.

1233. Beatty, S. **Note on the effect of oxygen and nitrogen [addition] on the hardness and lattice parameter of high-purity vanadium.** *J. Metals* 4, *Trans.* 987-8 (1952).—*C.A.* **46**, 9042*e*.

Small addns. of O_2 and N_2 result in a sharp increase in the lattice parameter and hardness of V. Progressive line broadening is observed with increasing impurities content.

1234. Becker, W. M. and Lark-Horovitz, K. **Semiconducting films.** *Proc. Natl. Electronics Conf.* **8**, 506-9 (1952).—*C.A.* **47**, 3689*g*.

By thermal dissocn. of GeH_4 at 600° Ge films were produced from less than 0.1μ to 1.5μ thick depending on temp. At room temp. all the films had p-type conduction, caused by lattice defects, as observed already with polished layers on n-type Ge. The carrier mobility was lower than in bulk Ge and only 20-140 cm^2/sec volt. The contacts were made with aquadag. By addn. of the hydrides of As, Sb, and Bi to GeH_4, films with n-type conduction could be made.

1235. Bouillon, F. **The dry oxidation of copper and its alloys. II. The isothermal oxidation of pure copper.** *Bull. soc. chim. belges* **60**, 451-8 (1952) (English summary).—*C.A.* **46**, 7498*a*.

CuO is formed only from Cu_2O and not from pure Cu directly. The Cu_2O layer must reach a crit. thickness before CuO can form. This thickness was detd. as 2600 A. Calcns. from parabolic kinetic constants at 173 and at 247° show that the activation energy is 19,000 cal/mole.

1236. Brace, A. W. **Gas removal from molten aluminum alloys.** *Metal Ind.* (London) **80**, 502-4 (1952).—*C.A.* **46**, 9494b.

In order to minimize gas porosity in Al alloys a trial heat was melted and raised to 880-900°. Pure Cl_2 was bubbled through this Al for 4 min. The metal was then allowed to cool and poured. Radiographs run on these castings showed a substantial decrease in porosity. Cl_2 evolved by the decompn. of org. chlorides exerted a coarsening effect on the grain structure, which could be corrected through use of a grain-refining element, such as B.

1237. Brasunas, Anton deS. and Grant, Nicholas J. **Accelerated oxidation of metals at high temperatures.** *Trans. Am. Soc. Metals* Preprint No. 3W, 30 pp. (1952).—*C.A.* **46**, 326*a*.

Six Mo-bearing and 3 V-bearing alloys were heated up to 1170° in O_2. At the metal-oxide interface, the concn. of the metal having a volatile or low-melting oxide was abnormally high; this is essential to high oxidation rate. Moving atms. that increased the rate of vaporization of volatile oxides retarded the oxidation rate of alloys that formed these oxides. The rate of reaction was frequently so rapid that the liberation of heat raised the temp. of the specimen.

1238. Breckenridge, R. G. and Hosler, W. R. **Titanium dioxide rectifiers.** *J. Research Natl. Bur. Standards* 49, 65-72 (1952) (Research Paper No. 2344).—*C.A.* **47**, 2062*e*.

Pure polished Ti metal when coated with TiO_2, which had been partially reduced, formed an elec. rectifier. Two processes used to form the semiconducting oxide layer were (1) oxidation of the metal by dry O_2 at 800°C for 9 hrs followed by reduction in H_2 at 500°C for 15 min. and (2) oxidation in H_2O at 600°C for 3 hrs. Process (2) carried out at 1 atm. was more easily controlled. It eliminated both O_2 and H_2 embrittlement of Ti, and produced a greater uniformity of surface oxide layer. Semiconducting films of 0.0003 in. thickness with an av. formula $TiO_{1.95}$ gave good rectification.

1239. BUMPS, E. S.; KESSLER, H. D., AND HANSEN, M. **The titanium-oxygen system.** *Trans. Am. Soc. Metals* Preprint No. 32, 18 pp. (1952).--*C.A.* 46, 9495*i*.

Micrographic analysis of arc-melted alloys contg. up to 56 at. % O_2 showed: (1) 2 peritectic reactions: melt $+ \alpha \rightleftarrows \beta$ at 1740° and melt $+ \alpha \rightleftarrows TiO$ at 1770°C; a peritectoid reaction $\alpha + TiO \rightleftarrows \delta$ at approx. 925°C; (3) max. m.p. of α-Ti + 10 at. % O_2 at 1990°C; (4) max. soly. of 1.8% O_2 in β-Ti at 1740° and of approx. 14.5% O_2 in α-Ti between 700° and 1600°C.

1240. BURSHTEĬN, R. KH. AND SHUMILOVA, N. A. **Interaction between iron and ozone.** *Doklady Akad. Nauk S.S.S.R.* 83, 251-2 (1952).—*C.A.* 46, 8478*d*.

Iron plates of 90 cm² true surface area were exposed, at 190°, 290°, 385°, and 430°K, to O_2 or to $O_2 + O_3$, and the thicknesses of the oxide layer formed were detd. by the amt. of H_2 necessary to reduce them. At each temp., the thicknesses of oxide layers formed in O_2 and in $O_2 + O_3$ were very close; the latter was only slightly thicker.

1241. BUTTNER, F. H.; FUNK, E. R., AND UDIN, H. **Adsorption of oxygen on silver.** *J. Phys. Chem.* 56, 657-60 (1952).—*C.A.* 46, 7396*e*.

The surface tension of solid Ag, measured by the weighted-wire method, was 1140 ± 90 dynes/cm in the range 870-945°C. The surface tension decreased linearly with the log of the O_2 partial pressure. Use of the data with the Gibbs adsorption isotherm indicated that O_2 was chemisorbed on Ag and that at 932°C there were approx. 1.4 atoms of O adsorbed per Ag atom at the surface.

1242. CIMINO, A. AND PARRAVANO, G. **Nickel carbide by decomposition of *n*-hexane on metallic nickel.** *J. Phys. Chem.* 56, 706-7 (1952).—*C.A.* 46, 8941e.

n-C_6H_{14} was passed in a stream of N_2 over powd., active Ni (obtained from $Ni(NO_3)_2$) at 250-327°C. Gravimetric detns., hydrogenation of the products, and x-ray analysis indicated that n-C_6H_{14} was decompd. and Ni_3C (stable up to at least 300°) and C were formed. The amt. of carbide formed as detd. by hydrogenation was about equal to the first rapid stage of the process and amounted to 95% of the total C deposited. The reaction proceeded by dissociative adsorption of n-C_6H_{14} on Ni, production of at. C, and diffusion through the Ni_3C formed.

1243. CLASING, M. AND SAUERWALD, F. **Effect of surface layers, especially oxides, on the sintering of metals.** *Z. anorg. u. allgem. Chem.* 271, 88-92 (1952).--*C.A.* 47, 5854*f*.

The powders were first reduced and then artificially oxidized. After sintering Cu in vacuo, a definite strength max. was found for an oxide layer of 400-600 A. When heavier oxide films surrounded the particles they could not be absorbed during sintering and interfered with bonding. When sintering Cu in H_2, highest tensile strength was found for approx. the same oxide film thickness. The drop in strengths for higher O_2 contents was attributed, in this case, to an excess amt. of loosening of the surface structure or too much H_2O vapor as a result of the reduction.

1244. CUBICCIOTTI, DANIEL. **The oxidation of calcium at elevated temperatures.** *J. Am. Chem. Soc.* 74, 557-8 (1952).—*C.A.* 47, 2077*g*.

Ca was oxidized 100 min. at 200 mm O_2 and 330-475°C. Oxidations below 435°C obeyed the parabolic law for at least 100 min. At 435°C the curve was not parabolic beyond the 1st 5 min. The oxidations had an induction period followed by a rapid rise to an approx. linear shape after about 50 min.

1245. CUBICCIOTTI, DANIEL. **The reaction between uranium and oxygen.** *J. Am. Chem. Soc.* 74, 1079-81 (1952).—*C.A.* 47, 4175*i*.

U oxidizes according to the parabolic law at 90-165°C, and according to the linear law at 165-215°C. At still higher temps. the oxidation curve was lower than 1st degree in the wt of C_2 consumed. The temp. of the parabolic to linear transition for U was lower than that for Th. In a long oxidation at 170°C, the initially parabolic oxidation became more rapid than parabolic after 100 min.

1246. CUBICCIOTTI, DANIEL. **The reaction of cerium with oxygen.** *J. Am. Chem. Soc.* 74, 1200-1 (1952).—*C.A.* 46, 6472g.

The oxidation of Ce obeys the parabolic law from 30 to 125°C. Above 125°C the reaction starts parabolically, but subsequently becomes linear. The parabolic portion becomes shorter as the temp. is increased. The oxidation of Ce is the most rapid of the known parabolic metal oxidations. The energy of activation of the parabolic reaction (12 kcal./mole) is the smallest yet observed.

1247. CULLELL, JOSE AGUILERA. **Degassing of light alloys by hexachloro-ethane.** *Inst. hierro y acero* 5, Spec. No. Feb. 209-14 (1952).—*C.A.* 46, 6573*i*.

The mean tensile strength for over 167 tensile test specimens was 19.25 kg² and 20.65 kg², resp., and elongation of 0.52% and 0.81%. The addn. consisted of 3 treatments of 140 g of C_2Cl_6 each for 100 kg of alloy at 800°C and below and then casting at 760°C.

1248. DANKOV, P. D. **The theory of oxidation of alloys.** *Zhur. Fiz. Khim.* 26, 753-8 (1952).—*C.A.* 47, 5224*a*.

The oxidation of a 80% Ni + 20% Cr alloy is discussed. The oxidation of this alloy ought to be characterized by 3 different successive steps. In the beginning, the outermost layer is NiO, the subjacent layer being $NiO.Cr_2O_3$ plus an excess of NiO. At later stages, a two-phase layer is formed with $NiO.Cr_2O_3$ plus an excess of Cr_2O_3. Finally, the outermost layer consists of α-Cr_2O_3, the subjacent layer being again $NiO.Cr_2O_3$ plus an excess of Cr_2O_3.

1249. Dawson, J. K. **The sublimation technique for the preparation of thin films of plutonium.** *Ministry of Supply, Harwell, Berks. (Eng.) At. Energy Research Estab., Unclassified* C/R 861, 26-9 (1952).—*C.A.* 46, 10991*i*.

Since a temp. of 2500°C at 10^{-6} mm Hg is necessary for the sublimation of U (from oxide produced from nitrate soln.), W is the only usable filament material. Ta filaments employed with Pu nitrate soln. give no stains on the collecting trays unless the soln. contains impurities such as Fe.

1250. Devienne, Marcel. **Condensation of molecular jets of antimony on a surface.** *Compt. rend.* 234, 80-1 (1952).—*C.A.* 46, 3359*b*.

At 25°C for the condensation plate and for a deposit of about 40 A., the condensation factor of Sb on Cu is very close to 0.74 (temp. of the furnace 320°C, pressure less than 10^{-4} mm of Hg.) The "condensation factor" increases with thickness; for a deposit of 14A., it is about 0.55 and for a deposit about 100A. thick, the factor is about 0.76.

1251. Dietrich, Isolde. **Measurement of the resistance of thin insulating layers between gold contacts in the region of the tunnel effect.** *Z. Physik* 132, 231-8 (1952).—*C.A.* 46, 9369*c*.

Known quantities of TiO_2 were evapd. on clean Au surfaces, and the thickness of the condensed layers was detd. from the change in wt and interferometrically. The sp resistance of TiO_2 layers was detd. from independent measurements. For thicknesses below 1000 A. the values found at room temp. were between 10^9 and 10^{10} ohm-cm. Up to TiO_2 thicknesses of 100 A. between Au contacts the resistance of the assembly was temp.-independent and detd. only by the tunnel effect and not by the resistance of the layer.

1252. Doring, H. and Moliere, K. **Dissociation of zirconium iodide on hot metal surfaces.** *Z. Elektrochem.* 56, 403-8 (1952) (in German) *C.A.* 46, 9390*e*.

The evacuated tube containing excess Zr was heated in an elec. oven between 150° and 550°C. Wire was heated by an elec. current to 1000° to 1500°C. The ZrI_4 vapor decompd. on the hot wire to Zr, which was deposited on the wire, and I_2, which recombined with the excess Zr powder. The rate of growth of the wire radius was independent of the time, and of the surface area of the wire, showing that the I_2 was absorbed by the Zr before returning to the wire. This was true only when the expts. were not continued too long, or the wire temp. was not too high.

1253. Dunnington, B. W.; Beck, F. H., and Fontana, M. G. **The mechanism of scale formation on iron at high temperature.** *Corrosion* 8, 2-13 (1952).—*C.A.* 46, 1419*d*.

Diffusion of lattice vacancies in the metal influences the type of oxide formed on Fe at high temp. An adherent layer forms on one side of thin specimens, and on the opposite side a loose, more highly oxidized layer forms. The oxide layer on a large specimen is uniform over the entire surface but of a different character from the layers formed on a thin specimen.

1254. Eggleton, A. E. J. and Tompkins, F. C. **Thermal accommodation coefficient of gases and their adsorption on iron.** *Trans. Faraday Soc.* 48, 738-49 (1952).—*C.A.* 47, 2567*f*.

Use was made of the large difference in the thermal accommodation coeff. (α) of Ne at the surface of a pure Fe wire in an investigation of the methods of producing a surface free of contaminants. Reduction in H_2 followed by flashing *in vacuo* at 1200°C proved ineffective, but Ne-ion bombardment was successful if this was preceded by a preliminary treatment with N ions. Values of α for Ne at surfaces covered with adsorbed gases were: 0.0995 at 3×10^{-4} mm H_2; 0.111 at 1.5×10^{-2} mm H_2; max. of 0.268 for O_2; max. of 0.438 for N_2. The value of $\alpha = 0.053$ is given for a clean Fe surface. O_2 can displace both H_2 and N_2 from the surface, and this emphasizes the importance of removing small traces of O_2 when using H_2 or N_2 as adsorbate.

1255. Eggleton, A. E. J.; Tompkins, F. C., and Wanford, D. W. B. **Measurements of the thermal accommodation coefficients of gases.** *Proc. Roy. Soc.* (London) A213, 266-73 (1952).—*C.A.* 46, 10732*i*.

The exptl. value for the accommodation coeff. for Ne at a W surface is discussed. App. is described and new results are reported. The continuous circulation of the inert gas through charcoal traps cooled with liquid N_2 is an essential precaution.

1256. Eischens, R. P. **Isotopic exchange rates as criteria of surface heterogeneity.** *J. Am. Chem. Soc.* 74, 6167-71 (1952).—*C. A.* 47, 3668*g*.

The exchange between chemisorbed and gaseous CO over unpromoted Fe was followed by introducing $C^{14}O$ as the chemisorbed phase and measuring the rate of its appearance in the gaseous phase. The most weakly bonded CO exchanges the fastest. The exchange data show that the Fe is heterogeneous. There is no difference in the chem. properties of $C^{14}O$ and CO within the limit of exptl. accuracy (1%).

1257. Eischens, R. P. and Webb, A. N. **Carbon-oxygen exchange in chemisorbed carbon monoxide.** *J. Chem. Phys.* 20, 1048-9 (1952).—*C.A.* 46, 10775*e*.

A mixt. of $C^{13}O$ and CO^{18} was chemisorbed on Fe and then progressively desorbed at temps. from –78 to 160°C. The desorbed gas was analyzed for $C^{13}O^{18}$ with a mass spectrometer. A significant intermol. O exchange occurred as low as –33°C (the detn. at –78° failed); at 120-160°C equil. was almost attained within a pumping time of 52 hrs. The desorbed gas collected at 120-160°C contained almost 50% CO_2; this gas was in isotopic equil. with the CO.

1258. Engell, H. J. and Hauffe, K. **Influence of of adsorption phenomena on the oxidation of metals at high temperatures.** *Metall* 6, 285-91 (1952).—*C.A.* 46, 8585*b*.

The nature of the oxide layer formed (porosity, diffusion of ions or electrons through this layer, or layer of scale, d. of the oxide layer), the lattice structure of the metal and the mode of entry of O_2 into the lattice, the influence of skin formation on the formation of a thick oxide layer, and various other factors are considered.

1259. Fedorchenko, I. M. **Heats of activation for surface self-diffusion of metals.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* **1952**, 560-71.—*C.A.* **47**, 6842*i*.

Powd. Fe, stainless steel, Cu, Ni, and Al were heated to 300-1200°C, and the decrease in specific surface was detd. The diffusion coeff. D was calcd. by means of an equation relating D to the specific surface. The heat of activation for surface diffusion, Q, was calcd. from the equation $D = Ae^{-Q/RT}$, A being a const. for each type of material.

1260. Feldman, Charles. **The protection of thin deposits of molybdenum by a layer of SiO obtained by evaporation in vacuo.** *Compt. rend.* **235**, 706-7 (1952).—*C.A.* **47**, 3073*g*.

The rate of oxidation was followed by measuring the elec. resistance. Thin layers of SiO offered moderate protection, whereas layers of the order of $1\ \mu$ in thickness offered very good protection. Oxidation is attributed to diffusion across the layer of SiO, either of the metal or of O_2.

1261. Fischer, W. A. and Ende, H. vom. **The solubility of oxygen in iron melts under ferrous oxide, silicic-acid- and lime-saturated ferrous oxide slags for temperatures from 1530° to 1700°C.** *Arch. Eisenhüttenw.* **23**, 21-33 (1952).—*C.A.* **46**, 5502*i*.

Crucibles were made of pure lime. Under FeO slags contg. FeO 85-90, Fe_2O_3 8-10, and MgO 2-5%, O_2 contents of 0.18-0.33% in the Fe were detd. in a magnesite crucible. Under SiO_2-satd. slags contg. 40-8% SiO_2 and the remainder essentially FeO, O-contents of 0.09-0.13% in the Fe in the sand crucible, and O-contents of 0.08-0.12% were found under lime-satd. slags contg. CaO 32-8, SiO_2 2-4, MgO 1, Al_2O_3 1, and total Fe 40-6% in the lime crucible.

1262. Fontana, C. M.; Gorin, Everett, and Meredith, C. S. **Chlorination of methane with copper chloride melts. Kinetics of oxygen absorption by the melt.** *Ind. Eng. Chem.* **44**, 373-8 (1952).—*C.A.* **46**, 4333*d*.

In the chlorination of light hydrocarbons by means of $CuCl_2$ melts, the rates of O_2 absorption were detd. by the decrease in pressure with time in reactors contg. melts of known compn. and known surface area. Extensive data illustrated the decrease in rate with increasing Cu-content the increase in rate with increasing KCl-content, the specific effects on the rate resulting from the replacement of KCl with NaCl or $CaCl_2$, and the unusually low values of the apparent activation energy (9-14 kcal./mole).

1263. Forestier, Hubert and Maurer, Joseph. **The influence of absorption of gas on the surface hardness of quenched and age-hardened beryllium copper.** *Compt. rend.* **234**, 2196-8 (1952).—*C.A.* **46**, 7973*i*.

Quenched specimens of Be-Cu (2.5% Be) were aged at 250° to 500°C in purified CO_2,A, and H_2, and *in vacuo*. Max. hardness varied slightly and occurred at 365° in CO_2, 375° in A, 400° in H_2, and 410°C *in vacuo* because of absorbed gas in the surface layers of the alloy to depths of approx. 0.1 mm. Rate of hardening was fastest in H_2 and slowest in CO_2.

1264. Fukuroi, Tadao.; Tanuma, Seiichi, and Tobisawa, Shotaro. **Electrical properties of antimony-doped tellurium crystals.** *Science Repts. Research Inst., Tohoku Univ., Ser. A.*, **4**, 283-97 (1952).—*C.A.* **47**, 5201*g*.

Sb-doped Te crystals (0.002-5 at. % Sb) were studied between −190 to 300°C and the Hall coeffs. detd. at −190°C and at room temp. Both resistivity and Hall coeff. of the purer samples showed the characteristics of the intrinsic cond. in the high-temp. range, whereas resistivity decreased from 4.2×10^{-1} to 1.7×10^{-3} ohm-cm at room temp. and from 2.4 to 8.2×10^{-4} ohm-cm at liquid-air temp. and the Hall coeff. changed from -3.6×10^3 to $+3.3$ electromagnetic units at room temp. and from $+3.9 \times 10^4$ to $+2.7$ at liquid-air temp. as the Sb content increased by 5.2%. The Hall coeff. of alloys contg. more than 1% Sb increased with rising temp. The thermoelec. power showed a complicated but systematic temp. variation with sign.

1265. Gemant, Andrew. **Film formations on metals in hydrocarbons.** *J. Electrochem. Soc.* **99**, 279-84 (1952).—*C.A.* **46**, 11063*h*.

Cu, Pb, and Zn were subjected to corrosion tests in oxidized transformer hydrocarbon oils and in fresh oils whose conductivities were increased by small addns. of tridecanoic acid (labelled with C-14), tributyl amine, and o-cresol. The radioactivity of the deposits served as a measure of the corrosion rate. The rates on all 3 metals were several fold higher in the mixt. than minus the amine. Pb was often attached as much as 50 times faster than Cu, and Cu was more rapidly attached than Zn. Visible deposits were observed. Electrochem. film formation was possible in addn. to chem. formation. The oxidized oils often dissolved corrosion products, especially those from Cu.

1266. Ghosh, J. C.; Sastri, M. V. C., and Kini, K. A. **Adsorption of hydrogen and carbon monoxide and their mixtures by cobalt Fischer-Tropsch catalysts.** *Ind. Eng. Chem.* **44**, 2463-70 (1952).—*C.A.* **47**, 7195*b*.

The adsorption of CO and H_2, as pure gases and in mixts. of 1-to-1 and 1-to-2, were studied at varying temps. on two Co catalysts. Catalyst A consists of 34.22% Co, 4.05% Cu, 2.33% thorium oxide, 0.24% cerium oxide, and the balance kieselguhr. Catalyst B was the same as A plus 4.6% chromium oxide. Catalyst B chemisorbed much more of either pure gas or mixts. than A. Rates of adsorption were higher with B than A.

1267. Gobrecht, H. and Barsch, G. **Radiation from freshly evaporated metal and salt layers.** *Z. Physik* **132**, 129-39 (1952).—*C.A.* **46**, 9971*a*.

Fe, Ni, Al, and Sb, or of salts such as NaCl and K_2SO_4, produced a blackening of a photographic plate held close to, but not necessarily in contact with them. The radiation was not related to the formation of the metal, but was one of slow electrons produced by oxidation or adsorption on the surface. Sharp edges, scratches, different layer thicknesses, different supports, and centers of metal formation affected the reaction rate.

1268. GRUNBERG, L. AND WRIGHT, K. H. R. **Russell effect on evaporated metal films.** *Nature* 170, 456-7 (1952).—*C.A.* 47, 2563*i*.

Evapd. films of metals, when exposed to the action of O_2 and water vapor, were found capable of producing an image on photographic plates. At a given ratio of water/O_2, the optical d. increased at first with increase in air pressure. At higher air pressures the d. became independent of the pressure.

1269. HACKERMAN, NORMAN AND COOK, E. L. **Dual adsorption of polar organic compounds on steel.** *J. Phys. Chem.* 56, 524-6 (1952).—*C.A.* 46, 7018*h*.

Portions of the surface of steel powder are apparently specific to the irreversible adsorption of alkyl carboxy acids, amines, alcs., and esters. Alcs. and esters are not irreversibly adsorbed by steel powder on which an acid has already been irreversibly adsorbed. The max. amt. of irreversible adsorption observed with the org. solutes is not sufficient to form a closed packed monolayer over the surface of the steel powder available for Kr adsorption.

1270. HALL, W. KEITH; TARN, WM. H., AND ANDERSON, ROBERT B. **Fischer-Tropsch synthesis. XIII. Structural changes of a reduced iron catalyst on reoxidation and on formation of interstitial phases.** *J. Phys. Chem.* 56, 688-91 (1952).—*C.A.* 46, 10582*g*.

Upon complete reduction at 450° or 550°C, a fused Fe synthetic NH_3 catalyst develops an extensive pore structure corresponding to about 45% porosity. On reoxidation, the vols. of the individual particles remain const., while the surface areas and pore vols. decrease. Formation of the interstitial nitrides and carbides causes the catalyst particles to expand and the pore vol. and av. pore diam. to increase.

1271. HARRIS, LOUIS AND BEASLEY, JOHN K. **The infrared properties of gold-smoke deposits.** *J. Optical Soc. Am.* 42, 134-40 (1952).—*C.A.* 46, 4365*g*.

Au-smoke deposits are very porous structures of colloidal Au particles prepd. by evaporating Au in an inert atm., such as N_2, at a pressure of about 2-3 mm Hg. The evaporated Au atoms condense to form particles about 100 A. in diam., which adhere to one another to form chains and aggregates.

1272. HARRISON, E. R. **A simple method of purifying hydrogen, nitrogen, and the inert gases.** *J. Sci. Instr.* 29, 295 (1952).—*C.A.* 47, 3529*g*.

Water vapor and O_2 are removed from com. H_2,N_2, and A by passing through a trap contg. a Na-K alloy. The trap consists of a large glass U-tube contg. a 25% Na-75% K liquid alloy. As a drying means the Na-K alloy trap compares favorably with silica gel and $CaCl_2$, but is slightly less efficient than Mg perchlorate.

1273. HART, R. K. **The thermal oxidation of tin.** *Proc. Phys. Soc.* (London) 65B, 955 (1952).—*C.A.* 47, 3669*i*.

Electron-diffraction expts. show that when Sn foil is thermally oxidized in air, an amorphous oxide layer is formed up to 130°C. Above 130° only cryst. SnO and SnO_2 are formed. The formation of a protective amorphous oxide with rising temp. precedes the growth of the cryst. oxide.

1274. HAUFFE, K. AND PFEIFFER, H. **The participation of phase-boundary reactions in the oxidation of metals and alloys at higher temperatures.** *Z. Elektrochem.* 56, 390-8 (1952).—*C.A.* 46, 9391*a*.

The rate-detg. step was the entrance of Fe into the FeO phase as Fe^{1+} ions and electrons. The lattice defect concn. in the FeO phase was calcd. as a function of the CO/CO_2 ratio. The Zn expts. made under N_2-O_2 mixts., also led to the conclusion that phase-boundary reactions played a part. In the NiS reaction, the NiS layer was porous and allowed the direct attack of metal by S_2 vapor, the dissocn. and adsorption of S_2 being rate-detg. MoO_3 or WO_3 catalyzed the oxidation of Ni, whereas Li_2O inhibited it; the reverse was true with Ti.

1275. HEAVENS, O. S. **The contamination in evaporated films by the material of the source.** *Proc. Phys. Soc.* (London) 65B, 788-93 (1952).—*C.A.* 46, 11028*h*.

Contamination was detected both by microchem. test and by radioactive-tracer method for Ag and Ge evapd. from Mo or W filaments. The limit of sensitivity of detection of the W and Mo was discussed. Evapn. from Ta filaments was also studied. Evapd. film thickness was detd. by multiple-beam interferometry.

1276. HEDVALL, J. ARVID; BRISI, CESARE, AND LINDNER, ROLAND. **Self diffusion in monocalcium ferrite.** *Arkiv Kemi* 4, 377-80 (1952).—*C.A.* 47, 3072*c*.

The self diffusion of Ca and Fe in tablets of $CaO.Fe_2O_3$ is detd. by use of Ca^{45} and Fe^{59} as the radioactive indicators. Equimolar amts. of $CaCO_3$ and Fe_2O_3 are heated first to 950°C and then to 1150°C, then powd., hand-pressed into tablets, and heated for 20 hrs at 1150-80°C. Measured amts. of the indicator in paste form are placed in intimate contact with the tablets, and the temp. functions of the diffusion consts. detd.

1277. HELWIG, G. **Electrical conductivity and structure of sputtered cadmium oxide layers.** *Z. Physik* 132, 621-42 (1952).--*C.A.* 46, 10745*c*.

By cathodic supttering of Cd with pure O_2 in a carefully controlled app. (water-cooled electrodes) CdO layers of great mech. strength high light transparency, and good elec. cond. were prepd. under reproducible conditions. Lattice defects and gas inclusions were shown present by electron interference studies.

1278. HENISCH, H. K. AND SAKER, E. W. **The effect of mercury on selenium.** *Proc. Phys. Soc.* (London) 65B, 149-54 (1952).—*C.A.* 46, 10994*i*.

Mercuric selenide formed when Hg liquid or vapor interacts with cryst. Se. Vol. and surface diffusion were measured by means of radioactive Hg. If Hg was added to Se before crystn., there resulted a high resistivity due to reduction in positive-hole mobility. The effect of Hg was not merely a surface effect but concerns thick layers.

1279. HEROLD, ALBERT; MULLER, PIERRE, AND ALBRECHT, PIERRE. **Permeability of steel by lithium.** *Compt. rend.* **235**, 658-9 (1952).—*C.A.* **47**, 2005*i*.

Pieces of Li were placed in 0.1% C steel tubes with 1-mm walls which were welded tight at the ends. They were heated in H_2, and the presence of Li on the outside was detd. spectroscopically. The element did not permeate steel in the gamma state or pure iron. Quenched steels remained impermeable to Li on heating at 600°C in H_2 on account of their fine distribution of carbides.

1280. HILL, TERRELL L. AND KEMBALL, CHARLES. **Thermodynamic functions of adsorbed molecules from surface-tension measurements: toluene, benzene, and heptane on mercury.** *J. Am. Chem. Soc.* **74**, 3946-8 (1952).—*C.A.* **47**, 9742*b*.

Calcd. adsorption isotherms for toluene, C_6H_6, and C_7H_{16} were of the conventional form; toluene and C_6H_6 showed some indications at the beginning of multilayer adsorption at the lighest pressures. At low coverages the order of decreasing energy of binding was toluene, C_6H_6, and C_7H_{16}; the energies of vaporization were 8.7, 7.5, and 8.3 kcal./mole, resp., at av. T = 310.1°K. There was little variation in the energy of adsorption over the range investigated.

1281. HOFFMAN, R. E. AND TURNBULL, D. **Effect of impurities on the self-diffusion of silver.** *J. Appl. Phys.* **23**, 1409-10 (1952).—*C.A.* **47**, 3645*e*.

The effect of Pb in dil. Ag-Pb alloys on diffusion of Ag is expressed by $D = D° + xD'$, where $D°$ is the self-diffusion coeff. in pure Ag, x is the mole fraction of Pb, and $D' = 7.6 \exp(-40{,}500/RT)$ cm^2sec^{-1}.

1282. HUDSWELL, F. **Methods available for the preparation of thin films.** *Ministry of Supply, Harwell, Berks. (Engl.) At. Energy Research Estab., Unclassified* **C/R 861**, 10-21 (1952).—*C.A.* **46**, 11078*i*.

Foils in the form of hollow Ta cylinders are heated by high-frequency induction. Ti and I_2 are enclosed in the same vessel, which is evacuated. Ti iodide is prepd. gradually by heating to 200°C. When the foil is heated to 1400°C the iodide is decompd. at its surface. Thus, the reservoir of metal is gradually combined with I_2 to build up a Ti film on the Ta foil.

1283. HUFF, G. F.; BAILEY, G. R., AND RICHARDS, J. H. **Sampling of liquid steel for dissolved oxygen (with discussion).** *J. Metals* **4**, *Trans.* 1162-1228 (1952).—*C.A.* **47**, 1004*g*.

An improved bomb-sampling technique is described for obtaining samples for O_2 analysis from liquid steel.

1284. HUGHES, R. C.; COPPOLA, P. P., AND EVANS, H. T. **Chemical reactions in barium oxide on tungsten emitters.** *J. Applied Phys.* **23**, 635-41 (1952).—*C.A.* **46**, 8510*e*.

When $BaCO_3$ is heated *in vacuo* in contact with W, the following reactions may occur in sequence as progressively higher temps. are reached: (1) $WO_3 + BaCO_3 \rightleftarrows BaWO_4 + CO_2$; (2) $3BaCO_3 + W \rightleftarrows Ba_3WO_6 + 3CO$; (3) $BaCO_3 \rightleftarrows BaO + CO_2$; (4) $6BaO + W \rightleftarrows Ba_3WO_6 + 3Ba$. At approx. 600° reaction (2) begins to occur with appreciable speed. Reaction (3) proceeds at 800-900°.

1285. HUGHES, R. C. AND COPPOLA, P. P. **Bariated tungsten emitters.** *J. Appl. Phys.* **23**, 1261-2 (1952).—*C.A.* **47**, 1483*a*.

Thermionic emitters consisting of Ba oxide dispersed throughout a body of porous W can be successfully made if suitable compds. of Ba are employed as the source of the oxide. Compds. such as the carbonate, are unsuitable. If by various means, BaO is dispersed in W, reaction occurs at the operating temp. of the cathode to generate free Ba slowly. $6BaO + W \rightarrow Ba_3WO_6 + 3Ba$, which diffuses to the surface and lowers the work function.

1286. INGRAHAM, T. R. AND PIDGEON, L. M. **Reactions of titanium tetraiodide on heated titanium and tungsten surfaces.** *Can. J. Chem.* **30**, 694-7 (1952).—*C.A.* **47**, 952*i*.

When TiI_4 is passed over a hot bar of Ti metal, the reactions depend on whether the temp. of the bar is above or below 1100°C. If the temp. is below 1100°, Ti is rapidly etched from the bar to form TiI_2. The activation energy for this reaction over the temp. range 800-1000° is 19.8 ± 0.5 kcal. At bar temps. above 1100°C TiI_4 is decompd. to Ti and I_2. The activation energy for the deposition of Ti on a W bar is 92.0 ± 2 kcal.

1287. ITTERBEEK, A. VAN; GREVE, L. DE, AND HEREMANS, F. **Measurements of the formation of thin tin films.** *Applied Sci. Research* **B2**, 352-60 (1952).—*C.A.* **46**, 8448*i*.

Sn films were sputtered in H_2, Ne, He, and A. The films formed in H_2 exhibited infinite resistance, but those formed in Ne, He, and A exhibited a finite resistance if they were not too thin. The sp resistance of the films sputtered in He was approx. ten times that of the films sputtered in Ne. The rate of oxidation was followed by measuring the change in resistance with time after admission of O_2 to a sputtered film.

1288. JENKENS, A. E. AND WORNER, H. W. **The structure and some properties of titanium oxygen alloys containing 0-5 atomic per cent oxygen.** *J. Inst. Metals* **80**, 157-66 (1951) (Paper No. 1337).—*C.A.* **46**, 2468*a*.

The limits of the $\alpha + \beta$ region up to 5 at.% O_2 were established by quenching expts. and thermoelec. measurements at various temps. Impurities in com. Ti caused a marked broadening of $\alpha \rightleftarrows \beta$ transformation range. Forging, cold working, and annealing procedures were given for alloys contg. 3.5 at. % O_2.

1289. JOSEFSSON, AKE AND KULA, ERIC. **Determination of nitrogen and carbon dissolved in α-iron by internal friction measurements on soft steel of commercial purity.** *Jernkontorets Ann.* **136**, 63-73 (1952).—*C.A.* **46**, 7487*g*.

Presence of impurities such as Mn and P changed the position of the internal friction curve for N_2 and broadened it. Fixation of N_2 by Al was illustrated, also the inclination of N_2 to stay in supersaturated solid solution, even at rather slow cooling rates.

1290. Kaiser, Wolfgang. **New light absorption in silver halides.** *Z. Physik* 132, 497-507 (1952).—*C.A.* 46, 9996*c*.

AgCl and Ag are condensed simultaneously to obtain thin films. New absorption bands at 375 and 530 mμ are found, of which the former is removable by irradiation. The corresponding bands for AgBr plus Ag occur at 400 and 570 mμ. The low-wave bands are probably caused by inclusion of dispersed at. Ag or by its surface adsorption.

1291. Kefeli, L. M. and Lel'chuk, S. L. **Pyrophoricity of the nickel skeleton catalyst.** *Doklady Akad. Nauk S.S.S.R.* 83, 697-9 (1952).—*C.A.* 46, 6916*g*.

It is not possible to desorb the H_2 dissolved in the catalyst by mere evacuation. Removal of the H_2 by oxidation under H_2O (through the O_2 dissolved in H_2O) is extremely slow; thus, after 2 months standing under H_2O, at room temp., the catalyst was still pyrophoric. Catalytic activity is contingent on occlusion of H_2 at the stage of formation of the catalyst. Likewise, films of Pt, Ni, Fe, or W, evapd. in strict absence of a gas, are inactive, and cannot be reactivated by subsequent treatment with a gas.

1292. Keier, N. P. **Role of the different adsorption centers in the hydrogenation of acetylene or metallic nickel. I. Investigation of the active surface of nickel with the aid of the differential isotopic method.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* 1952, 616-26.—*C.A.* 46, 10820*g*.

Desorption and catalytic reactions of C_2H_2 on Ni were investigated by following the C_2H_2 by portions, one of which was tagged with radioactive C^{14}; the desorbed gas or the gaseous reaction products were analyzed for C^{14} by radioactivity measurements. This catalyst did not adsorb C_2H_4 or C_2H_6, but did adsorb C_2H_2 in significant amts. even at room temp. On desorption at 150°C of C_2H_2 adsorbed at room temp. CH_4 and H_2 were found, along with C_2H_2, which were not evolved in the course of the adsorption. 3 kinds of active centers were inferred: centers from which C_2H_2 was desorbed reversibly, centers of hydrogenation, and centers of decompn. of C_2H_2.

1293. Kemball, C. **Reaction of ammonia and deuterium on evaporated nickel catalysts.** *Trans. Faraday Soc.* 48, 254-8 (1952).—*C.A.* 46, 8489*c*.

The exchange reaction was followed between 33° and 115°C by means of a mass spectrometer. The initial product was NH_2D and the other deuterioammonias were formed by successive reactions. The energy of activation for the initial reaction was 8.7 kcal./mole, and the rate of reaction was proportional to $p_{D_2}^{1/2}$ and to a slightly greater power of p_{NH_3}. The adsorption of NH_3 on a freshly prepd. Ni film was measured at 0°. The adsorption was complete in less than a min., and the amt. adsorbed corresponded to 6.2×10^{18} mols. per 100 mg of Ni at 0.07 mm. The adsorption of NH_3 was only slightly less than the adsorption of D_2 under the same conditions.

1294. Kemball, C. **Catalysis on evaporated films. I. The efficiency of different metals for the reaction between ammonia and deuterium.** *Proc. Roy. Soc.* (London) A214, 413-26 (1952).—*C.A.* 46, 10820*f*.

The exchange reaction between NH_3 and D_2 was studied on evapd. films of Pt, Rh, Pd, Ni, W, Fe, Cu, and Ag by use of a mass spectrometer. The initial product was always NH_2D, the other deuterio compds. forming successively. The energies of activation were correlated with the work functions of the metals. Catalysis of the reaction by films of oxidized Cu, W, Ni, and Zn and by ZnO is studied.

1295. Kitchener, J. A.; Bockris, J. O'M., and Spratt, D. A. **Solutions in liquid iron. II. Influence of sulfur on the solubility and activity coefficient of carbon.** *Trans. Faraday Soc.* 48, 608-17 (1952).—*C.A.* 47, 462*i*.

The soly. of graphite in liquid Fe was detd. between 1200 and 1700°C with the addn. of 0 to 1.4% S. To avoid an apparent supersatn. effect arising from the stabilization of Fe_3C by S it was necessary always to approach satn. with a slightly rising temp. S redued the soly. of graphite approx. proportional to its concn. The study of solute interactions by the change of soly. of a pure solid was preferable to gas-liquid equil. methods at high temps. because it avoided the uncertainties assocd. with thermal segregation in gas mixts.

1296. Kitchener, J. A.; Bockris, J. O'M.; Gleiser, Molly, and Evans, J. W. **Note on the solubility of oxygen in γ-iron.** *Trans. Faraday Soc.* 48, 995-7 (1952).—*C.A.* 47, 5334*g*.

1297. Kolomiets, B. T. **Mechanism of photoconduction and conduction in lead sulfide layers.** *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* 16, 70-80 (1952).—*C.A.* 46, 9414*i*.

PbS layers were evapd. onto Au electrodes and treated with O_2. Dark cond. measurements in air show that at 40-60°C the semicond. changes into metallic. Variations in cond. and photocond. are due to dissolved O_2, since layers cooled after degassing in Ne or H_2 did not show any increase in cond. Thermoelec. measurements indicate that the carriers of dark cond. are pos., but surprisingly measurements of photocond. with the condenser method show that the carriers in this case are electrons. The original electronic cond. of evapd. PbS changes to hole cond. after oxidation and the thermoelec. force changes from 60 to 400 microvolts per degree. Degassed samples have better frequency response.

1298. Lander, J. J.; Kern, H. E., and Beach, A. L. **Solubility and diffusion coefficient of carbon in nickel: reaction rates of nickel-carbon alloys with barium oxide.** *J. Appl. Phys.* 23, 1305-9 (1952).—*C.A.* 47, 2581*i*.

Between 700° to 1300°C, $\ln S = 2.480 - 4{,}880/T$, where S was the soly. in g of C per 100 g of Ni. Values obtained for the diffusion coeff. in the same range fitted the equation $\ln D=0.909-20{,}200/T$, where D is in sq cm per sec. Rates of reaction between diffused C and BaO coatings on Ni were measured. The rates are diffusion-limited over a wide range of conditions of interest.

1299. LEVINA, S. D. AND BURSHTEIN, R. KH. **Oxide layers on highly alloyed steels.** *Zhur. Fiz. Khim.* **26**, 555-9 (1952).—*C.A.* 47, 5336*d*.

The surface of a 18-8 Cr-Ni steel was reduced. Adsorption of O_2 at 20°C was used as a criterion of complete reduction. Thus, after heating at 800°C during 5 hrs in H_2, subsequent reduction or reduction at higher temps. did not increase the amt. of O_2 adsorbed on the reduced sample. Oxygen adsorption measurements on a reduced powder were: (mols. $10^{-15} O_2$ per cm^2 of true (BET) surface at temp. *t*°): 1.29 at 20°, 1.38 at 100°, 1.73 at 200°, 2.23 at 300°, 4.35 at 400°, 5.66 at 500°C.

1300. LI WANG, HUNG AND HACKERMAN, NORMAN. **Sorption of gases on metal powders and subsequent change in metal reactivity at room temperature.** *J. Phys. Chem.* **56**, 771-4 (1952).--*C.A.* 47, 378*b*.

Curves were given for the sorption of Cl_2, NO_2, O_2, and CO on unreduced and reduced stainless steel, Ni, and Mo powder at room temp. The quantities of gases sorbed on unreduced stainless steel and Ni powders could be arranged in the order: $Cl_2 > NO_2 > O_2 > CO$. For unreduced Mo powder the order was: $O_2 > NO_2 > CO$; the data for Cl_2 were very erratic. The uptake of O_2 on reduced powders was greater in all cases than with CO.

1301. MANTLE, E. C. **Nitrogen degassing and metal mold reaction in the production of gunmetal castings.** *Foundry Trade J.* **93**, 95-100 (1952).—*C.A.* 47, 2669*a*.

Phosphor-bronze shows the effects of gas pick-up. When the bronzes and gunmetals contain more than a certain amt. of P, they absorb gas by reacting with the steam produced when the hot metal is poured into a sand mold. The amt. of gas absorbed in this way can be regulated by adjusting the P content of the alloy and the pouring temp. A certain small amt. of gas is helpful, because it produces a more uniform distribution of unsoundness. A simple technique of gas-scavenging with N_2 is described.

1302. MCMASTER, J. G. **Oxygen determination in lead.** *Z. Erzbergbau u. Metallhüttenw.* **5**, 363-4 (1952).—*C.A.* 47, 69*h*.

The soly. of O_2 in the vicinity of the f.p. is less than 0.001%, but at higher temps. much more O_2 is dissolved. The surface layers contain considerable O_2 but the center contains much less. As much as 0.05% can be present at 800°C, but 0.0001% is found in the inner parts after cooling.

1303. MENZEL, ERICH. **Self-diffusion on the copper surface.** *Z. Physik* **132**, 508-28 (1952).—*C.A.* 46, 9925*d*.

The changes on the surface of a chemically etched Cu monocrystal were observed as a function of temp. The time required for a definite change to occur was a measure of the surface migration of Cu atoms on their own lattice. The surrounding atm. profoundly affected the results. For air pressures near 1 μ the surface migration in the region of 700°-1050° followed a Boltzmann law with an activation energy of 13 ± 2 kcal./mole.

1304. MICHEL, PIERRE. **The formation of thin layers of alloys by evaporating pure constituents in a vacuum.** *Compt. rend.* **235**, 377-9 (1952).—*C.A.* 47, 2105*i*.

Thin layers, deposited by simultaneous evapn. from pure Ag and Sn filaments, formed the following phases: face-centered cubic, *a* 4.15 A.; orthorhombic, *a* 2.99 A., *b* 5.15 A., *c* 4.77 A.; tetragonal Sn, *a* 5.82 A., *c* 3.17 A. Simultaneous evapn. of Au and Cu gave face-centered cubic solid soln. having parameters varying continuously with the compn. Successive evapn. of Ag-Mg and Au-Cu did not form any alloys. In the system Ag-Sn, successive evapn. always produced alloys in consequence of the high diffusion const. of Sn.

1305. MIYAZAWA, HISAO; NOGA, KINICHI; CHIKAZUMI, SOSHIN, AND KOBAYASHI, AKIO. **Composition of the antimony-cesium photocathode.** *J. Phys. Soc. Japan* **7**, 647-9 (1952).—*C.A.* 47, 6772*h*.

The cond. of the Sb decreased rapidly as soon as a small quantity of Cs is introduced. The metallic appearance of the Sb layer was lost and the deposit became fairly transparent. The cond. passed through a min. where Cs/Sb = 1.0 and the transmitted color of the layer was pale yellow. As the Cs/Sb ratio increased the layers became more and more deep red and the cond. showed subsequent min. at a ratio of 1.5 and 3.0. The photoelec. emission increased gradually with *R*, and saturated approx. as *R* approached 3. These intermetallic compds. CsSb and Cs_3Sb showed the properties of semiconductors.

1306. MOORE, WALTER J. AND LEE, JAMES K. **Kinetics of the formation of oxide films on nickel foil.** *Trans. Faraday Soc.* **48**, 916-20 (1952).—*C.A.* 47, 4710*d*.

The rate of growth of the layer of NiO on Ni was detd. from 400 to 900°C at 10 cm O_2 pressure. The film thickness *y* increased according to the parabolic law $dy/dt = k/y$, the rate const. *k* being, in theory, equal to 2*D*, where *D* was the self-diffusion coeff. of Ni in NiO. The heat of activation was 34.7 ± 0.8 kcal., and the entropy of activation −17.3 ± 0.9 cal/degree.

1307. MORTON, P. H. AND BALDWIN, W. M. JR. **The scaling of titanium in air.** *Trans. Am. Soc. Metals* **44**, 1004-29 (1952).--*C.A.* 46, 6570*g*.

Scaling in air of com. Ti strip from 3 sources was detd. at 930 to 2370°F for 0.1 to 600 hrs. Ti from one source showed parabolic scaling below 1290°F; deviations between 1380 and 1560°F; an isothermal transformation between 1560 and 1830°F with resulting higher rate of scaling, and a new form of scale which was affected markedly by O_2 partial pressure; and more complex conditions above 1830°F. The Ti from two other sources showed no transition.

1308. MORTON, P. H. AND BALDWIN, W. M. JR. **Scaling of titanium at high temperatures.** *Iron Age* **169**, No. 18, 133-8 (1952).—*C.A.* 46, 7015*b*.

At 850 to 1000°C, a transition from a primary light scale to a black scale was observed. This oxidation product was composed of 5 layers and was accompanied by a change from a low scaling rate to a much higher one. The black scale nucleated at relatively few points. It wells up from the interior of the primary scale, ultimately replacing it entirely. Below 850°C in air the exterior never became black. The outer scale was shown by x-rays to have the structure of TiO_2. Beneath this outer scale was a bronze-colored metallic layer, which proved to be TiO.

1309. Moss, T. S. **Properties of films of nonmetallic antimony.** *Proc. Phys. Soc.* **65A**, 147-8 (1952).—*C.A.* **46**, 10776*g*.

Semiconducting layers were obtained by evapn. *in vacuo* on substrates at 90°K. These changed irreversibly to the metallic form at 0°C. Resistance-temp. measurements were reported. Resistance decreased on irradiation.

1310. Müser, Helmut and Schilling, Helmut. **Measurements of thermoelectric forces of cuprous oxide at high temperatures.** *Z. Naturforsch.* **7a**, 211-12 (1952).—*C.A.* **46**, 8914*c*.

Samples of thin Cu foil of 20 μ thickness were suspended between 2 thermocouples of Pt/Pt-Rh and oxidized in com. N_2 with O_2 impurity or in purified CO_2 or N_2 with a low content of O_2. In the atm. with high O_2 impurity the thermoelec. force rose rapidly from 20 for Cu-Pt to 700 microvolts/degree and could be regarded as a consequence of p-conduction. With very low O_2 partial pressure initially on n-type conduction occurred with a max. of 150 microvolts/degree after which p-carriers were formed.

1311. Myers, H. P. **The secondary emission from copper and silver films obtained with primary electron energies below 10 e.v.** *Proc. Roy. Soc.* **215A**, 329-45 (1952).—*C.A.* **47**, 4188*f*.

The values for freshly evapd. Cu and Ag films of the secondary emission ratio are lower than those hitherto recorded, both Ag and Cu possessing a secondary emission ratio less than 0.1 in the primary energy range 1-5 e.v. Discrepancies with earlier work are attributed to the improved vacuum conditions used here.

1312. Nielsen, Anders and Bohlbro, Hans. **Investigation on surface properties of reduced iron catalysts for the synthesis of ammonia and correlation with crystal sizes and high-pressure conversion activities.** *J. Am. Chem. Soc.* **74**, 963-6 (1952).—*C.A.* **46**, 5414*d*.

K_2O-CaO-Al_2O_3-Fe catalysts were examd. by adsorption measurements, and the adsorption data were correlated with x-ray data and high-pressure conversion measurements. Crystal sizes detd. from line broadening in x-ray patterns and surface areas derived from low-temp. A and N_2 adsorption were in satisfactory agreement. The more active catalyst had the smaller surface area and the smaller CO chemisorption at −78°. A first-order phase transition of adsorbed N_2 at liquid N_2 and liquid O_2 temps. was found, and isosteric heats of adsorption were detd.

1313. Nury, Georges. **Influence of the disappearance of antiferromagnetism of nickel oxide on the chemical activity of this oxide.** *Compt. rend.* **234**, 946-8 (1952).—*C.A.* **46**, 10723*c*.

The amt. of reduction of NiO in 2 hrs in H_2 at temps. from 200° to 425°C shows max. at 265 and 350°C and is essentially zero in the ranges 300-340° and 355-400°C. The metallic Ni formed is estd. by a magnetic method.

1314. Oding, I. A. **Thermodiffusion in metals.** *Doklady Akad. Nauk S.S.S.R.* **86**, 67-70 (1952).—*C.A.* **47**, 2006*f*.

In the original absence of a concn. gradient a strain gradient will give a rise to a diffusion that will set up a concn. gradient and thus give rise to back diffusion counteracting the ascending diffusion. Dehydrogenation of steel could be made more efficient by cyclic heating and cooling. The soly. of H_2 in steel being, roughly, 8-10 times as high at 1300° as at 500°C, cooling of the outer parts ought to give rise to diffusion of H_2 into the hotter (more centrally located) parts of the metal; if there is a hollow, the H_2, on cooling, will be eliminated. On subsequent heating, the H_2 will diffuse to the outer surface and escape. Repetition of that cycle between 400 and 1100° should shorten the time needed for dehydrogenation.

1315. Ogawa, Iwao; Dôke, Tadayoshi, and Nakada, Ichirô. **Surface potentials of adsorbed gas films on evaporated metal deposits.** *Ôyô Butsuri* (J. Applied Phys.) **21**, 223-4 (1952).—*C.A.* **46**, 10776*i*.

Surface potentials of O_2 and H_2 films chemisorbed on Ni, Ag, Zn, and Cd evapd.-deposits were measured by the vibrating-condenser method in a vacuum. The observed values were: Ni-O_2 −550 mv., Ni-H_2 −400 mv., Ag-O_2 −600 mv., and Ag-H_2 −490 mv. Zn and Cd show complicated variations when the amt. of the gas changes.

1316. Olney, M. J. **Thermal etching of iron and steel.** *Metal Treatment* **19**, 347-54 (1952).—*C.A.* **46**, 9490*h*.

Eutectoid steels contg. 0.8% C show one clearly defined network after heating in the austenite range and cooling *in vacuo*, A, or H_2. Another network, consisting of broad diffuse boundaries related to the previous system of boundaries, is due to old austenite boundaries which once occupied these positions, when grain growth was for some reason temporarily halted. When hypoeutectoid steels are heated and slowly cooled *in vacuo*, A, or H_2, 3 networks are normally seen. Two of these are due to austenite.

1317. Paproth, H.; Rathje, W., and Stranski, I. N. **Electron emission of a silver surface acted upon by iodine vapor.** *Z. Elektrochem.* **56**, 409-14 (1952).—*C.A.* **47**, 398*c*..

Sublimed I_2 is directed against a high-purity Ag block. A Mo plate is used as the collecting electrode with the Ag cathode placed immediately opposite in a vacuum system. The emitted charge carriers are identified as pure electron emission by using magnetic deflection techniques.

1318. Perrot, Marcel and Tortosa, Jean. **Conductance of silicon.** *Compt. rend.* **235**, 143-5 (1952).—*C.A.* **47**, 18*a*.

Thin films deposited on glass in an atm. of N_2 by thermal evapn. of Si of 98.75% purity were used. About 10 films of thickness 0 to 300 mμ, estd. by reflection of monochromatic light were measured. The thinnest films had the most coloration; the thickest were red-brown by transmitted light with a slight metallic luster. The resistance increased with time. The current-voltage curves digressed from Ohm's law in the case of very thin films.

1319. PFEIFFER, HARALD AND HAUFFE, KARL. **Affecting the oxidation rate of nickel and titanium by alloying and treatment with metal oxide vapor.** *Z. Metallkunde* **43**, 364-9 (1952).—*C.A.* **47**, 1019*f*.

Addn. of Cr increased the oxidation rate of pure Ni but Ag had no noticeable influence which is ascribed to the difference of ionic radii of Ag_2O and NiO, hence the low soly. of Ag_2O in NiO. An improvement in the reduction of oxidation rate was found if Ni was treated with Li_2O vapor, or Ti with WO_3 vapor at 1000°C.

1320. PROBST, R. E.; MEYERSON, SEYMOUR, AND SEELIG, HERMAN S. **Adsorption and reaction of carbon monoxide on promoted iron catalysts.** *J. Am. Chem. Soc.* **74**, 2115-16 (1952).—*C.A.* **47**, 6747*h*.

During the course of studies at 0-108°C on the adsorption of CO on K_2CO_3-promoted Fe catalysts, chem. reactions occur that produce $Fe(CO)_5$ and CO_2. At temps. as low as 25°C, CO reacts with reduced Fe to form $Fe(CO)_5$. The interpretation of CO-adsorption expts. at temps. above 25°C is subject to question unless gas analyses are made to confirm the absence of chem. reactions.

1321. RANC, GASTON. **Thin metallic layers.** *Le Vide* **7**, 1211-19 (1952).—*C.A.* **47**, 2033*e*.

Thin layers were made by evapn. *in vacuo* where the mean free path of the mols. was 10 times the distance from the evaporator to the object. The resistivity of Au deposited on Plexiglas and left in air goes through a min. and increased without reaching a stable value in 1000 hrs. The min. was more pronounced in thin deposits and absent beyond a thickness of 300 A. Below a thickness of 50 A., the resistance tended to become infinite; above this thickness it diminished asymptotically to the value for massive Au. Deposits of Au on NaCl had a smaller resistance at the same thickness than on Plexiglas; the crit. thickness was 35 A. Deposits on glass and Rhodoid were similar to deposits on Plexiglas and deposits on KCl, KBr, and $NaNO_3$ to deposits on NaCl. Cu deposits were similar to Au.

1322. RAUSCH, W. **Adsorption of pentane, propl chloride, and other vapors on zinc and thin zinc phosphate layers.** *Z. physik. Chem.* **201**, 32-54 (1952).—*C.A.* **47**, 7286*e*.

The adsorption of PrCl, pentane, Et_2O, and CCl_4 vapors below satn. pressure was studied on Zn and on Zn that was covered with a thin layer of $Zn_3(PO_4)_2$. The evaluation of the adsorption isotherms showed that by covering Zn with a thin layer of $Zn_3(PO_4)_2$ the surface was increased by a factor of 5-6.

1323. REYNOLDS, F. W. AND STILWELL, G. R. **Mean free paths of electrons in evaporated metal films.** *Phys. Rev.* **88**, 418-19 (1952).—*C.A.* **47**, 1451*i*.

The prepn. of thin films of Cu and Ag was examd. Optimum cond. was obtained by using high rates of evapn. (500-1000 A./sec) and low residual gas pressure (~0.00001 mm). Films evapd. at slower rates, at higher residual pressures, or deposited by chem. or electrolytic processes departed from calcd. values. The resistivity and resistance-temp. coeffs. were reported at 25° fo films of Cu and Ag 100-1500 A. thick.

1324. RIENACKER, G.; BREMER, H., AND UNGER, S. **Catalytic activity and surface of silver powder.** *Naturwissenschaften* **39**, 259-60 (1952).—*C.A.* **47**, 6233*g*.

The catalytic activity of Ag powder in the HCO_2H reaction at 140°C was studied. For the range 300° to 900°C of H_2 pretreatment, the difference in activity (log k) was not outstanding. The B.E.T. surface decreased steadily with treatment temp.; the time of treatment had little effect. The activity per unit surface increased with temp. of treatment.

1325. ROBINSON, CHARLES F. **Effect of various gases on potassium-ion emission from hot platinum.** *J. Chem. Phys.* **20**, 1329 (1952).—*C.A.* **46**, 10857*e*.

The efficiencies of the 2 ionization processes (direct emission of K^+ from the Pt surface, and ionization by electron impact with the vapor phase) are widely different. While the 2 ionization processes have different probabilities, they also may have different efficiencies of measurement in the mass spectrometer.

1326. SAKURAI, TAKEMARO AND MUNESUE, SEIJI. **Resistivity of evaporated tellurium films.** *Phys. Rev.* **85**, 921 (1952).—*C.A.* **46**, 5922*h*.

Te was deposited in films 200-5000 A. thick by vacuum evapn. on Si plates. The resistivity R obeyed the equation $\log (R-r) = U/2kT +$ const., where U was the activation energy of a bulk specimen (0.34 e.v.), and r was a const. sensitive to the thermal history and thickness of the film.

1327. SASAKI, NOBUJI AND YUASA, TOSHIYOSHI. **Chemical studies on ion emission. I. The effect of beryllia on the electrical emission from alumina-coated tungsten filament.** *J. Chem. Soc. Japan*, Pure Chem. Sec., **73**, 273-5 (1952).—*C.A.* **46**, 6928*b*.

The W filament was stretched along the axis of a cylindrical diode bulb. The pos.-ion (alkali metal) current from the filament at 900° decreased exponentially from about 7×10^{-10} to 1.3×10^{-11} amp./cm within 1.5 hrs. Previous washing of the filament with water diminished the values to about one half. If the filament was coated with beryllia (about 0.1 mg per cm of the filament), both the pos.- and the neg.-ion currents remained almost unchanged at about 1×10^{-11} amp.

1328. SAVORNIN, JEAN AND COUCHET, GEORGES. **The thermoelectric force of aluminum in very thin layers.** *Compt. rend.* **234**, 1608-10 (1952).—*C.A.* **46**, 7838*c*.

The thermoelec. force was detd. between 15 and 300°C for thermocouples consisting of an Al layer evapd. onto glass at 10^{-5} mm Hg pressure and a Cu wire. Two samples of Al were applied and gave no difference (99.5 and 99.995%). The thermoelec. force was independent of thickness of the Al film.

1329. Schäfer, Klaus. **Energy-transfer mechanism and reaction rate on metallic surfaces.** *Z. Elektrochem.* **56**, 398-403 (1952).—*C.A.* **46**, 8944*e*.

The accommodation coeff. α for C_2H_6 on a series of Pt-Cu alloys was detd. between 0 and 105°C. In the same app., the initial rate of the reaction $C_2H_6 \rightarrow C_2H_4 + H_2$ was measured at 600°C. The temp. coeff. of α was much higher on pure Pt than on the alloys; this shows that energy transfer to a vibration transition was favored. There was a correlation between the rate of the decompn. reaction and the partial α of the $\delta'(\sigma,a)$ vibration, which, according to a model, should favor decompn. Pt was the best catalyst for the decompn., because the α for this vibration was high and that for others low.

1330. Schulz, L. G. **Oriented overgrowths of alkali halides on silver substrates.** *Acta Cryst.* **5**, 266-8 (1952).—*C.A.* **46**, 10761*i*.

CsCl, CsBr, LiF, NaCl, NaBr, KCl, RbBr, and KI were deposited from the vapor phase and from soln. on oriented Ag substrates. The orientation of the deposits was detd. by use of electron diffraction. Although the surface of the oriented Ag substrate might be microscopically irregular, a definite orientation was induced in the deposit. The lattice consts. of the substrate and the deposit, the method of growth of the deposit (vapor of soln.), and the elec. conditions at the interface were factors.

1331. Seddig, M. and Haase, G. **The measurement of pressures below 10^{-7} millimeters of mercury by means of an adsorption manometer.** *Z. Angew. Physik* **4**, 105-8 (1952).—*C.A.* **46**, 6439*e*.

A manometer based on the photoelec. principle for use below 10^{-7} mm Hg is described. The time dependence of the work of electron emission from an incandescent W surface is used as a criterion for the estn. of pressure changes.

1332. Shepherd, A. A. **Poisoning of oxide cathode emission by oxygen.** *Nature* **170**, 839-40 (1952).—*C.A.* **47**, 4188*b*.

The emission from mixed BaO and SrO cathodes at 1000-1200°K was reduced 10% of its initial value by liberation of O_2 from a heated W wire coated with BaO_2. The poisoning phenomenon was completely reversible, even after several previous attacks. The emission of ionized O from the cathode increased often by a factor of 10 or more, and gradually decayed to its original intensity as recovery was completed. The results indicated that the main cause of O_2 poisoning was probably the adsorption of thin films of O on both the outer cathode surface and the interior crystallite surfaces.

1333. Slichter, W. P. and Kolb, E. D. **Impurity effects in the thermal conversion of germanium.** *Phys. Rev.* **87**, 527-8 (1952).—*C.A.* **46**, 10758*c*.

The thermal history and exposure to pure water and to air had no effect on the $n \rightarrow p$ type conversion of Ge. Conversion was extensive on heating after contact with dil. $CuSO_4$ solns.

1334. Slifkin, L. M.; Lazarus, D., and Tomizuka, T. **Self-diffusion in pure polyscystalline silver.** *J. Applied Phys.* **23**, 1032-4 (1952).—*C.A.* **46**, 10749*h*.

Self-diffusion was measured with Ag^{110} as a tracer. The results of the high-temp. expts., where vol. diffusion was predominant, were in excellent agreement with those of other investigators. A least-squares calcn. with all available data on vol. diffusion of Ag gave as a value for the diffusion coeff. $D = 0.724 \exp(-45{,}500/RT)$.

1335. Slifkin, L. M.; Lazarus, D., and Tomizuka, T. **The diffusion of antimony in silver single crystals.** *J. Appl. Phys.* **23**, 1405 (1952).—*C.A.* **47**, 3645*d*.

Diffusion of Sb^{124} in Ag single crystals is described by $D = 0.29 \exp(-39{,}400/RT)$ in agreement with results of other radioactive tracer expts., differing considerably from older data.

1336. Suhrmann, R. **The adsorption status of adsorbed molecules at conducting surfaces.** *Z. Elektrochem.* **56**, 351-60 (1952).—*C.A.* **47**, 1457*d*.

The elec. changes at catalyzing metal surfaces of Ni and Pt were investigated during the adsorption or sorption of O_2, H_2, N_2O, and NH_3. Thin layers of these metals showed an increase of cond. when H_2 was adsorbed, because of the dissocn. of the H atoms and their migration in the crystal lattice as protons and electrons. O_2 decreased the cond. of a Ni film 2.6% at 290°K. Furthermore, the photoelec. emission of metal surfaces was very sensitive to adsorption of mols. Adsorption of H_2, H_2O, and NH_3 increased the photoelec. sensitivity by partial compensation of the electron affinity of the metal support. O_2 and N_2O showed the opposite effect.

1337. Takeuchi, Sakae and Igaki, Kenzô. **Statistico-thermodynamical studies on fundamental reactions concerning steelmaking. II. Oxidation and reduction equilibrium of wüstite ferrous oxide with gas phases.** *Science Repts. Research Insts., Tohoku Univ.*, Ser. A, 4, No. 2, 164-75 (1952).—*C.A.* **47**, 2102*i*.

The excess O_2 over the stoichiometric compn. FeO in wüstite is due to the fact that the crystal is ionic contg. a certain no. of lattice imperfections such as the vacant lattice points and the electron deficits of the form of the Fe^{+++} on the Fe^{++} lattice. The equil. condition between wüstite and the gas mixt. $CO\text{-}CO_2$ surrounding the crystal is deduced by making min. the total sum of the free energies of the crystal and the gas phase.

1338. Tödt, F. **The electrical measurement of small amounts of oxygen on metallic surfaces.** *Glass u. Hochvakuum-Tech.* **1952**, 109-10.—*C.A.* **47**, 3723*c*.

O_2, 10^{-12} γ or less than 0.0001 part of an at. layer, on the surface of noble metals can be measured by electrochem. means. The principle of the measurement depends on the condition that the current produced by a metal surface covered with O_2

is detd. against a practically unpolarizable anode. A smooth Pt surface exposed to air absorbs about 10 at. layers of O, based on the surface geometry.

1339. TRAMM, HEINRICH. **Technique of carbon monoxide hydrogenation.** *Erdöl u. Kohle* 5, 10-17 (1952).—*C.A.* 46, 4193f.

A study of the kinetics of reaction over Fe catalysts led to equations: $n_{CO}=k_1(P_{H_2})^2/P_{CO}$); $n_{CO_2}=k_3P_{H_2}/[P_{CO}(1+k_4(CO_2+H_2O)^7)]$ for the velocity of CO_2 formation; $n_{H_2O}=kP^2_{H_2}/[P_{CO}(1+k_2(CO_2+H_2O)^5)]$ for the synthesis reaction under H_2O formation; and $n_k=k_5P_{H_2O}$ for the conversion reaction (k stands for hydrocarbons). A qual. explanation of the kinetics was given by the behavior of catalyst adsorption at the reaction temp. At 250°C N_2 alone was physically adsorbed, while H_2, CO, CO_2 were all chemisorbed. Exptl. data for the derivation of the kinetic equations were given.

1340. TRAPNELL, B. M. W. **Nitrogen and ethylene adsorption on evaporated tungsten films.** *Trans. Faraday Soc.* 48, 160-5 (1952).—*C.A.* 46, 7858*h*.

The chemisorption of N_2 and C_2H_4 by clean evapd. W films was detd. together with the chemisorption of H_2 into adsorbed layers of these gases and of O_2. The poisoning of the catalytic para-H_2 conversion by C_2H_4 and O_2 layers was due to simple blockage of surface sites. The action of N_2 was to decrease the condensation coeff. of the incoming H_2.

1341. TRECO, R. M. **Some properties of high-purity zirconium and dilute alloys with oxygen.** *Trans. Am. Soc. Metals* Preprint No. 38, 19 pp. (1952).—*C.A.* 46, 9496*d*.

Mech. and phys. properties of alloys of high purity, I_2-refined Zr contg. up to 2.5% O_2 were increased greatly by O_2 with only slight decreases in ductility and resistivity which did not affect working properties.

1342. TRISCHKA, J. W.; MARPLE, D. T. F., AND WHITE, A. **The production of halogen negative ions at the surface of a thoriated tungsten filament.** *Phys. Rev.* 85, 136-7 (1952).—*C.A.* 46, 4356*d*.

By directing mol. beams of Cs halides at a thoriated W wire (at 1200-1500°K) large yields of halogen neg. ions were obtained. There were no mol. ions. The yield from pure W surfaces was much lower.

1343. VARETTO, J. AND LACOMBLE, L. **Determination of the oxygen and inclusions in steels.** *Rev. universelle mines* 8, 270-4 (1952).—*C.A.* 46, 9489*b*.

By combining reducing fusion *in vacuo* and anodic soln. the detn. of total O_2 was more exact and gave an approx. value of the content of inclusions of FeO + MnO.

1344. WABER, J. T. **The cubic law of oxidation.** *J. Chem. Phys.* 20, 734-5 (1952).—*C.A.* 46, 10710*a*.

Exptl. and theoretical studies were reviewed to indicate that a cubic law of oxidation occurred at low temps. Data for Ta and Ti were presented.

1345. WINEGARD, W. C. AND CHALMERS, B. **Self diffusion at silver surfaces.** *Can. J. Phys.* 30, 422-9 (1952).—*C.A.* 47, 4160*d*.

The surface self diffusion of radioactive Ag^{110} on electropolished, electroetched, and chemically etched polycryst. Ag and the (100), (110), and (111) planes of a Ag single crystal was investigated. Surface diffusion was accelerated during changes of surface shape. An abnormally high concn. of lattice vacancies was considered necessary for changes of surface shape to occur.

1346. YING, CHUNG FU AND FARNSWORTH, H. E. **Changes in work functions of vacuum-distilled gold films.** *Phys. Rev.* 85, 485-6 (1952).—*C.A.* 46, 5427*h*.

Au was deposited onto outgassed polycryst. Au at room temp. The effect of the thickness and of the thermal history on ψ was examd. It was improbable that gases adsorbed on, or absorbed by, a film were the only cause of its lower ψ. These results indicated that the Au film deposited on a surface at room temp. possessed some structure characteristics different from that of polycryst. bulk Au and that the structure of the film approached that of the bulk when the temp. of the film was raised.

1347. ANSBACHER, F. AND JASON, A. C. **Effects of water vapor on the electrical properties of anodized aluminum,** *Nature*, 171, 177-8 (1953).—*C.A.* 47, 6725*b*.

The capacity of a condenser made from anodized com. Al wire, 1/16 in. in diam., was measured at 25, 30, 40, 50, 60, and 70°C in the presence of various amts. of water vapor. Max. capacity was obtained when the vapor pressure reached satn. The leakage resistance of the Al_2O_3 at 50°, 60°, and 70°C decreased exponentially with increasing water vapor pressure.

1348. BECKER, J. A. AND HARTMAN, C. D. **Field-emission microscope and flash-filament techniques for the study of structure and adsorption on metal surfaces.** *J. Phys. Chem.* 57, 153-9 (1953).—*C.A.* 47, 6761*e*.

The properties of single-crystal W points are described as a function of temp. (0-2500°C) and field potentials (up to 50 million v. per cm). The conditions for surface mobility of Ba atoms adsorbed on W are given. Flash-filament techniques are used to det. rate of N_2 adsorption on W at low pressures, the sticking probability of N_2 as a function of the fraction of surface covered, and the activation energy for the conversion of a mol. to 2 adsorbed atoms.

1349. BOWERS, RAYMOND. **Thickness of the saturated helium II film.** *Phys. Rev.* 91, 1016-17 (1953).—*C.A.* 47, 11859*h*.

The satd. He II film on Al was investigated by a gravimetric method. The film was not affected by temp., 1.2-2.1°K. The 99.92% satd. film was 20 atoms thick. The satd. film was 55-175 atoms thick, depending on the height of the bulk liquid He.

1350. DREYFUS-ALAIN, BERTRAND. **Radiocrystallographic study of the adsorption of deuterium by lanthanum.** *Compt. rend.* 236, 1265-6 (1953).—*C.A.* 47, 7286*d*.

Two face-centered cubic structures were formed by the deuteride of La in which the parameter was either 5.60 or 5.67 A.

1351. Hauffe, Karl and Pfeiffer, Harold. **Kinetics of wüstite formation in the oxidation of iron.** *Z. Metallkunde* 44, 27-36 (1953).—*C.A.* 47, 3669*h*.

Linear oxidation rates for Fe → FeO were confirmed for the range 900-1000°C. The rate dependence was measured as function of the partial pressure of O_2, CO_2, and CO, and the effect of disorder loci is discussed.

1352. Healey, F. H.; Chessick, J. J., and Zettlemoyer, A. C. **Adsorption studies on metals. I. Physical and chemical adsorption of gases on molybdenum.** *J. Phys. Chem.* 57, 178-82 (1953).—*C.A.* 47, 7287*a*.

The adsorption of O_2, CO, N_2, and A was studied on unreduced, partly reduced, and reduced Mo powder at −195°C. The surface area increased by a factor of at least 2 during reduction. The reduced Mo was capable of chemisorbing O at −195°C equiv. to 10-20% of the surface; at 25°C the O pickup approached a complete monolayer. The value of the mol. of gas in a monolayer, for the unreduced oxide, was the same for O_2, A, and N_2. Continued reduction at 550-600°C caused the surface to decrease to about that of the original oxide. No chemisorption of either CO or N_2 at −195°C occurred.

1353. Holden, F. C.; Ogden, H. R., and Jaffee, R. I. **Microstructure and mechanical properties of iodide titanium.** *J. Metals* 5, *Trans.* 238-42 (1953).—*C.A.* 47, 2659*a*.

There is a fine structure in iodide Ti, which is attributed to the formation of Ti hydride whose soly. is very low at room temp. The degree of dispersion of the Ti hydride apparently has an important effect on impact-energy values. Variation of the grain size of equiaxed α Ti from 0.01 to 0.25 mm, in the A-cooled condition, produces relatively small changes in the tensile and impact properties.

1354. Keier, N. P. **Role of the different adsorption centers in the hydrogenation of acetylene on metallic nickel. II. Kinetics of hydrogenation and of activated adsorption of acetylene on a nickel catalyst.** *Izvest. Akad. Nauk. S.S.S.R., Otdel. Khim. Nauk* **1953**, 48-57.—*C.A.* 47, 5780*b*.

In consecutive expts. with the same sample of Ni, regenerated by prolonged outgassing in 300-500°C under 10^{-5} mm Hg), the C_2H_2 adsorbed at about 25° decreased; on the fresh catalyst the amt. adsorbed was 2.5 times as great. To obtain reproducible data, the pretreatment was: 1 hr at 130-50°C in N_2, 2 hrs at 300° under 10^{-4} mm with a liquid N_2-cooled trap, reduction with H_2, and 1 hr in vacuo at 500°C. Not all the centers that adsorbed C_2H_2 reversibly were useful for hydrogenation. The adsorption of H_2 was enhanced by adsorbed C_2H_2. Only a fraction of centers, occupying some 4-6% of the surface, were active in hydrogenation. On Ni catalysts CH_4 was formed only above 150°C, both in the presence and in the absence of H_2.

1355. Kitchener, J. A.; Bockris, J. O'M; Gleiser, Molly, and Evans, J. W. **Solubility of oxygen in γ-iron.** *Acta Met.* 1, No. 1, 93-101 (1953).—*C.A.* 47, 3775*g*.

The O_2 absorbed by high-purity Fe foil was detd. by deoxidation with pure H_2 at 1275°C, the H_2O formed being frozen out, vaporized, and measured manometrically in a small vol. High-purity irons from 3 different sources led to a result of 0.003 ± 0.003% by wt for the max. O-content of γ-Fe in equil. with FeO. Traces of Mn, Si, Cr, Al, and other impurities may lead to O-pickup by formation of oxidation products at grain boundaries.

1356. Morrison, John L. and Grummitt, W. E. **The accommodation-coefficient technique applied to a study of molecular oxygen film on tungsten.** *J. Chem. Phys.* 21, 654-8 (1953).—*C.A.* 47, 6734*d*.

Adsorption isotherms of the upper mol. O_2 film on W at 25 and 100°C and at pressures from 9×10^{-9} to 1×10^{-4} mm were measured by the accommodation-coeff. method. The entropy of adsorption was calcd. to be approx. 4 entropy units at low film concns. and less than 1 at high film concns. The large discrepancy between calcd. and theoretical entropies suggested either or both irreversible effects and nonlinearity of the relation between accommodation coeffs. and surface coverage.

1357. Rhodin, T. N., Jr. **Physical adsorption of single-crystal zinc surfaces.** *J. Phys. Chem.* 57, 143-8 (1953).—*C.A.* 47, 7286*i*.

By use of a modified quartz vacuum microbalance, the phys. adsorption of N_2 and A was measured at 78° to 90°K on the surface of single crystals of Cu and Zn. The adsorption data obeyed B.E.T. plots and indicated surface areas corresponding to roughness factors in the range 1.1 to 1.2. Calcd. heats of adsorption appeared to pass through max. at about monolayer coverage.

1358. Seybolt, A. U. and Sumsion, H. T. **Vanadium-oxygen solid solutions.** *J. Metals* 5, *Trans.* 292-9 (1953).—*C.A.* 47, 2660*b*.

The results of an investigation of V-rich V-O solid solns. are presented, indicating the structure and lattice parameters of 2 solns., α and β, and their approx. temp.-compn. existence. The α soln. is the terminal body-centered cubic one, and contains up to 3.2 at. % O. The β soln. has an ordered body-centered tetragonal structure, is formed at 1270°C, and exists from about 15 to 22 at. % O.

1359. Treco, R. M. **Effect of small additions of oxygen on lattice constants and hardness of zirconium.** *J. Metals* 5, *Trans.* 344-8 (1953).—*C.A.* 47, 2660*d*.

The effect of small addns. of O_2 on the hardness, d., and lattice parameters of high purity Zr has been investigated. Precision parameter values and d. of O-free Zr are given as: $a_0 = 3.2258$ kX units, $C_0 = 5.1373$ kX units, $d_{25} = 6.507$ g/cc.

1360. Turkdogan, E. T. and Leake, L. E. **An oxygen detector.** *J. Sci. Inst.* 30, 27 (1953).—*C.A.* 47, 3624*b*.

A strip of pure Fe 9 × 0.1 × 0.003 in. is connected and heated to about 600°C. If the gas passed through contains O_2 the Fe strip quickly changes to different hues of blue, brown, gray. If the temp. is raised the original bright color is restored. The app. will detect O_2 in inert gases if its partial pressure is not less than 10^{-6} atm. Before using, the strip should be reduced by passing through pure H_2 at 600-700°C.

1361. Vernon, W. H. J.; Calnan, E. A.; Clews, C. J. B., and Nurse, T. J. **The oxidation of iron around 200°.** *Proc. Roy. Soc.* (London) **216A**, 375-97 (1953).—*C.A.* **47**, 6229*d*.

There is predominant metal-ion diffusion above, and predominant O-ion diffusion below, 200°C, in the oxide film. An outer layer of rhombohedral α-Fe_2O_3 overlies a layer of cubic oxide which, initially nearer γ-Fe_2O_3, tends towards Fe_3O_4, rapidly and completely above 200°C, slowly and incompletely below 200°. Above 200°C the rate of oxidation is controlled by the diffusion of ions across the film. Thickening of the film and progression of colors may be long delayed during the period of O_2 uptake within the substrate.

1362. Weissler, G. L. and Wilson, T. N. **Work functions of gas-coated tungsten and silver surfaces.** *J. Appl. Phys.* 24, 472-5 (1953).—*C.A.* 47, 6760*b*.

The av. electronic work functions of W and Ag surfaces, subjected to glow discharges in various gases (He, A, H_2, N_2, O_2, freon-12) and to water vapor, were detd. Oxygen and freon-12 produced increases in work functions in excess of 1 e.v., whereas N_2 and particularly H_2 caused decreases of the order of 0.5 e.v. The inert gases and water vapor produced relatively few changes.

I-8. Gases on Inorganic Crystals

1363. Alimarin, I. P. **The preparation of anhydrous magnesium perchlorate ("anhydrone") and its use as a drying agent.** *Zavodskaya Lab.* **9**, 915-16 (1940).—*C.A.* **37**, 4315^7.

Add an excess of MgO to a 30% $HClO_4$ soln. (in small portions), filter, neutralize the filtrate with $HClO_4$ to a weakly-acid reaction, evap. and cool. Filter the crystals obtained on a Buchner funnel, dissolve in a small amt. of hot water, evap. and crystallize (twice). $Mg(ClO_4)_2.6H_2O$ melts 145-7°C in its crystn. water; on removal of water, it solidifies to porous $Mg(ClO_4)_2.3H_2O$. Heat the trihydrate with mixing to 170-200°C (melts) for 1-2 hrs, cool, grind and heat *in vacuo* first at 170°C, then at 220-40°C (for 3 hrs). The "anhydrone" obtained is a white porous mass contg. approx. 0.1% of H_2O and absorbs 60% of its wt.

1364. Cooper, J. A. and Garner, W. E. **Dehydration of crystals of chrome alum.** *Proc. Roy. Soc.* (London) **A174**, 487-503 (1940).—*C.A.* **34**, 3149^4.

The rate of growth of the dehydration nuclei over the 111 surfaces of $K_2SO_4.Cr_2(SO_4)_3.24H_2O$ was detd. from 0° to 40°C. The dehydration came to a stanstill when 12.1-12.3 moles of water of crystn. were lost, i.e., corresponding to a formula $K_2SO_4.Cr_2(SO_4)_3.12H_2O$.

1365. Pogodaev, K. N. **Diffusion of nickel in rock salt.** *Trudy Vostochno-Sibirskogo Gosudarst. Univ.* 2, No. 1, 65-86 (1940).—*C.A.* **37**, 4608^5.

The fundamental physical laws of diffusion could be studied under the simplest conditions when the diffusion took place in rock salt. The temp. dependence of Ni ions was studied in the interval 627-780°C. The relation between the coeff. of diffusion and the temp. was given by $D = 0.42 \exp(-132{,}220/T)\,cm^2/sec$. By means of the Born cycle it was shown, on the example of Ni and Cu ions in rock salt, that the occurrence of diffusion can be detd. by the energy ratio.

1366. Uyeda, Ryozi; Takagi, Satio, and Hagihara, Hitosi. **Cathode-ray investigation of the surface oxidation of zinc blende.** *Proc. Imp. Acad.* (Tokyo) **16**, 389-90 (1940).—*C.A.* **35**, 2762^2.

The orientation of ZnO crystals on the cleavage and natural faces of zinc blende was studied with artifically prepd. surfaces. The type of orientation was confirmed to be distinctly different on each tetrahedral surface.

1367. Pitzer, E. C. and Frazer, J. C. W. **The physical chemistry of hopcalite catalysts.** *J. Phys. Chem.* **45**, 761-76 (1941).—*C.A.* **35**, 5776^5.

X-ray data showed that active hopcalite catalysts were for the most part amorphous. Only the active metallic oxides Co_3O_4, MnO_2, Ni_2O_3 and Co_2O_3 had a metal to oxygen distance in the range 1.75 to 1.85 A. Poisoning expts. and a consideration of catalyst geometry suggested that the catalytic oxidation involved the adsorption of each mol. of CO on two points of the catalyst.

1368. Shirai, Shunji. **Orientation of molybdenum crystals deposited on sodium chloride crystals.** *Proc. Phys. Math. Soc. Japan* **23**, 914-18 (1941).—*C.A.* **41**, 6100*i*.

The structure of thin Mo films was examd. by the method of cathode-ray transmission. Mo films were prepd by evapn, in vacuo on the cleavage faces of rock salt heated to a high temp. A (110) axis of the Mo crystal was parallel to a (100) axis of the rock salt crystal. Mo films were mainly composed of oriented crystals when the temp. was higher than a certain crit. temp., whereas they were randomly oriented at a lower temp.

1369. Shirai, Shunji. **Orientation of molybdenum crystals deposited on sodium chloride crystal.** *Proc. Phys.-Math. Soc. Japan* **23**, 12-18 (1941).—*C.A.* **35**, 4652^3.

Thin films of Mo were evapd. on a heat-treated cleavage plane of NaCl. The latter was dissolved in water, the Mo was transferred to a collodion film and the crystal structure studied with cathode rays of 25-30 kv. The orientation of the Mo crystals depended on the heat-treatment given the NaCl.

1370. UYEDA, RYOZI; TAKAGI, SATIO, AND HAGIHARA, HITOSI. **Cathode-ray investigation of the surface oxidation of zinc blende.** *Proc. Phys. Math. Soc. Japan* **23**, 1049-58 (1941).—*C.A.* **41**, 6101*d*.

The orientation of ZnO crystals in the thin oxide layers formed on various faces of ZnS upon heating in air was investigated by means of cathode-ray diffraction. The surfaces investigated were the (111), $(\overline{111})$, (110), and (100) faces in the natural and etched states and also the cleaved (110) surface. The observed orientations of the oxide as a whole had the tetrahedral symmetry of zinc blende crystals, if etched with the same agent. Simple rules that det. the orientation were pointed out.

1371. WEISER, HARRY B.; MILLIGAN, W. O., AND BATES, J. B. **Isothermal dehydration of heavy-metal iron cyanides.** *J. Phys. Chem.* **45**, 701-6 (1941).—*C.A.* **35**, 3874^9.

Continuous dehydration isotherms for the gels of $Cu_2Fe(CN)_6$, $Cu_3[Fe(CN)_6]_2$, Prussian blue and Turnbull's blue indicated that these materials were not definite hydrates. The electron-diffraction pattern obtained in a high vacuum which removed all the water was identical with the x-ray diffraction pattern of the moist gel.

1372. HAGIHARA, HITOSI. **Cathode-ray investigation of the surface oxidation of galena. I.** *Proc. Phys. Math. Soc. Japan* **24**, 762-8 (1942).—*C.A.* **41**, 6101*c*.

For the very thin layer produced on the cleavage surface of galena upon heating in air, reproducible cathode-ray diffraction patterns were obtained for the oxidation at about 200°C. The oxidized layer was composed only of $PbSO_4$ crystallites.

1373. MORITA, NORIYOSHI. **The catalytic exchange reactions of oxygen atoms between gaseous oxygen and water vapor by iron oxide catalyst. I. Experimental. II. Theoretical.** *J. Chem. Soc. Japan* **63**, 659-64, 665-7 (1942).—*C.A.* **41**, 2974*h*, 2974*i*.

Four catalysts: (1) $\alpha-Fe_2O_3$, (2) $\gamma-Fe_2O_3$, (3) $Fe_2O_3+Bi_2O_3$ (2:1 by wt), (4) Bi_2O_3 were prepd. Their catalytic activity was detd. in the exchange reactions of O atoms in O_2 and water vapor. The first three catalysts showed about the same activity. The activity of the first two decreased with repeated use. All 4 catalysts lost their catalytic activity when heated above 800°C. The temp. of the exchange reaction was 300-700°C.

1374. OSUMI, YOSHIO AND MORITA, NORIYOSHI. **The catalytic exchange of isotopes of gaseous oxygen. XI. The exchange reaction of oxygen atoms between oxygen and steam on the surface of sodium and potassium hydroxides.** *Bull Chem. Soc. Japan* **17**, 217-20 (1942).—*C.A.* **41**, 4365*e*.

Steam of heavy water and the light oxygen gas obtained electrolytically were passed together over a mixt. of asbestos and alkali. The effluent steam, after being condensed, was weighed, and from the decrease in wt. the exchange percentage of the oxygen atoms was calcd. The activation energy for the exchange reaction was found to be 47 kcal. with NaOH as catalyst and 21 kcal. with KOH. Some peroxide was first formed on the alkali surface and the exchange was completed through its decompn.

1375. OSUMI, YOSHIO; MORITA, NORIYOSHI, AND CHITANI, TOSHIZO. **The catalytic exchange of isotopes of gaseous oxygen. XII. The exchange reaction of oxygen atoms between oxygen and steam on the surface of sodium and potassium carbonates.** *Bull. Chem. Soc. Japan* **17**, 189-96 (1942).--*C.A.* **41**, 4365*f*.

Steam of heavy water, together with electrolytic light oxygen was passed through finely granulated NaCl, Na_2SO_4, Na_3PO_4, Na_2CO_3, or K_2CO_3. The effluent condensate was weighed. Catalytic exchange reaction took place with carbonates only. The activation energy of the exchange reaction was 23 kcal for Na_2CO_3 and 27 kcal for K_2CO_3. Further expts. showed that the exchange reaction took place between O atoms of solid Na_2CO_3 and steam of heavy water. Anomalously large values shown in the beginning of the expts. were attributed to the indirect exchange between carbonate and steam.

1376. ZEIMENS, K. E. **Surface determination and diffusion measurements by radioactive noble gases. (Practice and quantitative method.) I. The practical procedure of measuring.** *Z. physik. Chem.* **A191**, 1-53 (1942).—*C.A.* **37**, 5648^5.

Temp. considerations with respect to various kinds of emanations as thoron, actinon, radon, etc., are graphically shown from 0° to 1200°C. A study of Xe from I with AgI shows the existence of two emanations, one of half life of 10 min. which is weak compared with the other of 9.4 hrs. The activity of the latter is compared with time to the iodide of half life of 6.6 hrs from which it is obtained.

1377. FEIGL, FRITZ; MIRANDA, LUIZ INÁCIO, AND SUTER, HANS ALBERTO. **Reactions in the solid state.** *Anais acad. brasil. cienc.* **15**, 151-86 (1943).--*C.A.* **38**, 910^2.

Reactions between solids do not occur if the reaction product remains in situ. Temp., contact area and time are necessary, but not always sufficient. *Type A* (reactions analogous to those in soln): (1) When $CuSO_4$ or $Fe_2(SO_4)_3$ is heated with MgO, the color changes from white to gray (CuO) or brown (Fe_2O_3). (2) When $MnSO_4$, $NiSO_4$ or $CoSO_4$ is heated with MgO in air, darker higher oxides of the heavy metals result. *Type B:* reactions not obtained in soln., usually because of insoly. of one or more reagents. Such reactions are mainly addns. of acidic and basic oxides, etc.

1378. HASEGAWA, SHIGEO. **Formation of the reaction nuclei in the reduction of cupric oxide by hydrogen.** *Proc. Imp. Acad. (Tokyo)* **19**, 393-7 (1943) (in English).—*C.A.* **41**, 5777*h*.

The reduction of CuO by H_2 is explained by 3 assumptions: (1) a reaction between adsorbed H_2 and CuO at the interface of reduced Cu, creating a reaction nucleus; (2) the nuclei on CuO are small in no. and are not in contact with one another in the beginning; (3) the reaction progresses in proportion to the velocity of the growth of the nuclei which increase also in no.

1379. Hedvall, J. A. and Hedin, R. **The importance of surface structure for the velocity of oxidation processes and the thermal decomposition processes of solid substances.** *Die Chemie* **56**, 45-7 (1943).—*C.A.* **37**, 3999^4.

The dissocn. of calcite and pyrites was detd. for various temps. and times of reaction. Individual crystals or crystal particles were used. The reactions were performed in N_2. The data showed small but definite differences in reactivity for different surface types.

1380. Shirai, Shunji. **Structure of a thin silver film deposited on some alkali halide crystals.** *Proc. Phys. Math. Soc. Japan* **25**, 633-6 (1943).—*C.A.* **41**, 6100g.

The structure of a Ag film on crystals with NaCl structure was investigated by the transmission of cathode rays. The dependence on temp. of the substrate was different from that of a Au film, though Au and Ag had almost the same lattice const. It resembled that of a Ni film.

1381. Wooten, L. A. and Brown, Callaway. **Surface area of oxide-coated cathodes by adsorption of gas at low pressures.** *J. Am. Chem. Soc.* **65**, 113-18 (1943).—*C.A.* **37**, 1317^4.

Adsorption isotherms for ethylene at −183° and −196°C and butane at −116°C on oxide-coated cathodes were used to deduce the surface area of the oxide coating. Areas of approx. 10 cm^2/mg of oxide were obtained. The method was capable of detg. surface areas as small as 10 cm^2. Ethylene adsorption at −183°C on alk. earth oxides showed an abrupt adsorption rise in the pressure region 0.25 to 0.30 p_0, where p_0 was the vapor pressure of the gas at the temp. of the isotherm.

1382. Barrer, R. M. and Ibbitson, D. A. **Occlusion of hydrocarbons by chabazite and analcite.** *Trans. Faraday Soc.* **40**, 195-206 (1944).—*C.A.* **38**, 5445^9.

Sorption rates or equil. were studied for gases: O_2, NH_3, HCl, CH_4, C_2H_6, C_3H_8, n-C_4H_{10}, iso-C_4H_{10}, n-C_5H_{12}, iso-C_5H_{12}, n-C_7H_{16}, and iso-octane. When the minerals were suitably outgassed the sorption of He, A, N_2, O_2, CH_4 and C_2H_6 occurred in chabazites and in "active" analcite at very great velocity. C_3H_8, n-C_4H_{10}, n-C_5H_{12} and n-C_7H_{16} were sorbed fairly rapidly at temps. of 100-300°. Hydrocarbons with side chains were totally excluded under all conditions. The sorption was reversible and could be approached from the adsorption or desorption side. The affinity of solutes for the lattice increased in the order $He < H_2 < O_2$, or $A < N_2$, or $CH_4 < C_2H_6 < C_3H_8 <$ n-C_4H_{10}.

1383. Barrer, R. M. and Ibbitson, D. A. **Kinetics of formation of zeolite solid solutions.** *Trans. Faraday Soc.* **40**, 206-16 (1944).—*C.A.* **38**, 5451^9.

Mols. with a cross-sectional diam. not more than 4.0 A. (He, H_2, O_2, N_2, CH_4, C_2H_6) are taker up by dehydrated chabazite or active analcite. Mols. with a cross-sectional diam. = 4.89 A. (paraffins) are occluded by a slow process of diffusion, in which an energy of activation is needed to move the mol. along the interstices from one position of max. sorption potential to another. Mols. with a cross-sectional diam. not less than 5.58 A. (isoparaffins and aromatic hydrocarbons) are totally excluded. There is a limiting pressure above which no further significant increase in sorption rate is possible. The kinetics of sorption are those of a pure diffusion process. The rate of sorption was greatly modified by the conditions of dehydration of the original mineral.

1384. Barrer, R. M. **Thermodynamics and statistics of zeolitic solid solutions.** *Trans. Faraday Soc.* **40**, 374-84 (1944).—*C.A.* **39**, 1096^1.

The existing data for the soln. of gases and vapors in zeolites and of H_2 in Pd, V, Zr, Th and Ti are used to calc. the free energy and the entropy changes. The solute mols. are assumed to possess various degrees of mobility within the crystal lattice, and isotherms are then calcd. and compared with quantities derived from exptl. data. Good agreement was obtained when the solute mols. or atoms were treated as possessing a mobility corresponding to 3 vibrational degrees of freedom in the interstitial vol. and with free rotation. No large fraction of the solute mols. can possess even one-dimensional translational freedom within the zeolite.

1385. Barrer, R. M. **Sorption by gmelinite and mordenite.** *Trans. Faraday Soc.* **40**, 555-64 (1944).—*C.A.* **39**, 2442^3.

Gmelinite resembled chabazite; dehydrated samples occluded CH_4, C_2H_6, and C_3H_8 as typical solutes, but not isoparaffins and aromatic hydrocarbons. Mordenite occluded O_2, N_2, A, CH_4, C_2H_6, HCl, CS_2, NH_3, MeCN, $MeNH_2$, MeOH, but not normal paraffins, isoparaffins, or aromatic hydrocarbons. Ba and Ca base-exchange mordenites were prepd. by heating the powd. mineral with strong aq. $Ba(NO_3)_2$ and $Ca(NO_3)_2$ between 265° and 225°C and were identified by x-ray data. The minerals were dehydrated for periods up to 30 hrs at 300-350°C; they appeared to be quite stable. The mordenite modified by base exchange could not occlude CH_4, C_2H_6, MeOH, or MeCn, but was still able to occlude O_2, N_2, A, NH_3, and HCl. The occlusion and heats of occlusion of O_2 and N_2 increased in the order: natural mordenite, Ba mordenite, Ca mordenite.

1386. Bower, John H. **Revised results obtained with certain dehydrating agents used for drying gases.** *J. Research Natl. Bur. Standards* **33**, 199-200 (1944) (Research Paper 1603).—*C.A.* **39**, 1350^3.

New values were obtained for silica gel and Al_2O_3. The materials studied (with amt. of residual H_2O in mg per liter for air dried), in order of increasing efficiency at 30°C, were: $CuSO_4$ (anhyd.) (2.8); $CaCl_2$ (granular) (1.5); $CaCl_2$ (tech. anhyd.) (1.25); $ZnCl_2$ (sticks) (0.98); $Ba(ClO_4)_2$ (anhyd.) (0.82); NaOH (sticks) (0.80); $CaCl_2$ (anhyd.) (0.36); $Mg(ClO_4)_2$.3-H_2O (0.031); KOH (sticks) (0.014); silica gel (0.006); $CaSO_4$ (anhyd.) (0.005); CaO (0.003); $Mg(ClO_4)_2$ (anhyd.) (0.002); Al_2O_3(0.001); BaO (0.00065).

1387. Briner, E. and Knodel, Ch. **The thermal decomposition of $CaSO_4$ in the presence of water vapor.** *Helv. Chim. Acta* **27**, 1406-14 (1944) (in French).—*C.A.* **39**, 2923[7].

At 1300°C the rate of decompn. of $CaSO_4$ into CaO, SO_2 and O_2 is increased 5-fold if water vapor is circulated over the salt in place of air. After 4 hrs pure $CaSO_4$ is 84% decompd., whereas if water is absent the same extent of decompn. is attained only at 1450°C. Under the same conditions anhydrite is 93.5% decompd.

1388. Kleber, W. **Nonstructural enantiomorphism of crystals.** *Naturwissenschaften* **32**, 77-8 (1944).—*C.A.* **42**, 4015*e*.

Enantiomorphism in solid substances without the crystal structure, e.g., with Cu_2O, can be explained by supposing that there is selective adsorption of some optically active substances from the soln., melt, or vapor. The selective adsorption of foreign mols. may alter the relative rates of growth of different crystal faces. Asymmetric mols. can be differently adsorbed on d- and l-faces, and it is possible that at a certain stage of growth one of the faces disappears.

1389. Barrer, R. M. **Separation of mixtures using zeolites as molecular sieves. I. Three classes of molecular-sieve zeolite.** *J. Soc. Chem. Ind.* **64**, 130-1 (1945).—*C.A.* **39**, 4789[8].

Three different classes are defined. At room temp. class-1 minerals, such as chabazite, active analcite, gmelinite, and a synthetic mineral, exclude isoparaffins, occlude normal paraffins, such as propane, slowly, and occlude methane, ethane, and mols. of smaller cross-section rapidly. Class-2 minerals, such as mordenite, exclude both normal paraffins and isoparaffins, occlude methane and ethane slowly, and smaller mols. rapidly. Class-3 minerals such as Ca and Ba base-exchanged mordenites prepd. hydrothermally at high temps., show negligible occlusion of methane, ethane, and higher normal paraffins and isoparaffins, but occlude O_2, N_2, and smaller mols.

1390. Prilezhaeva, N. A. **Absorption spectra and electronic state of molecules in interaction processes.** *Bull. acad. sci. U.R.S.S., Ser. phys.* **9**, 211-13 (1945) (in Russian).—*C.A.* **40**, 1093[4].

The absorption spectrum of I_2 adsorbed on CaF_2 and also on NH_4Cl aerosol was enhanced over the vapor, owing to the lengthening of the path of the light through repeated reflections on the crystals of the disperse phase; a second max. was found coinciding with the max. shown by solns. in solvents. The absorption increased in the direction of shorter waves, in analogy with solid I_2. NH_3 adsorbed on NH_4Cl aerosol showed absorption between 3100 and 2400 A., in which region also lay the max. of its photochem. decompn. on various other adsorbents ($CuSO_4$, CdI_2, MgO, Cu, glass). Preliminary expts. showed that CO_2 adsorbed on solid benzene plates acquired absorption in the region of 3000 A.

1391. Boer, J. H. de. **The determination of surface areas by adsorption methods.** *Rec. trav. chim.* **65**, 576-9 (1946) (in English).—*C.A.* **41**, 1908*a*.

Adsorption isotherms for I_2 on $BaCl_2$ or CaF_2 layers sublimed on glass walls had the sigmoid shape assocd. with the B.E.T. adsorption theory. The data agreed with the theory at relative pressures from 0.05 to 0.35, but surface areas calcd. from the theory were lower than the true surface areas by a factor of 2 to 4. The true areas were detd. by the surface action of alizarin or by measuring the chemisorption of H_2O. The adsorption of I_2 on salt layers formed unimol. layers only.

1392. Boer, J. H. de. **The formation of two-dimensional nuclei by ionic molecules.** *Proc. Koninkl. Nederland. Akad. Wetenschap.* **49**, 1103-10 (1946) (in English).—*C.A.* **41**, 5360*b*.

Condensation of ionic mols. from the vapor phase on a cool surface in a high vacuum under conditions avoiding collisions of the salt mol. gave rise to two-dimensional nuclei which grew two-dimensionally. Energies for the formation of agglomerates of 2, 3, and 4 mols. of NaCl (with interionic distance of 2.5A) showed that the two-dimensional structure was favored. At. mols. such as Al_2O_3, ZrO_2, SiO_2, and AgCl, for which van der Waals' forces prevail, condensed to compact layers only.

1393. D'Eustachio, D. **Surface layers on quartz and topaz.** *Phys. Rev.* **70**, 522-8 (1946).—*C.A.* **41**, 1522[b].

X-ray studies of single crystals of quartz and topaz showed that there existed on the surfaces of these crystals disturbed layers that were not removed by etching, and that they exerted an effect on etched surfaces to a depth of 5 μ or more. The disturbance was not caused by plastic flow. Good, single-crystal quartz wafers, 35 μ thick, changed when they were etched to 15 μ. The thin plates no longer appeared to be single-cryst. This "poly-cryst." state was stable at room temp. Thin crystals underwent further changes when flexed. Similar results were observed with topaz.

1394. Gregg, S. J. **An electrical sorption balance.** *J. Chem. Soc.*, July, **1946**, 561-2.—*C.A.* **40**, 6302[3].

A balance suitable for adsorption measurements consisted of a glass beam and sample supports, with steel needle and glass-cup bearings, enclosed in a glass tube vessel which may be evacuated. The construction permitted out-gassing the sample conveniently. The sensitivity was 0.3 mg, independent of the total load, which may be 10-20 g.

1395. Gregg, S. J. and Wintle, M. F. **An automatically recording electrical sorption balance.** *J. Sci. Instruments* **23**, 259-64 (1946).—*C.A.* **41**, 2282*h*.

A continuous plot is made of time vs change in mass of a solid adsorbent. As the mass changes, the balance beam is automatically brought to its null position by alteration of the current flowing through a control solenoid. Photoelectrically operated relays adjust the position of a wiper moving along a potentiometer which is uniformly wound and carries a stabilized voltage. The voltage picked up on the wiper is used to control the balance. The max. mass change which can be recorded is 300 mg, and the sensitivity is given as 1.44 mg per mm. A typical curve for the decompn. of pptd. lead carbonate at 420°C and *in vacuo* is given.

1396. Hintenberger, Heinrich. **The effect of gases especially of traces of oxygen, on the electrical properties of "evaporated" lead sulfide films.** *Z. Naturforsch.* **1**, 13-17 (1946).—*C.A.* **41**, 4987*i*.

Although N_2 and A had no effect on the elec. properties of PbS, air and especially O_2 even in slight traces, had a marked effect. Treatment with O_2 had an effect similar to treatment with S. The first traces of O_2 fitted into vacant positions and could be removed again only at 350°C. This filling in of vacant lattice positions took place in an analogous manner for S and for O^{--}. As a result, the Pb^+ ions in the neighborhood of the vacant S positions were converted into Pb^{++} ions and were no longer available to furnish electrons for excess conduction. At lower temps. (below 150°) the O_2 can become incorporated in the PbS in another manner. Tempering in H_2 increased the cond. of the "over-leaded" films.

1397. Kondrat'eva, H. and Kondrat'ev, V. **Detection and measurement of the concentration of hydrogen atoms in a hydrogen flame.** *Acta Physicochim. U.R.S.S.* **21**, 1-12 (1946).—*C.A.* **40**, 5613^9.

The concn. of H atoms in a H_2 flame can be measured by a thermoelec. method based on the temp. increase of a thermocouple coated with $ZnO.Cr_2O_3$ which catalyzes the recombination of atomic H.

1398. Ruess, G. L. **Binding of water in halloysite.** *Monatsh* **76**, 168-73 (1946).—*C.A.* **41**, 1181^e.

The structure proposed by Hendricks for hydrated halloysite of alternating layers of neutral $[(OH)_4Al_2Si_2O_5]_n$ and $[(H_2O)_2]_n$ was confirmed by x-ray and available water-content studies. The so-called metahalloysite formed at 50°C by the removal of water from hydrated halloysite corresponds to a kaolinite of low-ordered arrangement. Thus, hydrated halloysite can be regarded as the forerunner of kaolinite.

1399. Agliardi, N. **Adsorption of sulfur dioxide and oxygen on silver vanadate catalyst.** *Atti accad. nazl. Lincei, Classe sci. fis., mat. e nat.* **2**, 617-22 (1947).—*C.A.* **42**, 2734*c*.

Ag vanadate is found to adsorb SO_2 at about the same rate as does V_2O_5, while O_2 is adsorbed at a lower rate. The rate of adsorption does not drop with increased amt. adsorbed, as is the case with V_2O_5. Adsorption data alone do not give any clue to the reason for the superiority of Ag vanadate over V_2O_5 in the manuf. of SO_3 and H_2SO_4.

1400. Barrer, R. M. **Molecular-sieve action at low temperatures.** *Nature* **159**, 508 (1947).—*C.A.* **41**, 5772*b*.

Mol.-sieve behavior could be extended considerably by sorbing at −183° to −195°C those gases that had a small energy of activation for diffusion. By using a suitable mol.-sieve sorbent, differences in the sorption rates of O_2, N_2, and A were found which permitted quant. or semiquant. resolution of their mixts. The relative amts. of these gases sorbed by 1 g of dehydrated levynite at −184°C at various times were given.

1401. Bering, B. P. and Serpinskiĭ, V. V. **Adsorption of methanol vapor on barium sulfate.** *Doklady Akad. Nauk S.S.S.R.* **58**, 1061-4 (1947).—*C.A.* **46**, 4318*b*.

The adsorption isotherm at 20°C has S-shape, with apparent unimol. adsorption up to 0.3, followed by multilayer adsorption, with 2nd layer completed at 0.98 and 3rd at 0.99. The isotherm equation is $\log(a/h) = A'a^2 + B = (A/s^2)a^2 + B$, which in this instance gives $A' = 9.88 \times 10^{-4} g^2/\mu M^2$ and $B = -6.16$.

1402. Berthillier, J. **Manufacture of photoelectric cells.** *Electricite* **31**, No. 126, 69-74; *Engrs. Digest, Am. Ed.* **4**, No. 11, 500-3 (1947).—*C.A.* **45**, 4149*d*.

In the prepn. of Cs_2O cathodes, Cs is deposited on the walls of the ampul contg. the cup in which pellets of mixed Cs salts and a reducing metal (Zr, Si, or Al) are heated to 700-800°C by induced eddy currents. The cathode of the Cs_2O cell is Ag (or electrodeposited Cu covered with electrodeposited Ag) with a layer of Ag_2O, plus a layer of Cs_2O, and finally one of Cs. The anode is usually Ni.

1403. Billings, Bruce H. and Hyman, Mark, Jr. **Infrared refractive index and dispersion of evaporated stibnite films.** *J. Optical Soc. Am.* **37**, 119-21 (1947).—*C.A.* **43**, 2062*a*.

The n at 10 μ of evapd. Sb_2S_3 films on AgCl was detd. by comparison of the transmission curves, from 1 to 13 μ, of coated and uncoated AgCl. After making a correction for the adsorption of the Sb_2S_3, detd. by comparison of the max. transmission of the 2 plates, n of Sb_2S_3 was calcd. A second detn. was obtained from a dispersion curve which was extrapolated to 632 mμ, where a single value of n was measured.

1404. Dunn, R. C. and Pomeroy, H. H. **A vapor-phase sorption study of iodine and active magnesium oxide utilizing the McBain-Bakr sorption balance.** *J. Phys. & Colloid Chem.* **51**, 981-4 (1947).—*C.A.* **41**, 6791*d*.

Rapid, irreversible sorption of I_2 vapor occurred on MgO at 82°. MgO had a B.E.T. surface area of 126 ± 10 m2/g. The area calcd. from the flat portion of the I_2 sorption isotherm (a unimol. layer being assumed) was 122 m2/g. The I_2 sorption method is more direct and definitive than sorption from soln. and easier to carry out than low-temp. N_2 sorption.

1405. Gol'danskiĭ, V. I. and Chirkov, N. M. **Multimolecular adsorption on mica.** *Doklady Akad. Nauk S.S.S.R.* **58**, 1065-7 (1947).—*C.A.* **46**, 4317*h*.

Adsorption on mica of vapors of H_2O, EtOH, AcOH, EtOAc, and aq. HCl was studied by the method of residual pressure. EtOAc gave most pronounced adsorption, with layer thickness reaching 3×10^{-6} cm; in descending order were: EtOH, H_2O, AcOH, and 20% aq. HCl. All curves had similar shapes in accord with Polanyi theory.

1406. Jolibois, Pierre and Berges, Marthe. **The preparation of oxides by electrolysis.** *Compt. rend.* **224**, 78-9 (1947).—*C.A.* **41**, 2340*b*.

Dehydration of $Mg(OH)_2$ and $Be(OH)_2$, was followed by continuous weighing with a thermobalance. $Mg(OH)_2$ began to lose water at 340°C and was totally dehydrated at 800°C. For $Be(OH)_2$ the corresponding figures were 230° and 900°C, resp.

1407. Kawai, Heiji. **Effect of humidity on the surface electric resistance of Rochelle salt.** *Proc. Phys. Soc. Japan* **2**, 193-5 (1947).—*C.A.* **44**, 10421*g*.

When Rochelle salt was brought from the dry state (relative humidity less than 60%) into the wet state (more than 70%), or vice versa, the surface elec. resistance of (001) plane varied to some extent until it became const.

1408. Lemmlein, G. G. **Rendering a very fine surface structure on crystals visible by a dew method.** *Doklady Akad. Nauk S.S.S.R.* **58**, 1939-42 (1947).—*C.A.* **44**, 8726*i*.

A step-like or even a spiral secondary structure can frequently be observed on SiC crystals that have grown undisturbed and that have smooth, well formed (0001) faces. The thickness of this layer is about 0.5 μ. Photographs of such a (0001) face made by a "dew method" were obtained by the condensation of water vapor on crystals that had been carefully cleaned with $CHCl_3$ and then slightly cooled or breathed upon. The droplet pictures so obtained were reproducible and indicated a surface structure of the order of magnitude of 10 A.

1409. Powers, T. C. and Brownyard, T. L. **The physical properties of hardened portland cement paste. IV. The thermodynamics of adsorption of water on hardened paste.** *J. Am. Concrete Inst.* **18**, 549-602 (1947).—*C.A.* **41**, 3271*f*.

A discussion is given of the energy changes of adsorption of water in hardened paste and their relations to swelling, capillary flow, and moisture diffusion.

1410. Powers, T. C. and Brownyard, T. L. **The physical properties of hardened portland cement paste. V. Studies of the hardened paste by means of specific-volume measurements.** *J. Am. Concrete Inst.* **18**, 669-712 (1947).—*C.A.* **41**, 3272*g*.

The total H_2O in a satd. specimen of hardened paste is divided into a part with a sp. vol. less than 1.0, termed compressed H_2O and a part with a sp. vol. of 1.0. The mean sp.vol. of the H_2O is calcd. from the vol. of the satd. granular samples and vols. and wts of ingredients.

1411. Schwab, Geo. Maria. **Crystallite orientation in coating films. III. Orientation of silver iodide upon silver bromide.** *Trans. Faraday Soc.* **43**, 715-23 (1947), *Kolloid-Z* **101**, 204 (1942).—*C.A.* **42**, 5294*c*.

"Coating films" were discussed, e.g. AgBr films formed by reaction of (a) Ag surfaces with Br_2 or (b) AgCl surfaces with KBr solns. AgI films formed by exchange coating of AgBr in I^- solns. were examd. by x-rays to obtain their lattice orientation. As long as they did not undergo recrystn. or polymorphous change, they grew upon the lattice of the basic Br^- crystals such that the hexagonal basis (001) coincided with the octahedral plane (111) of the Br^-. Both planes had the same closest hexagonal arrangement of atom and contained ions of one sign only. Because of this, the phenomena differed from the formation of the other Ag halides on each other or on Ag.

1412. Schwob, Yvan. **Thermal dissociation of dolomite. The effect of small amounts of flux.** *Compt. rend.* **224**, 47-9 (1947).—*C.A.* **41**, 2306*d*.

The dolomite structure was stable up to 770°C. Near 780°C it underwent violent nonreversible decompn.: $CaCO_3.MgCO_3 \rightarrow CaCO_3 + MgO + CO_2$, as if it were in unstable equil. above the dissocn. temp. of magnesite (630°C). Near 900°C a second dissocn., reversible, occurred: $CaCO_3 \rightleftharpoons CaO + CO_2$. Addn. of 1 to 5% Na_2CO_3 or K_2CO_3 to the powd. dolomite completely upset the decompn. process. The first reaction then began at about 630°C and is completed before 800°C. The second dissocn. proceeded normally. 1% NaCl or NaF induces fusion without release of CO_2 at about 680°C.

1413. Vonnegut, B. **Nucleation of ice formation by silver iodide.** *J. Applied Phys.* **18**, 593-5 (1947).—*C.A.* **41**, 5360*e*.

AgI particles serve as nuclei for the formation of ice crystals in supercooled water and in water vapor supersatd. with respect to ice, probably because it very closely resembles ice in crystal structure. The dimensions of the unit cell of ice and of AgI are the same to within approx. 1%. The max temp. at which AgI particles serve as nuclei is approx. −4° for particles 1 μ in diam., and −8° for particles 100 A. in diam. Mixts. of I_2 and Ag vapors are also effective in producing ice nuclei.

1414. Aldrich, L. T. and Nier, Alfred O. **Argon 40 in potassium minerals.** *Phys. Rev.* **74**, 876-7 (1948).—*C.A.* **43**, 485*e*.

The isotopic compn. of A from orthoclase, microcline, sylvite, and langbeinite was detd. In each of these K minerals the ratio A^{40}/A^{36} was high compared to that of atms. A; K^{40} decayed to both Ca^{40} and A^{40}.

1415. Barrer, R. M. **Synthesis of a zeolitic mineral with chabazite like sorptive properties.** *J. Chem. Soc.* **1948**, 127-32.—*C.A.* **42**, 4422*i*.

A new group of minerals was synthesized from analcite, leucite, and pptd. aluminosilicates by autoclaving a mixt. of the aluminosilicate, an equal vol. of $BaCl_2$, KCl, or KBr, and H_2O equal to the apparent vol. of the solids in a stainless steel autoclave at 180-220°C for 2-6 days. With $BaCl_2$, the compd. has the compn. corresponding to $(Na_2O, BaO). Al_2O_3.4SiO_2.-xBaCl_2.yH_2O$, with x equal to about 0.66. X-ray diffraction patterns were detd.

1416. Barrer, R. M. and Riley, D. W. **Sorptive and molecular-sieve properties of a new zeolitic mineral.** *J. Chem. Soc.* **1948**, 133-43.—*C.A.* **42**, 4423*c*.

Outgassing of the new synthetic zeolite at 300-360°C for 24 hrs after extn. of $BaCl_2$ yielded a microporous sorbent which retained sorptive properties indefinitely. It did not occlude iso-C_4H_{10} or C_6H_6, sorbed n-C_4H_{10} and C_3H_8 slowly at room temp. by a process of activated adsorption, and sorbed CH_4, C_2H_6, and other small mols. rapidly at all temps. Sepns. of n-C_4H_{10} from iso-C_4H_{10}, iso-C_5H_{12}, C_6H_6, and other mixts. were made at 160°C. Isotherms with O_2, N_2, A, He, Kr, Xe, CH_4, C_2H_6 and NH_3 were detd. from −194° to 300°C. The new xeolite showed a better selectivity at −194°C for the rare gases than did charcoal.

1417. Barrer, R. M. and Woodhead, M. **The mercury-chabazite system.** *Trans. Faraday Soc.* **44**, 1001-7 (1948).—*C.A.* **43**, 7288g.
Sorption of Hg by chabazite up to 400°C under high-vacuum conditions was measured by a modified McBain-Baker silica-spring balance. In the absence of O_2, Hg was not sorbed significantly at room temp. or below and it was suitable as a manometric liquid in studies with chabazite. Max. sorptions possible per 100 g chabazite were: less than 0.1 g at 100°C, 0.8 at 200°C, 1.9 at 250°C, 3.9 at 300°C, 7.0 at 350°C, 11.6 at 400°C, 19.0 at 450°C. The sorption heat was 5800 cal/g atom of Hg, which was less than the initial sorption heat of N_2 and about the same as that of A.

1418. Bering, B. P. and Serpinskiĭ, V. V. **Adsorption of vapors by crystalline adsorbents.** *Zhur. Fiz. Khim. (J. Phys. Chem.)* **22**, 1058-71 (1948).—*C.A.* **43**, 461*f*.
The app. contained 3 adsorbents, *A*, *B*, and *C*. *A* and *B* were birchwood charcoal and were suspended on spring balances of two different sensitivites. They were satd. with the vapor at, e.g., −60°C. *C* was $BaSO_4$ crystals with the most frequent radius of 0.06 μ and the geometrical area of 7 m^2/g. By heating *A* or *B* some vapor was released and then equilibrated with *C*; the vapor remaining in the gas phase was readsorbed by *A* or *B* on cooling, and the amt. adsorbed by *C* was calcd. from the wt of *A* or *B* before and after the expt. Adsorption isotherms on $BaSO_4$ were given for MeOH at 20° and 50°C. They were reversible. Up to the relative pressure $h = 0.5$ they can be represented by the equation $\ln (a/h) = k_1 - k_2a^2$; a was the adsorbed amt., and k_1 and k_2 were consts. At higher h, the adsorption seemed to be multimol. The heat of adsorption calcd. from the temp. coeff. of a was 12,000 to 16,000 cal/mol.

1419. Briner, E.; Pamm, G., and Palliard, H. **The dissociation equilibria of calcium sulfate, potassium sulfate, and sodium sulfate alone or in the presence of additional compounds.** *Helv. Chim. Acta* **31**, 2220-35 (1948).—*C.A.* **43**, 2493*i*.
In the presence of SiO_2 or metakaolin, Na_2SO_4 melted before the dissocn. pressure was large enough to be measured with precision. The results with $CaSO_4$ alone agreed reasonably well with the values calcd. thermodynamically, but those with addn. of SiO_2 did not agree, presumably because of the formation of polysilicates. Kaolin markedly increased the dissocn. pressures of $CaSO_4$ and K_2SO_4 because of its decompn. to SiO_2 and Al_2O_3.

1420. Cole, James W.; Salsbury, Melvin, and Yoe, John H. **Photoelectric detection and estimation of carbon monoxide with granules coated with palladous silicomolybdate.** *Anal. Chim. Acta* **2**, 115-26 (1948).—*C.A.* **42**, 8710*d*.
The continuous detection of CO in air was based on the color change from yellow to green and blue of translucent granules of silica gel coated with $Pd_4[Si(Mo_2O_7)_6]$. Measurements were made of the decrease in photoelec. current when the incident light touched the treated gel during the passage of air contg. CO. The scale of the instrument was calibrated in terms of the vol. % of CO. Concns. down to about 0.001% can be estd. with an accuracy within about 10% in 1 min.

1421. Crawford, V. A. and Tompkins, F. C. **Adsorption of gases sulfur dioxide, ammonia, carbon dioxide, and nitrous oxide on barium fluoride crystals.** *Trans. Faraday Soc.* **44**, 698-708 (1948).—*C.A.* **43**, 2485*b*.
The adsorption between −78 and 119°C was reversible and complete within 5 min. of gas admission. The B.E.T. plots were linear except at low pressures where departures were anticipated. The vol. adsorbed tended to be too small at high pressure, in keeping with the decrease in the heat of adsorption. The latter were detd. by use of the Clausius-Clapeyron and the B.E.T. equations.

1422. Dilke, M. H.; Eley, D. D., and Maxted, E. B. **Catalytic poisons and magnetic susceptibility.** *Nature* **161**, 804 (1948).—*C.A.* **42**, 6184*h*.
The change in magnetic susceptibility of Pd due to adsorption of Me_2S (a catalytic poison) were detd. to study the nature of the adsorption link. Only the chemisorbed layer affected the susceptibility. A chemisorbed mol. transferred an electron to a vacant surface *d* orbital, and thus the susceptibility of the surface Pd atoms was reduced to zero.

1423. Fok, N. V.; Gol'danskiĭ, V. I., and Chirkov, N. M. **Adsorption of water vapor and of aqueous solutions of hydrogen chloride on mica.** *Doklady Akad. Nauk S.S.S.R.* **61**, 673-6 (1948).—*C.A.* **43**, 462*g*.
The adsorptive capacity of muscovite (2.1 m^2) was improved considerably by preliminary adsorption of HCl (from HCl + H_2O vapor), resulting in a strongly adherent film of 2.5×10^{15} mols. HCl/cm^2. Adsorption of H_2O on this film gave a typical Langmuir curve with a level portion extending from $p/p_s = 0.02$ to 0.1. Above $p/p_s > 0.1$, the adsorbed films were multimol., the adsorption isotherms rising very nearly exponentially. Adsorption of H_2O from HCl + H_2O, and its adsorption from pure H_2O, but on a surface with an adsorbed monolayer of HCl, involved marked hysteresis; it was absent in adsorption from pure H_2O on a HCl-free surface.

1424. Gray, T. J. **Application of measurements of semiconductivity to heterogeneous reactions.** *Nature* **162**, 260-1 (1948).—*C.A.* **43**, 474*h*.
The effect of adsorption of O_2, N_2, H_2, and CO on the resistance of semiconducting films composed of Cu_2O-CuO were studied. O_2 and N_2 decreased the resistance, whereas H_2 and CO increased the resistance of the film on adsorption. On desorption the films treated with O_2, N_2, H_2, returned to their initial value, whereas that for CO did not.

1425. Gruner, E. **The osmotic and zeolitic binding of the volatile phase.** *Kolloid-Z.* **111**, 31-46 (1948).—*C.A.* **43**, 4537*a*.
Water may be held in the solid phase by chem. binding, sorption, capillary binding, or osmotic-zeolitic binding. Osmotically-bound H_2O was not in any sense chemically bound. The vapor pressure

on thermal decompn. followed Raoult's law. Zeolitically-bound H_2O was wholly or partly chemically bound or affected by the solid phase. The systems studied were: H_2O and zeolite, S and ultramarines, NH_3 and zeolites, CO_2 and limestones, and SO_2 and zeolites.

1426. Gyulai, Z. **Crystal growth processes.** *Z. Physik* **125**, 1-17 (1948).—*C.A.* **43**, 8787*g*.

The various forms in which NaCl crystals grow from the vapor phase are described and illustrated by photographs. In some cases there is evidence of surface diffusion.

1427. Harris, Louis; McGinnies, Rosemary T., and Siegel, Benjamin M. **The preparation and optical properties of gold black.** *J. Optical Soc. Am.* **38**, 582-9 (1948).—*C.A.* 42, 6603*i*.

The optical properties of gold smokes deposited on cellulose nitrate films under different exptl. conditions were studied. The conditions of pressure of the inert atm., purity of the gas, rate of evapn., and the distance between source and deposition surface giving the highest infrared absorption per unit mass were found. The thermal mass required for high infrared absorption was small compared with the thermal masses of other receivers used for infrared measurements. The gold "blacks" turned yellow and had lower infrared absorption when heated above 110°C.

1428. Huttig, Gustav F. and Heinz, Helga. **The rate of decomposition of calcium carbonate and the effect of foreign gases on it.** *Z. anorg. Chem.* **255**, 223-37 (1948).—*C.A.* **43**, 2078*e*.

Decompn. of $CaCO_3$ depended on the rate of heating, and hence varied with the size of the sample and the size and rate of rotation of the oven. Decompn. was slowest in a vacuum. In the presence of He, A, N_2, air or CO_2 the evolution increased inversely with the mol. wt of the gas. H_2 had a much greater effect, probably because of catalytic action. NH_3 and H_2O also strongly increased the decompn. rate, and here also a chem. action probably occurred. Mixts of NH_3 and H_2O had less effect than the pure gases.

1429. Katz, Morris and Katzman, John. **Rapid determination of low concentrations of carbon monoxide in air.** *Can. J. Research* **26F**, 318-30 (1948).—*C.A.* **43**, 1686*e*.

Granular $AgMnO_4$ deposited on ZnO carrier was effective for the oxidation of CO at room temps. Results accurate to 5 p.p.m., in the range of 10-200 p.p.m., have been obtained. The heat of the reaction was detd. by means of the potential generated in a thermocouple cell. A linear relationship between concn. and e.m.f. was found to exist. The presence of H_2 in excess of the CO content, caused no appreciable error.

1430. Khan, G. A. **Adsorption of air on minerals.** *Gornyi Zhur.* **122**, No. 9, 34-7 (1948).—*C.A.* **43**, 3325*f*.

The conditions necessary for an air bubble to form on the surface of a mineral particle were $W = 2\pi\sigma(2R^2 - p^2)$ where W was the energy spent to form the bubble, σ was the surface tension at the liquid gas interface, R was the radius of the bubble, and p was the radius of curvature of the contour of bubble adhesion. Sulfidic minerals prepd. by dry method or prepd. by wet method and subsequently dried adhered strongly to air bubbles. The same minerals left wet after prepn. did not adhere to bubbles unless a surface-active substance (collector) was added.

1431. Morrison, J. A. and Szasz, G. J. **The heat capacity of nitrogen adsorbed on titanium dioxide between 20°K and 80°K.** *J. Chem. Phys.* **16**, 280-6 (1948).—*C.A.* **42**, 4041*f*.

A low-temp. adiabatic calorimeter suitable for thermal measurements on adsorbed gases was described. Heat-capacity values for 0.00996 and 0.01974 mole N_2 adsorbed on 96.8 g TiO_2 (rutile) were presented. Although the measurements were complicated by the appearance of warm drifts in the calorimeter over part of the temp. range when N_2 was present, at these concns. and temps. the adsorbate was present as a condensed phase.

1432. Plyler, Earle K. and Ball, Joseph, J. **Infrared absorption of deposited blacks.** *J. Optical Soc. Am.* **38**, 988 (1948).—*C.A.* **43**, 944*b*.

Infrared-absorption measurements of gold blacks recently reported to 15 μ have been extended to 39 μ with films deposited on windows of thallium bromide-iodide. Transmission curves of carbon, bismuth, zinc, and gold blacks from 1 to 39 μ show that (unlike carbon, bismuth and zinc blacks) gold blacks do not change appreciably in transmission throughout this range of spectrum.

1433. Stranski, I. N. and Moliere, K. **Structural deviations in the surface of ionic crystals.** *Z. Physik* **124**, 421-8, 429-40 (1948).—*C.A.* **43**, 4072*d*.

The surface of a NaCl crystal was discussed in terms of an incipient formation of NaCl mols. with crevices between them. The effect of these crevices on the tensile strength and rate of flow of the crystal was considered. Partial soln. of a crystal increased the tensile strength by rounding off the cube corners and removing the crevices. If the mean ionic polarizability was above a certain value (approx. that of NaCl) the tangentially distorted form of the surface was favored.

1434. Voevodskii, V. V. and Lavrovskaya, G. K. **Recombination of atoms on solid surfaces.** *Doklady Akad. Nauk S.S.S.R.* **63**, 151-4 (1948).—*C.A.* **43**, 1635*d*.

Recombination of O atoms produced in a discharge under 300 v., 350 milliamp., and detd. by the rise of the temp. on the wall of a side capillary connected with the discharge tube, proved to be weak on glass and quartz, covered or not with KCl, LiCl, or $K_2B_4O_7$, fairly intense on surfaces coated with sputtered Pt, $ZnO.Cr_2O_3$, or $AgNO_3$.

1435. Zawadzki, J. and Szamborska, W. **Kinetics of the decomposition of zinc carbonate.** *Bull. intern. acad. polon. sci., Classe sci. math. nat., Ser. A*, **1940-46**, 27-31 (1948) (in English).—*C.A.* **43**, 7306*d*.

The decompn. in vacuum of $ZnCO_3$ into ZnO and CO_2 was detd. Between 400° and 420°C a noticeable speeding-up of decompn. and the appearance of 2 velocity max. were observed. Similar effects were absent at 440°C. ZnO bound on the surface a part of the CO_2 from the decompn. of $ZnCO_3$, and the velocity of this tendency increased with increased temp. At 440°C this tendency predominated; at lower temp. it did not. Decompn. was not complete in any of the expts., and never exceeded 91%. X-ray analyses indicated no $ZnCO_3$ above 90% decompn., but only ZnO and adsorbed CO_2. Below 90% decompn. $ZnCO_3$ was present.

1436. Zawadzki, J. and Bretsznajder, S. **Kinetics of reaction in which solid phases take part.** *Bull. intern. acad. polon. sci., Classe sci. math. nat., Ser. A*, **1940-46**, 60-4 (1948) (in English).—*C.A.* **43**, 7307*f*.

The decompn. of $CaCO_3$ in vacuum and in the presence of CO_2 was studied to det. the velocity of decompn. of crystals of the same size and compn. Numerous difficulties were encountered and the results were erratic. Likewise, a study of the system $4CaSO_3 \rightleftharpoons CaS + 3CaSO_4$ showed that the transformation was accompanied by increasing mobility of the structural elements, which almost reached the passage through the liquid phase. At 500° and several months no $CaSO_3$ resulted from CaS and $CaSO_4$.

1437. Arnold, James R. **Adsorption of gas mixtures. Nitrogen-oxygen on anatase.** *J. Am. Chem. Soc.* **71**, 104-10 (1949).—*C.A.* **43**, 3263*h*.

Adsorption isotherms at const. gas compn. were detd. at 78.2°K, for five N_2-O_2 mixts. on Harkins' anatase. Isotherms for the two pure gases were also detd. The isotherms showed selective adsorption of N_2 by this surface at low coverage. There was evidence against at least one of the assumptions of the B.E.T. theory. Use of a "liquid entropy" model gave semiquant. agreement with expt.

1438. Badger, E. H. M.; Griffith, R. H., and Newling, W. B. S. **The catalytic decomposition of simple heterocyclic compounds. I. Preparation and properties of molybdenum sulfide and nickel sulfide catalysts.** *Proc. Roy. Soc.* (London) **A197**, 184-93 (1949).—*C.A.* **44**, 2357*e*.

The decompn. of thiophene, furan, and pyrrole on MoS_2 catalysts occurred by 2-point adsorption, which lead to a half-hydrogenated state from which the hetero-atom was then broken off. Retardation was caused by mols. also capable of giving 2-point adsorption. These changes arose from any reactant that could compete for Ni atoms, or that could cover the subsulfide surface and prevent its conversion to metal.

1439. Barrer, R. M. **Preparation of some crystalline hydrogen zeolites.** *Nature* **164**, 112-13 (1949).—*C.A.* **43**, 9296*e*.

Cryst. H-zeolites were made by heating the corresponding NH_4 zeolites in O_2. H-mordenite and H-chabazite were excellent sorbents and gave x-ray powder photographs characteristic of the parent minerals. Propane was sorbed more rapidly by H-chabazite than by natural chabazite. Propane was excluded by natural mordenite, and was occluded, though slowly, by H-mordenite.

1440. Bischoff, F. **Catalytic effects through gas phases in calcining gypsum, limestone, and magnesite.** *Radex-Rundschau* **1949**, 8-13.—*C.A.* **43**, 8621*i*.

Air and O_2 influence the equil. in mixts of $CaSO_4$ and SiO_2 markedly, while N_2 and A are completely inert. Water vapor acts with increasing partial pressure, catalytically promoting the reaction. The thermal dissocn. of $CaCO_3$ is particularly promoted by H_2, H_2O, NH_3, and N_2O. The decompn. of magnesite is promoted not only by H_2O and NH_3, but also to a very high degree by moisture in the atm.

1441. Boissonnas, Charles G. **Latent images on the surface of a macro-crystal of silver bromide.** *Science et. inds. phot.* **20**, 361-3 (1949).—*C.A.* **44**, 57*f*.

Molten AgBr was crystd. under red light and cut into disks 2-3 cm in diameter and few mm thick. Development in an alk. hydroquinone soln., sometimes contg. Na_2SO_3, was observed under the microscope. Ag grains appeared on the polished surface of unexposed AgBr a few sec after contact with the developer. If the AgBr was exposed to a pencil of white light, an image of the pencil developed. If polished AgBr was used, the Ag grains were much less numerous in the exposed than in the unexposed regions. If the AgBr surface had been roughened with emery it behaved like a photographic emulsion and a negative was obtained on development.

1442. Briner, E.; Pamm, G., and Paillard, H. **The velocity of thermal dissociation of the sulfates of calcium, potassium, and sodium in the presence of added materials reaction strongly accelerated by water vapor.** *Helv. Chim. Acta* **32**, 635-46 (1949)((in French).—*C.A.* **43**, 6895*g*.

The reaction, $CaSO_4 \rightleftharpoons CaO + SO_2 + 1/2\ O_2$, was studied from 400° to 900°C in pure N_2, H_2O, and N_2-H_2 mixts. The accelerating actions of metakaolin ($2SiO_2.Al_2O_3$), SiO_2, and 3 types of bauxite were investigated. In all cases the addn. of H_2O vapor, metakaolin, SiO_2, or bauxite increased the percentage reacted and the rate of the reaction.

1443. Chufarov, G. I. and Averbukh, B. D. **Oxidation of iron sulfide by oxygen.** *Zhur. Obshchei Khim. (J. Gen. Chem.)* **19**, 857-62 (1949).—*C.A.* **43**, 7854*g*.

FeS (area about 0.1 m^2/g) was oxidized by dry O_2 at 50° or 100°C and at initial pressure of 0.1 mm. Under these conditions, the reaction stopped very soon. Up to 250°C, the oxidation took place without evolution of gas; consequently, the product was $FeSO_4$. The early stoppage of the reaction was due to the dense structure of this product. If the oxidized sample was heated to 600°C or higher, the $FeSO_4$ was partly dissocd. to a less dense oxide, and the sample became susceptible to renewed low-temp. oxidation.

1444. Clark, L. M. **The effect of gases on the sintering of lime.** *Rec. trav. chim.* **68**, 969-82 (1949).—*C.A.* **44**, 3221*d*.

Rates of sintering of lime at 1000°-1250°C were detd. from the decrease in surface area as measured by adsorption of the dye hydroxyazobenzene-2-carboxylic acid (0.08 g in 20 ml of 98% $CHCl_3$-2% alc. for 0.5 g sample). When lime was heated in vacuo or in A, rates of loss of surface were the same. Rates increased with N_2, O_2, or air, H_2O vapor, CO_2, and SO_2 atms. and in this order.

1445. Cremer, E. and Gatt, F. **The position of the equilibrium $MgCO_3 \rightleftharpoons MgO + CO_2$ at different firing temperatures.** *Radex Rundschau* **4**, 144-9 (1949).—*C.A.* **44**, 3339*d*.

The entropy and enthalpy values were calcd. for the 3 components and the equil. for the range 300-1200°K also detd. at 100° intervals. The theoretical temp. of dissocn. at a CO_2 pressure of 1 atm. was 350°C. However, calcns. showed that equil. was reached very slowly, and could not be attained in expts.

1446. Cremer, E. and Gatt, F. **Kinetics of the thermal decomposition of magnesite.** *Radex Rundschau* **4**, 257-61 (1949).—*C.A.* **44**, 4317*i*.

Expts. were made at various temps. on natural $MgCO_3$ with grain sizes from 0.75 to 0.01 mm. Although the surface area calcd. on the basis of grain size varied greatly, no difference in the speed of decompn. in excess of exptl. error was apparent. The process detg. the velocity was a diffusion process that takes place in the primary particles, the size of which was assumed to be about 10^{-5} cm. The dependence on temp. of the diffusion const. corresponded to a diffusion heat $Q = 50$ kcal., and a proportionality factor $A = 10^{-3}$ cm² per sec.

1447. Croatto, Ugo. **Chemical manometers.** *Ricerca sci.* **19**, 1160-3 (1949).—*C.A.* **45**, 6435*b*.

Chem. systems in equil. with a gas have been studied as chem. manometers. The systems CdO_x, CoO_x, and Ag_2S_x at 600-500°, 1000-950°, and 400-350°C, resp., were studied for gas pressures of 2-760 mm, 10^{-7}-10 mm O_2, and 10^{-6}-5 mm S, resp. The materials were prepd. in small cylinders with Pt contacts, and the elec. cond. was measured at various gas pressures. All 3 gave good reproducibility and constancy with time at a fixed temp.

1448. Dell, H. A. **The physical properties of thin films used in the reduction of surface reflection.** *Proc. Phys. Soc.* (London) **62B**, 81-93 (1949).—*C.A.* **44**, 893*g*.

Evidence is given suggesting that polished or aged cryolite films behave as if they consisted of a lower stratum of cryolite surmounted by a secondary layer of higher n. Some of the properties of this layer are described. The self-stripped specimens suggest that the high-index layer may sometimes penetrate some distance into the original cryolite film.

1449. Duval, Clément. **Pyrolysis of asbestos.** *Anal. Chim. Acta* **3**, 163-4 (1949 in French).—*C.A.* **43**, 8310*b*.

The asbestos in a Gooch crucible loses wt gradually above 283°C, when studied by means of a thermobalance. Accordingly, it should only be used below this temp.

1450. Esin, O. A.; Gel'd, P. V., and Popel, S. I. **Redistribution of ions in the thermal dissociation of double salts.** *Zhur. Priklad. Khim.* (J. Applied Chem.) **22**, 354-60 (1949).—*C.A.* **43**, 7306*g*.

The initial process is the dissocn. of $CO_3^{--} \rightarrow CO_2 + O^{--}$, at the surface which results in a loosening of the lattice. Decompn. is easier where CO_3^{--} is surrounded by Mg^{++} than in the neighborhood of the larger Ca^{++}. The rates of decompn. increase in the order dolomite, $MgCO_3$, $CaCO_3$ since the diffusion of ions that follows the decompn. of CO_3^{--} is easier the higher the temp. The accelerating effect of NaCl consists in the redistribution of Mg^{++}, Ca^{++}, O^{--}, and CO_3^{--} ions. $NaNO_3$, NaF, KCl, $Na_2C_2O_4$, and to a lesser degree Na_2CO_3, have an effect similar to that of NaCl.

1451. Frenkel, Ya. I. **Diffusion and spontaneous diffusion in substances that are complicated chemically.** *Zhur. Eksptl. Teoret. Fiz.* **19**, 814-18 (1949).—*C.A.* **46**, 10758*d*.

Beginning with considerations of the mechanism of diffusion into NaCl crystals on the basis of the pore theory, the considerations of diffusion without essential heat exchange are extended to more complicated binary systems and to polymers.

1452. Furst, Otto; Glocker, Richard, and Richter, Hans. **The atomic arrangement in amorphous germanium.** *Z. Naturforsch.* **4a**, 540-2 (1949).—*C.A.* **44**, 4745*b*.

Evapd. films of Ge were built up on a rock-salt surface, and monochromatized x-rays of 1.54 A. wave length were used to det. the angular dependence of scattering intensity. There were 4 atoms at a distance of 2.40 A. and 12 at 3.95 A. Tetrahedra of atoms could be arranged so that the atom at the peak of one tetrahedron was at the center of the next. These tetrahedra were free to turn relatively to one another, with the result that long-range order was destroyed, but short-range order was preserved.

1453. Giauque, W. F. **An example of the difficulty in obtaining equilibrium corresponding to a macrocrystalline nonvolatile phase in the reaction.** *J. Am. Chem. Soc.* **71**, 3192-4 (1949).—*C.A.* **43**, 8823*a*.

It was shown that the true dissocn. pressure in the reaction $Mg\text{-}(OH)_2$ (cryst.) = MgO (cryst.) + H_2O (g), as detd. from the 3rd law of thermodynamics, was some 130% higher than accurately measured values which were reproducible to 0.1%. This result was attributed to the colloidal nature of the MgO produced under equil. conditions. The colloidal particles approached essentially zero entropy at very low temp. and evidently approximated a perfect cryst. structure. Many equil. measurements involving gases and finely divided dry solid phases, produced by the evolution of gases, or formed by reaction with gases, did not correspond to the properties of macroscopic materials.

1454. Gray, T. J. **The application of semi-conductivity measurements in the study of catalysis on copper oxide.** *Proc. Roy. Soc.* **A197**, 314-20 (1949).—*C.A.* **44**, 2355*f*.

An app. was constructed to measure the elec. cond. of thin films of oxides. Semi-cond. of the Cu_2O-CuO system was used to obtain a qual. picture of the processes of adsorption and catalytic reaction while these processes were being quant. followed by alternative methods.

1455. Gregg, S. J. and Razouk, R. I. **The kinetics of the thermal decomposition of magnesium hydroxide.** *J. Chem. Soc.* **1949**, S36-44.—*C.A.* **43**, 8816*c*.

The dehydration of pptd. $Mg(OH)_2$ and naturally occurring brucite was studied between 300° and 370°C in a vacuum. The decompn. curves were of the usual sigmoid type. The reaction came practically to a standstill at some 3-5% short of complete dehydration, and it was necessary to heat to 500°C for a short time to expel the last traces of H_2O. The rate of dehydration of brucite was not generally affected by its state of subdivision, and at a given temp. was of the same order as for the pptd. $Mg(OH)_2$.

1456. HARRIS, B. L. **Surface area of vermiculite.** *J. Am. Chem. Soc.* **71**, 353 (1949).--*C.A.* **43**, 4826*i*.

The B.E.T. surface area of unexfoliated vermiculite was found to be 0.52 m^2/g. Exfoliation by 5 min. exposure at 950°C increased the area to 10.35 m^2/g. The loss in weight on exfoliation was 19.6%. The area changes corroborated previous observations that the structure collapses above 750°C.

1457. HEILAND, GERHARD AND KELTING, HEINKE. **Absorption of light by potassium chloride crystals with excess potassium and added calcium chloride.** *Z. Physik* **126**, 689-96 (1949).--*C.A.* **44**, 2817*a*.

KCl crystals contg. Ca ions were grown from melts, heated in the presence of K vapor, tempered at elevated temps. until the absorption spectrum was const., and rapidly cooled to room temp. These crystals had a red color produced by a broad absorption band with a max. at 540 mμ. This band was not changed by lowering the temp. to -183°C. Holding the crystals at 500-600°C developed the band due to F centers at 563 mμ at the expense of the Ca band.

1458. HOPKINS, D. W. **A reaction between solids: the formation of zinc ferrite from zinc oxide and ferric oxide.** *J. Electrochem. Soc.* **96**, 195-203 (1949).--*C.A.* **43**, 8933*h*.

The formation of Zn ferrite from a stoichiometric mixt. of ZnO and Fe_2O_3 was investigated from 600 to 1150°C. There was a sharp decrease in the reactivity of the ferric oxide if the temp. of prepn. exceeded about 675°C. The reaction was controlled by the diffusion of Fe_2O_3 through the ferrite layer. The activation energies for the low-and high-temp. Fe_2O_3 were 110,000 and 57,000 cal/mole, resp.

1459. INGRAM, G. **The use of silver vanadates as absorbents for sulfur dioxide.** *Anal. Cnim. Acta* **3**, 137-43 (1949) (in English).—*C.A.* **43**, 8308*g*.

A new solid absorbent for SO_2 was described, which was effective at room temp., and which did not absorb CO_2. Exhaustion of the material was indicated by a color change from green to brown. The reagent was made by heating mol. quantities of Ag_2O and $AgVO_3$ together at 150°C. The product had the same empirical compn. as orthovanadate, but very different properties from that produced by the usual pptn. method.

1460. JAMES, HUBERT M. **Conduction in photoconductive lead sulfide films.** *Science* **110**, 254-6 (1949).--*C.A.* **43**, 8848*e*.

Photoconductive PbS films with Pb and O impurities lead to n- and p-type semiconductors, resp. High photosensitivity of PbS films might result from closely-balanced fairly-high contents of n- and p-impurity atoms in homogeneous films about 1μ thick. The required potential fluctuations in the film arise from the random impurity distribution.

1461. JURA, GEORGE. **Thermodynamic properties of the surface of magnesium oxide.** *J. Chem. Phys.* **17**, 1335 (1949).—*C.A.* **44**, 4749*e*.

From a comparison of published values for the heat capacity of large crystals of MgO and a very fine cryst. prepn. (50 m^2/g), an approximation of the surface thermodynamic properties was made. These included the free surface energy, entropy, and total surface energy.

1462. KALLWEIT, HERBERT. **Mix crystals of calcium carbonate-strontium carbonate studied by the "emanation" method.** *Z. Naturforsch.* **4a**, 140-9 (1949) (in German).--*C.A.* **43**, 8271*f*.

Mix crystals of $CaCO_3$-$SrCO_3$ in varying proportions were mixed with small amt. of Th X nitrate. The crystals were heated at a rate of 10-12° per min. to temps. of 1300°C. A stream of CO_2 over the crystals gave an electroscope reading proportional to the amt. of emanation. Maxima in the curves as a function of temp. corresponded to changes in the crystal structure. The temp. of the rhombic-hexagonal transition was a linear function of compn. of the crystal. The rhombic-hexagonal transition for mixts. ranging from pure $CaCO_3$ to 50% $CaCO_3$, 50% $SrCO_3$ was not reversible but mixts. from pure $SrCO_3$ to 30% $CaCO_3$, 70% $SrCO_3$ were reversible.

1463. KEENAN, A. G. AND HOLMES, J. M. **The adsorption of nitrogen, argon, and oxygen on potassium cloride at 78-90°K.** *J. Phys. & Colloid Chem.* **53**, 1309-20 (1949).—*C.A.* **44**, 4747*c*.

The adsorption of N_2, A, and O_2 on KCl (area about 3 m^2/g) was measured between 78 and 90°K at relative pressures between 0.01 to 0.9. The B.E.T. surface-area values calcd. from the N_2 isotherms were about 25% smaller than those calcd. from the isotherms for A and O_2. Plots yielded smooth curves for O_2 and A and 2 straight lines intersecting at about 0.25 relative pressure for N_2.

1464. KELTING, HEINKE AND WITT, HORST. **Potassium chloride crystals with additions of alkaline earth chlorides.** *Z. Physik* **126**, 697-710 (1949).—*C.A.* **44**, 2817*c*.

As the crystal grows from the melt, successive layers had increasing concns. of bivalent ions and the slower the growth the higher the concn. Concns. in the crystal decreased in the order Sr, Ba, Ca for equal rates of growth and concns. in the melt. Although the bound alk. earth ions had zero mobility in an elec. field they caused an addnl. sp cond. in the crystal that was approx. proportional to their concn. and independent of the chem. species.

1465. KOSKI, W. S. **Diffusion of oxygen in potassium chloride.** *J. Chem. Phys.* **17**, 582 (1949).—*C.A.* **43**, 8863*f*.

By bombarding KCl with slow neutrons, S is formed. If appropriate care is taken to exclude oxidizing agents the bulk of the S^{35} is in the form of either elementary sulfur or more probably sulfide ion. Radio-sulfur is thus randomly distributed through the KCl crystal. If O_2 is permitted to diffuse into such a crystal the sulfide ions will be oxidized to SO_3. The position of the oxidation boundary in any one crystal can be detd. by permitting the crystal to dissolve slowly in an appropriate solvent, and analyzing the resulting soln. for sulfide and sulfate activity from time to time.

1466. LOCKEMANN, GEORG. **Formation of basic calcium carbonate by ignition of the carbonate.** *Z. anal. Chem.* **129**, 213-17 (1949).—*C.A.* **44**, 74*e*.

When a dried CaC_2O_4 ppt. is heated in a porcelain crucible which is inside a somewhat larger one, a basic carbonate is obtained which corresponds almost exactly to the formula $CaO.CaCO_3$. $CaCO_3$ is stable up to 600°C but the basic carbonate is stable at 700°C.

1467. LONGUET-ESCARD, J. **Reaction in the solid state at low temperatures, in the presence of water.** *Bull. soc. chim. France* **1949**, D153-6.—*C.A.* **43**, 6531*f*.

The formation of ferrites, chromites, sulfides, silicates, and aluminates was studied between room temp. and 100°C in the presence of H_2O. Several of the products formed were similar to those found in nature, notably franklinite, chalcopyrite, and antigorites. The hydroxides of Ni, Co, Zn, and Mg crystallized in the hexagonal system, type CdI_2.

1468. MAXTED, E. B. **The nature of chemisorptive bonds. I. Some observed regularities.** *J. Chem. Soc.* **1949**, 1987-91.—*C.A.* **44**, 3777*g*.

Deficiencies in the d-bond of the metal play a crit. part in hydrogenation catalysis and adsorption. Three types of strongly-held adsorbates are discussed as to toxicity: (a) nonmetals of Groups Vb and VIb: S, P, or N compds., which have free electron pairs in the valency shell. (b) Metallic ions: The adsorption complex probably resembles an intermetallic compd. (c) Compds. with unsatd. bonds.

1469. REISS, HOWARD. **An approximate solution of certain diffusion problems.** *Trans. N. Y. Acad. Sci.* **11**, 236-9 (1949).—*C.A.* **44**, 2823*e*.

The method is used to investigate problems of the growth of aerosols and of S-hydrosols. In a napthalene-like aerosol system, growing by the diffusion of vapor toward sinks which cannot support supersatn., spontaneous nucleation will not occur if the no. d. of nuclei exceeds 100 per cc. The growth of S-hydrosols can be explained on the basis of a simple diffusion mechanism.

1470. SCHULZ, L. G. **Structure and growth of evaporation lithium fluoride and sodium chloride films on amorphous substrates.** *J. Chem. Phys.* **17**, 1153-62 (1949).—*C.A.* **44**, 2317*c*.

Thin films of LiF and NaCl were prepd. by evapn. in a vacuum. On amorphous substrates the films possessed a crystal orientation that varied with the film thickness. For both LiF and NaCl deposits thinner than 100 A. showed almost completely random structure, but with a small amt. of (100) preferred orientation. As the thickness was increased, there was a change, first to completely random, and then to a very definite and strong preferred orientation which was (111) for LiF and (110) for NaCl. A less extensive study of five other substances showed the following orientation: CaF_2 (111); KCl (110); MgF_2 (302); NaBr and KBr random or a vague (211).

1471. SCHWOB, YVAN. **The simple and complex rhombohedral carbonates of calcium, magnesium, and iron. Their thermal dissociation.** *Rev. Materiaux construction trav. publ., Ed. C.* No. **411**, 409-20 (1949).—*C.A.* **44**, 3339*f*.

The dissocn. and recarbonation of $CaCO_3$ from various sources was detd., the rate of heating being 5° per min. The thermal-analysis curves showed that thermal dissocn. took place around 900°C and that recarbonation started at 880°C, but that recarbonation was not complete under the conditions of the expt. The decarbonated CaO particles had the same dimensions as the original calcite crystals, but they were completely isotropic. Calcite, pptd. $CaCO_3$, chalk, and marble showed decreasing degrees of recarbonation in the order listed. The addn. of water vapor to the CO_2 increased the extent of recarbonation; also, increasing the rate of flow increased recarbonation.

1472. SELWOOD, P. W.; MOORE, T. E.; ELLIS, MARYLINN, AND WEITHINGTON, KATHRYN. **Supported oxides of manganese.** *J. Am. Chem. Soc.* **71**, 693-7 (1949).—*C.A.* **43**, 5654*b*.

The susceptibility isotherm method was extended to supported oxides of Mn. It was found that supported transition group oxides may imitate the crystal structure of the support even to the extent of changing oxidation state.

1473. SHUTTLEWORTH, R. **The surface energies of inert-gas and ionic crystals.** *Proc. Phys. Soc.* (London) **62A**, 167-79 (1949).—*C.A.* **44**, 894*f*.

The surface energies of inert-gas crystals were proportional to their sublimation energies. The const. of proportionality was evaluated for the (111), (100), and (110) faces for different assumed forms of the interat. repulsive forces. To within 15% it was independent of the face, and of the form of the repulsive force. The contribution of van der Waals-type forces to the surface energy of a (100) face was almost half the total. Elementary methods were given for the evaluation of lattice sums. Contributions of electrostatic, dipole-dipole, dipole-quadrupole, and repulsive forces to energies were calcd.

1474. SPANGENBERG, K. **New measurements of the vapor pressures and decomposition temperatures of alums.** *Neues Jahrb. Mineral., Geol., Monatsh.* **1949A**, 113-38.—*C.A.* **43**, 8785*h*.

Vapor-pressure measurements at 5 to 70°C were given for 41 alums, and detns. of temps. of sintering and melting for 43 alums, $A^IB^{III}(XO_4)_2.12H_2O$ The vapor pressures of the alums of Tl, NH_3Me, and NH_3OH were higher than would be expected from the ionic radii, which was ascribed to the non-noble gas character of the ions. For alums with the same A^I, the vapor pressures increased in the order Al, Cr, V, Fe, Co.

1475. SPANGENBERG, K. **The binding of water in the alums.** *Neues Jahrb. Mineral., Geol., Monatsh.* **1949A**, 99-112.—*C.A.* **43**, 8936*g*.

The measurements of vapor pressure and decompn. temp. are not in accord with the assumption that 6 H_2O are coordinated with A^I and 6 H_2O with B^{III}, nor are the distances calcd. for neighboring atoms in good agreement with theory. A structure is proposed in which all the H_2O is coordinated in double mols. around B^{III}, these mols. forming zigzag chains along the (110) direction. In this structure, the size and nature of the B^{III} ion has the greatest effect on the vapor pressure and stability.

1476. Spooner, Robert B. and Selwood, P. W. **Nuclear induction and the structure of catalytically active solids.** *J. Am. Chem. Soc.* **71**, 2184-7 (1949).—*C.A.* **43**, 8831*i*.
The chief application is the promise of making *in situ* observations while the catalyst is promoting a chem. reaction. Relaxation times for Fe and Nd oxides, each supported on γ-alumina, and for MnO_2 on rutile, detd. *in situ*, are in agreement with theory.

1477. Stranski, I. N. and Wolff, G. **The forced condensation of arsenic oxide. A theory for the rate of vaporization from crystals.** *Z. Elektrochem.* **53**, 1-4 (1949).—*C.A.* **43**, 5250*b*.
A theoretical discussion of the vaporization and condensation of As oxides.

1478. Walker, G. F. **Water layers in vermiculite.** *Nature* **163**, 726-7 (1949).—*C.A.* **43**, 6949*d*.
A powd. specimen and single flake of vermiculite were heated at 110°C and sealed in a thin glass tube. The basal reflection of this material was 11.8 A. as against 14.2 A. for vermiculite. The H_2O-layer thickness of the dehydrated material was 2.54 A., approx. half the original value. The removal of half the H_2O was accompanied by replacement of an original double H_2O layer by a single layer. The rapid and spontaneous rehydration which took place on contact with atm. moisture appeared to be related with the very high cation-exchange capacity of this mineral.

1479. Wieninger, L. and Adler, N. **Formation of microscopic crystals on crystal surfaces exposed to α-rays.** *Nature* **163**, 989 (1949).—*C.A.* **43**, 7769*g*.
The surface of rock salt exposed to α-rays from Po became dull. Examn. under a microscope showed that the surface was covered by minute birefringent crystals. The crystals were identified as $NaNO_3$, and were formed by the action of NO_2 produced by the α-rays in air. Crystals of KNO_3 were formed also on KCl, but on KBr, isotropic triangular crystals were formed. Anisotropic crystals were found also on fluorite and calcite.

1480. Zvorykin, A. Ya. and Timokhina, N. I. **Sintering of salts and oxides.** *Zhur. Priklad. Khim.* (J. Applied Chem.) **22**, 1063-7 (1949).—*C.A.* **44**, 892*g*.
The ratio of the temps. of beginning sintering to their temp. of fusion (t_s/t_f) was 0.44 for salts, and 0.8 for oxides and silicates. Powders sintered at temps. above t_s were tested for mech. strength, *s*, by detn. of the min. wt necessary to crush a specimen. For NaF, NaCl, NaBr, KCl, KBr, and KI, $t_s = 285$, 204, 181, 216, 190, and 137°C, heated at 500°C, $s = 25.0$, 47.5, 92.4, 65.6, 87.1, and 371.7 g/0.95 cm^2. CaF_2 heated at 400-700°C, reached only small *s* of 9.2-56.4. Heating of $Ca_3(PO_4)_2$ at 700-1000°C resulted in $s = 2.7$-11. With $CaHPO_4$ *s* increased sharply with the temp. from 800° upwards, reaching 782.5 g at 1000°C. SiO_2 began to sinter only at 1000°C. For Fe_2O_3, the rise of *s* with the temp. of heating reflected the transitions of that oxide. $CaCO_3$ showed a very slow rise of *s* up to 800°, followed by very fast increase above 800°C.

1481. Barrer, R. M. **Intracrystalline sorption.** *J. Chim. Phys.* 47, 82-94 (1950).—*C.A.* **44**, 6701*a*.
The sorption of gases in silicate and ionic crystals increase in relative accessibilities of the interstitial adsorption sites in the order: beryl < silicate glasses < silica glass < harmotome < levynite < mordenite < gmelinite, chabazite, and synthetic cryst. zeolite $BaAlSi_2O_6.2\text{-}3H_2O$. The last six of the zeolites listed above are discussed from the point of view of sieve action in adsorption, thermodynamics of adsorption, and kinetics of adsorption.

1482. Bielański, A. **Sorption of water vapor by dehydrated potassium alum.** *Bull. intern. acad. polon. sci. Classe sci. math. et nat.*, Ser. A, **1950**, 35-72 (in English).—*C.A.* **46**, 2872*h*.
Potassium alum was dehydrated to $K_2SO_4.Al_2(SO_4)_3.(2.65 \pm 0.25)H_2O$ *in vacuo* at 55°C and rehydration studied at 45°, 55°, and 62°C with p_{H_2O} of 4 to 94 mm. Primary hydration up to a max. of 7.7 moles H_2O per mole alum showed a linear relation between wt increase and the sq root of the time. If p_{H_2O} exceeded 50-60% satn., secondary hydration occurred, which caused the crystal to become translucent and finally opaque owing to dendritic growths.

1483. Bielański, A. and Tompkins, F. C. **Sorption of water by dehydrated alum crystals.** *Trans. Faraday Soc.* 46, 1072-81 (1950).—*C.A.* **45**, 4996*b*.
Single crystals of potash alum dehydrated for 18 hrs at 55°C were investigated between 45 and 62°C at relative vapor pressure between 0.04 and 0.95. First-layer adsorption on the easily accessible surface was reversible and complete at a relative pressure of 0.04. Second (and higher) layer adsorption proceeded at higher pressures and largely controlled the rate of diffusion of water into the dehydrated alum. The heat of "desorption" was 11 kcal./mole water, and the activation energy assocd. with the diffusion process was less than 500 cal/mole.

1484. Clancey, V. J. **Evaporation and mobility of naphthalene molecules.** *Nature* **166**, 275 (1950).—*C.A.* **44**, 10425*g*.
The rates of evaporation of solid naphthalene into a vacuum from different crystal faces were measured by masking two crystals so that only portions of the faces to be studied were exposed and mounting these crystals so that the evaporation produced a torque which was measured with a quartz suspension fiber. It was found that both the abs. rate of evapn. and its temp. coeff. were different for different crystal faces; this indicated variations in condensation coeffs. and energies. Anomalies appeared in the results which suggested possible mobility of the mols. over the solid phase and the glass support. Measurements were made with mica, tin (foil), graphite, and glass as the substratum.

1485. Crawford, V. A. and Tompkins, F. C. **Adsorption of gases on calcium fluoride.** *Trans. Faraday Soc.* **46**, 504-14 (1950).—*C.A.* **44**, 9768d.

Adsorption isotherms were detd. on CaF_2 crystals for SO_2 at 0°, 19.1°, 32.9°, 55.9°, 74.9°, and 98.5°C; CO_2 at -22.8°, 0°, 19.7°, 32.4°, and 55.9°C; N_2O at -22.8°, 19.4°, and 35.5°C. The adsorption was reversible and complete within 3-4 min. Heats of adsorption were calcd. in the various temp. intervals from the Clausius-Clapeyron equation and decreased with increase of vol. adsorbed for all gases but were sensibly independent of temp.

1486. Forestier, Hubert and Kiehl, Jean Pierre. **Influence of the adsorption of gas on polymorphic transformations.** *Compt. rend.* **230**, 2288-90 (1950).—*C.A.* **44**, 10412*g*.

The following transformations were studied in He, H_2, Ne, N_2 air, O_2, and CO_2 at a no. of different temps.: Tl $\alpha\rightarrow\beta$, SnO_2 $\alpha\rightarrow\beta$, KNO_3 ortho→rhombic, $AgNO_3$ ortho→hexagonal, Fe $\alpha\rightarrow\gamma$, and steel (0.8%C) $\alpha\rightarrow\gamma$. The temp. of transformation of different substances examd. varied according to the nature of the adsorbed gas. The importance of the lowering of the temp. of transformation varied with the material studied; it was negligible for the steel eutectic which was in accord with the considerable weakening of the phys. adsorption of gases at this temp.

1487. Forst, P. von der; Ruter, Fr., and Schenck, Rudolf. **Surface chemistry: the system zinc sulfide-silver sulfide.** *Z. anorg. Chem.* **262**, 100-8 (1950).—*C.A.* **44**, 7618*h*.

ZnS, freshly prepd. at 400°C, prevents the reduction of Ag_2S by H_2. Pretreatment of ZnS affects the quantity of irreducible Ag_2S. The greatest effect is obtained at 650°C whereas upon heating to 1000°C no appreciable effect is observed. The phenomenon is attributed to adsorption of solid Ag_2S on surface-rich ZnS. In contrast to pure Ag_2S, adsorbed Ag_2S and Cu_2S can be partially sulfurized, probably owing to the formation of AgS or Ag_2S_3 in the surface layer.

1488. Frank, F. C. **The structure of a crystal surface.** *Phil. Mag.* **41**, 200-5 (1950).—*C.A.* **44**, 6225*f*.

Dislocations play an essential role in the growth of crystals. The crystal structure of beryl is discussed in terms of growth from screw dislocations. The dependence of the 2-dimensional crystal growth rate on the orientation of the step line imposes a characteristic distortion of the growth spirals and loops, exhibiting the symmetry of the crystal face. A fairly simple theory can be given to account for the shape assumed by each growth layer as it expands.

1489. Frauenfelder, Hans. **Radioactive investigation of surface processes.** *Helv. Phys. Acta* **23**, 347-80 (1950).—*C.A.* **44**, 10531*i*.

Adsorption of thin gas layers at low pressure can be studied by means of recoil atoms from K-capture. Exptl. results with Ag, Cu, Cd, and Hg on mica and on surface diffusion of Cu and Cd are compared with earlier results, obtained by nonradioactive methods. These techniques can be applied to the rapid sepn. of radioactive mixts. and to the prepn. of very thin sources.

1490. Funaki, Koemon and Asada, Kazuo. **Fundamental research on the metallurgy of tungsten. I. The heterogeneous equilibrium among tungsten, its oxides, hydrogen, and water vapor.** *J. Electrochem. Soc. Japan* **18**, 250-3 (1950).—*C.A.* **45**, 8423*b*.

The reduction process on heating WO_3 in a stream of H_2 was studied by measuring the weight of WO_3 by a thermobalance and the following 7 stages of reduction were found: $WO_3\rightarrow W_4O_{11}\rightarrow W_2O_5\rightarrow W_4O_9\rightarrow WO_2\rightarrow W_2O_3\rightarrow WO\rightarrow W$. The exptl. results for the H_2 reduction of WO_3 were satisfactorily explained.

1491. Garner, W. E.; Gray, T. J., and Stone, F. S. **Reactions on the surface of copper oxide.** *Disc. Faraday Soc.* **1950**, No. 8, 246-50.

The nature of the various stages occurring in the interaction of CO and O_2 on the surface of CuO was studied. For this purpose two techniques had been combined, one based on measurements of changes of surface conductivity due to the adsorption of gases, and the other on measurements of heats of adsorption.

1492. Gray, T. J. and Savage, S. D. **Reactions on the surface of copper oxide. I. Semiconductivity measurements.** *Disc. Faraday Soc.* **1950**, No. 8, 250-4.

The adsorption of O_2 increased the semiconductivity of the Cu_2O-CuO system, giving a surface-energy of 4.96 kcal. The rate of development of cond. on the adsorption of O_2 at 140-200°C over the low-pressure range indicated that the rate-detg. step was first order. It was uncertain whether this related to the dissocn. of O_2 or to the formation of O^- from O atoms. At room temp. 50% of the adsorbed O_2 reacted with CO to give CO_2, whereas there was no significant reaction with an evacuated film. A similar reaction occurred between CO_2 and adsorbed O_2 to give CO_3 comples. The rate of adsorption on porous oxide was controlled by the activated diffusion of O atoms. These results indicated that in the dissocn. of O_2, one atom entered the lattice and the other was free to move over the surface.

1493. Gray, T. J. **Semiconductivity and catalysis.** *Discussions Faraday Soc.* **8**, 331-7 (1950).

The adsorption and interaction of gases on semiconductors led to a variation in semiconductivity which could be successfully applied to the study of adsorption catalysis. Fundamental information was simultaneously furnished regarding the semiconductivity process. An experimental technique was described for a study of the adsorption of gases by variation in semiconductivity.

1494. Griffin, L. J. **Observation of unimolecular growth steps on crystal surfaces.** *Phil. Mag.* **41**, 196-9 (1950).—*C.A.* **44**, 6225*d*.

Surface line markings on natural surfaces of beryl crystals were the height of only one unit cell. These lines followed contour lines of the surface topography. The lines were widely spaced where the surface was relatively flat, and crowded together where there was a steep gradient. The only evident departure from contouring was that occasionally a single line terminated at a point in the face, instead of forming a closed loop.

1495. Grillot, Edmond and Bancie-Grillot, Marguerite. **Influence of oxidation state of fluorescence centers on the luminescent color of zinc sulfide activated with copper.** *Compt. rend.* **231**, 966-8 (1950).—*C.A.* 45, 3718*e*.

If ZnS contg. trace amts. of Cu is prepd. in the total absence of O_2, the luminescence is blue-violet and not at all persistent; if O_2 is present during prepn. the luminescence is either nonpersistent blue with a persistent green afterglow, or clear persistent blue, or green with a bit of blue at the start, depending upon the amt. of O_2 introduced. The amt. of O_2 necessary to change from blue to green luminescence is of the same order of magnitude as the amt. of Cu present.

1496. Hass, Georg. **Preparation, structure, and applications of thin films of silicon monoxide and titanium dioxide.** *J. Am. Ceram. Soc.* **33**, 353-60 (1950).—*C.A.* **45**, 1403*d*.

A material whose compn. satisfied the formula SiO was prepd. by heating a mixt. of finely divided Si and SiO_2 in the closed end of a SiO_2 tube. The SiO evolved from the heated mixt. condensed at a temp. above 800°C, forming a light-brown, loose material; at lower temps. the condensate was dark brown to black, massive, and glassy. The SiO was structurally different from Si or SiO_2, and existed only in amorphous form. These vacuum-deposited films of SiO decompd. to Si and SiO_2 when heated for several hrs at temps. above 600°C in an inert atm., and oxidized to SiO_2 when heated in air. Films of TiO_2 were prepd. by evapg. Ti and oxidizing it in air at 400-450°. These films had a rutile structure.

1497. Johnson, Gerald W. **Some observations of the epitaxy of sodium chloride on silver.** *J. Chem. Phys.* **18**, 154-5 (1950).—*C.A.* **44**, 5175*b*.

Ag film, grown on NaCl was removed and dipped into a satd. soln. of NaCl. Almost complete orientation of the NaCl crystals resulted, with the cube edges of the crystallites parallel to the (110) direction of Ag. A lightly etched polycryst. sheet of Ag also exhibited orienting effects. Crystn. was much more profuse on the grains that showed the greatest epitaxy. When a mica sheet was treated similarly, the (111) planes of NaCl were in the plane of the surface.

1498. Johnson, W. T. M. and Krieger, K. A. **Use of carbon^{14} in a study of the mechanism of the heterogeneous oxidation of acetylene over silver nitrate.** *Brookhaven Conf. Rept.*, Chem. Conf. No. 4, 16-38 (Jan., 1950).—*C.A.* **45**, 1857*a*.

Small amts. of C_2H_2 were removed from an air stream, using $AgNO_3$ supported on alumina as a catalyst. $C^{14}O_2$ resulting from the oxidation of labeled C_2H_2 was measured radiometrically. C_2H_2 removal was due to 2 distinct and successive processes: adsorption and oxidation (combustion), the $AgNO_3$ being reduced to Ag. The start of the combustion process, characterized by both evolution of CO_2 and rise in temp. of the catalyst bed, depended on the temp. of the reaction. Oxidation did not occur at temps. much below 140°; it was delayed for a period of about 50 min. at 149°. A definite "population density" of C_2H_2 was required on the $AgNO_3$ surface, either as adsorbed mols. or as a definite surface compd., before reaction began.

1499. Kawamura, Hajimu and Shinohara, Akira. **Resistance of interface of oxide-coated cathode.** *J. Phys. Soc. Japan* **5**, 90-5 (1950).—*C.A.* **45**, 5539*g*.

When the impurity forms an interstitial compd. such as Ba_2SiO_4 at the interface, a double rectifying layer in series is formed. A bad vacuum can cause double rectifying. It is best to use core materials which do not contain impurities such as Mg, Ca, or Ba.

1500. Krasnovskii, A. A. and Gurevich, T. N. **Relation between atmospheric stability of pigmented paint films and the pigment-photosensitized formation of peroxide compounds.** *Doklady Akad. Nauk S.S.S.R.* **74**, 569-72 (1950).—*C.A.* **46**, 755*c*.

In case of TiO_2, peroxides were detd. by a colorimetric method based on measuring intensity of coloration from reaction of Fe^{+++} and CNS^-; accelerated atm.-stability tests were made under a C arc of 2000 w. In case of ZnO, measurements were made of the fading of methylene in an aq. suspension of ZnO instead of direct detn. of peroxide. TiO_2 with the structure of anatase was photochemically more active than rutile. Muffle ZnO had bright yellow fluorescence and ZnO obtained by calcination of carbonates had dark brown fluorescence.

1501. Laporte, Francois. **The surface of pulverulent solids.** *Pubs. sci. et tech. ministère air* (France), *Notes tech.* No. **39**, 1-38 (1950).—*C.A.* **45**, 2744*a*.

The enthalpy of immersion of anatase, TiO_2 (surface area 10.6 m^2/g) varied from 48 $ergs/cm^2$ before treatment to 490 after heating for 16 hrs at 500°C and 10^{-2} mm pressure.

1502. Lauterbach, Kenneth E.; Laskin, Sidney, and Leach, Leonard. **Specific-surface determinations of uranium dusts by low temperature adsorption of ethane.** *J. Franklin Inst.* **250**, 13-24 (1950).—*C.A.* **44**, 9211*b*.

The adsorption of C_2H_6 on the sample was detd. and the surface area for the micropulverized dusts was: 0.38 m^2/g for UO_3, 0.43 for UO_2, and 0.69 for $UO_2(NO_3)_2 \cdot 6H_2O$. Microscopic measurements were 0.36, 0.24, and 0.37 m^2/g, resp., indicating relatively nonporous materials. Values of 0.71 and 0.19 for adsorption and microscopic measurements indicated surface irregularity in the UF_4. However, for the peroxide the values were 5.74 m^2/g by adsorption and 0.49 by microscopic examn. indicating considerable porosity. The UO_2 sample of "fine suspensions" showed a surface (4.23 m^2/g) ten times that of "coarse suspensions" (0.47).

1503. Lihl, F. **Pyrophoric iron oxide.** *Monatsh.* **81**, 632-46 (1950).—*C.A.* **45**, 3276*i*.

The thermal decompn. of iron formate or iron oxalate results in a carbon-bearing FeO. This γ-FeO has the same structure and nearly the same lattice const., $a = 8.375$, as has Fe_3O_4. The oxide is pyrophoric; it burns to Fe_2O_3 on exposure to air, but retains its spinel structure. The

γ-Fe_2O_3 thus formed is ferromagnetic, and has the lattice const. $a = 8.330$. The structure of the γ-FeO is stabilized only if a definite min. no. of carbon atoms are present in the lattice; carbon-free γ-FeO cannot exist.

1504. Loeser, Edward H. and Harkins, W. D. **Surfaces of solids. XXI. Areas of nonporous solids from adsorption isotherms of heptane or hexane.** *J. Am. Chem. Soc.* **72**, 3427-31 (1950).--*C.A.* **44**, 10443*f*.

The areas of the following nonporous solids calcd. from n-C_7H_{16} adsorption isotherms at 25°C by the Harkins-Jura relative method and by the B.E.T. method were in satisfactory agreement: Fe_2O_3, rutile, graphite, SnO_2, PbS, CuO, CuS, Fe_3O_4, Ag, Ag_2S, Cr, PbO, Sn, Fe, Pb. The value of k in the H.J. relative method was 16.9 (or 18.2 more rarely) for heptane at 25°C. The effective cross-sectional area of heptane at 25°C used in the calcn. of areas by the B.E.T. method was 64 A². Similar agreement for a smaller no. of solids was obtained by use of the isotherms of hexane at 0°C. The value of k for hexane was 14.3, and the hexane area was 58.9 A². The values for the areas were in satisfactory agreement with those calcd. from the adsorption isotherms of N_2.

1505. Long, Earl A. and Meyer, Lothar. **Superfluidity and thermomechanical effect in the adsorbed helium II film.** *Phys. Rev.* **79**, 1031-2 (1950).--*C.A.* **44**, 10419*i*.

Superfluidity occurred in films of He II adsorbed on Fe_2O_3. The temp. was a function of the no. of adsorbed layers and of the pressure difference across the superleak. Superfluidity occurred at the temp. of the bulk liquid, and was independent of the no. of adsorbed layers. The transition He II → He I became first order in adsorbed layers. The normal rate of flow from the adsorbent system to the collection can be greatly increased or even reversed by changes of few ten-thousandths of a degree in the bath temp.

1506. Mapother, Dillon; Crooks, H. Nelson, and Maurer, Robert. **Self-diffusion of sodium in sodium chloride and sodium bromide.** *J. Chem. Phys.* **18**, 1231-6 (1950).—*C.A.* **45**, 2739*e*.

The self-diffusion coeff. of Na in NaCl and NaBr was measured as a function of temp. A comparison of the self-diffusion coeff. with the electrolyte cond. revealed that the Einstein relation was satisfied at high but not as low temps. A possible explanation for the failure of the Einstein relation in terms of assocn. between multivalent foreign ions and vacancies was suggested.

1507. Miyahara, Yutaka. **Adsorption of water vapor by zinc oxide. III.** *J. Chem. Soc. Japan*, Pure Chem. Section, **71**, 153-6 (1950).—*C.A.* **45**, 4522*d*.

The adsorption of water vapor by ZnO was measured by a const.-vol. method, and adsorption velocity and adsorption isotherms at the temps. ranging from 200° to 350°C were observed. The chem. adsorption was fairly rapid and reversible below 200°C. The max. values of the adsorption were obtained at about 200°C. The surface area of ZnO was calcd. from these values by use of the lattice consts. of ZnO crystal. The surface area thus obtained agreed well with that obtained from the phys. adsorption of benzene vapor.

1508. Ordonneau, Jacques. **Hygroscopicity of salts. Potassium chloride.** *Ann. Mines* **139**, 35-63 (1950).--*C.A.* **44**, 6587*b*.

The wt of H_2O absorbed was proportional to time and surface, although the method of prepn. of the KCl, e.g. cryst. ground, or fused, had some effect. Various coating materials applied from water and nonaq. solvents were found to reduce water absorption. Paraffin waxes and high-boiling petroleum fractions (350°C) were particularly effective. The caking tendency was detd. by forming test bars from 100 g KCl and 25 ml satd. KCl soln. plus the coating material or other additive, drying at 80°, and measuring the breaking strength.

1509. Pahl, M.; Hiby, J.; Smits, F., and Gentner, W. **Mass spectrographic determination of argon in potassium salts.** *Z. Naturforsch.* **5a**, 404-5 (1950).--*C.A.* **45**, 1924*c*.

The geol. age of K salt deposits is derived from measurement of the A^{40} content. The abs. amt. of A is measured, and the ratio of A^{40}, formed by the decay of K^{40}, to A^{36} is measured to correct for atm. contamination.

1510. Pashley, D. W. **Oriented growth of silver in silver halide crystallites.** *Acta Cryst.* **3**, 163-4 (1950) Fundamental Mechanisms of Photo. Sensitivity **1951**, 39-45.--*C.A.* **44**, 6696*b*.

Completely oriented layers of AgBr and AgCl were found to change gradually to Ag until only a very small amt. of the halide remained. The Ag from AgCl at first grew parallel to the AgCl crystal and later developed twinning about the (111) axes. The Ag from AgBr showed similar behavior at first but later developed other orientations.

1511. Podgurski, H. H.; Kummer, J. T.; DeWitt, T. W., and Emmett, P. H. **Preparation, stability, and adsorptive properties of the carbides of iron.** *J. Am. Chem. Soc.* **72**, 5382-8 (1950).—*C.A.* **45**, 2835*e*.

A hexagonal form of Fe_2C can be produced by carefully carbiding an Fe synthetic NH_3 catalyst at about 215°C with CO. This carbide appears to be stabilized by the presence of Cu. The formation of carbide appeared to take place through nuclei, as evidenced by the fact that there is still considerable free Fe on the surface of the sample after most of the Fe has been converted to Fe_2C. The completely carbided sample does not chemisorb appreciable amts. of CO at either 100 or 200°C. It does, however, still adsorb a considerable amt. of H_2 at 100°C. Even a small amt. of carbide formation eliminates completely the chemisorption of H_2 at -78° to 0°C.

1512. Preston, J. S. **Constitution and mechanism of the selenium rectifier photocell.** *Proc. Roy. Soc.* (London) **A202**, 449-66 (1950).—*C.A.* **45**, 5045*e*.

Expts. were made to elucidate the structure of the Se rectifier photocell, especially that of the thin surface film. A technique was described for sputtering films of Cd oxide which, though transparent in the thickness required for a cell, have an elec. cond. exceeding that of graphite. The thickness of the films can be closely controlled. With such films, on pure cryst. Se, cells were produced with white-light sensitivities of over 700 microamp. per lumen. Expts. with single films of Au, and double films of Zn oxide and Au, illustrated the behavior of these, in intimate contact with Se. The metal-Se contact yielded a poor photocell.

1513. Reiss, Howard. **Time lag in the nucleation of supercooled water clouds by silver iodide smokes.** *J. Chem. Phys.* **18**, 529-33 (1950).—*C.A.* **44**, 9211*f*.

A mechanism was proposed by means of which the time lag in phase transitions initiated by foreign bodies may be calcd. The half-lives of AgI particles in supercooled water clouds were calcd. There was extremely sharp dependence on both radius and temp. The decrease from 253° to 248°C transformed the half-life of particles of radius 0.8×10^{-6} cm from what was almost an infinity to a virtual zero. This meant that a fraction of a degree change in this interval, transformed the AgI particle from essentially a non-nucleus to a nucleus. At 253°C increasing the radius from 0.8×10^{-6} cm to 10^{-6} cm also reduced the half-life from an infinity to zero.

1514. Schulz, L. G. **Polymorphism of cesium and thallium halides.** *J. Chem. Phys.* **18**, 996 (1950) Acta Cryst. **4**, 487-9 (1951).—*C.A.* **44**, 7612*f*.

Salts having the CsCl-type structure (CsCl, CsBr, CsI, TlCl, TlBr, TlI) were deposited by evapn. onto cleavage surfaces of mica, LiF, NaCl, KBr, CI, and CaCO. Electron-diffraction examn. showed that the crystals touching the substrate often had the NaCl-type structure (CsCl and CsBr on all, TlI only on LiF). Lattice parameters, a_0, for the new structures of the above salts, in order, were: 6.94, 7.23, 7.66, 6.30, 6.58, and 6.94 A.; the interat. distances were lower than in the CsCl-type structure by 0.09 to 0.17 A.

1515. Seitz, Frederick. **Influence of plastic flow on the electrical and photographic properties of the alkali halide crystals.** *Phys. Rev.* **80**, 239-43 (1950).—*C.A.* **45**, 411*i*.

The effect of plastic flow on the ionic cond. and darkenability of the alkali halides is discussed on the assumption that vacant lattice sites are generated during lattice flow and subsequently condense to form clusters. These assumptions lead to a reasonable interpretation of the available expts.

1516. Selwood, P. W.; Ellis, Marylinn, and Davis, Charles F. Jr. **The disperse structure of paramagnetic oxides and hydroxides.** *J. Am. Chem. Soc.* **72**, 3549-57 (1950).—*C.A.* **45**, 1828*h*.

Paramagnetic oxides of the transition-group elements may exist in either a gel-like disperse state or in a cryst., massive state. The magnetic properties of the disperse state differed greatly from those of the massive state. The magnetic moments derived from the several chromia gels were consistent with the spin-only formulas for Cr^{3+}. Slow isobaral dehydration results in a moderate decrease of attenuation, accompanied in some cases by a moderate increased in surface area. But at the glow point the area and susceptibility both decreased precipitously as the x-ray pattern developed.

1517. Smits, F. and Gentner, W. **Argon determinations in tertiary potassium salts.** *Geochim. et Cosmochim. Acta* **1**, 22-7 (1950) (in German).—*C.A.* **45**, 5083*b*.

The direct detn. of A from Tertiary (Oligocene) sylvite of Buggingen (Upper Rhine) was important for the calcn. of the K:A ratio and of the abs. age. In air, the ratio A^{40} to A^{36} was 296:1, and A^{36}: $A^{38} = 5.4$; from the deviations of the observed isotope ratio the contamination was measurable. The He content of the A was less than 0.05 mm^3/100 g salt, in contrast with the considerably higher contents previously detd. The A evolved from sylvite varied from 3.4 to 7.1 mm^3/100 g K; the coarsely cryst. sylvite layer which was richest in A was situated between layers with a markedly lower A content; evidently A was lost from these, either by diffusion, or by geol. processes.

1518. Stone, T. S. and Tiley, T. F. **Reactions on the surface of copper oxide. II. Surface processes and heats of adsorption.** *Disc. Faraday Soc.* **1950**, No. 8, 254-8.

The heat of adsorption of O_2 was 54, of CO 20, and of CO_2 23 kcal/mol. The adsorption of CO between 20-200°C reduced the conductivity due to adsorbed oxygen, probably by the formation of a CO_3 complex. At the higher temperature the formation of CO_2 was a three-stage process.

1519. Taylor, H. F. W. **Hydrated calcium silicates. I. Compound formation at ordinary temperatures.** *J. Chem. Soc.* **1950**, 3682-90.—*C.A.* **45**, 3569*g*.

Ca silicate hydrate was prepd. by action of H_2O on tricalcium silicate, double decompn. of $Ca(NO_3)_2$ and Na silicate, and from $Ca(OH)_2$-silica gel reaction. Compn. varied from $CaO.SiO_2$ aq. to $3CaO.2SiO_2$ aq. without change in x-ray pattern.

1520. Tseft, A. L. and Salibaev, T. O. **The effect of ore components on the kinetics of the dissociation of sodium sulfate and carbonate.** *Zhur. Priklad. Khim.* **23**, 1047-50 (1950); *J. Applied Chem. U.S.S.R.* **23**, 1113-16 (Engl. translation).—*C.A.* **46**, 7857*h*.

Na_2SO_4 and Na_2CO_3, either alone or in the presence of SiO_2, Al_2O_3, Fe_2O_3, or V_2O_5, were heated in a Pt boat in a tube furnace at 10° per min. with air passing over at the rate of 1 liter per hr. The beginning of dissocn. was detd. by means of adsorption flasks. Dissocn. of Na_2SO_4 began at 1070°C, in presence of Al_2O_3 1045°, Fe_2O_3 1045°, SiO_2 1030°, V_2O_5 740°. Dissocn. of Na_2CO_3 in the presence of Al_2O_3 began at 670°, Fe_2O_3 670°, SiO_2 560°, V_2O_5 450°C.

1521. Vedeneeva, N. E. **Luminescence of clay minerals as an indication of their secondary structure.** *Kolloid. Zhur.* **12**, 88-94 (1950).—*C.A.* **44**, 5711*b*.

Halloysite, chrysotil, silica gel, and permutite luminesced in long-wave ultraviolet. The luminescence disappeared after heating to 250°, 150°, 150°, 300°C, resp. The intensity of emitted light generally decreased from 405 to 560 mμ, but there was indication of broad luminescence bands different for different minerals. The luminescence of fibers stained with eosin was similar. Plate-shaped crystals of montmorillonite were colored by benzidine and did not fluoresce, while its needle-shaped crystals fluoresced and took up benzidine.

1522. Wieninger, Lepold and Adler, Norbert. **Formation of microcrystals on crystal surfaces exposed to polonium α-rays.** *Acta Phys. Austriaca* 4, 81-4 (1950).—*C.A.* 45, 4110*i*.

Crystals of $NaNO_3$ could be identified on exposed rock salt surfaces. Apparently NO_2, produced from atm. N_2 by the α-rays, and a little moisture were responsible, as the same crystals were found on salt exposed to moist NO_2. Similarly, irradiated KCl crystals formed anisotropic KNO_3 microcrystals which could be identified by their crystal form and m.p., and also small isotropic triangular pyramids of m.p. > 500°.

1523. Yagi, Hisao. **Photoconduction of alkali halide crystals which adsorb dyes.** *Mem. Coll. Sci., Univ. Kyoto Ser.* **A**, **26**, 75-84 (1950).—*C.A.* **47**, 6770*i*.

Dicyanine-A, kryptocyanine, and phenosafranine dyes were adsorbed by means of vacuum sublimation to a thickness of one micron on artificial single crystals of rock salt. The adsorption spectra of these dyes in water, MeOH and adsorbed on rock-salt crystals were measured by using a grating monochromator and a Mazda PG-65-G photocell in connection with an amplifier. Observations of the photoelec. effect in rock-salt crystals revealed a difference of energy between the ground state and *F*-centers of 4.9-4.4 e.v. in agreement with previous measurements. Crystals upon which these dyes were absorbed became photosensitive at 1.8 e.v., while the pure crystal was photosensitive at 9 e.v. and one contg. *F*-centers at 2.7 e.v.

1524. Zhuravlev, V. F. and Zhitomirskaya, V. I. **Binding properties of crystal hydrates of the sulfate type.** *J. Applied Chem. U.S.S.R.* **23**, 115-19 (1950) (Engl. translation); *Zhur. Priklad. Khim.* **23**, 113-17.—*C.A.* **45**, 3141c.

The dehydration of $MgSO_4$ was studied with thermal analysis by use of the Kurnakov pyrometer; dissocn. began above 900°C. Binding tests on powd. partially dehydrated $MgSO_4$ showed it commenced to set in 3 min. and setting was complete in 6 min. After storage in air for one year, samples retained hardness, strength, and color.

1525. Amelinckx, S. **An interferometric study of cleavage surfaces of artificially grown crystals of sodium chloride.** *Phil. Mag.* **42**, 324-7 (1951).—*C.A.* **46**, 1328*i*.

Cleavage surfaces of an artificially grown crystal of NaCl were examd. by multiple-beam interferometry. Two main features were noted, namely long, narrow, more or less parallel strips, and superposed on this a secondary fine-grain structure. Ag films on NaCl were unstable and apparently photosensitive. Main and secondary cleavage structures were revealed and discussed in terms of crystal blocks.

1526. Anous, M. M. T.; Bradley, R. S., and Colvin, J. **The rate of dehydration of chrome alum.** *J. Chem. Soc.* **1951**, 3348-54;—*C.A.* **46**, 3837*b*.

The rate of dehydration *in vacuo* of large crystals of chrome alum of mass about 1 g was studied at thermostate temps. of 15-35°C. The activation energy was about 23 kcals. per mole, and the kinetics of dehydration agreed roughly with the Polanyi-Wigner expression. The dehydration was also studied at -1.7 to -12°C, at which temps. self-cooling was negligible. At the low temp. the activation energy was about 30 kcal. per mole.

1527. Arizumi, Tetsuya and Narita, Shin-ichiro. **Activation of the oxide-coated cathode.** *J. Phys. Soc. Japan* **6**, 15-20 (1951) (in English).—*C.A.* **45**, 5511*d*.

A Ni cathode activated with BaO was studied. The surface was poisoned by momentary exposure to O_2 and the recovery of activity was measured. The diffusion energy of free Ba atoms was estd. to be 0.75 e.v. A cathode exposed to O_2 for a relatively long time (not given) recovered its activity linearly with time at low temp. The activation energy for transferring a Ba atom from the normal lattice site to an impurity center was 3.9 e.v. Exposure of the cathode to O_2 for 30 min. increased greatly the work function.

1528. Aurelio, Burdese. **Adsorption of water vapor by magnesium oxide.** *Atti accad. sci. Torino. Classe sci. fis. mat. e nat.* **86**, 107-12 (1951-52).—*C.A.* **47**, 3079*g*.

The adsorption of water vapor by MgO was studied at 20°C. The behavior of the adsorption isotherms can be referred to type IV of Brunauer's classification.

1529. Barrer, R. M. and Grove, D. M. **Flow of gases and vapors in a porous medium and its bearing on adsorption problems. I. Steady state of flow.** *Trans. Faraday Soc.* **47**, 826-37 (1951).—*C.A.* **46**, 1818*d*.

The flow of He, Ne, A, Kr, H_2, O_2, N_2, NH_3, CCl_4, and SO_2 through a bed of small nearly spherical synthetic analcite crystals was studied. Flow rates, permeabilities, Knudsen and Poiseuille contributions to permeability, and permeability consts. were detd. and significant deviations were observed, especially for vapors.

1530. Barrer, R. M. and Grove, D. M. **Flow of gases and vapors in a porous medium and its bearing on adsorption problems. II. Transient flow.** *Trans. Faraday Soc.* **47**, 837-44 (1951).—*C.A.* **46**, 1818*d*.

By measuring the time-lag in setting up the steady state of flow, the diffusion coeffs. of gases in porous media could be detd. and a mean pore radius and an internal surface obtained of the porous medium independently of all steady state methods. In the beds of analcite crystals the inert gases, permanent gases, and CCl_4 behaved as though they were not adsorbed appreciably at low pressures, while NH_3 and SO_2 showed strong adsorption effects. The lifetimes (τ) in the adsorbed states were: NH_3 $\tau = 3.1 \times 10^{-11}$ exp (4300/RT) sec; SO_2 $\tau = 6.6 \times 10^{-11}$ exp (3010/RT) sec.

1531. BAYLEY, S. T. **Dielectric properties of adsorbed water layers on inorganic crystals.** *Trans. Faraday Soc.* **47**, 518-22 (1951).—*C.A.* **45**, 9953*g*.

Small amts., probably unimol. layers, of adsorbed water gave rise to sharp peaks at about -30° in the temp. variation of dielec. const. and power factor of powd. crystals of inorg. salts. The effect, not confined to H-bonded materials, was found in $NaHCO_3$, $NaHSO_4$, Na_2SO_4, NaCl, $KHCO_3$, $KHSO_4$, NH_4Cl, and $(NH_4)_2SO_4$. The observations were made *in vacuo* at a frequency of 3000 cycles/sec with a Schering bridge.

1532. BLANCHIN, LOUIS; IMELIK, BORIS, AND PRETTRE, MARCEL. **Modification of the texture and structure of gibbsite during dehydration.** *Compt. rend.* **233**, 1029-31 (1951).--*C.A.* **46**, 7395*f*.

The detn. of the equil. at each stage of the dehydration was made at each temp. The decompn. was arrested in an interval of 100 degrees, when the solid attained the approximate compn. $2Al_2O_3.H_2O$. This single phase had the boehmite structure.

1533. BLANCHIN, LOUIS; IMELIK, BORIS, AND PRETTRE, MARCEL. **Modifications of texture and structure of a boehmite gel during dehydration.** *Compt. rend.* **233**, 1106-8 (1951).--*C.A.* **46**, 7395*h*.

Boehmite gel was prepd. by treating a soln. of Na aluminate with warm acid. By thermo-gravimetry at pressures of 0.001 mm and 750 mm, it was found that the compn. after removal of adsorbed water was $2Al_2O_3.3H_2O$, which contained more water than boehmite but had the same x-ray pattern. The dehydration proper was complete at 400 or 500°C and the porous structure was maintained to the end of the dehydration.

1534. BÖHM, WOLFGANG. **Colloids and color centers in additively colored rock salt.** *Österr. Akad. Wiss., Math.-naturw. Kl. Sitzber. Abt. IIa* **160**, 70-97 (1951).—*C.A.* **47**, 3084*b*.

The reversible coloring of rock salt between yellow and violet-blue by suitable thermal treatment in the presence of Na, is paralleled by a transition of Na atoms between color centers and colloids. The no. of Na atoms involved in color centers and in formation of colloids remains const. during the color change; i.e. there is quant. passage of Na from centers into colloids.

1535. BOSE, BENOY B. AND KHUNDKAR, M. H. **Dehydration of dihydrates of bivalent iron, nickel, cobalt, and manganese chlorides.** *J. Indian Chem. Soc., Ind. & News Ed.* **14**, 45-9 (1951).—*C.A.* **46**, 4943*h*.

Attempts were made to obtain anhyd. $FeCl_2$, $NiCl_2$, $CoCl_2$, and $MnCl_2$ from the dihydrates by heating in air and in HCl vapor. In the first method there was a tendency toward hydrolysis, decreasing in the order in which the compds. were listed. The second method was successful in all cases. The min. temps. for complete dehydration over a 4-hr period were 150-175°C.

1536. BOSE, BENOY B. AND KHUNDKAR, M. H. **Dehydration of magnesium chloride hexahydrate.** *J. Indian Chem. Soc., Ind. & News Ed.* **14**, 171-4 (1951).--*C.A.* **46**, 8561*c*.

Loss of HCl was not observed during the release of the first three mols. of H_2O, but it occurred later. A slow stream of HCl vapor checked the hydrolysis entirely, and complete dehydration was obtained at 250°C.

1537. BOWDEN, F. P. AND THROSSELL, W. R. **Adsorption of water vapor on solid surfaces.** *Nature* **167**, 1038 (1951).--*C.A.* **45**, 9334*c*.

If clean metal surfaces are washed with tap water and dried, there is a large increase in wt when they are exposed to water vapor well below its satn. pressure. With surfaces that have been cleaned by heating in vacuo, this is not observed. The adsorption, however, is appreciable and is measurable by direct weighing and by the use of polarized light.

1538. BRADLEY, R. S. **Rate of growth of nuclei in dehydration of hydrates.** *Trans. Faraday Soc.* **47**, 630-3 (1951).--*C.A.* **45**, 10017*c*.

The relatively slow rate of growth of small nuclei formed on the surface of hydrates in vacuo may be due to the effect of the dehydrated phase on the activation energy necessary for the escape of water mols. The nuclei are assumed to be hemispheres on the surface of the crystal, and a theoretical treatment shows that log(da/dt), where a is the radius of a nucleus, is a linear function of $1/a$.

1539. BURSTEIN, E.; OBERLY, J. J.; HENVIS, B. W., AND DAVISSON, J. W. **The distribution of impurities in alkali halides.** *Phys. Rev.* **81**, 459-60 (1951).—*C.A.* **45**, 3713*b*.

The formation if impurity aggregates in NaCl crystals contg. Pb^{++} is shown from optical data. Transmission curves are given for NaCl with 0.0005-0.01% Pb, for KCl with 0.01% Pb, and for crystals heat-treated at 100°, 200°, and 750°C.

1540. CHEMLA, MARIUS. **Diffusion of phosphorus^{32} and sulfur^{35} in sodium chloride.** *Compt. rend.* **232**, 1553-5 (1951).—*C.A.* **45**, 8314*i*.

The diffusion of the products of the reactions $Cl^{35}(n,p)S^{35}$ and $Cl^{35}(n,\alpha)P^{32}$ was observed in NaCl heated to 660°C during 4 or 7 hrs. Monocryst. NaCl plates ($0.25 \times 1.2 \times 1.2$ cm) were cut by a biologist's microtome to various depths after irradiation and subsequent heating. The activity of the powder removed by the microtome at each depth was measured, and curves were drawn for the ratios (sample activity)/(activity of unheated crystal) *vs.* depth. Each curve had a max. at the crystal center and sharp rises near each face.

1541. CLUSIUS, KLAUS AND MEYER, HORST. **Formation of precipitates from gas currents by thermal diffusion.** *Z. Naturforsch.* **6a**, 401-2 (1951).—*C.A.* **46**, 6898*g*.

The pptn. of NaCl on a cold surface from an aerosol prepd. by vaporizing NaCl in a H_2 flame is uniform at pressures near atm. Below 100 mm the deposit takes the form of 2 unrolling whirls. Since the velocity of convection is proportional to the pressure, convection prevents the formation of whirls at high pressures.

1542. Colombani, Antoine and Ranc, Gaston. **Crystallization of very thin layers of gold.** *Compt. rend.* **232**, 1344-6 (1951).—*C.A.* **46**, 2868*h*.

Thin layers of Au were deposited by thermal evapn. *in vacuo*. Rate of crystn. of the layers was studied by change of resistance with time. Films deposited on amorphous Plexiglas showed spontaneous crystn. only if they were thicker than 50 A. The corresponding min. thickness for spontaneous crystn. was 35 A., for films deposited on NaCl.

1543. Colombani, Antoine and Ranc, Gaston. **Effect of the support on crystallization of very thin gold films.** *Compt. rend.* **233**, 46-8 (1951).—*C.A.* **46**, 2868*g*.

Au films were crystd. on KCl, KBr, $NaNO_3$, NaCl, Rhodoid, Plexiglas, and glass. The thickness at which crystal development began was always lower on oriented bases than on amorphous ones. At equal thicknesses the resistivity was always lower on cubic (NaCl) or rhombohedral ($NaNO_3$) than on the amorphous materials, and was comparable for all crystal bases.

1544. Ehrenberg, W. and Hirsch, J. **The conductivity-temperature characteristics of lead sulfide. The influence of oxygen and of the rate of heating.** *Proc. Phys. Soc.* (London) **64B**, 700-6 (1951).—*C.A.* **46**, 9963*h*.

Tests made on PbS films in O_2 led to conclusions about the stages of oxidation. To obtain a high rate of heating, the semicond. was deposited as a narrow strip on one side of a thin mica lamella next to a Pt strip (Pt thermometer) whose resistance as a function of temp. was known. The back of the mica lamella was platinized (heater). The range between 100° and 600°K could be covered in slightly more than 0.1 sec.

1545. Forestier, Hubert and Maurer, J. **Effect of adsorbed gas on the fusion temperature of crystals.** *Compt. rend.* **232**, 1664-6 (1951).—*C.A.* **45**, 7402*e*.

The solid was pulverized, degassed slightly below the m.p. in vacuo, the gas was introduced, and after a short interval to allow adsorption to occur the m.p. was detd. For high-melting solids such as LiCl the amt. of gas adsorbed was so small that no effect can be detected. The m.p. of KNO_3, Pb, Bi, and Sn, in He, H_2, Ne, A, CO_2 and N_2 were given.

1546. Frost, G. B.; Moon, K. A., and Tompkins, E. H. **The role of amorphous intermediate products in the dehydration of certain hydrated salts.** *Can. J. Chem.* **29**, 604-32 (1951).—*C.A.* **45**, 8868*f*.

$CuSO_4.5H_2O$ and $ZnSO_4.7H_2O$ were dehydrated at 0.8 mm Hg and at several temps., and some time after admitting dry air heat evolution was observed. X-ray pictures taken before and after the heat evolution confirmed the transformation from amorphous to cryst. material. No heat effect was observed when the dehydration pressure was 1.85 mm Hg. No heat effect was observed with $MnSO_4.4H_2O$ and $FeSO_4.7H_2O$ and a slight but reproducible heat effect with $CoCl_2.6H_2O$. $CuSO_4.5H_2O$ and $ZnSO_4.6H_2O$ were dehydrated at a series of water vapor pressures between 0.02 and 2.21 mm Hg, and the heat of soln. in water and the x-ray diagram of the products was detd. The products of the dehydration of $CuSO_4.5H_2O$ probably contained only the pentahydrate and the cryst. and amorphous monohydrate.

1547. Fuller, A. A. **Epitaxis of rubidium iodide on a barium stearate substrate deposited on mica.** *Nature* **168**, 471 (1951).—*C.A.* **46**, 2868*d*.

RbI crystd. from aq. solns. on glass or on Ba stearate layers on glass forms cubic crystals, whereas on mica the crystal outline is mostly an equilateral triangle with sides parallel to the traces of the (010), (110), and $(1\bar{1}0)$ planes of mica; the (111) plane of RbI being parallel to the (001) plane of mica. If the crystn. is effected on Ba stearate layers deposited on mica, the proportion of unoriented cubic crystals increases with the thickness of the Ba stearate layer.

1548. Gallo, G. and Del Guerra, M. **The reaction of hydrogen with metallic oxides and sulfides.** *Ann. Chim. (Rome)* **41**, 51-60 (1951).—*C.A.* **45**, 8395*e*.

The oxides and sulfides of the following metals were treated with H_2. The temp. at which initial reduction of oxides with H_2 was observed: Co: 80°, Ni: 95°, Cd: 95°, Cu: 102°, Bi: 150°, Pb: 160°, Sn: 175°, Fe: 180°, Mn: 260°, Zn: 340°. In general the affinity of these metals for S was greater than for O_2.

1549. Gregg, S. J. and Sing, K. S. W. **The effect of heat-treatment on the surface properties of gibbsite. I. Adsorption isotherms of nitrogen and oxygen at -182.7°.** *J. Phys. & Colloid Chem.* **55**, 592-7 (1951).—*C.A.* **45**, 6005*g*.

The surface activity of gibbsite increased sharply with increasing temp. of heat-treatment up to approximately 410°C. Samples treated at higher temps. showed a decrease in activity. Gibbsite treated above 1000°C exhibited negligible N_2 adsorption. The O_2 isotherms that extended to relative pressures close to unity exhibited hysteresis loops at the high-pressure end.

1550. Gregg, S. J. and Sing, K. S. W. **The effect of heat-treatment on the surface properties of gibbsite. II. Isotherms of carbon tetrachloride vapor at 25°A.** *J. Phys. & Colloid Chem.* **55**, 597-604 (1951).—*C.A.* **45**, 6005*h*.

The CCl_4 isotherms on successive samples prepd. by heating portions of gibbsite at temps. between 300 and 1000°C fall into 2 classes corresponding to the ranges 300-450°C and 480-1000°C. The main distinction between the two is the presence of an addnl. point of inflection in the latter case and a much greater length of the steep portion of the desorption branch. All isotherms exhibited permanent hysteresis loops.

1551. Gregg, S. J. and Willing, E. G. J. **The dehydration of gypsum. I. A study of the thermal decomposition of gypsum by the adsorption of oxygen and nitrogen at -183°.** *J. Chem. Soc.* **1951**, 2373-7.—*C.A.* **46**, 370*i*.

The surface area of gypsum dehydrated at a succession of temps. between 100° and 700°C was detd. by adsorption of N_2 and O_2. Maximum areas were found in samples which have been heated to approx. 180° and 280°C. In the region 150° to 350°C the area calcd. from O_2 adsorption was significantly greater than that calcd. from N_2 adsorption. Above 400°C the O_2 and N_2 areas agreed closely.

1552. Gregg, S. J. and Willing, E. G. J. **The dehydration of gypsum. II. A study of the thermal dehydration of gypsum by means of adsorption of carbon tetrachloride vapor at 25°.** *J. Chem. Soc.* **1951**, 2378-80.—*C.A.* **46**, 371*a*.

The adsorption isotherms are of the B.E.T. type II, with a small value of the parameter *c*, so that the surface area cannot be detd. by the usual B.E.T. procedure. Since, however, all the isotherms can be superposed by adjustment of the adsorption ordinates, the relative area values can be obtained from adsorption at a given pressure. These are consistently less than the previously obtained values, on account of the larger CCl_4 mol.

1553. Gregg, S. J. and Willing, E. G. J. **Dehydration of gypsum. III. Dehydration and rehydration of gypsum by adsorption methods. IV. Heat of immersion, heat of hydration, specific gravity, sedimentation volume, and bulk density of the dehydration products.** *J. Chem. Soc.* **1951**, 2916-20, 2921-4.—*C.A.* **46**, 2872i.

Samples of gypsum were dehydrated between 110 and 700°C, and the surface area of the product was estd. by CCl_4 adsorption, both before and after detg. the water adsorption isotherm at 25°. The surface area generally diminished by the H_2O treatment. The maxima found in the surface area-temp. curves at 180-190° and 300°C originate in the reactions: gypsum → hemihydrate + water, and hemihydrate → anhydrite + water.

1554. Haul, R. A. W.; Stein, L. H., and Louw, J. D. **Exchange of carbon^{13} dioxide between solid carbonates and gaseous carbon dioxide.** *Nature* **167**, 241-2, 727 (1951).—*C.A.* **45**, 7855*e*.

Exchange of C^{13} dioxide was measured over dolomite and calcite under pressure of 400 mm CO_2 at 700°C. Exchange occurred in the surface layer, as indicated by decreasing content of C^{13} dioxide in the CO_2 with successive decompn. of the dolomite after initial exchange. The result could be explained by the hypothesis that dolomite decompd. to CaO and MgO followed by the reaction of CaO to $CaCO_3$.

1555. Hayashi, Toyozo and Satō, Shigeo. **Dehydrating properties of gypsum.** *Gypsum* **1**, 137-41 (1951) (English summary).—*C.A.* **46**, 10574*h*.

The dehydration velocity of 6 samples of com. gypsum (differing in microscopic cryst. structures) in an elec. furnace (a) kept at 150°C or (b) heated up to 300°C at 1°/min. was plotted against the temps. of the samples. From the curves, 3 samples formed 1 group calcined at lower temps., the rest another calcined at higher temps. Those having finer cryst. structures tended to be calcined more rapidly. The dehydrating properties, besides the chem. purity, distinguished the quality of gypsum samples.

1556. Hüttig, G. F.; Theimer, O., and Mehlo, W. **The theory of adsorption. III. The isotherms of the barium sulfate-water system and their evaluation.** *Kolloid-Z.* **121**, 50-4 (1951).—*C.A.* **45**, 8319*i*.

Adsorption isotherms are measured at 0°, 10°, 20°C for the system water vapor/$BaSO_4$ in the pressure range of 0.025 mm up to the vapor pressures of water (4.58 mm, 9.21 mm, 17.64 mm). No disturbing effects are observed. The differential heats of adsorption were calcd. and found to be about 14,400 cal at small surface coverings and to approach slowly, with increasing d. of the adsorbate, the molar latent heat of evapn. of water (10,630 cal). The exptl. isotherm is in fairly good agreement with the B.E.T. theory.

1557. Kane, Evan O. **Optical absorption of barium oxide with excess barium.** *J. Applied Phys.* **22**, 1214-15 (1951).—*C.A.* **46**, 1867*b*.

Small crystals of BaO grown from soln. in molten Ba are deep red in color. The absorption may be due to interstitial Ba atoms or to O_2 vacancies.

1558. Kitchener, J. A. and Ignatowicz, S. **Reduction equilibria of zinc oxide and zinc silicate with hydrogen.** *Trans. Faraday Soc.* **47**, 1278-86 (1951).—*C.A.* **46**, 6472f.

A known vol. of H_2, dild. with N_2, was passed through a bed of Zn_2SiO_4 or ZnO. The quantity of Zn vapor carried off by the gases drawn through a sampling capillary tube from the center of the bed was detd. The partial pressure of H_2 in the ingoing gas detd. the compn. of the equil. mixt. in the bed according to reactions: $Zn_2SiO_4(s) + 2H_2(g) \rightleftarrows 2Zn(g) + 2H_2O(g) + SiO_2$; $ZnO(s) + H_2(g) = Zn(g) + H_2O(g)$.

1559. Lawson, W. D. **A method of growing single crystals of lead telluride and lead selenide.** *J. Applied Phys.* **22**, 1444-7 (1951).—*C.A.* **46**, 4305*g*.

Single crystals measuring up to 1 1/4 cm diam. and 6 cm long were grown in sealed SiO_2 crucibles. Extreme purity of the materials and cleanliness of the crucible were essential. Attempts to introduce excess of one of the constituents, Pb or Te, into the crystal lattice during growth were not successful so far.

1560. Macaulay, James M. **Adsorption of water vapor on solid surfaces.** *Nature* **167**, 1038 (1951).—*C.A.* **45**, 9334*b*.

A fresh, clean, mica surface in an atm. of clean unsatd. water vapor took on a measurable layer of moisture only with the greatest difficulty.

1561. Margolis, L. Ya. **Sorption of oxygen on magnesium chromite.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* **1951**, 262-7.—*C.A.* **45**, 9333*a*.

Rates of adsorption of O_2 under low pressures (up to 2 mm Hg) on $MgCr_2O_4$, at 185, 230, 260, 300, and 340°C, are given in the form of plots of the amt. adsorbed q (cc./g) as a function of the time τ (min.). Linearity of the plots of log q as a function of log τ proves the applicability of the equation $q = A\tau^{1/n}$, where $1/n = aRT$; $A = H/a\tau_0{}^{1/n}$, where H and a are consts.; $\tau_0 = 1/K_0p^3$, where K_0 = a factor of the rate const., p = pressure. The exptl. values of $1/n$ at 185, 230, and 260°, are 0.476, 0.626, and 0.680, resp. (initial pressures p_0 = 0.545, 0.575, and 0.582 mm, resp). Addn. of Na_2SiO_3 to the $MgCr_2O_4$ results in a lowering of the adsorption.

1562. Mastrangelo, S. V. R. and Aston, J. G. **Thermodynamic data and some notes on the nature of adsorbed helium.** *J. Chem. Phys.* **19**, 1370-5 (1951).—*C.A.* **46**, 2372*f*.

The adsorption isotherms and heat capacities of He on TiO_2 in the rutile cryst. form were obtained. On the basis of the observed shift in λ-point with coverage, the behavior of the adsorbed phase was correlated with the behavior of the bulk liquid and solid under pressure.

1563. Neuhaus, A. **Partial isomorphous systems. XI. Oriented crystal precipitation on activated carrier surfaces.** *Fortschr. Mineral.* **29-30**, 18-23 (1951).—*C.A.* **46**, 7838*g*.

KBr, KCl, NaBr, and NaCl were sublimed onto orthoclase at high vacuum and at temps. of 340 to 500°C. Several different oriented overgrowths were noted.

1564. Nikol'shii, G. P.; Bagdasar'yan, Z. A., and Kazarnovskii, I. A. **Ozonides of sodium, rubidium, and cesium.** *Doklady Akad. Nauk S.S.S.R.* **77**, 69-72 (1951).—*C.A.* **45**, 5554*h*.

Reaction between finely ground anhyd. NaOH (98.2%) and ozonized O_2 (8-9% O_3) at temps. between -50 and -60°C produced an intensely yellow color. Extn. with liquid NH_3 (at the same low temp.) and evapn. left a finely cryst. dark-red powder, which analyzes about 90% NaO_3, some 2-3% NaOH, and 4-6% H_2O. With RbOH (99%), at -30°C, an orange finely cryst. product was obtained contg. from 40 to 67% RbO_3, the rest RbOH (no H_2O). From CsOH (98.9%), the red-brown product obtained by the same method contained 64-7% CsO_3, the rest CsOH (no H_2O).

1565. Saito, Hirotaro. **The manganese oxide catalysts. I. The sorption velocity of oxygen by manganese sesquioxide.** *J. Chem. Soc. Japan*, Pure Chem. Sect., **72**, 262-4 (1951).—*C.A.* **46**, 812*g*.

The sorption of O_2 by Mn_2O_3 consisted of rapid surface adsorption and a slow sorption that followed. The former was instantaneous and reversible and turned into pure chemisorption above 110°C. This was due to the combination of O_2 with the surface Mn atoms that had been exposed as a result of the evapn. of O_2 caused by preliminary high-temp. evacuation.

1566. Schreiner, H. **The character of the porous condition of various sintered natural magnesites.** *Radex Rundschau* **1951**, 149-57.—*C.A.* **46**, 2767*a*.

Samples of high-Fe raw magnesite and of very pure natural Zillertal magnesite were sintered for 1 hr at 1300, 1400, 1500, 1600, and 1700°C. The sinters were crushed and sieved. Only particles finer than 100 μ were used. Porosity and bulk porosity were calcd. During sintering at 1300-1500°C porosity decreased considerably, especially in the high-Fe magnesite. At 1500-1600° porosity increased slightly, but at 1600-1700° a further decrease took place. Absorption isotherms were calcd. by using Hüttig's isotherm equation. The surface area decreased at 1300-1400°. It decreased to min. values at 1400° and 1600°C for pure and high-Fe magnesite, resp.

1567. Schreiner, H. **The influence of manner of deposition of solid powdered adsorbents on the adsorption of gas.** *Kolloid-Z.* **123**, 113-16 (1951).—*C.A.* **46**, 8928*c*.

Tests were run with electrolytic Cu powder, $BaSO_4$ and Al_2O_3 powders to adsorb MeOH vapors, 3 exptl. variations being followed: (1) loose deposition of the powder at low depth on a flat bottom, (2) deposition of the powder in a 4.8 mm glass tube in a deep layer without, however, obtaining highest possible d., (3) steady restratification of the powder during the test. Adsorption isotherms were taken for each powder with the same adjustment time of 10 min. in each case. In a layer of great depth the adsorption kinetics was detd. by diffusion of the gas to the lower strata. Even after longer time the adsorption was somewhat lower. Even a small variation in deposition, such as by weighing operation, affects the adsorption.

1568. Schulz, L. G. **Growth of alkali halide crystals from the vapor phase and from solution onto substrates of mica.** *Acta Cryst.* **4**, 483-6 (1951) (in English).—*C.A.* **46**, 4875*c*.

KF, NaCl, NaBr, KCl, NaI, KBr, KI, NH_4I, and RbI were oriented to the larger at. network in muscovite mica. LiCl with a mismatch of 30% and NaF showed a [111] fiber structure; the latter showed considerable diln. with crystals having random orientation. LiF was unique in orienting to the smaller hexagonal mica network. Crystal growth from soln. was studied by exposing the salt deposited on the mica to moist air and evapg. H_2O after returning it to the camera. The growth of salts with a_0 less than 6.5 A. supported the oriented nucleus hypothesis, whereas the growth of salts with a_0 greater than 6.5 A. supported the monolayer hypothesis.

1569. Sproull, R. L.; Dash, W. C.; Tyler, W. W., and Moore, A. R. **Growth and manipulation of barium oxide crystals.** *Rev. Sci. Instruments* **22**, 410-14 (1951).—*C.A.* **46**, 1326*b*.

Seeds of BaO crystals were placed in an enclosure of compressed BaO powder in a vacuum furnace and heated to 1400°C whereby crystals were grown from the vapor. Crystals 1 × 10 × 10 mm were grown.

1570. Stitt, Fred and Tomimatsu, Yoshio. **Sensitized paper for estimation of mercury vapor.** *Anal. Chem.* **23**, 1098-1101 (1951).—*C.A.* **45**, 10127*h*.

Impregnate filter paper with red Se by soaking it in KSeCN soln., drain, and expose to an atm. contg. HCl. The paper reacted with Hg in the air at 65°C or higher; the length of blackening was directly proportional to the concn. of Hg at 65-200°C.

1571. Stitt, Fred; Tjensvold, A. H., and Tomimatsu, Yoshio. **Rapid estimation of small amounts of ethylene in air.** *Anal. Chem.* **23**, 1138-41 (1951).—*C.A.* **46**, 63*g*.

Air and the C_2H_4 were passed over red HgO at 285°C; the Hg released was detected by Se sulfide paper at 125°C. The low practical limit was 5 p.p.m. Possible interfering substances such as EtOH, MeCHO, esters of fatty acids, geraniol, and limonene were removed by 95% H_2SO_4 pumice traps.

1572. Stone, F. S. and Tiley, P. F. **Influence of a chemisorbed film on subsequent physical adsorption processes on solids.** *Nature* **167**, 654-5 (1951).—*C.A.* **45**, 7406*f*.

The adsorption of Kr by a Cu oxide catalyst at 90°K is given as a function of pressure. Isotherms are given for a clean surface, for a surface that has absorbed CO, and for a surface contg. CO that has been converted to a CO_3-surface complex by the addn. of O_2. The curves are discussed qualitatively with reference to the B.E.T. theory.

1573. Tompkins, F. C. and Young, D. M. **Adsorption of gases on cesium iodide.** *Trans. Faraday Soc.* **47**, 77-87 (1951).—*C.A.* **45**, 6454*d*.

The adsorption of CO, N_2, A, and O_2 by CsI between 65.5 and 91.6°K was measured. Heats of adsorption were calcd. from the Clausius-Clapeyron equation and, within ± 100 cal in the range 0.2 to 0.8 coverage, they showed no definite trend with temp. Over the initial region of decreasing heat with coverage, the log p against log x plots were accurately linear for A, O_2, and N_2. The initial decrease in the heat of adsorption of A, O_2, and N_2 with coverage was attributed to the nonuniformity of the surface.

1574. Tompkins, F. C. and Young, D. M. **Adsorption of gas mixtures.** *Trans. Faraday Soc.* **47**, 88-96 (1951).—*C.A.* **45**, 6454*f*.

The adsorptions of two binary gas mixts. (N_2+ CO at 83.6°K and A+ O_2 at 77.5°K) by CsI were detd. by using a const.-vol. method. The total amts. of the two gases for each compn. originally admitted were in a fixed ratio. N_2 and CO mixts. followed a "mixed" Langmuir equation and O_2 and A followed the Freundlich equation. This was due to the much lower net heats of adsorption of O_2 and A which allowed multilayer adsorption to occur well before the monolayer was complete. In the lower-pressure range the amts. of these two gases adsorbed were smaller and deviations from the Langmuir equation due to heterogeneity were more marked.

1575. Tourneux, C. and Devin, C. **Adsorbing properties of ammonium phosphomolybdate.** *Compt. rend.* **232**, 2430-2 (1951).—*C.A.* **45**, 8846*h*.

$(NH_4)_3PO_4(MoO_3)_{12}$ adsorbed gases and vapors reproducibly and reversibly. Prepns. of smallest crystal size adsorbed 8 mols. H_2O per mol. adsorbent, those of largest crystal size adsorbed 4 mols. from humid air at 20°C. For homologous series the adsorption decreased with increasing no. of C atoms. HCOOH and AcOH were adsorbed less than were the corresponding alcs., and CO_2 and CS_2 less than was HCOOH. The primary butanols were equally adsorbed but more so than the secondary and tertiary isomers. C_6H_6 was adsorbed much more than cyclohexane and the latter a little more than hexane.

1576. Tourneux, C. and Devin, C. **Adsorbing properties of ammonium phosphomolybdate.** *Compt. rend.* **233**, 43-5 (1951).—*C.A.* **45**, 8846*i*.

The adsorbing power of prepns. differing in crystal size is not a matter of specific surface but one of homogeneity of the crystals. The small, highly adsorbing crystals are made by very rapid crystn.; the large, less adsorbing crystals are made by very slow crystn. from only slightly supersatd. soln., and their crystn. is more nearly perfect. The adsorption is intracryst., therefore a matter of voids. A peculiarity of the adsorption of most org. compds. by phosphomolybdate is a change in color from yellow to more or less deep green either during or some time after completion of adsorption. The color change indicates reduction of the Mo and oxidation of the adsorbate but there is no change in weight.

1577. Trillat, Jean J. **The conversion of silver bromide to silver.** *Compt. rend.* **233**, 1188-9 (1951).—*C.A.* **46**, 2868*f*.

Thin films of AgBr prepd. by vacuum evapn. are microcryst. when deposited on an amorphous surface (gelatin) and monocryst. when deposited on a freshly cleaved NaCl crystal (200). *Bombardment* of such films by *electrons* produces very small crystals of Ag randomly oriented.

1578. Uno, Tatsuji. **Reaction of hydrogen sulfide on calcium oxide.** *Tetsu-to-Hagane* **37**, No. 1, 14-17 (1951).--*C.A.* **46**, 2382*a*.

H_2S gas mixed with H_2 was passed over CaO at 900° to 1100°C, and the equil. const. of the reaction $CaO + H_2S = CaS + H_2O$ was detd. from the analysis of H_2S to be $\log K = \log\text{-}(P_{H_2O}/P_{H_2S}) = 3231.83/T - 0.060$.

1579. Villaseca, L. Bru and Gharpurey, K. G. **Orientation of silver on the (110) and (111) faces of rock salt.** *Anales real soc. españ. fis. y. quim.* **47A**, 101-10 (1951).—*C.A.* **45**, 7842*i*.

Ag was sublimed gently on polished faces of NaCl (111) and (110). X-ray diffraction showed that the Ag grows on NaCl faces in parallel orientation in spite of the 30% difference in lattice consts. The NaCl structure continued through the interface. Rotational slip around the (110) axis was observed.

1580. Watanabe, Yasuyoshi and Kimoto, Shizuo. **Orientation between silver and sodium chloride crystal.** *Science of Light* (Japan) **1**, No. 1, 37-41 (1951).--*C.A.* **47**, 4680*g*.

In the electron-diffraction pattern of Ag film evapd. on a cleavage surface of synthetic NaCl single crystal and exposed to moist air, the pattern was found to correspond to the NaCl crystal oriented as if the substrate NaCl crystal was rotated by $\pi/4$ about the axis normal to the surface. When NaCl was evapd. on the fresh Ag film prepd. so that its (001) plane is parallel to the surface, the (111) or (001) plane of evapd. NaCl was oriented parallel to the surface.

1581. Weaver, E. R. **Electrical measurement of water vapor with a hygroscopic film.** *Anal. Chem.* **23**, 1076-80 (1951).—*C.A.* **45**, 10136*h*.

Very sensitive films of H_2SO_4 and H_3PO_4 can be used rapidly but require calibration at the time of use. The procedure is based on the measurement of the elec. cond. of the film. The method has been used for detg. H_2O in cylinders contg. O_2, for measuring the water vapor pressure of liquids, and is applicable to detg. water in butter, soaps, lubricants, bituminous materials, and emulsions of various kinds.

1582. WEBER, HEINRICH. **Discoloration of magnesium oxide crystals by lattice materials.** *Z. Physik* **130**, 392-402 (1951).—*C.A.* **46**, 823*g*.

Heating in O_2 at about 1500°K under pressure discolors the crystals so that they show adsorption bands at 285 and 216 mμ (half widths 0.63 and 1.28 e.v.) at 293°K which are only slightly temp.-sensitive. Mg vapor also penetrates the crystals, causing them to absorb over a wide wave length region. Both discolorations disappear completely on heating the crystals in a high vacuum.

1583. WHALEY, THOMAS P. AND KLEINBERG, JACOB. **A contribution to the chemistry of the alkali metal "ozonates."** *J. Am. Chem. Soc.* **73**, 79-82 (1951).—*C.A.* **45**, 4591*i*.

O_3-treated NaOH decomp. in H_2O with evolution of O_2, but does not liberate I_2 from acidified KI soln. Ozonated KOH and CsOH also evolve O_2 upon decompn. in H_2O but liberate I_2 from acidified I^- soln. Analyses of the gross products of ozonization of NaOH and CsOH agree with the formulas NaO_3 and CsO_3 for the colored, paramagnetic materials.

1584. YOUNG, D. M. **Calculation of the adsorption behavior of argon on octahedral potassium chloride.** *Trans. Faraday Soc.* **47**, 1228-33 (1951).—*C.A.* **46**, 4318*d*.

The (111) plane of KCl was composed of equilateral triangular arrays of ions, so that an A atom might be adsorbed over 2 distinct types of array. Including adsorption above an ion, 6 adsorption sites were considered, namely, 3 including K^+ in surface and 3 including Cl^-. The potential energy of an isolated A atom as a function of distance above the (111) plane was calcd. at 6 different positions on the crystal surface, and heats of adsorption were evaluated.

1585. AIGRAIN, P. R. AND DUGAS, C. R. **Adsorption on semiconductors.** *Z. Elektrochem.* **56**, 363-6 (1952).—*C.A.* **47**, 1458*i*.

The electrostatic changes during the adsorption at surfaces of semiconductors as consequence of the exchange of electrons between adsorber and adsorbed mol. are considered. The elec. and energetic conditions are calcd. for the adsorption, if the adsorbed mols. have no chem. affinity to the adsorber. The no. of adsorbed mols. is detd. by the concn. of impurity centers. With 2% impurities only 10% of the surface is covered.

1586. BUTYAGIN, P. YU. AND ELOVICH, S. YU. **Adsorption studies of platinum-supported catalysts.** *Zhur. Fiz. Khim.* **26**, 692-700 (1952).—*C.A.* 47, 5233*e*.

Adsorption isotherms at low temp. of propylene and oxygen were obtained on the following adsorbents: $BaSO_4$, $BaSO_4$+ 5 wt % Pt, $BaSO_4$+ 8 wt % Pt. Special attention was devoted to a comparison of the isotherms obtained on $BaSO_4$ and on the other two adsorbents: Pt modified the spectrum of heats of adsorption. A new method was proposed to det. the relative surface areas of catalyst and support. The method was based on the irreversibility of the adsorption of O_2 or C_3H_6 at low temp. on Pt. The adsorption on Pt corresponded to the difference between 2 adsorption isotherms obtained with O_2, at −183°C, on the catalyst: the first one was obtained after preliminary evacuation of the catalyst at high temp. (320°); the 2nd one was obtained after pumping at −183°C.

1587. CLARKE, EDWARD N. AND FARNSWORTH, H. E. **The photoelectric work functions and low-speed electron diffraction from thin films of silver on the (100) face of a silver single crystal.** *Phys. Rev.* **85**, 484-5 (1952).—*C.A.* **46**, 5427*e*.

The lattice structure and orientation of the deposited film are the same as those of the supporting crystal. Deposition of Ag produces a decrease of work function, ψ, only if the crystal temp. is less than approx. 65°C. Deposition of doubly distd. Ag in a high vacuum may result in a more gas-free surface as detd. by electron diffraction, i.e., a Ag-crystal surface producing no diffraction beams or weak beams can be made to produce strong beams by proper deposition of Ag onto the surface.

1588. COLOMBANI, ANTOINE AND RANC, GASTON. **Copper crystallization in thin layers.** *Compt. rend.* **234**, 78-80 (1952).—*C.A.* **46**, 3359*f*.

A technique used to deposit a thin layer of Au was extended to Cu, Pb, and Bi. Results similar to those with Au were obtained, Cu being deposited on an amorphous support (Plexiglas) and on an oriented crystal of NaCl. For deposits of less than 110A. on Plexiglas the evolution of the resistivity was an increasing function of time. Above 110A. it decreased with time. The same observations were made with NaCl, but the transition point was at 65A. For the same thickness, the resistivity of the Cu layer on an oriented crystal was always inferior to one made on amorphous support.

1589. COULTER, L. V. AND CANDELA, G. A. **Adsorption of water vapor by silver iodide.** *Z. Elektrochem.* **56**, 449-52 (1952).—*C.A.* **46**, 10774*b*.

Adsorption isotherms were detd. volumetrically at 16.0°, 34.0°, and 50.0°C. Normal surface adsorption was accompanied by a phase transition which appeared to be the formation of a chem. hydrate by a surface impurity. After correcting for this effect, a type-**111** isotherm was obtained. The isosteric heat of adsorption was found to be approx. 1 kcal. less than the heat of liquefaction of water at the same temp.

1590. CRAIG, A. AND McINTOSH, R. **The preparation of sodium chloride of large specific surface.** *Can. J. Chem.* **30**, 448-53 (1952).—*C.A.* **46**, 10780*f*.

NaCl was evapd. at 750-850°C and collection of the smoke particles made in an electrostatic precipitator at 20,000 v. The prepns. had areas varying from 7.1 to 54.4 m2 per g, measured by CO_2 adsorption at −78.5°C. The areas were checked by estg. from electron micrographs. One sample having a specific area of 40 m2 by CO_2 adsorption showed a specific area of 60 m2 by N_2 adsorption.

1591. DRAIN, L. E. AND MORRISON, J. A. **Interpretation of the thermodynamic properties of adsorbed argon at low surface coverages.** *Trans. Faraday Soc.* **48**, 316-26 (1952).—*C.A.* **46**, 9931*c*.

Measurements of A adsorbed on TiO_2 (rutile) at low surface coverages could be interpreted satisfactorily on a model of localized adsorption on a heterogeneous surface without interactions. The distribution function for the energy of the adsorption sites was obtained from the heat of adsorption data and used to calc. entropies and heat capacities of the adsorbed phase. It was unlikely that a single distribution function could be used to fit the thermodynamic data for all systems, particularly at low temps.

1592. Drain, L. E. and Morrison, J. A. **Thermodynamic properties of argon adsorbed on rutile.** *Trans. Faraday Soc.* **48**, 840-7 (1952).--*C.A.* 47, 3079*e*.

The heat capacity of A adsorbed on rutile was detd. at 4 different surface coverages in the region of the monolayer over the range 13° to 95°K. Also, the integral and isosteric heats of adsorption were detd. at 85°K up to a vol. adsorbed of 4.6 V_m. Approx. 40 heat-capacity detns. were made for each of 4 surface coverages, and smoothed molar-heat-capacity values of 5° intervals were tabulated. The adsorption isotherm at 85°K was detd. with 41 points. Inflection points occurred in the integral and isosteric heats of adsorption at 85°K as a function of the vol. adsorbed.

1593. Engel, Olive G. **Model for epitaxy in metal-rock salt pairs.** *J. Chem. Phys.* **20**, 1174 (1952).—*C.A.* **46**, 10772*g*.

The ionization process on the surface consists of the steps $M - ne \rightarrow M^{n+}$ and $nS + ne \rightarrow nF$, where M is the metal in question, S is a vacant anion site on the surface which serves as an electron trap, and F is a color center. Calcns. show that the model is energetically feasible for, e.g., Ag and Pd on rock salt. For the cleavage face of rock salt, distances between deposit-metal ions and Cl ions in the substrate (which det. the bonding energy) must be as small as possible, and distances between deposit-metal ions and Na ions (which det. the antibonding energy) must be as large as possible.

1594. Ewles, J. and Heap, C. N. **Luminescence and adsorption phenomena in some oxides and halides.** *Trans. Faraday Soc.* **48**, 331-8 (1952).—*C.A.* **46**, 9990*b*.

Solids, in which the luminescence assocd. with adsorption had been removed by long heating in dry air or pure dry O_2, lose to a considerable extent their power of adsorption. Reheating *in vacuo* or in reducing gases introduced new luminescent effects and restored in appreciable measure the power of adsorption and the luminescence assocd. with it. The luminescent effects described arose in mols. adsorbed at active sites provided by anion defects in the crystal lattice of the adsorbent.

1595. Flood, H.; Førland, T., and Motzfeldt, K. **The oxygen electrode in molten salts.** *Acta Chem. Scand.* **6**, 257-69 (1952) (in English).—*C.A.* **46**, 8544*f*.

The electrode behaved as a reversible O_2-O^{2-} electrode. Na_2SO_4 and Na_2CO_3 formed an ideal soln., and the junction potential was negligible. In order to find if the electrode worked also at higher acidites, the sýstem K_2CrO_4-$K_2Cr_2O_7$ was studied in a similar cell. The observed e.m.f. was 15% lower than calcd.

1596. Garner, W. E.; Stone, F. S., and Tiley, P. F. **The reaction between carbon monoxide and oxygen on cuprous oxide at room temperature.** *Proc. Roy. Soc.* **A211**, 472-89 (1952).

The differential heat of adsorption of oxygen during the formation of the first few layers of Cu_2O on Cu were detd. A constant value of 55 kcal. was obtained after the first few layers. The adsorbed O_2 reacted with CO and CO_2, giving a CO_3 complex as an intermediate stage in the reactions. The complex was unstable in the presence of CO. The reactivity of the adsorbed O decreased with time, due to the diffusion of Cu^+ ions to the surface, which partially built the oxygen ions into the lattice. The reaction mechanism of the catalytic reaction involved CO, O_2, and CO_3 complex in the stationary state on the surface, the last two species being present in small amount.

1597. Gregg, S. J. and Sing, K. S. W. **The effect of heat-treatment on the surface properties of gibbsite. III. The chemical nature of the products formed.** *J. Phys. Chem.* **56**, 388-91 (1952).—*C.A.* **47**, 28*d*.

Samples of gibbsite were heated for 5 hrs at a succession of fixed temps. and the products examd. by x-rays and by measurements of volatile matter, sp.gr., and bulk d. Below 200°C practically no chem. change was observed. Heating between approx. 300° and 500°C resulted in a product that was a mixt. of boehmite and γ-Al_2O_3. From 500 to 1000°C the γ-Al_2O_3 of crystallite size progressively diminished with increasing temp.

1598. Gritton, H. T. S.; Gregg, S. J., and Winsor, G. W. **Calcination of dolomite. I. Kinetics of the thermal decomposition of calcite and of magnesite.** *Trans. Faraday Soc.* **48**, 63-9 (1952).—*C.A.* **46**, 6909*i*.

The kinetics were detd. *in vacuo* with an automatically recording sorption balance at 720-780°C for calcite and 540-600°C for magnesite. The decompn. was represented by $(w/w_0)^n = -kt + a$, where w/w_0 = the fraction still undecompd. at time t; k, a, and n were const. The decompn. probably occurred at an interface advancing from the outside to the interior, requiring $(1 - n) = 0.67$ in the ideal case. Deviations were due to self-cooling, to impedance in the escape of CO_2, and to a somewhat slow rate of formation of decompn. nuclei.

1599. Gritton, H. T. S.; Gregg, S. J., and Winsor, G. W. **Calcination of dolomite. II. Thermal decomposition of dolomite.** *Trans. Faraday Soc.* **48**, 70-5 (1952).—*C.A.* **46**, 6910*b*.

Four specimens of dolomite were studied *in vacuo* between 640° and 720°C. The decompn. advanced from an interface at the exterior of the sample to the interior. The initial product was a solid soln. of (Ca, Mg) O which quickly broke up into crystallites of CaO and of MgO. If the escape of CO_2 was hindered, quantities of $CaCO_3$ only would be formed behind the interface. When vacuum-decompd. dolomite was exposed to CO_2 at 800°C, the gas was rapidly taken up to an extent smaller than that corresponding to the total Ca content.

1600. Grossweiner, Leonard I. and Seifert, Ralph L. **The reaction of beryllium oxide with water vapor.** *J. Am. Chem. Soc.* **74**, 2701-4 (1952).—*C.A.* **46**, 9390*d*.

At high temps. the volatility of BeO is greatly increased by the presence of water vapor. Measurements of the effect of temp. (1199-600°C), flow rate, and partial pressure of water (76-750 mm) on the rate of volatilization of BeO indicate that the increased volatility results from the reaction $BeO(s) + H_2O(g) \rightarrow Be(OH)_2(g)$.

1601. Higuchi, Izumi and Utsugi, Hiroshi. **Capillary condensation in contact zones between nonporous particles of a powder.** *J. Chem. Phys.* **20**, 1180-1 (1952) Science Repts. Tohoku Univ. **36**, 27-36 (1952).—*C.A.* **46**, 10701*h*.

Adsorption isotherms were obtained at 0°C for EtOH on anatase (particle radius 0.05μ). The steep slope of the adsorption curve was attributed to capillary condensation in the contact zones of the particles. Formulas were derived for the vol. of the interstices corresponding to closest packing, planar close packing, and linear packing of the particles.

1602. Higuchi, Izumi and Utsugi, Hiroshi. **The differential molar entropy of adsorbate and the mobility of molecules adsorbed on a solid surface.** *Science Repts. Tohoku Univ.* **36**, 37-9 (1952).—*C.A.* **47**, 5759*i*.

The differential molar entropy of C_2H_5OH and *n*-butane at 0°C was calcd. as a function of surface coverage. Adsorptions in the initial parts of the curves for ethanol on anatase and for C_4H_{10} on glass beads and carbolac indicated that the adsorbates were essentially two-dimensional gases. In the case of butane on SiO_2 gel there was an entropy decrease. For the adsorption of EtOH on $3TiO_2.3Fe_2O_3$ gel, steep falls in the differential molar entropy at low coverage indicated partial fixing of adsorbate mol.

1603. Holm, Else. **Theory of the silicon carbide contact.** *J. Applied Phys.* **23**, 509-17 (1952).—*C.A.* **46**, 7911*e*.

Practically clean SiC possessed a superficial layer which functioned as a potential hill for the electrons. Because of its thinness the hill was penetrable for the elec. current by means of the tunnel effect. The tunnel resistance per unit area was investigated with terminal areas of the order of 2 mm^3. Being const. at small voltages, it dropped down through some orders of magnitude within the voltage range of 0.5 to 5 v. The thickness of the potential hill was of the order of 10 to 20 A.

1604. Holzman, G. R. and Moore, K. H. **Electron-diffraction study of the reorientation of certain alkali halides deposited on mica and on mica surfaces covered by organic films.** *J. Colloid Sci.* **7**, 396-406 (1952).—*C.A.* **46**, 10762*c*.

Electron diffraction patterns of NH_4I sublimed in air on mica showed a partial tetrahedral orientation that becomes complete on exposure to limited amts. of H_2O vapor. Sublimation of NH_4I on an org. film (cellulose acetate) produced no orientation, even after exposure to H_2O vapor. NH_4I sublimed in air on mica coated with films 100-200A. thick of cellulose acetate, Formvar, or chlorinated rubber showed no initial orientation, but complete tetrahedral orientation occurred on exposure to H_2O vapor.

1605. Honig, Jurgen M. **Adsorption of NO_2-N_2O_4 on rutile surfaces.** *Univ. Microfilms, Pub.* No. **4356**, 104 pp. *Dissertation Abstracts* **12**, 810-11 (1952).—*C.A.* **47**, 3079*g*.

1606. Honig, J. M. and Reyerson, L. H. **Adsorption of nitrogen, oxygen, and argon on rutile at low temperatures; applicability of the concept of surface heterogeneity.** *J. Phys. Chem.* **56**, 140-4 (1952).—*C.A.* **46**, 8458*h*.

The adsorption of N_2, O_2, and A on rutile was measured in the region of low relative pressures at temps. between 77 and 91°K. The data obeyed B.E.T. plots over the relative pressure range 0.05 to 0.3 for O_2 and A; for N_2 they fitted from the lowest relative pressures up to 0.2. N_2 was adsorbed extensively at much lower relative pressures than O_2 or A. At 77°K for $p/p_0 = 0.001$ the surface was 66% covered by N_2 but only 13 and 10% by O_2 and A, resp.

1607. Jury, Stanley H. and Licht, William Jr. **Static sorption isotherm for β-soluble anhydrite and humid air.** *Ind. Eng. Chem.* **44**, 591-4 (1952).—*C.A.* **46**, 4882*c*.

The equil. characteristics of the system β-sol. anhydrite and moist air, particularly in the low-humidity range, were studied from both the adsorption and desorption sides. Some hysteresis was observed. The effects of repeated regeneration and of varying the regeneration cycle were also studied.

1608. Kern, Raymond. **The effect of the rate of evaporation of aqueous solutions of alkali halides on the faces of crystalline precipitates.** *Compt. rend.* **234**, 970-1 (1952).—*C.A.* **46**, 9372*h*.

Crystals were obtained by evapn. from a microscope slide of glass or of Pt and observed with a microscope. Salts studied were LiF, NaF, NaCl, KCl, KBr, and KI. Slow evapn. gave only the 100 faces. A crit. rate was found above which octahedra form and were in the order given above.

1609. Kiehl, Jean Pierre. **Influence of heat of transformation of solids on the displacement of their transformation temperature by adsorbed gases.** *Compt. rend.* **234**, 943-5 (1952).—*C.A.* **46**, 10837*f*.

Transformations were studied by thermal analyses after admitting the vapors under study to the evacuated powder. Hexagonal AgI changed to cubic at 143.6°C in He, at 139.0°C in CO_2. Change of Na_2MoO_4 from γ to δ at 440° was not influenced by adsorbed gas. The heat of transformation detd. the magnitude of lowering of transformation temp. for a given gas.

1610. Lawson, W. D. **Oxygen-free single crystals of lead telluride, selenide, and sulfide.** *J. Applied Phys.* **23**, 495-6 (1952).—*C.A.* **46**, 6455*i*.

Anomalies in the type of cond. of artificially prepd. crystals of lead selenide and lead telluride were the result of the presence of O_2. A method was developed for eliminating O_2 from the specimens by melting the elements into the crucible in H_2. Single crystals of lead sulfide were grown when O_2 was eliminated from the specimen in this way.

1611. Lindner, Roland. **Diffusion of radioactive iron in iron (III) oxide and zinc-iron spinel.** *Arkiv Kemi* 4, 381-4 (1952) (in German).—*C.A.* **47**, 3072*a*.

The diffusion of Fe^{59} as an indicator into Fe_2O_3 at 930-1270°C and into Zn-Fe spinel at 750-1300°C was detd. Pressed tablets of Fe_2O_3 and the spinel were prepd., and Fe^{59} indicator applied in the contact method. The temp. function of the diffusion const. for Zn-Fe spinel was $D = 8.5 \times 10^2 \exp(-82{,}000/RT)$ cm^2/sec and for Fe_2O_3 $D = 4 \times 10^4 \exp(-112{,}000/RT)$ cm^2/sec.

1612. Lindner, Roland. **Self diffusion in lead oxide.** *Arkiv Kemi* 4, 385-8 (1952) (in German).—*C.A.* **47**, 3072*b*.

Th B (Pb^{212}) was used as an indicator in the study of the self diffusion of Pb in PbO. The indicator, prepd. in the form of a natural soln., was applied to pressed tablets of PbO and the tablets heated. The diffusion const. $D = 10^5 \exp(-66{,}000/RT)$ cm^2/sec. No difference in the value of D was found for various crystallographic directions.

1613. Lindner, Roland; Austrümdal, St., and Åkerström, A. **The kinetics in calcium oxide.** *Acta Chem. Scand.* **6**, 468-74 (1952) (in German).—*C.A.* **47**, 30*c*.

Study of the diffusion of Ca in CaO by the contact method gave the following value for the diffusion const.: $D = 0.4 \exp(-81{,}000/RT)$ cm^2 sec^{-1}. The self-diffusion consts., detd. from partial ionic mobilities, agreed fairly well with those detd. by radioactivity measurements and indicated exclusively Ca-ion diffusion in CaO.

1614. Lucas, L. N. D. **Oriented chemical growth on single crystals of zinc and cadmium.** *Proc. Roy. Soc.* (London) **215A**, 162-74 (1952).—*C.A.* **47**, 4160*h*.

The oriented chem. growths of the oxides were studied on different surfaces of single crystals of Zn and Cd and also of Cd sulfide. The orientation depended on the surface topography of the substrate which could be detd. in favorable cases. The clean surfaces of the metallic crystals used were prepd. by electrolytic methods. The inner potentials of Zn and ZnO were measured. Very thin layers of ZnO on a cleavage face of Zn did not have the pseudomorphic structure but had the normal bulk structure. ZnO grew on Zn in a parallel or pseudoparallel orientation, for all substrate surfaces used. CdO grew on Cd such that the oxide contact planes were (111) for (100), (101), and (001) Cd contact planes.

1615. Lyashenko, V. I. **Adsorption of molecules and the photoconductivity of cuprous oxide.** *Doklady Akad. Nauk S.S.S.R.* **87**, 33-5 (1952).—*C.A.* **47**, 3686*f*.

If adsorption of a mol. at the surface lowered the work function, the cond. of a pos.-type semiconductor was decreased, and that of an electronic semiconductor was increased; if the adsorption raised the work function, the cond. of a pos. semiconductor would be increased, and that of an electronic conductor decreased. Thus, adsorption of substances which did not themselves absorb light of the wave length exciting photocond., should alter the photocond. of a semiconductor. This was confirmed by oscillography of the photocond. of samples of $Cu_2O \sim 1\mu$ thick, excited by II-shaped light impulses of 3 millisec. duration, with dark pauses of 115 millisec., *in vacuo* ($\sim 10^{-4}$ mm Hg) and in the presence of vapors of Me_2CO or EtOH. All the observed effects of adsorption were completely reversible.

1616. Mitsuki, Chikara. **Dehydration of gypsum.** *J. Ceram. Assoc. Japan* **60**, 92-5 (1952).—*C.A.* **46**, 6805*a*.

After gypsum began dehydration at about 100°C, it continued even when the temp. was lowered, e.g. below 87°C. No differences were found in crystal structure and hardness between the plaster of Paris prepd. from hemihydrate by dehydration and that prepd. from anhydrite by hydration. By dehydration gypsum changed into directly sol. anhydrite.

1617. Monier, Jean C. **Regular orientation of dimethylglyoxime on different supports.** *Compt. rend.* **234**, 1185-6 (1952).—*C.A.* **46**, 8448*h*.

Dimethylglyoxime was sublimed and oriented on fresh cleavage faces of crystals placed in the vapor of dimethylglyoxime. When dimethylglyoxime was deposited on KCl, NaCl, CaF_2, $BaSO_4$ $NaNO_3$, mica, and calcite, it was oriented preponderantly about its *b* axis.

1618. Monier, Jean C. **Epitaxy of *p*-aminophenol on different supports.** *Compt. rend.* **234**, 2375-7 (1952).—*C.A.* **46**, 8448*h*.

p Aminophenol was sublimed, at atm. pressure, onto crystals of NaCl, KCl, $NaNO_3$, calcite, barite, and celestite. Although many orientations were found, crystals of p-$NH_2C_6H_4OH$ always had their 100 planes attached to the supporting crystal.

1619. Monier, Jean C. **Epitaxes of organic crystals by sublimation on blende.** *Compt. rend.* **234**, 2456-8 (1952).—*C.A.* **46**, 9922*d*.

The epitaxes of *o*-aminophenol, *p*-aminophenol, and dimethylglyoxime obtained by sublimation on blende are described. A study of twin crystal of dimethylglyoxime confirms former studies showing that the blende has a peculiar effect on this compd. not present with other compds.

1620. Mukhlenov, I. P. **Mechanism of the arsenic poisoning of vanadium catalysts in the production of sulfuric acid.** *Zhur. Priklad. Khim.* **25**, 793-6 (1952).—*C.A.* 47, 4714*i*.

The catalyst consists of an aluminosilicate and $BaSO_4$ carrier, with an alkali polyvanadate as the catalytically active substance. A side reaction, $m\text{As}_2\text{O}_5 + \text{M}_2\text{S}_2\text{O}_7 \rightleftarrows \text{M}_2\text{O}.m\text{As}_2\text{O}_5 + 2\text{SO}_3$, favors the poisoning by diminishing the amt. of solvent for the alkali polyvanadate. In the beginning of the poisoning, the main reaction proceeds rapidly, and its limiting stage is sorption. A sharp acceleration of the fall of activity occurs when all the excess alkali metal has been bound and V_2O_5 begins to crystallize. Sorption of greater amts. of As is easily reversed and results in no permanent poisoning. Only the chemically bound As poisons irreversibly. This poisoning is due to the alkali metal contents of the com. catalysts. Pure V_2O_5 is not poisoned by As.

1621. Mutô, Tokio; Fukase, Masahiko; Sekine, Eiiji, and Waku, Shigeru. **Gas evolution of artificial mica.** *Ôyô Butsuri* (J. Applied Phys.) **21**, 164-8 (1952).—*C.A.* **46**, 10854*e*.

Gas evolution and dielec. const. are measured of an artificial mica $F_2KMgAlSi_3O_{10}$ for electron tubes. The mica prepd. in a carbon-black crucible evolves more gas, which is mainly adsorbed air and some H_2S, than that prepd. in a Pt crucible.

1622. Neuhaus, A. **Nucleus formation and orientation of precipitated materials on alien crystalline surfaces.** *Z. Elektrochem.* **56**, 453-8 (1952).—*C.A.* **47**, 2564*e*.

Material in the gaseous phase was deposited on cryst. surfaces at a very slow and controllable rate. For a thickness of deposit less than 100 A. there was almost random distribution, after which a quasi-two-dimensional orientation took place. Special emphasis was given to the effect of the deposit on hardness. The orientation of alizarin on alkali halides and the lattice periodicity and the misfit of deposit and substrate plane was shown.

1623. Neven, P. and Tiggelen, A. van. **A reaction involving the quantitative absorption of hydrogen.** *Bull. soc. chim. Belges* **61**, 328-9 (1952).—*C.A.* **47**, 5291*a*.

H_2 is absorbed quantitatively by either Ag_3PO_4 or $Ag_2B_4O_7$, forming metallic Ag, and either H_3PO_4 or $H_2B_4O_7$. The activation energies are 16 kcal. for the phosphate and 17 for the borate.

1624. Pace, E. L.; Sasmor, D. J., and Heric, E. L. **Heat capacity of methane adsorbed on titanium dioxide between 55 and 90°K.** *J. Am. Chem. Soc.* **74**, 4413-15 (1952).—*C.A.* **47**, 32*e*.

A low-temp. adiabatic calorimeter was used to det. the heat capacity of CH_4 adsorbed on TiO_2 between 50 and 90°K at coverages of approx. 0.2, 0.4, 0.8, and 1.0 monolayer. The heat capacity of the adsorbed CH_4 at all coverages was greater than that of solid CH_4, and at 89°K it exceeded the value for liquid CH_4. The heat capacity-temp. curves pointed to the absence of any 1st-order phase transitions under the exptl. conditions used.

1625. Pagel, H. Armin and Oita, Itsumi Jack. **Air adsorption error in the micro-Dumas method for nitrogen.** *Anal. Chem.* **24**, 756-8 (1952).—*C.A.* **46**, 11034*b*.

Expts. are described indicating that the adsorbed air on CuO in the micro-Dumas detn. is less than 0.001 ml. High N-values are caused mainly by incomplete combustion.

1626. Papée, Denis. **Relation between the adsorption velocity and isotherms.** *Compt. rend.* **234**, 437-9 (1952).—*C.A.* **46**, 5928*b*.

Adsorption curves of water vapor on boehmite and bayerite show that the rapid attainment of equil. at a partial pressure of 0.96 in the case of boehmite is due to the isotherm turning towards the abscissa. In the case of bayerite the slow attainment of equil. is explained by the asymptotic form of the isotherm at satn.

1627. Pashley, D. W. **Oriented deposits on crystalline surfaces.** *Proc. Phys. Soc.* (London) **65A**, 33-8 (1952).—*C.A.* **46**, 10762*b*.

Layers of Ag and Th halides were evapd. onto cleavages or rock salt, KBr, MgO, and mica, and the films were studied by electron diffraction. Both high and low interat. misfits were observed between the substrate and oriented overgrowths. In AgCl on KBr a reaction occurred. ThCl crystallized in a rock-salt-type structure on KBr, but was normal on other substrates. AgCl oriented on mica with a misfit of -24%.

1628. Pashley, D. W. **Oriented chemical overgrowths and surface topography.** *Proc. Roy. Soc.* (London) **A210**, 354-76 (1952).—*C.A.* **46**, 10778*d*.

The growth of thin halide tarnish layers on silver crystals was studied. Contact planes between Ag and halide were often not parallel to the macroscopic surface. Halide orientation on Ag facets was independent of the position of those facets with respect to the macroscopic surface. The orientations depended considerably on the topography of the substrate. A small percentage misfit was not an essential condition for the appearance of oriented overgrowths.

1629. Pashley, D. W. **Orientation of silver formed during electron bombardment of silver halides.** *Acta Cryst.* **5**, 850 (1952) (in English).—*C.A.* **47**, 3107*a*.

Electron bombardment of AgBr deposited on KI cleavage faces caused growth of Ag oriented parallel to the AgBr. Thus, the substrate was not responsible for the Ag orientation. Expts. with detached AgBr or AgCl films showed some parallel oriented Ag formed. Formation of parallel oriented Ag was the effect of decompn. of AgBr or AgCl.

1630. Patterson, D. **Surface stability of alkali halide crystals.** *Trans. Faraday Soc.* **48**, 877-87 (1952).—*C.A.* **47**, 4681*a*.

The instability of the surface layer could be regarded as brought about by stretching the 2-dimensional lattice from its equil. spacing so that it fitted the substrate. The repulsive forces between ions were lowered, which, with the electrostatic forces of the substrate, maintained the regular spacing on the surface. The equil. spacing of the two-dimensional lattice was detd. using the point-charge model but including van der Waals forces and without assuming equal polarizabilities of the ions.

1631. Pickering, H. L. and Eckstrom, H. C. **Physical adsorption of gases on anatase.** *J. Am. Chem. Soc.* **74**, 4775-7 (1952).—*C.A.* **47**, 1456*h*.

Adsorption data at -195° and -183°C and for CO_2 at -78°C were detd. by the abs. method of Harkins and Jura. The calcd. mol. cross-sectional area values in general agreed poorly with those obtained from liquid adsorbate d. data. A simple relation was obtained between the B.E.T. cross-sectional area values (σ) and the Harkins and Jura const. (k) for adsorption on anatase: $k = 0.251\sigma$ (for vols. in ml at S. T. P.).

1632. Pieri, Mario. **The absorption of moisture by raw calcium cyanamide.** *Chimica* (Milan) 7, 158-60 (1952).—*C.A.* **46**, 8335*i*.

During the pulverization and ventilation (with atm. air), $CaCN_2$ absorbs about 0.75% H_2O, which is partially absorbed by CaO and CaC_2 and partially by graphitic carbon. The presence of H_2O may cause explosions, when $CaCN_2$ is stored in the silos. This danger can be avoided by using a pure CaO in the prepn. of $CaCN_2$, by ventilating with dried air, and by oiling the powder.

1633. Reynolds, S. E.; Hume, William II, and McWhirter, Max. **Effects of sunlight and ammonia on the action of silver iodide particles as sublimation nuclei.** *Bull. Am. Meteorol. Soc.* **33**, 26-31 (1952).—*C.A.* **46**, 6461*a*.

AgI smoke from a hot Pt filament produces 100 times as many ice crystals in a supercooled cloud in a lab. cold chamber at -13°C if a little NH_3 vapor is added to the cloud. An air sample contg. deactivated AgI produces large nos. of ice particles in a supercooled cloud when NH_3 vapor is added to the cloud, but if NH_3 vapor is added to the air sample before exposure to sunlight the rate of decay is increased and nucleating effects are not enhanced by adding NH_3 to the supercooled cloud.

1634. Salmanov, G. D. **Zeolitic water of hydrated calcium silicate.** *Tsement* **18**, No. 5, 16 (1952).—*C.A.* **47**, 1353*e*.

Synthetic β-$2CaO.SiO_2$, contg. no free CaO, was ground to -60, mixed with 30% of H_2O, and made into 20 x 20 x 20-mm test pieces. After 21 days the loss of H_2O upon heating was detd. Loss of H_2O began at 100-200°C, became slower at 200-350°C, was nearly complete at 350-800°C, and complete at 800-1000°C.

1635. Schulz, L. G. **Growth of alkali halides from the vapor on single-crystal substrates of alkali halides.** *Acta Cryst.* 5, 130-2 (1952).—*C.A.* **46**, 4305*d*.

Alkali halides of the NaCl-type structure (LiF, NaF, LiCl, KF, NaCl, NaBr, KCl, KBr, KI, and RbI) were deposited from the vapor phase by evapn. in a vacuum onto cleavage surfaces of LiF, NaCl, KCl, and KBr. Crystals of the initial deposit were oriented with their crystallographic axes parallel to those of the substrate for all deposit-substrate combinations.

1636. Schulz, L. G. **Overgrowths of alkali halides on calcium carbonate and sodium nitrate.** *Acta Cryst.* **5**, 264-5 (1952) (in English).—*C.A.* **47**, 937*c*.

Crystals of NaCl, KCl, KBr, CsCl, CsBr, RbI, KI, NaF, LiF, and CsF were grown from the vapor and from soln. on cleavage faces of $CaCO_3$ and $NaNO_3$. The orientations were detd. by electron diffraction. A deposit 10A. thick usually showed a well-defined pattern, but with thicknesses greater than about 150A., random orientation occurred.

1637. Siat, Albert and Hocart, Raymond. **Statistical nature of the epitaxy of molybdic anhydride on molybdenite.** *Compt. rend.* **234**, 2377-9 (1952).—*C.A.* **46**, 8448*f*.

Crystals of MoO_3 were slowly sublimed onto a cleavage face of MoS_2. The deposit showed rectangular crystals of MoO_3 having their 010 planes in contact with 0001 of MoS_2. The largest group of crystals (60 to 70%) had their long axis inclined at 12.5° to the trace of the $01\bar{1}0$ plane of MoS_2. A second group (15 to 20%) had the long axis of MoO_3 inclined at 30° to the trace of $01\bar{1}0$ of MoS_2.

1638. Smith, G. Frederick; Bernhart, D. N., and Wiederkehr, V. R. **Desiccator data.** *Anal. Chim. Acta* **6**, 42-6 (1952) (in English).—*C.A.* **46**, 7253*b*.

The time rate of dehydration of air in lab. desiccators had been detd. by direct measurement of residual moisture at given time intervals. By using $Mg(ClO_4)_2$, BaO, and $CaSO_4.\frac{1}{2}H_2O$, a 3000-ml desiccator produced a bone dry atm. within 7.5-15 min. Anhyd. $CaCl_2$ was found to be rapid in reaction, but not quite 100% efficient. In large desiccators the time rate of dehydration was but slightly reduced.

1639. Young, D. M. **Adsorption of argon on octahedral potassium chloride.** *Trans. Faraday Soc.* **48**, 548-61 (1952).—*C.A.* 46, 10773*b*.

Two samples of octahedral KCl were obtained by crystn. in the presence of Pb^{2+} and the dye Amaranth, resp. The adsorptive properties at liquid-air temps. of the two prens. were similar. Theoretical calcns. for the variation in the heat of adsorption of A on (111) KCl with the amt. adsorbed gave results which agreed with expt. Exptl. and theoretical evidence showed that the adsorption behavior of A on the (111) differed considerably from that on the (100) plane.

1640. Ballou, E. V. and Ross, Sydney. **Adsorption of benzene and water vapor by molybdenum disulfide.** *J. Phys. Chem.* 57, 653-57 (1953).

Adsorption isotherms of N_2, C_6H_6 and H_2O on molybdenum sulfide were detd. A hydrophilic layer of molybdenum trioxide was found on sulfide surfaces that had been heated to 110°C. The oxide layer was largely removed by treatment with NH_4OH at room temp., or by this treatment followed by H_2S at 125°C. The oxide-free surface was hydrophobic and the amt. of H_2O adsorbed proportional to the extent of surface oxidation.

1641. Frost, G. B. and Campbell, R. A. **The rate of dehydration of copper sulfate pentahydrate at low pressures of water vapor.** *Can. J. Chem.* 31, 107-19 (1953).—*C.A.* 47, 5772*f*.

The rate of dehydration of $CuSO_4 \cdot 5H_2O$ was detd. in the presence of water vapor; the water vapor pressures were very low, in the range of 0.002 to 4.57 mm Hg. As the pressure was increased, the rate dropped very rapidly, but at about 0.3 mm Hg the rate rapidly increased until at about 2 mm Hg the rate slowly declined. $CuSO_4 \cdot 5H_2O$ was similar in this respect to $MnC_2O_4 \cdot 2H_2O$ which was formerly considered unique in its behavior.

1642. Healey, F. H.; Fetsko, J. M., and Zettlemoyer, A. C. **Physical adsorption on cadmium oxide.** *J. Phys. Chem.* 57, 186-8 (1953).—*C.A.* 47, 7286*c*.

Relative values for the vol. of adsorbate in a monolayer, on crystals of CdO, were found from adsorption isotherms to be 96 and 89, resp., for N_2 at -195 and -183°C; 106 and 103 for O_2; 102 and 97 for CO; and 100 and 107 for A. The absence of adsorption in preferred positions, such as previously observed for MgO, was explained on the basis of the weak potential field of the Cd^{++} ion as compared to the strong field of the small Mg^{++} ion.

1643. Smakula, Alexander and Klein, Myron W. **Investigation of crystal growth by thermal etching and oriented overgrowth.** *J. Chem. Phys.* **21**, 100-4 (1953).—*C.A.* **47**, 4160*f*.

Thermal etching of Tl bromide iodide single crystals in vacuum takes place preferentially at points where the crystal is distorted. The etching proceeds in regular steps with the formation of pits always bounded by (110) planes. High temp. produces a disordered etching and marked surface striation. Deposition of vapor on single crystals of the bromide iodide leads to the formation of isolated hillocks whose sides are bounded by (110) planes.

1644. Taylor, H. F. W. **Hydrated calcium silicates. V. Water content of calcium silicate hydrate I.** *J. Chem. Soc.* **1953**, 163-71.—*C.A.* **47**, 5209*a*.

Ca silicate hydrate I prepd. at room temp. had a typical layer structure, with some analogies to clay minerals; the compn. was 1 to 1.5 $CaO.SiO_2.xH_2O$, with $x = 2$ to 2.5 at room temp., $x = 1.0$ over CaO, or if heated to 100-150°C, or after NH_3 extn. Riversideite was a natural regular intergrowth of an apatite-like mineral (wilkeite), with hydrate I. Isobaric dehydration curves, combined with x-ray powder diagrams, were detd., which confirmed that 1 mol. H_2O remained above 100°C, or after standing over CaO at room temp., fixed in the structure. The isobaric dehydrations all showed an inflection at about 220°C which possibly indicated the existence of a hemihydrate. As long as the dehydration did not remove the fixed 1 mol. H_2O, the samples could be rehydrated, but with a typical hysteresis of the rehydration curve which was the more pronounced, the higher was the temp. of dehydration.

1645. Walker, W. C. and Zettlemoyer, A. C. **Active magnesia. V. Adsorption in preferred positions.** *J. Phys. Chem.* **57**, 182-6 (1953).—*C.A.* **47**, 7285*i*.

Adsorption-isotherm data for N_2 and A at −195°C; N_2, A, and O_2 at −183°C; CO_2 at −78°C; CH_3OH at 0°C; C_2H_2 at −80°C; I_2 at 25°C; and CO_2 (chemisorption) at 25°C were obtained on samples of pure MgO having an area of about 200 m² per g. When 16.2 A² was used for the area occupied by a N_2 mol. at −195°C, the areas by all other adsorbates (except I_2 and CO_2 at 25°C) averaged 14.3% too low. If the area per N_2 mol. was taken as 14.0 A², these same adsorbates showed areas for the MgO differing by an av. of 2% from that obtained with N_2.

I-9. Gases on Glass and Quartz

1646. Itterbeek, A. van and Vereycken, W. **The adsorption of vapors of water and of deuterium oxide on glass.** *Meded. Kon. Vlaamsche Acad. Wetensch., Letteren Schoone Kunsten België, Klass Wettensch.* **1940**, No. 9, 3-15.—*C.A.* **37**, 3989^8.

From the adsorption isotherms at 0°, 18° and 42°C, water vapor was adsorbed more strongly than D_2O. Measurements at const. vol. at 18° to 350°C showed that the adsoprtion decreased sharply with rising temp. and became zero for water at 180°C and for D_2O at 160°C. The heat of adsorption of H_2O was about 4000 cal greater than that of D_2O. The adsorption isotherms were explained by the B.E.T. theory. The adsorption surface corresponded closely with that calcd. from the adsorption isotherms if for each mol. a square was assumed having a length of side equal to the diam. of the mol.

1647. Smith, Paul L. and Taylor, Nelson W. **Diffusion of helium through several glasses.** *J. Am. Ceram. Soc.* **23**, 139-46 (1940).—*C.A.* **34**, 4871^4.

The diffusion at 300-500°C through 4 different glasses showed that the heat-treatment of the glass had a marked effect. He appeared to pass through holes of at. size in the network of atoms which constituted the glass structure. As the glass became more basic so that pos. ions, such as Pb or Na, could occupy some of these holes the freedom of movement of He became less. Glasses high in SiO_2 or B_2O_3 or both showed the greatest permeability. A silicate glass of high alkali content, and no B_2O_3, showed the lowest permeability.

1648. Chapek, M. V. **Study of the "disjoining action" under conditions of the sorption of water vapors.** *Compt. rend. acad. sci. U.R.S.S.* **31**, 588-90 (1941) (in English).—*C.A.* **37**, 815^2.

Small cylinders of monodispersed quartz and kaolin were placed between metal disks, of which the upper one was connected to a mirror and thence to a registering device. The cylinders were subjected to a pressure of 0.01 mm Hg and then exposed to vapor. The expansion of cylinders due to sorption was transmitted through the mirror onto a screen. Sorption occurred even at very low partial pressures of the vapor.

1649. Keesom, W.H. and Schweers, J. **Measurements of hydrogen adsorption on glass.** *Physica* **8**, 1007-19 (1941) (in English).—*C.A.* **37**, 1637^4.

The adsorption isotherms for H_2 on glass were detd. at 20.31°, 19.96°, 17.07°, 14.20°, 8.70° and 8.62°K for equil. pressures up to 9 dynes/cm². From 20° to 14°K the isotherms were given by: $\log (X/p) = (226.54/T) - \log T - 15.328 - [(5.8050/T) + 0.1108] \times 10^{10}$, where X was the quantity absorbed in mols./cm² and p was the pressure in dynes/cm². Within the accuracy limits of the expts., the adsorption energy between 14° and 20°K was independent of the temp. It decreased linearly with increasing X.

1650. KEESOM, W. H. AND SCHWEERS, J. **Measurements of helium and neon adsorption on glass.** *Physica* 8, 1020-31 (1941) (in English).—*C.A.* 37, 1637^6.

The adsorption isotherms of He at 9°-1.2°, and for Ne at 20°-11°K were detd. at max. equil. pressures of approx. 20 dynes per cm^2. It was likely that more than 1 layer of absorbed mols. was formed. The adsorption energies, within the limits of exptl. accuracy, were independent of the temp. and depended strongly on the surface coverage.

1651. KEESOM, W. H. AND SCHWEERS, J. **Measurements of the adsorption of helium on solidified layers of some gases.** *Physica* 8, 1032-43 (1941) (in English).—*C.A.* 37, 1637^7.

The adsorption of He at 4°-1°K and max. equil. pressure, approx. 10 dynes per cm^2, was detd. on solidified layers of H_2, Ne, N_2, and O_2 on glass. At the same pressure and temp. (4.2°, 3.2° and 2.2°K) the amt. of He adsorbed on H_2 was $\frac{1}{70}$-$\frac{1}{35}$ the amt. adsorbed on glass; at 1.33°K it was $\frac{1}{4}$-$\frac{1}{3}$ the amt. adsorbed on glass. The adsorption of He on Ne was $\frac{1}{3}$-$\frac{1}{2}$ the adsorption on glass. The adsorption of He on N_2 and O_2 was approx. the same as on glass and more than one layer of He mols. were adsorbed.

1652. HEDVALL, J. ARVID; ALFREDSSON, S.; OHLSON, KNUT; RUNEHAGEN, O.; WALDENSTRÖM, S., AND ÅKERSTRÖM, S. **Reactivity and the effects of lattice distortion in important glass-technical and ceramic systems.** *Glastech. Ber.* 20, No. 2, 34-42 (1942).—*C.A.* 37, 4866^9.

The characteristics of oxides were considerably influenced by treatment with "neutral" gases. The physicochem. as well as the mech. properties of oxides and their products varied to a considerable degree, depending on the kind and amt. of dissolved and adsorbed gas. The effects of O_2-, N_2-, SO_2- and SO_3- treated prepns. of various modifications of SiO_2, Al_2O_3 and "Jena Supremaxglass" on their reactivity with CaO in the solid state were reported.

1653. HEDVALL, J. A.; ALFREDSSON, S.; RUNEHAGEN, O., AND ÅKERSTRÖM, P. **The effect of normally inactive gases on the chemical activity of solids.** *Iva* 1942, 48-64.—*C.A.* 37, 5641^3.

Various modifications of SiO_2 quartz, tridymite, cristobalite and SiO_2 glass were treated with O_2, N_2, SO_2 or SO_3 at various temps., and the reactivity of the resulting material toward CaO was detd. Al_2O_3 and α-Al_2O_3 were treated similarly. O_2, N_2 and SO_2 activated and SO_3 deactivated the SiO_2 and Al_2O_3. The activating and deactivating effects held for all modifications of SiO_2; the effects increased with increasing time of treatment and also with increasing temp. to a max. of 1000°C. The effect of SO_3 was attributed to a change in the surface tension produced by this gas. Extensive expts. with quartz that was treated with O_2 at temps. from 400° to 1325°C and then reacted with CaO at temps. from 800° to 1000°C showed that activation occurred only when the preliminary treatment was at temps. above 400°C. The optimal temp. for the gas treatment was 800-1200°C and the upper limit of activation was 1400°C.

1654. EMMETT, P. H. AND DEWITT, THOMAS W. **The low-temperature adsorption of nitrogen, oxygen, argon, hydrogen, butane and carbon dioxide on porous glass and on partially dehydrated chabazite.** *J. Am. Chem. Soc.* 65, 1253-62 (1943).—*C.A.* 37, 4950^1.

The adsorption of N_2, O_2, H_2, A, CO_2 and butane on porous glass and on partially dehydrated chabazite indicated that the surface area of porous glass could apparently be measured satisfactorily by the low-temp. gas-adsorption method. Chabazite, when only 50% dehydrated, adsorbed no N_2 at -195°C, but would adsorb considerable H_2 at -195°C and CO_2 at -78°C. The occurrence of reproducible hysteresis loops in the adsorption-desorption curves on porous glass was discussed. The largest pores were about 60 A. in radius as calcd. by the Kelvin equation from the low-temp. isotherms for A, O_2, N_2 or butane.

1655. SMAKULA, A. **Reflection on glass surfaces and its elimination.** *Sprechsaal* 76, 237-40 (1943).—*C.A.* 42, 5184*e*.

The types of layers that may be applied to glass surfaces to reduce reflection and the refractive properties of these layers are discussed.

1656. SAWAI, IKUTARO; TASHIRO, MEGUMI, AND UMEYA, KAORU. **Fundamental studies on the chemical resistance of optical glasses. III.** *J. Japan. Ceram. Assoc.* 52, 198-200, 200-202, 258-62 (1944).—*C.A.* 45, 7320*b*.

The corrosion of a glass surface by the alternating action of hot water and air was observed under the microscope. The glass used was Na_2O-$2SiO_2$, and the temp. was 80°C. Shivering was formed by water in the thin film on the glass surface, and this film was removed by cragging formed by drying. The activation energy of dissoln. of the thin film on the glass surface was calcd. Borosilicate soda glass separated on heating into two phases, SiO_2-rich glass and alkali- and H_3BO_3-rich glass. The glassy phases were less resistant to corrosion than was the original glass.

1657. SCHWARZ, HELMUT. **Gas absorption and change in the measurement of lowest pressures by the ionization gage. A critical investigation in H_2, N_2, and A.** *Z. Physik* 122, 437-50 (1944).—*C.A.* 39, 2681^1.

Because of gas take-up by metal and glass surfaces the use of ionization gages for very low gas pressures was critized. The more the ionization was increased by improved construction, the poorer the tube was as a manometer.

1658. VEITH, H. **Simple arrangement for determination of the thickness of water films adhering to glass.** *Z. physik. Chem.* 193, 378-85 (1944).—*C.A.* 41, 1908*f*.

Two cylindrical vessels of the same height but of different diams., a vacuum system contg. a supply of water and a manometer were used. The procedure involved pressure measurements and condensation of the water in dry ice. If the adsorbed liquid film had the same d. as liquid water, its thickness (at room temp. and between pressures of 5 and 15 mm) varied between 5° and 800°A. for several varieties of soft and hard glass.

1659. VASICEK, ANTONIN. **Chemistry of the preparation of unimolecular layers on glass.** *Chem. Listy* 39, 63-5 (1945).—*C.A.* 44, 9648*c*.

If the H_2SO_4 used for etching glass contained some Pb, the *n* of the layer increased, e.g., from 1.48 to 1.525. The surface layer contracted when exposed to air, and it was necessary to make the layer accordingly thicker.

1660. BAKER, T. C. AND PRESTON, F. W. **Effect of water on the strength of glass.** *J. Applied Phys.* 17, 179-88 (1946).—*C.A.* 40, 3241^6.

Measurements were made in dry air, vacuum, autoclave at steam pressures from 600 to 800 p.s.i. and in solns. contg. CO_2, $Ca(OH)_2$, and NaOH. In high vacuum, thoroughly baked glass had a strength fairly independent of duration of load, up to 10 sec. Glass exposed to moisture rapidly lost its strength under stress. In 10 sec. the strength could decay to 50 or 40% of the vacuum strength, and might decay to 33% in 24 hrs. For long durations the chem. compn. was so important as to be the controlling factor in strength.

1661. ELEY, D. D. **Structure of catalytic metal films.** *Nature* **158**, 449 (1946).—*C.A.* **41**, 1537*a*.

The evapn. of metals onto glass at room temp. often yields films of high catalytic activity. These data are best explained by a microcryst. film, in accordance with electron-diffraction evidence. If equal spheres are assumed, the diams. of W and Ni films are 0.0043 - 0.007 μ. These dimensions are profoundly affected by chemisorbed gases; H_2 at 10^{-6} mm will lower the surface tension of W by 500 dynes/cm.

1662. HODGINS, J. W.; FLOOD, E. A., AND DACEY, J. R. **The flow of gases and vapors through media.** *Can. J. Research* **24B**, 167-77 (1946).—*C.A.* **40**, 6932^5.

The flow of He, H_2, N_2, Et_2O, and EtBr through a sintered glass plug was studied. The permanent gases were transferred by a combination of Knudsen and Poiseuille flow, whereas the flow of condensable vapors diverged from these equations in such a fashion as to suggest surface transfer. The flow rates of the condensable vapors began to fall off at about 50% of the satn. pressures. Hysteresis effects were also observed in this region.

1663. HUBBARD, DONALD. **Hygroscopicity of optical glasses as an indicator of serviceability.** *J. Research Natl. Bur. Standards* 36, 365-75 (1946) (Research Paper No. 1706).—*C.A.* 40, 6768^2.

The hygroscopicities of a no. of powd. glasses (optical and chem. glasses, window glass, and Corning 015 (used for making glass electrodes) and other special glasses) were detd. Typical optical glasses in common use were much less hygroscopic than the av. commercial sheet and container glasses. The pH response of a glass was primarily a function of its hygroscopicity. Tests made on a binary series Na_2O-SiO_2, K_2O-SiO_2, Li_2O-SiO_2, and PbO-B_2O_3 reflected some of the crit. compns. of the respective phase equil. diagrams.

1664. KONDRAT'EVA, E. I. AND KONDRAT'EV, V. N. **Catalytic recombination of active centers and its application for determining their concentration in the reaction zone.** *J. Phys. Chem. (U.S.S.R.)* **20**, (1946) 1239-47 (in Russian).—*C.A.* **41**, 2972*d*.

The temp. increase of a thermocouple coated with $ZnO.Cr_2O_3$ and kept in a H_2-O_2 flame shows that the rate of adsorption of H atoms by the walls is almost independent of temp. between 800° and 900°K.

1665. TSUCHIHASHI, SHOJI. **The surface-chemical study of the solid-water interface.** *Rev. Phys. Chem. Japan, Shinkichi Horiba Commem. Vol.* **1946**, 31-4.—*C.A.* **44**, 4306*i*.

Contact angles were measured (by a photographic method) of small H_2O droplets on glass coated with films of various resins. On polystyrene the contact angle was larger than 90°C; with "Kurulugamu," vinyl acetate, ethyl- and benzylcellulose the contact angles were between 60 and 70°C, and with polyvinyl alc. about 36°C, presumably because this film adsorbed H_2O readily. In this case visibility should be least hindered.

1666. VOEVODSKII, V. V. **The role of the hydroxyl adsorption in the chain mechanism of the combustion of hydrogen.** *J. Phys. Chem. (U.S.S.R.)* **20**, 779-88 (1946) (in Russian), *Acta Physicochim. U.R.S.S.* **22**, 45-60 (1947) (in English).—*C.A.* **41**, 2310*g*.

The theory attributing the termination of chain reactions to recombination of H atoms at the walls was not applicable to gas mixts. contg. much O_2 and little H_2. In these mists. recombination of OH radicals at the walls could be more important. The probabilities P_H and P_{OH} of a recombination on contact with the wall could be correlated with the concn. limits of ignition. At 500-530°C on glass, P_H was 1.5×10^{-3} to 2.4×10^{-5}, and P_{OH} was 8×10^{-2} to 2.5×10^{-3}.

1667. WEYL, W. A. **Some aspects of the surface chemistry of glass.** *Bull. inst. verre* **1946**, No. 3, 1-10.—*C.A.* 40, 7543^9.

On the surface of glass valence forces are not satd. which results either in increased adsorption of water or in a repelling by Si to the surface of weaker-bound particles such as alkali or B. The alkali can be neutralized by SO_2 from furnace gases. In glass treated with acids or with hydrosilicates such as clay, H ions replace surface cations and increase chem. resistence. A change in refraction causes the appearance of a colored film on the surface. Treatment of glass with chlorinated Si org. compds. (Drifilm) sats. the surface with org. radicals and makes them water-repellent.

1668. BANGHAM, D. H. **Physical processes involved in sintering.** *J. Soc. Glass Technol.* 31, 264-6 (1947).—*C.A.* **42**, 8062*f*.

The shrinkage occurring when presses powders are fired is a manifestation of the tendency of the material to reduce its surface energy to a min. The surface forces act locally at the contacts between particles and tend to broaden these areas. The elastic forces resident in the particles resist such deformation, but become relatively (as well as absolutely) less powerful as the temp. is raised.

1669. BATESON, S. **The application of magnesium fluoride antireflection films to glass surfaces.** *J. Soc. Glass Technol.* **31**, 170-93 (1947).—*C.A.* **42**, 2067*g*.

The vacuum equipment and the process by which MgF_2 films are produced are described in some detail. In order to realize max. hardness and durability the work must be thoroughly heat-conditioned and the glass held at a temp. not lower than 250 °C during film deposition. Adhesion between the film and the glass is further influenced by the kinetic energy of the incident mols. By selecting a source which produces a high-velocity mol. beam, harder films can be secured.

1670. DERYAGIN, B. V.; GOL'DANSKII, V. I., AND KARASEV, B. V. **Multimolecular adsorption and condensation of vapor on glass as studied by optical methods.** *Doklady Akad. Nauk S.S.S.R.* **57**, 697-700 (1947).—*C.A.* **46**, 4881*a*.

The adsorbed films were examd. by detn. of the parallel and perpendicular components of reflected polarized light on the surface in question, with the green Hg line as light source. Adsorption isotherms for EtOH, AcOH, H_2O, and EtOAc on glass were given graphically. Near the site of condensation of vapor adsorbed layers about 5×10^{-6} cm thick were observed.

1671. DURÁN MIRANDA, ARMANDO AND SÁNCHEZ DEL RIO y SIERRA, CARLOS. **Theory of absorbent, antireflection, optical coatings.** *Anales fís. y quím. (Madrid)* **43**, 671-8 (1947).—*C.A.* 42, 1097*c*.

When light strikes an air-glass surface, an antireflection layer of adequate thickness and refractive index can be used to avoid loss by reflection. If this layer consists of an absorbent material, the most suitable index is given by $(M + n^{1/2} + M^2)$ M being a term dependent on the absorption. Cases of homogeneous and nonhomogeneous absorption are considered.

1672. EMMETT, P. H. AND CINES, MARTIN. **Adsorption of argon, nitrogen, and butane on porous glass.** *J. Phys. & Colloid Chem.* **51**, 1248-62 (1947).—*C.A.* **42**, 1100*h*.

Low temp. adsorption and desorption isotherms were detd. for N_2 and A at - 195°C and for n-C_4H_{10} at 0°C on five different samples of porous glass. The pores of each glass seemed to be rather uniform in size as judged by the large desorption that occurs at an approx. const. relative pressure. The av. pore size as calcd. by the ratio of pore vol. to pore area agreed within an av. of about 2 A. with that calcd. by applying the Kelvin equation to the desorption isotherms. On one glass five sets of scanning curves were taken with A at -195°C. The surface-area values of one glass (m^2 per g) were 232, 217, 156, 159, 207, 128, and 164, for N_2, A, C_4H_{10}, CO_2, NH_3, H_2O, and C_2H_2, resp.

1673. GIGUERE, PAUL A. **Thermal decomposition of hydrogen peroxide vapor. II.** *Can. J. Research* **25B**, 135-50 (1947).—*C.A.* 41, 4364*g*.

The decompn. of H_2O_2 vapor was studied at low pressures in the temp. range 50-420 °C in round one-liter flasks made of soft glass, Pyrex, quartz, or metallized glass. In most cases the decompn. was found to be of the first order, but the rates varied from one vessel to another. On a quartz surface, the reaction at low temps. was preceded by an induction period. A superficial fusion of the surface reduced the speed and seemed to increase the activation energy. This fusion effect was removed by washing with acid. The marked surface effects pointed strongly to a heterogeneity in the reaction, which was further shown by a range of values for the energy of activation from 8 to 20 kcal.

1674. KISTMAKER, J. **Anomalous adsorption of helium gas on glass, between 3 and 1.7°K.** *Physica* 13, 81-7 (1947).—*C.A.* 41, 6106*f*.

Adsorption was measured with x-ray shadowgraphs between 1.7° and 3°K over a pressure range of 4 to 16 mm Hg (corresponding to 9 to 99% of the vapor pressure). The no. of adsorbed layers varied from about 5 to 31; this indicated the probable preformation of the liquid He film.

1675. WEYL, W. A. **Some practical aspects of the surface chemistry of glass. II.** *Glass Ind.* **28**, 300-2, 324-6 (1947).—*C.A.* 42, 2411*h*.

Structural changes of glass surfaces are discussed under their mol. rearrangements due to surface and interfacial tensions, the volatility of glass constituents, base-exchange reactions of dry glass surface, and the dealkalization of the glass surface such as with a clay treatment at 400 °C.

1676. WEYL, W. A. **Some practical aspects of the surface chemistry of glass. III.** *Glass Ind.* **28**, 349-53, 370, 372, 374, 376, 382. (1947).—*C.A.* **42**, 2411*i*.

Methods of superficially reducing metals in glass and the deposition of metals and compds. on glass are presented. The hydrolysis and wettability of glass surfaces and the reactions of the silica gel with aq. solns. and vapors and org. compds. are discussed.

1677. BADIN, ELMER J. **The reaction between atomic hydrogen and molecular oxygen at low pressures. Surface effects.** *J. Am. Chem. Soc.* **70**, 3651-5 (1948).—*C.A.* **43**, 2079*i*.

In the low-temp. reaction (-196°C), the rate of peroxide and water formation was proportional to O_2. At temps. slightly above -196°C, water formation increased at the expense of a decrease in peroxide formation. The effect of Pyrex, phosphoric acid, and KCl surfaces at higher temps. was studied. The effects were attributed to the relative amts. of water present on the 3 surfaces. Surfaces of LiCl, NaCl, and KCl gave essentially similar results. The decrease in peroxide and water had been attributed to destruction of OH (or possibly HO_2) in addn. to H recombination to give H_2 and O_2.

1678. BANNON, J. AND CURNOW, C. E. **Structure of calcium fluoride films evaporated on polished glass surfaces.** *Nature* **161**, 136-7 (1948).—*C.A.* **42**, 3235*f*.

The films were deposited on crown glass over a range of surface temps. X-ray measurements were made of the films. At 25 °C the (111) planes of the crystallites were not appreciably oriented. There was considerable orientation of the (111) planes at 75 °C with a random arrangement of the (110) planes. At 105 °C the (111) planes were completely oriented. A max. was reached at 100 °C after which the double refraction weakened as the temp. was increased to 300°C. The films were of a fibrous structure and the oriented (111) planes were perpendicular to the axis of the fibers and parallel to the glass surface.

1679. Canneri, G. and Cozzi, D. **New method for the determination of fluorine by means of the alteration of glass surface.** *Anal. Chim. Acta.* 2, 321-7 (1948).—*C.A.* 43, 4599*e*.

The wettability of glass was reduced when it was dipped into CrO_3 cleaning-mixt. contg. HF. Measurement of the contact angle was made of a captive air bubble which appeared at the bottom of a glass capillary tube previously dipped into the test soln. These angles varied from 30° for 0.003 g NaF per liter to 82° for 1.5 g NaF per liter. As little as 0.5γ could be detd. in a drop of soln. Boric acid and silicic acid interfered.

1680. Cohn, Gunther and Kolthoff, I. M. **Thermal aging of silica.** *Festskr. J. Arvid Hedvall* 1948, 97-116.—*C.A.* 42, 6196*e*.

Relative sp. surface, bulk and apparent d., microscopic examn., x-ray data, and the compressive strength of pellets (pressed from loose SiO_2 powder) were detd. The bulk d. decreased, whereas the apparent d. increased with an increase in the water content of the SiO_2. When SiO_2 was heated in air at 865°C for 1-5 hrs. there occurred a decrease in sp. surface, an increase in apparent d., whereas the bulk d. approached the value of amorphous SiO_2 (2.20). When the SiO_2 was treated in water vapor at 865°C the bulk d. reached 2.23. The sp. surface (detd. by adsorption of methyl red) decreased gradually from 47.5 mg of adsorbed methyl red at room temp., up to 600°C, then remained const. at about $\frac{1}{5}$ its original value to about 900°C, after which it dropped to extremely low values.

1681. Coles, Harold W.; Schulz, Walter F.; Levy, Sylvia, and Wheatley, Thomas A. **Optical lens coatings.** *Modern Plastics* 25, No. 11, 123-6, 167-70, 172, 174, 176-81 (1948).—*C.A.* 44, 9648*d*.

Spun coating on glass optical lenses had been made with a no. of polymers and the coatings examd. Allymer CR-39 (an allyl diglycol carbonate polyer) was most resistant to marring, but had to be used in an inert atm. An alkyd-modified melamine resin was second best and did not need such special care. Diallyl phthalate was also good against marring. A silicone, a trimethylcyclohexyl methacrylate, and Kotol coatings were most resistant to roof exposure and H_2O.

1682. Davis, R.T., Jr. and DeWitt, T.W. **The adsorption of butane on glass spheres.** *J. Am. Chem. Soc.* 70, 1135-41 (1948).—*C.A.* 42, 4422*h*.

Data were presented for a relative pressure range from below 0.0001 to near satn. at -78°, -46°, and 0°C. Heats of adsorption, calcd. from the Clausius-Clapeyron equation, remained const. at approx. 2,500 cals/mole up to several % surface coverage. It then decreased approx. logarithmically with increasing adsorption. Exptl. heats and entropies of adsorption were compared with the corresponding quantities calcd. from the B.E.T. equation.

1683. Dietzel, A. **Gases in glass.** *Glashutte* 75, 125-27 (1948).—*C.A.* 44, 9646*i*.

Examples of chem. gas reactions were the soln. of water in the glass melt by the formation of OH^- ions, the oxidation of FeO by O_2. The phys. problem of gas evolution was one of the formation of a new surface in the interior of the melt, for which high energies must be made available. At the end of fining with 1% CeO_2 pronounced gas under-pressure was observed and explained by the resorption of O_2 by Ce_2O_3 at a lower temp. (800°C) than that of max. fining (900°C). Phenomena observed in this borax glass-CeO_2 system were also valid if sulfate or As were used as the fining agent. Two gases (SO_2 and O_2) were formed, however, with sulfate which could lead to a persistance of bubbles.

1684. Dietzel, A. **Glass structure and glass properties. II.** *Glas-tech. Ber.* 22, 81-6 (1948).—*C.A.* 45, 7317*c*.

The free space of 17% present in vitreous SiO_2 compared with quartz was discussed in the light of gas diffusion and soly. The soly. of He or H_2 of 0.0045 cc./g SiO_2 at 445°C was considered to be caused by the flaws rather than the pores of the random network, which were closed to the gas mols. on the basis of the dimensions. Gas diffusion at increased temps. was attributed to the breaking of bonds isolating neighboring pores, thus depending on mobility of the lattice which explained the temp. dependence of the diffusion.

1685. Dufour, Ch. **Technique of evaporation of multiple thin layers.** *Le Vide* 3, 480-6 (1948).—*C.A.* 43, 1621*e*.

Lenses coated with fluorides (cryolite, MgF_2) of low *n* have better reflective properties if the layers of fluorides are combined with layers of a material of high *n* (ZnS, TiO_2, Sb_2S_3) at a detd. thickness. A method and the equipment necessary to obtain such composite layers are completely described.

1686. Green, Robert L. and Blodgett, Katherine. **Electrically conducting glasses.** *J. Am. Ceram. Soc.* 31, 89-100 (1948).—*C.A.* 42, 3921*a*.

Samples were lightly sandblasted, placed in an asbestos boat at spaced intervals, and reduced by H_2 in an elec. furnace at 250-600°C. The glass batches were mostly silicate (some borate) glasses, contg. Pb, Bi, or Sb oxides, or combinations of these. Results indicated that electronic conduction was maintained in a reduced surface layer less than 0.0001 in. thick. This surface conduction increased with increase in reducible oxide.

1687. Markevich, A. M. **The role of the surface in the thermal reaction of chlorine and hydrogen.** *J. Phys. Chem.* 22, 941-52 (1948).—*C.A.* 43, 474*c*.

To decide whether the combination of H_2 and Cl_2 (a stoichiometric mixt.) in glass was a vol. or a surface reaction, the temp. difference in a reaction vessel and on the reaction wall was carefully detd. The process was a chain reaction and the chains started from the wall and, in the absence of O_2, extended over the whole vol. They were broken by O_2, and in the presence of O_2 the reaction took place in a thin (e.g. 0.8mm) layer adjacent to the walls.

1688. RAZOUK, RASHAD I. AND SALEM, AHMED S. **The adsorption of water vapor on glass surfaces.** *J. Phys. & Colloid Chem.* **52**, 1208-27 (1948).—*C.A.* 43, 1623*f*.

Adsorption isotherms of water vapor were detd. on a glass of known compn. in the form of fibers, powder, and microspheres. The real surface was about 2 to 3 times the geometric surface in the case of water-washed glass and 10 to 20 times in the case of acid-treated glass. The adsorption of water vapor on glass surfaces was due in part to a chemisorbed monolayer and partly to a physically adsorbed film.

1689. SCHULZ, L. G. **Preparation of aspherical refracting optical surfaces by an evaporation technique.** *J. Opt. Soc. Am.* **38**, 432 (1948).

By selective depostition of evaporated dielectrics it was found possible to form aspherical surfaces on plane glass plates which, when used with a lens, made the combination free from spherical aberration. LiF was used as the dielectric because of its low melting point and the success with which it had been used in the construction of interference filters. MgF_2, the only other dielectric tested, was used to give a final thin, insoluble coating over the somewhat more soluble LiF.

1690. TSINZERLING, E. V. **Investigation of the hardness and fragility of quartz.** *Doklady Akad. Nauk S.S.S.R.* **60**, 1033-6 (1948).—*C.A.* 43, 976*e*.

The hardness data were always lower for colored parts than they are for the colorless ones. HF etched the colored crystal parts much easier than the colorless ones, e.g., on (0001) and $(11\bar{2}0)$ of quartz crystals with a pronounced zonal structure or with sector subdivision. The fragility or brittleness of colored parts was also greater than in colorless fields. Many local defects in the disturbed lattice structure of the colored quartz in comparison with the more regular structure of the colorless explained the observed differences.

1691. WEYL, W. A. **The surface properties of glasses as effected by heavy metal ions.** *J. Soc. Glass Technol.* **32**, 247-59 (T) (1948).—*C.A.* 43, 2386*e*.

Most glass-forming ions have 8 outer electrons and the stability of this arrangement in the elec. fields of neighboring ions of opposite charge makes it possible to treat some ions as rigid spheres. Large ions, such as Ba^{2+}, or ions having an electronic structure that differs from that of the noble-gas atoms (Zn^{2+} Cd^{2+}, Pb^{2+}) cannot be treated as rigid spheres, but their deformation has to be taken into consideration. The deformed Pb^{++} ion explains why some PbO-contg. glasses have a pos. temp. coeff. of surface tension.

1692. ABELÈS, FLORIN. **Determination of refractive index and thickness of thin layers.** *Compt. rend.* **228**, 553-5 (1949).—*C.A.* 45, 8315*a*.

When linearly polarized light is reflected from a glass plate, half of which is covered by a thin layer, the angle of incidence (θ) at which the 2 halves reflect equally is given by: $\tan\theta = n_1/n_0$, where n_0 refers to the first medium, usually air, and n_1 to the thin layer. Equations are also given for the simultaneous detn. of n_1 and the layer thickness when the latter is $>\lambda/4$.

1693. ALLERTON, JOSEPH; BROWNELL, LLOYD E., AND KATZ, DONALD L. **Through-drying of porous media.** *Chem. Eng. Progress* 45, 619-35 (1949).—*C.A.* 44, 6*h*.

Drying by passing air through porous media and by vaporizing water contained in the media was termed through-drying. Through-drying expts. under adiabatic conditions were performed on porous beds composed of uniform glass balls, crushed quartz, and a binary mixt. of glass balls. During max. rate drying, the air left the bed virtually satd. with water and picked up moisture in the bed so quickly that drying might be considered to take place in a narrow zone. When the bottom of the narrow zone reached the bottom of the bed, the drying rate began to decrease rapidly. It had been correlated with the vaporization efficiency, with the max. drying rate, the moisture content, and a drying factor.

1694. BAILEY, DONALD A. **A note on the conversion of amorphous silica to quartz.** *Am. Mineral.* 34, 601-5 (1949).—*C.A.* 45, 1835*b*.

Amorphous silica with 5 to 10% CaO or $CaCO_3$ was converted to quartz when heated between 1070° and 1100°C. MgO in place of CaO was inactive. Decrease in grain size increased the rate of conversion.

1695. CALHOUN, JOHN C., JR.; LEWIS, MAURICE, JR., AND NEWMAN, R. C. **Experiments on the capillary properties of porous solids.** *Am. Inst. Mining Met. Engrs., Tech. Pub. No.* **2640**, J. Petroleum Technol. **1**, 189-96 (1949).—*C.A.* 44, 1248*h*.

Exptl. work was performed on the capillary retention of H_2O within porous solid systems consisting of consolidated quartz, the displacement being made with air and toluene, benzene, cyclohexane, tetradecane, and oleic acid. Theoretically, there was no "irreducible min." and zero H_2O satn. was reached at some finite value of capillary pressure.

1696. CHMUTOV, K. V. **Sorption phenomena in capillary systems. II.** *Kolloid. Zhur.* **11**, 44-9 (1949).—*C.A.* 43, 6882*d*.

The dimensions of liquid drops condensed from vapor between 2 quartz lenses were detd. for different vapor pressures at 20°C. Visible drops appeared when the relative vapor pressure p/p_0 was greater than 0.7, but persevered at lower p/p_0 (e.g., 0.2). The curvatures of the menisci calcd. from the Kelvin equation were several times that calcd. from the distance between the lenses for benzene, H_2O, and EtOH. The Kelvin equation could not be used for computing the pore radius of adsorbents.

1697. DOUGLAS, R. W. AND ISARD, J. O. **The action of water and of sulfur dioxide on glass surfaces.** *J. Soc. Glass Technol.* **33**, T 289-330, discussion, 331-5 (1949).—*C.A.* 44, 6592*e*.

The reaction with water involved the exchange of Na^+ by H^+ and was limited by the rate of diffusion of Na^+ to the surface. The reaction with SO_2 at 20-100°C in gas satd. with water vapor involved the same process and proceeded at the same speed as the reaction with water. The SO_2 reaction at 100-600°C was limited by the rate of diffusion of Na through a compacted layer of glass at the surface which arose from a secondary dehydration process, and with anhyd. reagents Na and O ions diffused on the glass surface.

1698. Franke, Emmanuel and Longchamp, Marthe Hout De. **Production of artificial quartz crystals in large sizes.** *Compt. rend.* **228,** 1136-7 (1949).—*C.A.* 43, 6026*h*.

Single crystals of quartz, (3 × 2 × 0.5 cm and weighting 8-10 g) were grown in alk. soln. (NaOH, LiOH, $NaHCO_3$, Na_2CO_3, $Na_2B_4O_7$, etc.) at 200-300 °C and a pressure of 60 atms. in 3-4 weeks. Best results were obtained when the seed crystal exposed the pyramid faces; the growth occurred very slowly on the prism faces, and very rapidly and irregularly on the basal faces. The crystals were identical with natural quartz.

1699. Harris, B. L. and Emmett, P. H. **Adsorption studies. Physical adsorption of nitrogen, toluene, benzene, ethyl iodide, hydrogen sulfide, water vapor, carbon disulfide, and pentane on various porous and nonporous solids.** *J. Phys. & Colloid Chem.* **53,** 811-25 (1949).—*C.A.* 43, 7288*d*.

The adsorbents were Pyrex glass spheres, ground Pyrex glass, porous glass, reduced-iron synthetic-ammonia catalysts, and Ag. Areas calcd. from the data for the various adsorbates by the B.E.T. method had to be multiplied by factors ranging from 1.03, for C_2H_5I on glass spheres, to 3.7 for CS_2 on ground Pyrex glass, to obtain values agreeing with those calcd. from N_2 isotherms.

1700. Jones, W. H. **Electrostatically charged particles in the detection of minute surface defects in porcelain enamel.** *J. Can. Ceram. Soc.* **18,** 29 (1949).—*C.A.* 43, 6802*e*.

A method to use electrically charged particles was developed to disclose minute surface-discontinuities in nonconducting materials.

1701. Kitaĭgorodskiĭ, I. I. **Preparation of high-silica porous bodies at low temperatures.** *Doklady Akad. Nauk S.S.S.R.* **64,** 219-21 (1949).—*C.A.* 44, 11047*i*.

Finely ground quartz glass (99.9% SiO_2) and a special low-melting boro-silicate glass were thoroughly mixed in various ratios, moistened, shaped into 20 × 3-5 mm disks, by using pressure of 60 kg/cm², and fired at around 750 °C. The disks were treated in boiling 0.5 *N* HCl and the remaining porous bodies contained 96 to 98% SiO_2. Water absorption was 30% regardless of initial compn., apparent porosity was 37%, and true porosity was 45%.

1702. Newkirk, Terry F. and Tooley, F. V. **Study of effect of cation concentration and size on helium permeability of alkali-silica glasses.** *J. Am. Ceram. Soc.* **32,** 272-8 (1949).—*C.A.* 43, 9401*c*.

Permeability detns. were made at 300 °C on fused SiO_2, Pyrex chem. glass, Na_2O-SiO_2 glasses contg. 20, 25, and 30 mol. % Na_2O, a K_2O-SiO_2 glass contg. 30 mol. % K_2O, and a Li_2O-Na_2O-SiO_2 glass contg. 5 mol. % Li_2O and 25 mol. % Na_2. The addns. of Na_2O caused a rapid decrease in permeability; it decreased exponentially over the range 0-30 mol. % Na_2O. The comparative packing index was a potentially valuable guide to permeability only for glasses contg. the same atoms, because new atoms introduced a new polarizing factor.

1703. Rood, Joseph L. **Some properties of thin evaporated films on glass.** *J. Optical Soc. Am.* **39,** 854-9 (1949).—*C.A.* 44, 14*a*.

Properties of thin evapd. films of MgF_2 and of $CaSiO_3$ on glass were studied. Thicknesses of the films were detd. from measurements of reflected intensity as a function of wave length, and *n*s were computed. Density was measured for MgF_2 films. All these properties differed from those of the corresponding bulk materials, and moreover, changed with time.

1704. Seddig, Max and Haase, Günter. **Experimental investigations of the critical condensation temperature.** *Kolloid-Z.* **114,** 169-74 (1949).—*C.A.* 44, 4306*g*.

In a vacuum (10^{-6} mm) a stream of vapor from Hg at 20 °C did not condense on chemically-cleaned glass at temps. above -140 °C, and vapor from Cd at 220-90° not above -80 °C. But on cleaned glass baked for 2 days at 350-450 °C condensation in a 10^{-8} mm vacuum occurred at temps. up almost to the temp. of the metal. On the specially clean glass, a thin layer of metal was first adsorbed, as shown by an increase in the surface cond. of the glass, and then vapor condensed visibly on this layer.

1705. Weyl, W. A. **Surface structure and surface properties of crystals and glasses.** *J. Am. Ceram. Soc.* **32,** 367-74 (1949).—*C.A.* 44, 808*i*.

The difference between the surface structure and the interior of a crystal depends on the polarization properties of the ions. A similarity is shown between the surface of crystals and the structure of glasses. The devitrification of a glass surface, the effect of imperfections on the transformation of crystals, the sintering of highly refractory oxides, the dielec. const. of polycryst. materials, and the elec. absorption of stratified dielectrics are discussed.

1706. Zhdanov, S. P. **Irreversible hysteresis of water vapor adsorption isotherms on porous glass and on silica gel.** *Doklady Akad. Nauk S.S.S.R.* **68,** 99-102 (1949).—*C.A.* 43, 8790*h*.

Porous glass at 15 °C showed an adsorption-desorption hysteresis loop limited to a narrow medium range of p/p_s. After the glass was heated to 300 °C, a larger hysteresis loop was formed, and after heating to 650 °C the loop extended over the whole range from $p/p_s = 0$ to 1. Silica gel, when heated to 650 °C, showed a complete hysteresis loop at 15 °C. When the adsorption-desorption expt. was repeated after evacuation at room temp., without heating, the loops shrank to their normal width and extension. Adsorption of H_2O took place mainly at the OH groups. The O-bridges produced by dehydration were again hydrated by adsorbed H_2O to OH groups.

1707. Aron, Ya. B. **Behavior of liquid drops at the boundary of two solid phases.** *Zhur. Fiz. Khim.* **24,** 82-4 (1950).—*C.A.* 44, 4748*f*.

H_2O drops (0.034 g) were placed on a surface partly of glass and partly of mica. The contact angle between glass, H_2O, and air was 50°, and between mica, H_2O, and air was 26°. When the drop was partly on glass and partly on mica, both angles depended on the ratio of the glass to mica surfaces covered by the drop.

1708. Blackmer, L. L. and Farnsworth, H. E. **Effect of the type of support on the photo-electric work function of silver films.** *Phys. Rev.* 77, 826-9 (1950).—*C.A.* 44, 6257*b*.

Ag was doubly and fractionally distd. with the middle fraction deposited on previously outgassed bulk Ag, on smooth fused quartz, and on outgassed Mo sheet in a sealed-off, gettered tube. A film of Ag on bulk Ag caused the work function, ϕ, to decrease by amts. of 0.25 e.v. to 4.50 ± 0.02 e.v. Subsequent heating below 100°C caused ϕ to increase to the original value. For a Ag film on smooth fused quartz and on outgassed Mo sheet ϕ was 4.41 e.v. The variations in the observed values was due to a dependence of the sizes of the microcrystals on the structure of the support.

1709. Blau, H. and Johnson, J. R. **Radioactive tracer methods for the study of glass constitution.** *Glastech. Ber.* **23**, 180-2 (1950).—*C.A.* 44, 10274*i*.

Abs. reaction rates opened a way for an understanding of the activation energies for at. mobility in glass frameworks. As a first approximation to an exptl. realization of such ideas, the study of the diffusion process in glass as a function of temp. was made possible by radioactive tracer methods. The diffusion coeff. -1/T curve showed a typical inflection range between the limits of log $n = 8$ and 15 which correspond to an at. mobility change in the transformation range of the glass.

1710. Boettcher, A. **Production and structure of aluminum-silver and aluminum-magnesium films.** *Z. angew. Physik* **2**, 193-203 (1950).—*C.A.* 46, 9921*g*.

An analysis of the change in compn. of the melt together with the known phase diagram showed that an Al-Ag alloy contg. 10% by wt of Al deposited first in the form of crystals of the α-modification, followed by thinner layers of β', γ and δ-crystals, with the latter phase in a very thin layer. On heating an Al-Ag mixt. of 6% Al, the elec. resistance rose steeply at about 150°C, owing to a rapid increase of the β'-phase which had the smallest cond. of all the phases in question. The situation was completely altered in a condensate contg. 19% Al. On heating to room temp., a marked decrease of the resistance set in, which was completed at 200°C. With increasing Al content, the decrease in resistance became less pronounced because of the smaller concn. of the β crystallites.

1711. Borzyak, P. G. **Study of oxygen-cesium films.** *Zhur. Tekh. Fiz.* **20**, 928-36 (1950).—*C.A.* **45**, 438*f*.

Wedge-shaped films of Cs on glass were produced by condensation from a mol. beam. Oxidation of this Cs film with O_2 at the temp. of liquid air produced a colorless transparent film, undetectable in transmittance, but noticeable by interference figures in reflection. By microweighing, the oxidized film had the compn. CsO_2, remaining unchanged on heating to room temp. and above; the same film, but whitish, was obtained by oxidation at room temp. When a CsO_2 film was treated with Cs vapor at 150-180°C, an external photoelec. effect began to appear even while the film was still colorless; the effect increased with the progress of incorporation of Cs, with the color veering progressively to yellow.

1712. Dunoyer, Jean Michel. **The electric properties of thin layers of germanium.** *Compt. rend.* **230**, 1664-5 (1950).—*C.A.* 44, 10423*g*.

Thin layers of Ge were vaporized onto a quartz support and then the resistance was measured at room temp. With the support above 370°C the resistance was always of the order of 0.025 ohm/cm; held at 270-370°C the resistance increased rapidly, and results were difficult to reproduce; below 270°C the resistance was of the order of 10^5 ohms/cm. When the Ge was vaporized onto a cold support, then heated, the transformation occurred a little below 400°C. A slight rectifying effect could be observed which was considerably increased by utilization of alternate cryst. and amorphous layers.

1713. Faust, R. C. **An interferometric study of some optical properties of evaporated silver films.** *Phil. Mag.* 41, 1238-54 (1950).—*C.A.* 45, 2738*b*.

Thermally evapd. Ag films were studied in the reflectivity range of 4 to 95%. The air-Ag and glass-Ag reflection and transmission coeffs., the corresponding reflection phase changes and the apparent film thickness were measured and compared with those of sputtered Ag films.

1714. Franke, I. **Action of pure water below its critical point on α-quartz and fused silica.** *Bull. soc. franc. mineral. et. crist.* 73, 503-10 (1950).—*C.A.* 45, 3689*f*.

The soly. of α-quartz in pure H_2O at 350°C, measured by the loss in wt of the quartz originally used, was 0.67 mg = 10%/g of H_2O used. The soly. was independent of the degree of pressure applied. Fused silica was tested in H_2O at 370°C and the results showed that the loss in silica was a function of the amt. of pressure applied. The fused silica was transformed into cristobalite in the satd. vapor.

1715. Gibson, George and Vogel, Richard C. **Migration of lithium and several multicharged ions through quartz plates in an electric field. II.** *J. Chem. Phys.* **18**, 1094-7 (1950).—*C.A.* 45, 411*g*.

The migration was induced by an elec. field and probably took place through tunnels inherent in the crystal structure and parallel to the principal axis of the quartz. The rate-detg. step was assocd. with the passage of the Li ions into or out of the quartz plate because the rate of diffusion was independent of plate thickness. The activation energy of diffusion of Li ions at 190 varied from 17.8 to 21.5 kcals./mol. Neither Mg, Zn, Cd, nor Bi ions would migrate through quartz plates under these exptl. conditions. Cu ions migrated through the quartz plates but caused the plate to crack in each expt.

1716. Haase, G. **Wetting of glass surfaces.** *Glastech. Ber.* **22**, 262 (1949) *Ceram. Abstracts* **1950**, 220.—*C.A.* **45**, 7320*a*.

The wetting properties of glasses are strongly influenced by adsorbed layers of other materials. The wetting of glasses by Hg after treatment in a very high vacuum is considered as being due to the formation of an invisible adsorbed Hg film.

1717. Heavens, O. S. **Adhesion of (metal) films produced by vacuum evaporation.** *J. phys. radium* **11**, 355-9 (1950).—*C.A.* **46**, 4447*a*.

The load on a Cr steel point drawn across the surface at a known rate so as to remove the film is measured. Films prepd. at pressures of $<10^{-8}$ mm Hg in all-glass vacuum systems show much greater adherence and coherence than do those deposited at 10^{-5} mm Hg. Al films are particularly sensitive to Hg contamination. Adhesion of films to plates subjected to glow discharge is better than that to plates which have been preheated only. The adhesion of Cr to glass is much better than that of Ag or Al. No improvement in adhesion of Al films results from previous deposition of a Cr film 1 mol. thick. Cr films approx. 300 A. thick are required to improve the adhesion of Al and Ag films.

1718. Hedvall, J. Arvid; Jagitsch, Robert, and Olsen, Gillis. **Coating glass surfaces with protective films.** *Z. physik. Chem.* **196**, 23-34 (1950).—*C.A.* **45**, 8730*f*.

Various possible coatings were studied to det. their suitability for protecting glass museum pieces. Most suitable was a soln., as concd. as possible, of methacrylate resin in high-boiling "lacquer benzine."

1719. Iberall, Arthur S. **Permeability of glass wool and other highly porous media.** *J. Research Natl. Bur. Standards* **45**, 398-406 (1950).—(Research Paper No. 2150).

An elementary treatment was developed for the permeability of fibrous materials of high porosities, based on the drag of the individual filaments. The fluid inertia resulted in a permeability that varied with flow even at low Reynolds number. The permeability to gaseous flow was also shown to vary with the absolute gas pressure. Data suitable for the design of linear flowmeters utilizing fibrous materials of high porosity were given, including data on the useful porosity range of fibrous media.

1720. Itterbeek, A. van; Greve, L. de, and Francois, M. **Measurements of the oxidation of thin metallic films (nickel, iron, and lead).** *Mededel. Koninkl. Vlaam. Acad. Wetenschap., Belg., Klasse Wetenschap.* **12**, No. 16, 3-17 (1950) (in English).—*C.A.* **45**, 7840*b*.

Metallic films, 30-400 $m\mu$ in thickness, were sputtered on Pyrex strips and the change in elec. resistivity was followed as a function of time at 75°, 20°, -23°C, and at the temp. of liquid air. Oxidation was carried on for 2 hrs in 5 cm of O_2. No pronounced difference was observed in the oxidation characteristics of films sputtered in Ne, H_2, or N_2. Electron micrographs of the films indicated that they had a granular structure. Oxidation was greatest for the Pb films. No oxidation was observed at liquid air temps. At 75°C for the thinnest films an S-shaped curve was observed. The curves for Fe and Ni at room temp. were very similar to typical Langmuir adsorption isotherms.

1721. Jebsen-Marwedel, H. and Dinger, K. **Comparative effect of various stabilizing treatments on the extractability of fresh glass surfaces.** *Glastech. Ber.* **22**, 57-62 (1948).—*C.A.* **45**, 5811*c*.

The pretreatment of glass plates in cold water gave a slight but observable decrease in extractability in the standard stability test. The treatment with an $SO_2 + O_2$ gas mixt. at 500° to 600°C for only a few min. gave an effect which was around 16 times that of cold water on the initial untreated glass. A gas treatment of 5 min. at 550°C had twice the effect of a 1-hr treatment in hot aq. HCl in improving extractability. By examg. the Na_2SO_4 layer on variously treated samples, the percentage improvement in stability was shown to be directly proportional to the thickness of the sulfate layer formed.

1722. Kinumaki, Jo. **Glass surfaces. I. Migration of alkali ions through the surface layer.** *Science Repts. Research Insts., Tohoku Univ.* **2**, 405-11 (1950).—*C.A.* **45**, 4418*i*.

The surface alky. and the elec. vol. cond. of com. soda lime-silica glass were measured as functions of pretreatment, time, and temp. A parabolic rate law derived for the diffusion of alkali to the surface (detd. by measuring surface alky. as a function of time), and the activation energy of this process was 12 kcal./mol. in the range 350-450°C.

1723. Nagaeda, Shumpei. **Changes of glass surface by acidic gases.** *J. Japan. Ceram. Assoc.* **50**, 648-50 (1942) *Ceram. Abstracts* **1950**, 4.—*C.A.* **45**, 5379*e*.

Eight samples of optical glass were heated to 300°C for 4 hrs in CO_2 or SO_2. The glass surfaces were subjected to the stain test after cooling to room temp. Dry SO_2 and CO_2 reacted with glass surfaces equally and attached the edges of the 5 × 10 × 10-mm test pieces. Moist gases formed thin films of hydrated silica on the surfaces.

1724. Rouard, P. **Optical properties of thin platinum films and their comparison with those of other metals.** *J. phys. radium* **11**, 390-3 (1950).—*C.A.* **46**, 4876*e*.

A distinct min. of the reflection factor (R) characterized a film of Pt approx. 25 A. thick deposited on glass, whatever the wave length (λ) of light used. Thin films of Cu and Fe produced by thermal evapn. and of Au and Ag produced by cathode sputtering were characterized by a min. value of R, but with all these metals this min. corresponded to a different thickness of film for different λ of the incident light. Al, Be, Zn, and Mg films behave like a Pt film.

1725. Saksena, B. D. and Pant, L. M. **The development and the surface energy of the planes of the primary rhombohedron in a-quartz.** *J. Chem. Phys.* **18**, 1304-5 (1950).—*C.A.* **45**, 17*b*.

The Si-O bonds in quartz lay very close to the planes of the primary rhombohedron; this caused the large development of those planes. The surface energy of the primary rhombohedral face was calcd. to be 1895 ergs/cm^2; this was reduced to 1340 if the angle with the Si-O bond was considered. The energy of the inverse rhombohedral faces was 3790, and of the hexagonal-prism faces, 2368 ergs/cm^2. The surface energies of the (111) and (100) planes of crystobalite were 1420 and 2460 ergs/cm^2, resp.

1726. Tamres, Milton and Frost, Arthur A. **Adsorption effects in the decomposition of hydrogen peroxide vapor.** *J. Am. Chem. Soc.* 72, 5340 (1950).—*C.A.* 45., 2294*h*.

At room temp. and at 45°C the pressure increase was greater than 50%, the expected increase for a homogeneous reaction. Addn. of glass wool to the system clearly showed the adsorption of H_2O_2, but coating the surface with Cerese wax AA or Dri-Film 9987 had little effect on the rate.

1727. Terent'ev, A. P.; Klabunovskii, E. I., and Patrikeev, V. V. **Asymmetric synthesis with the aid of catalysts: deposited on right and left quartz.** *Doklady Akad. Nauk S.S.S.R.* 74, 947-50 (1950).—*C.A.* 45, 3798*c*.

The reactions were carried out on metals deposited by either reduction or evapn. on either left (*l*) or right (*r*) quartz powder. The metals included Cu, Ag, Ni, Pb, Pd. Syntheses of optically active compds. from compds. without an asym. C atom were given.

1728. Tsinzerling, E. V. **Residual tensions in glass and quartz.** *Zapiski Vsesoyuz. Mineral. Obshchestva* (Mém. soc. russe minéral.) 79, 223-4 (1950).—*C.A.* 45, 833*h*.

A rapid heating of glass and quartz plates to 300°C, or the application of a diamond point under load, brings about fine cracks which show under crossed nicols at distinct spots the characteristic fanlike "torches" of anomalous birefringence. The changes observed in the light-interference "brushes" by rotating the microscope stage are described; they often resemble conoscopic interference figures of biaxial crystals, and indicate in quartz the trace of $(11\bar{2}0)$ by the symmetry plane of the figure.

1729. Blanc-Lapierre, Andre; Perrot, Marcel, and Nifontoff, Nicolas. **The conductivity of thin carbon deposits.** *Compt. rend.* 233, 141-3 (1951).—*C.A.* 46, 1892*h*.

The deviation from Ohm's law of the conductivities of thin layers of carbon deposited on glass was investigated. Resistances of the specimens were lower than 500,000 ohms, and the applied potentials varied from 0.1 to 40 v. The various curves of R vs. I were sepd. by sharp bends into two distinct regions, interpolative formulas for which, along with a table of the consts. involved, were given.

1730. Blodgett, Katherine B. **Surface conductivity of lead silicate glass after hydrogen treatment.** *J. Am. Ceram. Soc.* 34, 14-27 (1951).—*C.A.* 45, 2642*g*.

An x-ray shield glass contg. PbO 61, BaO 8, SiO_2 31% was used. The surface was ground with 150-mesh SiC and treated with dil. HCl or dil. HNO_3 to produce a surface film of SiO_2 which gave protection to the conducting layer beneath it. The conducting layer was only 50-100 A. thick and lay immediately under the SiO_2 film. Its specific resistance was 800 ohm-cm or more, depending upon the H_2 treatment. The best method of developing a specified resistance was to continue the H_2 treatment until the resistance was considerably less than that desired and then to bring it up to the specified value by treatment in hot H_2O or in hot damp air.

1731. Bockris, J.O'M.; Kitchener, J. A., and Davis, A. E. **Ionic transport in liquid silicates.** *Chem. Phys.* 19, 255 (1951).—*C.A.* 45, 3692*e*.

The silicate (Li_2O-SiO_2 system) was heated *in vacuo* at 800°C in a Mo cell with a C anode and an Al_2O_3 anode compartment. The O_2 liberated attacks the C and the resulting CO and CO_2 were adsorbed on charcoal at liquid-air temp. and subsequently analyzed. Within the exptl. error of ±5% the conduction was completely ionic.

1732. Carman, P. C. and Raal, F. A. **Role of capillary condensation in physical adsorption.** *Nature* 167, 112-13 (1951).—*C.A.* 45, 4522*f*.

The adsorption of CF_2Cl_2 on Linde silica as a loose powder and a compressed plug was studied at -33.1°C. Below 250 mm both the powder and the plug yielded identical results. At higher pressures the plug exhibited greater adsorption, and a marked hysteresis loop was noted upon desorption. No hysteresis was found with the loose powder. The results indicated the contribution of capillary condensation to phys. adsorption.

1733. Dartnell, R. C.; Fairbanks, H. V., and Koehler, W. **Investigation of the adherence of glass to metals and alloys.** *J. Am. Ceram. Soc.* 34, 357-60 (1951).—*C.A.* 46, 225*b*.

The adherence temps. of W, Ni, and Monel were above 1000°F. In a C-Fe series the adherence temp. decreased with increase in C, the highest being 920°F at 0.05% C. A sample of electrode-grade C had an adherence temp. of 1145°F. A sample of brass used for glass molds had a nodular structure and its adherence temp. was 900°F while a mold of the same compn. showed, after service, a dendritic structure and its adherence temp. was lowered to 850°F.

1734. Dietzel, A. **Reactions and adhesion between glass and metal sealings.** *Glastech. Ber.* 24, 263-8 (1951).—*C.A.* 46, 1726*i*.

(1) The melt was adherent on a highly roughened metal surface by mech. indentation. This was the typical adhesion-oxide phenomenon in enamels on Fe (steel). (2) The glass (enamel) may adhere on the metal surface over an intermediate oxide layer, by chem. valence forces. (3) The glass (enamel) may in other cases (e.g. on Cu, Ag, etc.) adhere without any intermediate oxide layer, if O (as oxide) was dissolved in the metal, and diffuse with a considerable speed in it. At all events, the presence of O_2 was indispensable for every adhesion phenomenon.

1735. Ewles, J. and Youell, R. F. **Luminescence effects associated with the production of silicon monoxide and with oxygen deficit in silica.** *Trans. Faraday Soc.* 47, 1060-4 (1951).—*C.A.* 46, 3860*e*.

The production of O-deficits in SiO_2 by heating *in vacuo* or H_2 caused luminescent properties, and the products of condensed SiO were luminescent. SiO_2 heated in H_2 at 750°C for 2 hrs had 0.05% O-deficit; when heated *in vacuo* at 1250°C for 4 hrs it had 0.01% O-deficit; and when heated in air at 1000° for 24 hrs it had no deficit. SiO_2 was reduced with Si and with C. SiO could exist at least for a few hrs in the solid state and might be able to exist for a long time in solid soln. with SiO_2.

1736. FLINT, D. AND LINDSAY A. W. **Catalytic oxidation of sulfur dioxide on heated quartz surfaces.** *Fuel* **30**, 288 (1951).—*C.A.* **46**, 707*h*.

Catalytic oxidation of SO_2 in flue gas could not take place in a quartz tube with flue gas at 1300°C and elec. heating of the quartz tube to 300°C. Only a very short portion of the tube would reach a max. surface temp. of 600°C and the time of contact in this zone would be of the order of 0.05 sec.

1737. GEFFCKEN, W. **Thin layers on glass.** *Glastech. Ber.* **24**, 143-51 (1951).—*C.A.* **45**, 8730*h*.

The application of interference in multiple-layer complexes was discussed for the production of light filters of highly specified characters. This method could be extended to the application of chalcogenides on glass surfaces to produce light filters with particularly sharp and steep absorption characteristics.

1738. HEAVENS, O. S. **Measurement of the thickness of thin films by multiple-beam interferometry.** *Proc. Phys. Soc.* (London) **64B**, 419-25 (1951).—*C.A.* **46**, 9378*g*.

The small-scale irregularities on the surfaces of optical flats and other optically worked glass were studied. Thickness measurements were made on films of Ag and of LiF with several different metals as reflecting layers. The measurements covered the range 120 A. to 1400 A. With Ag as the reflecting layer an accuracy of ±10 A. could be expected.

1739. KLABUNOVSKIĬ, E. I. AND PATRIKEEV, V. V. **Mechanism of the asymmetrizing effect of metal catalysts deposited on right and left quartz.** *Doklady Akad. Nauk S.S.S.R.* **78**, 485-7 (1951).—*C.A.* **45**, 7860*a*.

The outstanding facts are (1) the necessity of a well-developed metal-quartz, phase boundary, (2) the identity of the sign of the rotation of the catalyzate and of the quartz in the case of destructive asym. synthesis, (3) the opposition of the signs of the rotations of the catalyzate and of the quartz in the case of asym. hydrogenation, and (4) the occurrence of low-temp. catalysis with amorphous catalysts deposited on quartz. Owing to the selective adsorption, the concn. of the (+) antipode at the surface is greater than that of the (-) antipode, and the rate of its reaction at the active centers (at the Cu/quartz boundaries) is greater; as a result, the catalyzate shows (-) rotation. Chromatographic sepn. of the antipodes of 2-butanol through asym. adsorption on left quartz powder of 0.5-0.75 mm grain size, in a column 130 cm long, 2.5 cm in diam., moving downward against a rising stream of the vapor, gave, in 30 cycles, a rotation of 0.05°C, corresponding to 0.22% sepn.

1740. KUBOTA, HIROSHI. **Interference color of a thin film viewed from the theory of colorimetry. II.** *Repts. Sci. Research Inst.* (Japan) **27**, 125-31 (1951).—*C.A.* **46**, 9368*b*.

The interference color of a thin nonmetallic film on glass when the angle of incidence of light is less than 90° was theoretically discussed mainly in reference to the parallel component of the reflected rays. From this and the manipulation of 4 characteristic angles of incidence, a film can possibly be made to any precise thickness for sensitive polarizers, filters, and semitransparent mirrors.

1741. LAING, K. M.; EMHISER, D. E.; FITZGERALD, J. V., AND JONES, R. E. **The location of sodium by nuclear activation in glass-corroded tank block refractories.** *J. Am. Ceram. Soc.* **34**, 380-3 (1951).—*C.A.* **46**, 2256*i*

Clay-grog and fused-cast refractories were subjected to corrosion by molten plate glass at 2650°F, either in Pt crucibles or in a small glass-melting tank. Activation and isotope tracing were used to study the location and concn. of Na. All of the clay-grog samples showed the same distribution of Na. The fused-cast samples all showed greater resistance to corrosion than did the clay-grog samples, but varied considerably in the extent to which Na had penetrated.

1742. NICOL, D. L. **Drying granular solids by high-frequency heating.** *Ind. Chemist* **27**, 339-44 (1951).—*C.A.* **46**, 8905*h*.

The high-frequency heating of water, salt solns., and glass beads (0.19 and 0.49 mm in diam.) wetted with these was studied in an arrangement with a tray between horizontal condenser plates. The frequency was 16-18 Mc. and expts. were run at const. "output power." With decreasing H_2O content the drying rate of glass beads, in g H_2O removed/min., increased rapidly, then more slowly, to a max. at 5-10% H_2O, and then decreased sharply. Heat input decreased in a similar manner. The temp. of the drying bed rose to 100°C and remained const. until most of the H_2O was evapd. when it fell rapidly. The explanation lay in the fact that heat was developed only in the water.

1743. RICE, F. O. AND HERZFELD, K. F. **The mechanism of some chain reactions.** *J. Phys. & Colloid Chem.* **55**, 975-85, discussion 986-7 (1951).—*C.A.* **45**, 26*c*.

A mechanism was proposed in which the chain-starting step was a loss of a H atom to the wall: wall + substrate = adsorbed $H + R_2$. The chain-breaking mechanism may occur in one of two ways according as the large-chain radical R_2 was unstable and decomp. readily into a small radical R_1 and a mol. or whether the large-chain radical was comparatively stable and was present in relatively large concn. in the gas. The two endings were: adsorbed $H + R_1 = R_1H +$ free wall; or adsorbed $H + R_2 = H +$ free wall.

1744. Rood, Joseph K. **Evaporated zinc sulfide films.** *J. Optical Soc. Am.* **41**, 201-2 (1951).—*C.A.* **45**, 4511*c*.

Evapd. ZnS films on glass were studies, including method of prepn., optical properties, and aging effects. The influence of rate of evapn. and pressure during evapn. was noted. Thicknesses and *ns* of the films were detd. from measurements of reflected intensity as a function of wave length. ZnS films were soft just after prepn. but became harder if aged in a dry atm.

1745. Slavyanskiĭ, V. T. **Fused glass on platinum in various gas atmospheres.** *Zhur. Fiz. Khim.* **25**, 1059-63 (1951).—*C.A.* **46**, 2766*d*.

Glass was fused on Pt *in vacuo* (10^{-4}mm) or in a controlled gas atm. and the behavior observed visually. Two different samples of glass were used of compn. Na_2O-$2SiO_2$ and 2.7% Na_2O-97.3% B_2O_3. *In vacuo*, N_2, H_2, CO_2, and H_2O fused glass did not wet the Pt surface. Upon introduction of traces of O_2, fused glass flowed slowly over the whole Pt surface. Thus, wetting of Pt by glass was attributed to an oxide film on the Pt surface.

1746. Stahl, Paul. **Influence of adsorbed gas on the polymorphic transformation of quartz, $\alpha \rightleftarrows \beta$.** *Compt. rend.* **232**, 1669-70 (1951).—*C.A.* **45**, 7422*a*.

The polymorphic transformation of α quartz to β quartz at temps. near 570°C varied according to the nature of the gas used. The liquefaction temps., °K, and the transition temps., °C, were He 4, 578.0; H 20, 577.5; Ne 27, 576.5; air 81, 575.5; A 87, 574.0; CO_2 195, 573.0; H_2O 373, 572.0. The effect was attributed to a diminution of the stability of the surface cryst. system by adsorption of gas.

1747. Amberg, C. H. and McIntosh, R. **Adsorption hysteresis by length changes of a rod of porous glass.** *Can. J. Chem.* **30**, 1012-32 (1952).—*C.A.* **47**, 4686*h*.

As adsorption occurs with increasing P/P_0 up to 0.6 (inflection point in the isotherm), a regular extension of a porous glass (Vycor) rod occurs. From $P/P_0 = 0.6$ to $P/P_0 = 0.87$, the adsorption isotherm rises steeply but the rod length remains virtually const. This is interpreted as resulting from a compensation of forces: a further reduction of surface free energy due to capillary filling and formation of concave menisci compensated by the neg. pressure created under the menisci. Thus no net change in length occurs as larger and larger pores are filled. The rod begins to lengthen again with adsorption at P/P_0 above 0.87. When water is desorbed in the region below $P/P_0 = 0.87$, although very little is removed, marked shortening of the rod occurs (reversibly) down to $P/P_0 = 0.70$. The no. of pores/g is about 10^{17}, the surface area about 129 m^2/g.

1748. Antal, John J. and Weber, A. H. **Tracer method for the thickness measurement of thin bismuth films.** *Rev. Sci. Instr.* **23**, 424-6 (1952).—*C.A.* **47**, 2610*f*.

A direct method for the detn. of Bi film thickness was based on the counts/min. produced by a Bi film and those produced by a standard film of known thickness. The films are made by evapn. from a furnace of Bi contg. Bi^{210} (as tracer). The standard was calibrated by evapn. and condensation of the Bi onto glass and weighing the relatively thick (about 300 A.) film.

1749. Barrer, R. M. and Barrie, J. A. **Sorption and diffusion in porous glass.** *Proc. Roy. Soc.* (London) **A213**, 250-65 (1952).—*C.A.* **46**, 10772*i*.

Sorption, gas-phase diffusion in mol. streaming, and surface diffusion were studied using O_2, N_2, A, SO_2, and NH_3. Porosity, surface area, and mean pore radius were evaluated. The Henry's law sorption coeffs. were derived for O_2, N_2, A, K, methane, and ethane. The microstructure was so fine that nonsorbed gases diffused only by mol. streaming at a pressure of half an atm.

1750. Bishop, F. L. and Mowrey, F. W. **Deterioration of the surface of sheet glass.** *Am. Ceram. Soc. Bull.* **31**, 13-15 (1952).—*C.A.* **46**, 2253*b*.

The accelerated test appeared to be a dependable guide to the breakdown of the surface during com. storage. To det. surface breakdown samples 2 × 2 in. cut from the sheets were boiled under reflux in 400 ml of distd. H_2O, and the cond. of the solns. was detd.; detns. of pH were of less value. Surface breakdown was increased greatly by dusting with wood flour during packing, but was decreased somewhat by coating the glass with SO_2 in the lehr during drawing.

1751. Blanc-Lapierre, Andre; Perrot, Marcel, and David, Jean P. **Electric properties of very thin layers of silver, aluminum, and silicon.** *Compt. rend.* **234**, 1133-5 (1952).—*C.A.* **46**, 8446*f*.

Films of the above metals, approx. 0.01 μ thick, were deposited on glass plates provided with Ag electrodes. The elec. resistivity of the films increased with time, very rapidly at first and subsequently at a much slower rate. In the case of Ag, stabilization occurred much sooner than with Al or Si. With Al and Si films, a "drag" phenomenon was described characterized by deviation of the current-voltage curves for increasing and decreasing voltage changes.

1752. Boer, J. H. de and Steenis, J. van. **The behavior of hydrogen atoms on surfaces. I. Adsorption, reflection, and reaction on the surfaces of glass and of inorganic salts.** *Proc. Koninkl. Ned. Akad. Wetenschap.* **55B**, 572-7 (1952).—*C.A.* **47**, 5759*f*.

H atoms on the surfaces of glass, rock salt, LiF, and CaF_2 were strongly adsorbed on these surfaces to form a nearly completed unimol. layer at room temp. A small fraction of H atoms impinging on the 1st layer reacted with adsorbed atoms to form H_2, whereas other H atoms were reflected or adsorbed only for a short time. The 1st layer of H atoms on a cleavage face of LiF formed a two-dimensional pattern of the regularity and dimensions of the surface F ions. At liquid-air temp. a 2nd layer of H atoms may be adsorbed and formed the "nonrecondensable gas" described by Langmuir.

1753. Boettcher, A. **Glass surfaces in a high vacuum.** *Glastech. Ber.* **25**, 347-53 (1952).—*C.A.* **47**, 1347*f*.

Sorption phenomena as functions of the chem. compn. of glass are reviewed with applications to the production of electron tubes and to deposition of metallic films by evapn. *in vacuo*.

1754. BRIEGLEB, G.; SCHOLZE, H., AND STROHMEIER, W. **Is hydrazine associated in the gaseous state? Vapor density and adsorption measurements.** *Z. physik. Chem.* **199**, 15-21 (1952).—*C.A.* **46**, 8918*d*.

Vapor-d. measurements on N_2H_4 at 30-60 °C in the range of relative pressures greater than 0.5 showed a steady increase in f, $f = p_0v_0/pv$, with increase in p/p_0 at const. temp. This increase in f was due to adsorption on the glass walls and not to an assocn. of N_2H_4 mol. This adsorption was of the same order of magnitude as for H_2O. MeNH-NHMe, Me_2N-NH_2, and $(NH_2$-$CH_2)_2$ were less strongly adsorbed, to an extent about 0.1 as much.

1755. COLOMBANI, ANTOINE AND RANC, GASTON. **The thermal evolution of thin gold layers and the transformation points of Fery.** *Compt. rend.* **234**, 1757-9 (1952).—*C.A.* **46**, 9403*h*.

The resistance of Au layers 2000-10,000 A. thick, evapd. onto a polished sheet of SiO_2, was investigated during heating to elevated temps. Between 20 and 140 °C the resistance decreased because of a crystn. effect. Beyond 140 °C the resistance increased, and a reversible curve was obtained on alternating cooling and reheating for layers more than 5000 A. thick.

1756. GURNEY, C. **The effect of surface condition on the strength of brittle materials.** *Symposium on Properties of Metallic Surfaces* (Inst. Metals, London) **1952**, 145-60.—*C.A.* **47**, 2564*b*.

The strength of plastics and of glass, except when drawn into fine fibers, is not nearly so dependent on the mech. perfection of the surface. In the case of glass, the kind of damage that occurs during normal handling results in a strength about half that of glass with a perfect surface. Deliberate scratching of the surface with a diamond reduces the strength by a further factor of 2.

1757. HOLLAND, L.; MOUTON, C., AND HACKING, K. **Optical properties of layers of iron oxide obtained by evaporation.** *Rev. optique* **31**, 209-17 (1952).—*C.A.* **46**, 8968*h*.

Iron oxide was evapd. on glass in vacuum to form light-absorbing layers. The reduction could be minimized by (1) evapg. at higher residual gas pressures (about 1 μ), (2) subsequent baking of the film in air, or (3) evapg. mixts. of Fe_2O_3 and transparent oxides. The reflectivity could be further reduced by deposition of an antireflection film of MgF_2.

1758. KAISER, RUDOLF. **Disturbance centers of high concentration in alkali halides.** *Z. Physik* **132**, 482-96 (1952).—*C.A.* **46**, 9995*i*.

By evaporating *in vacuo* both alkali halides and free alkali metal and condensing the vapor on a quartz plate kept at low temp. (20-90° K) thin layers ($<1\mu$) of very high color-center concn. can be produced. In the system KCl + K a concn. of 1.1% can be obtained. An excess of a foreign alkali or alk. earth metal but not of a heavy metal can also serve as electron donor for the occupation of perturbation centers. However, in cryst. KCl plus 2% AgCl as base and 2% K as electron donor at. Ag can be identified with a new absorption band at 285 mμ. It is produced by the combination of Ag^+ ions with electrons migrated from the place of condensation of the K atom.

1759. LEGER, M. **Adsorption of gases by glass.** *Silicates ind.* **17**, 121-5 (1952).—*C.A.* **47**, 1347*f*.

Volumetric and gravimetric detns. showed SO_2 to be adsorbed more rapidly than CO_2. After the first (more rapid) sorption was completed, the const. rates of (slower) sorption decreased in the order H_2O, SO_2, CO_2.

1760. LYASHENKO, V. I. AND STEPKO, I. I. **Influence of adsorption on surface charges and conductivity of a semiconductor.** *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* **16**, 211-17 (1952).—*C. A.* **46**, 10018*d*.

Cu_2O samples were made by vacuum deposition of Cu on quartz, heating for 30-45 min. at 1030 °C, and quenching with H_2O. The samples were aged by exposure to air for 1 month. The layer thickness was 1×10^{-5} cm, and the Hall const. was 12-18 sq. cm v.$^{-1}$ sec^{-1}; this indicated smaller mobility than in thick samples. CuO, ZnO, and CdO samples were obtained by vacuum deposition of the metal and oxidation. MnO_2 samples were obtained by decompn. of $Mn(NO_3)_2$. In CdO the work function was increased by adsorption. The "screening" length was measured by measuring the cond. of the semiconducting plate forming 1 electrode of a condenser while applying a field to the other electrode.

1761. MORITA, NOBUYOSHI. **Evaporated magnesium fluoride films.** *J. Sci. Research Inst.* (Tokyo) **46**, 127-30 (1952).—*C.A.* **47**, 4159*h*.

The ratio of transmissivity of glass coated with a ¼-wave film in vacuum to that of plain glass was measured. The highest calcd. n was $1.39_1 \pm 0.007$ where the temp. of the glass was 20 °C during the deposition. Max. transmissivity was at 4900 A. The lowest n was $1.36_0 \pm 0.003$ where the temp. was 350 °C.

1762. NORTON, FRANCIS J. **Diffusion of gases through solids.** *Gen. Elec. Rev.* **55**, No. 5, 28-9 (1952).—*C.A.* **46**, 10743*e*.

The rate of permeation of He through various glass walls was measured by noting evapn. rates of liquid N_2 out of Dewar flasks made of the glasses under test, and the outside surfaces of which were exposed to He to diffuse it into the vacuum space, thereby affecting the quality of the Dewar flask.

1763. OVERBEEK, J. TH. G. AND SPARNAAY, M. J. **Long-range attractive forces between macroscopic objects.** *J. Colloid Sci.* **7**, 343-5 (1952).—*C.A.* **46**, 10717*f*.

The attractive forces between flat, highly polished glass and quartz plates were measured in a dry system evacuated to 0.04 mm Hg pressure and in the presence of an ionizing source to prevent electrostatic effects. The force F, measured by the bending of a spring on which one of the plates was mounted, increased as the distance D between the plates decreased from 15,000 to 5000 A., following an equation: $F = (\text{const.})/D^n$, where n had a value of approx. 3.

1764. PIPER, WM. W. **Growth of zinc sulfide single crystals.** *J. Chem. Phys.* **20**, 1343 (1952).—*C.A.* **46**, 10765*c*.

ZnS crystals (wurtzite structure) up to 5 mm long and 3 mm² cross section were grown on a quartz wall by condensation from the vapor phase. Pure ZnS was evapd. at 1170-1200°C and condensed at 1070-1120°C. Small amts. of Cu or Ag could be incorporated by adding $Cu(NO_3)_2$ or $AgNO_3$ to the vaporization chamber.

1765. SARAKHOV, A. I. **High-sensitivity adsorption balance.** *Doklady Akad. Nauk S.S.S.R.* **86**, 989-92 (1952).—*C.A.* 47, 5729*c*.

A quartz-thread torsional balance, permited an accuracy of 8×10^{-8}g per 1 g, and measurement of a total change of wt of 2.3-2.5g. The use of the balance was illustrated by an adsorption isotherm of C_6H_6 vapor on highly dispersed quartz at 20°C.

1766. SATOR, ABDELHAK. **A reversible cell in which the electrolyte is a crystal deposited in a thin layer by evaporation.** *Compt. rend.* **234**, 2283-5 (1952).—*C.A.* 46, 9453*e*.

The $PbCl_2$ electrolyte was deposited as a thin layer (approx. 1 μ) over a thin layer of Ag on glass and then covered by another layer of Ag. Prolonged charging at 0.5 microamp. formed AgCl on one Ag electrode and Pb on the other. The e.m.f. of the cell at 22°C was 0.460 v. and the temp. coeff. between 21° and 26°C was -3×10^{-4} v./degree.

1767. THOMPSON, JOHN B.; WASHBURN, E. ROGER, AND GUILDNER, L. A. **Adsorption of carbon dioxide by glass.** *J. Phys. Chem.* 56, 979-81 (1952).—*C.A.* 47, 2010*i*.

"Scotchlite" brand glass beads yielded a surface area of 0.158 m² per g by the application of the B.E.T. equation to the adsorption of CO_2 at about -77°C. The area calcd. from observations of the particle-size distribution was 0.151 m² per g. Type 120 beads yielded an area 1.7 times the geometric area if sample was degassed at 180°C; however, the surface area was up to 3 times as large with incomplete degassing to remove water vapor as with degassing at 180°C. Roughness factors increased by factors of 21 and 12 for types 520 and 120, resp., on soaking the beads in water at room temp. for 33 days. Measurements on glass wool yielded a type-III isotherm.

1768. TOLSTOĬ, D. M. **Slip of mercury on glass.** *Doklady Akad. Nauk S.S.S.R.* **85**, 1329-32 (1952).—*C.A.* 47, 1450*g*.

The velocity v of rise of the meniscus of Hg was detd. as a function of the pressure, in extremely fine glass capillaries obtained by drawing out a thermometer capillary to a thread. The effective capillary radius r was detd. by calibration with H_2O and checked with C_6H_6. Measurements with Hg at 21.3 ± 0.1°C, in capillaries of $r = 13.3$ and 3.48 μ, gave an apparent $\eta = 1.45$ and 1.21, resp. (as against the normal $\eta_0 = 1.547$).

1769. YAROSLAVSKIĬ, N. G. AND KARYAKIN, A. V. **Changes of the infrared OH absorption band of microporous glass on low-temperature adsorption of oxygen and nitrogen.** *Doklady Akad. Nauk S.S.S.R.* **85**, 1103-6 (1952).—*C.A.* 47, 967*g*.

Microporous glass evacuated at +550°C and then cooled to -180°C showed a narrow absorption band with a sharp max. at 1.365 μ (7326 cm^{-1}) corresponding to the 1st harmonic of the valence vibration in the O—H bond, and a low secondary max. at 1.380 μ (724.5 cm^{-1}). Upon admission of N_2, the 1st peak decreased gradually and disappeared completely after 20-30 min. Heating up to room temp. restored the original spectrum, as a result of desorption of the N_2. On admission of O_2, at -180°C, the OH peak disappeared instantaneously, and a secondary max. appeared, more diffuse than with N_2. O_2 is held at the glass surface more firmly than N_2.

1770. LIANG, S. CHU. **Physical adsorption at low coverages.** *J. Phys. Chem.* 57, 84-7 (1953).—*C.A.* 47, 5211*a*.

The adsorption of Kr and A on 3-mm glass spheres shows the glass surface to be heterogeneous. Isotherm data for low surface coverages show that repeated treatment at 300°C *in vacuo* progressively increases the no. of highly active sites but leaves the total no. of adsorption sites unchanged. Addnl. adsorption on the monolayer is similar to that on a uniform surface, even though the glass surface is heterogeneous.

1771. NORTON, FRANCIS J. **Helium diffusion through glass.** *J. Am. Ceram. Soc.* 36, 90-6 (1953).—*C.A.* 47, 4567*i*.

A mass spectrometer was used both as an analytic tool and to det. the rate of diffusion of He, at -80 to 600°C, through 9 types of glass, including fused SiO_2, borosilicate, phosphate, soda lime, combustion tubing, x-ray shield, Pb borate, and chem. glassware. The highest rates of diffusion were for fused SiO_2 and Corning Vicor glass (SiO_2 96, B_2O_3 3, Al_2O_3 1%); the lowest were for x-ray shield and Pb borate glasses. The rate of diffusion decreased enormously with decrease in the percentage of SiO_2, B_2O_3, P_2O_5 in the glass.

1772. SCHULZE, A. AND EICKE, H. **Electric behavior of thin metal layers.** *Metall* 7, 171-82 (1953).—*C.A.* 47, 6725*h*.

Thin layers were obtained by cathode sputtering in a vacuum. For Au and Ir the temp. coeff. of resistance was zero at resistance values of 10^6 ohms, yet here the required layer thickness was still so thin that the loose structure had no definite value of resistance. With Ni the temp. coeff. was pos. at low magnitudes of resistance and neg. at high magnitudes of resistance. No conducting Fe layer was established, although upon the base a visible metal layer could be perceived. With Sb the measured temp. coeff. was neg. and the same linear relation as found with other metals existed. In the case of Cu, Ag, and Mn the detn. of the temp. coeffs. was not possible.

I-10. Gases on Silica Gel

1773. ZEL'DOVICH, A. G. **Drying oxygen as a means for combating the corrosion of oxygen cylinders.** *Avtogennoe Delo* 11, No. 8-9, 25-7 (1940).—*C.A.* 37, 2893[2].

To avoid corrosive attacks upon O_2 cylinders, the moist O_2 must be well dried by means of silica gel.

1774. GROTH, W. AND HARTECK, P. **Study of adsorbent surfaces by means of xenon isotopes.** *Naturwissenschaften* 29, 535-6 (1941).—*C.A.* 37, 2634[9].

With 25 g of silica gel, 6.8 cc. of a heavy Xe mixture was adsorbed at -125°C. The adsorbent was then treated with 8 cc. of a light Xe mixture, ½ hour at -125 °C. Upon desorption by slow temperature rise in 3 fractions no difference in composition was found. The same experiment was conducted with 14 g of activated carbon. The desorption temperatures for activated carbon were higher and the lighter isotopes appeared at higher concentrations in the first fractions. The heavier isotopes, first adsorbed, were found in the last fractions.

1775. LADKA, F. AND PROKOP, V. **Preparation of granular active silicic acid on a laboratory scale.** *Chem. Listy* 35, 218-19 (1941).—*C.A.* 37, 4288[4].

A water glass soln. (7.49% Na_2O, 25.08% SiO_2, dild. 1:1 with H_2O) was poured with stirring into HCl (30 cc. concd. HCl, 200 cc. H_2O, methyl orange) until the resulting soln. was weakly acidic. When evapd. on a water bath until 80% H_2O, a gel formed which was cut into small pieces and washed with H_2O by decantation until absence of Cl^-. The gel was dried above 180°C and the final form of the product depended upon the method of drying.

1776. WACHTER, H. **The adsorption capacity of silica gels for water vapor (drying in vacuum apparatus).** *Chem. Fabrik* 14, 376-8 (1941).—*C.A.* 37, 2242[6].

Seven products with various pore sizes were investigated at vapor tensions between 3.6 and 30.9 mm Hg. Comparison of small-, medium- and wide-pore gels showed that small-pore gels were best for drying gases. When drying in chambers evacuated with the usual lab. app., it was not possible to reduce the pressure much below 0.1 mm Hg with silica gel as the drier, and under high vacuum (10^{-3} mm or less) the use of these materials was of no value.

1777. BÉKÉSY, NIKOLAUS v. **A drying tube in which a high vacuum is obtained by adsorption.** *Biochem. Z.* 312, 107 (1942).—*C.A.* 37, 6500[8].

A vacuum drying tube of the Abderhalden type was provided with moistened silica gel. The tube was evacuated with a water pump (20-35 mm Hg) and a slow stream of air introduced at the opposite end, to displace the air with water vapor from the moistened silica gel. The evacuation was continued until the gel temp. was 270-280°C. The system was then closed and allowed to cool. Pressures of 0.05 mm were always obtained. Benzene or alc. could be substituted for water to moisten the gel.

1778. DUNTZE, RICHARD. **Scientific basis and technical progress in the use of silica gel.** *Chem.-Ztg.* 66, 196-9 (1942).—*C.A.* 38, 1931[9].

The prepn. of SiO_2 gel, its structure and properties are reviewed historically. The principal use is for the drying of gases. Static and dynamic considerations of drying are discussed.

1779. ISHIGAKI, YOKA. **Silica gel from iron ore tailings. I, II.** *J. Soc. Chem. Ind. Japan* 45, 73-8 (1942).—*C.A.* 43, 1925*i*.

SiO_2 gel was prepd. from the Fe ore tailings which contained 75% of SiO_2. About 70% (or 52.5% of the ore) was recovered as SiO_2 gel when the material was fused with 3 times its wt of Na_2CO_3. The SiO_2 gel contained a small amt. of Fe_2O_3. The max. adsorption for C_6H_6 was 65% of the wt of SiO_2 gel with very small amt. of residual C_6H_6 found upon desorption.

1780. MAGNUS, A. **Adsorption capacity of silica gels.** *Z. ver. deut. Ing., Verfahrenstech.* 1942, No. 4, 102.—*C.A.* 38, 4490[4].

Adsorption isotherms of seven com. sample of silica gel were obtained and the results shown graphically. The adsorption isotherms all indicated capillary condensation.

1781. RANDS, M. B. **Moisture problem in transformer insulation.** *New Zealand J. Sci. Tech.* 23B, 217-23 (1942).—*C.A.* 38, 1584[2].

Large transformers were shipped to New Zealand with the oil removed and with the case either sealed or fitted with a breather contg. silica gel. In spite of such precautions the paper or pressboard insulation frequently acquired some moisture and this should be removed before the transformer is put into service. $CaCl_2$ was formerly used as the desiccant in the breather tubes in shipment, but this was generally now replaced by silica gel. The use of $CoCl_2$ as an indicator for moisture in the silica gel had not proved satisfactory.

1782. REYERSON, L. H. AND CINES, MARTIN R. **Adsorption of propane and propylene by silica gel and metallized silica gel.** *J. Phys. Chem.* 46, 1060-8 (1942).—*C.A.* 37, 2977[2].

Sorptions of propane and propylene on silica gel and on silica gel metallized with Pd were measured at -25°, 0° and 35°C. The olefin was more strongly sorbed by the metallized surface than by the untreated gel, and it was more strongly sorbed than the paraffin. The results were in reasonably good agreement with the B.E.T. theory.

1783. WHITE, J. F. **Manufacture of silica aerogel-description of process and heat transfer problems.** *Am. Inst. of Chem. Engrs.* 38, 435 (1942).

The method of preparing aerogels with particular emphasis on autoclaving a silica alcogel was described. The major portion of heat transfer was accomplished by convection, the amount being transferred by radiation and conduction being negligible in the pilot plant autoclave described. The advantages of diphenyl vapor as a heat transfer medium was described.

1784. ANON. **Production of silica aerogel.** *Chem. & Met. Eng.* 50, 144-47 (February) 1943.

The large scale production of silica aerogel at the Boston plant of the Monsanto Chemical Co. was described and illustrated by photographs. The process depended upon the heating of a silica gel system satd. with EtOH to temps. and pressures above the critical state for the liquid phase present in the gel. The heating was done at 550°F and the pressure maintained at 1150 lb.

1785. BRINER, E. AND LACHMANN, A. **Oxidation of SO_2 by O_2 or O_2-O_3 mixtures in presence of silical gel. Adsorption of O_3 on silica gel, alumina gel and cotton.** *Helv. Chim. Acta* 26, 346-57 (1943).—*C.A.* 37, 6532^2.

SO_2-O_2 mixts. at 0°, 100°, 200° and 400°C in contact with partially dehydrated silica gel formed very little SO_3. The use of O_3 together with silica gel had little value for H_2SO_4 manuf. The reaction probably proceeded through formation of H_2SO_3 on the gel and subsequent oxidation (accelerated by O_3) to H_2SO_4. Adsorption of O_3 on silica gel increased greatly as the temp. decreased from 0° to -80°C; at the same time the proportion of O_3 decompd. decreased. Alumina gel gave nearly the same magnitude of O_3 adsorption and decompn.

1786. CRALLEY, LESTER V.; SHEA, THOMAS E., AND CRALLEY, LEWIS J. **Modification of the silica gel method for the determination of atmospheric organic solvent vapors.** *J. Ind. Hyg. Toxicol.* 25, 172-3 (1943).—*C.A.* 37, 5926^9.

CCl_4 was adsorbed by silica gel, then removed by EtOH, and the gel decompd. by alc. KOH. Between 90 and 99% of CCl_4 was recovered as Cl^- by this method.

1787. DOBROWSKY, ALFRED. **Diffusion equations, preparation of their models, and diffusion experiments in silica gel. I. Theory of the model and application in unlimited space. II.** *Kolloid-Z* 104, 87-96 (1943); 105, 56-70 (1943).—*C.A.* 38, 2254^6, 2545^2.

A hydraulic diffusion model was described consisting essentially of a no. of vertical glass tubes connected in series by means of capillary tubes and supplied with liquid by means of a const.-level device. The results of some expts. on diffusion in silica gel were used to illustrate the math. methods.

1788. CAPELL, R. G.; HAMMERSCHMIDT, E. G., AND DESCHNER, W. W. **Dehydration of commercial gases by solid adsorbents.** *Ind. Eng. Chem.* 36, 779-84 (1944).—*C.A.* 38, 6520^2.

Silica gel, activated alumina grade A, florite (a natural bauxite), and Hi-florite (florite impregnated with 12-14% manganous chloride) were tested in units 7 3/8 in. inside diam. with adsorbent beds 34 1/2 in. deep. Tests were run on dehydrating natural gas, and reactivation gas supplied by the com. plant heater at about 350°F. All 4 adsorbents showed initial increases in capacity followed by slow declines in 29 runs on each material. Oil vapors in humid gas seemed to cause the most pronounced decline. H_2S, expecially along with O_2, and nonvolatile compds., also caused decline in capacity. Data were presented for the pressure drop through adsorbent beds for various screen analyses between 2 and 8 mesh and varying gas velocities.

1789. HIGUCHI, IZUMI. **Sorption isotherms for benzene on silica gels with special reference to the condition of their preparation.** *Bull. Inst. Phys. Chem. Research (Tokyo), Chem. Ed.* 23, 40-6 (1944).—*C.A.* 43, 7774*b*.

An excellent SiO_2 gel was prepd. as follows: dil. 200 cc. water glass (d. 1.26) 17 times by vol. and gradually add 400 cc. 2 *N* $FeCl_3$ to pH 4. Let stand 11 days at room temp. and dry 44 hrs at 50°C. Filter the product and wash with hot water 2 hrs, then with 6 N HCl, finally wash by decantation and dry.

1790. HIGUCHI, IZUMI. **Dielectric properties of substances in the sorbed condition. III. Coagulation of nitrobenzene sorbed on silica gel.** *Bull. Inst. Phys. Chem. Research (Tokyo), Chem. Ed.* 23, 359-66 (1944).—*C.A.* 42, 6593*e*.

The dielec. polarization of nitrobenzene sorbed on silica gel at -75 to 75°C was detd. The value for the liquid increased with increase in capillary diam. From the change in dielec. polarization, it appeared that a condensed liquid coagulated below the m.p., and ΔT was greater the smaller the capillary diam. Since there was no lowering of the m.p. when adsorbed, the lowering of dielec. polarization at low temps. was attributed to abnormal dispersion arising from the adsorbing forces.

1791. KATSURAI, TOMINOSUKE AND NAKAHIRA, MITSUOKI. **The change in silica sol caused by autoclaving.** *Bull. Inst. Phys. Chem. Research Chem. Ed.* 23, 345-6 (1944).—*C.A.* 42, 5304*g*.

By dialyzing a soln. of Na_2SiO_3 against dil. HCl, a stable silica sol was obtained. the sol was acidic and showed no cataphoresis. By autoclaving at 200°C, the sol was transformed into a gel, which turned to a sol by shaking. This transformation could be repeated. The sol did not transform into a gel simply by standing.

1792. KUBELKA, PAUL AND PROSCHKA, RUDOLF. **The super cooling of water in a silica gel.** *Kolloid-Z.* 109, 19 (1944).—*C.A.* 41, 4995*c*.

The water enclosed within the capillaries of a silica gel tended to undergo supercooling. The supercooling temp. was sharply reproducible and independent of the rate of cooling. The solidification of the water in the gel was followed by thermal analysis in a bulb filled with Hg.

1793. PERNELL, CARROLL. **Collection and analysis of halogenated hydrocarbon vapors employing silica gel as an adsorbing agent.** *J. Ind. Hyg. Toxicol.* 26, 331-3 (1944).—*C.A.* 39, 886^1.

Silica gel was an efficient adsorbent of halogenated hydrocarbons under normal sampling rates (1-2 liter/min.) and with concns. normally encountered in industry. The adsorbed compds. were completely decompd. by digesting with alc. KOH or by burning an alc. soln. of them. A desiccating agent was unnecessary for air 40-60% satd. with water vapor.

1794. FOSTER, A. G. **Low-pressure isothermals and heats of sorption.** *J. Chem. Soc.* 1945, 360-6.—*C.A.* 39, 4785^7.

Sorption isothermals of water, EtOH, toluene, dioxane, *n*-octane, and CCl_4 were detd. at 25°C on silica and Fe_2O_3 gels. All gave the linear plot of p/c against p. Heats of sorption were calcd. by means of the Clapeyron equation and compared with the values calcd. by statistical theory from the const. of Langmuir's equation. The entropy changes accompanying the sorption process were shown to be consistent with the view that the adsorbed mols. behaved as three-dimensional oscillators.

1795. FREIDLǏN, L. KH.; BALANDIN, A. A.; FRIDMAN, G. A., AND LEBEDEVA, A. I. **Mechanism of vapor-phase catalytic substitution by hydroxyl of halogen attached to aryl group.** *Bull. acad. sci. U.R.S.S., Classe sci. chim.* **1945**, No. 2, 154-61 (in English, 162).—*C.A.* **39**, 4792¹.

A theory of the vapor-phase hydrolysis of aryl halides, catalyzed in the liquid phase by Cu and in the vapor phase by SiO_2 gel, was advanced.

1796. GYANI, B. P. AND GANGULY, P. B. **Adsorption in relation to constitution. IV. Adsorption of hydrocarbons by silica gel.** *Bull. Patna Sc. Coll. Phil. Soc. No.* **15**, 29-39 (1945).—*C.A.* **42**, 1101*h*.

The adsorptions of pentane, heptane, octane, cyclohexane, benzene, tolune, and xylenes were measured on silica gel at 35°C. Silica gel adsorbed about one-third its own weight of the various org. vapors near max. adsorption. The orientation of adsorbed paraffins was analogous to the orientation obtained for the adsorption of dibasic acids at low concn. With aromatic hydrocarbons, the mols. stood on their edges with the plane of the ring perpendicular to the surface. The behavior of benzene and its homologs was explained by an orientation brought into play by substitution in different positions in the ring. Cyclohexane mols. laid flat on the surface at low relative pressures, but at higher relative pressures, a tilting of the plane occurred owing to the closer packing, the mols. tending to stand on edge.

1797. TAYLOR, ROGER K. **Water-adsorption measurements on silica gel.** *Ind. Eng. Chem.* **37**, 649-52 (1945).—*C.A.* **39**, 3989⁸.

Adsorption of H_2O on silica gel was independent of temp. over a limited range at const. relative humidity. The measurements were extended to higher temp. in a special static-method app. permitting the detn. of adsorption in the absence of air, the use of measured amts. of air-free water, and activation and deaeration of the SiO_2 gel of known water content. In the activation treatment, it was noted that the last portions of adsorbate removed from the gel contained more air than the first portions. The isosteres, plotting relative humidity vs. temp., were straight lines for percentages of adsorbed water from 1 to 30%, for relative humidities to 75% and temp. to 230°. Isosteres at 5% and 30% added water did not show hysteresis in the presence of air added at 10 mm partial pressure.

1798. RODE, T. V. AND BALANDIN, A. A. **A physicochemical study of silica-gel catalysts.** *Acta Physicochim. U.R.S.S.* **21**, 853-68 (1946) (in English).—*C.A.* **41**. 1920*c*.

The best unmixed catalysts for the vapor hydrolysis of chlorobenzene were silica gels. Differential heating curves were given for 2 samples, an imported one and one prepd. by the method of Okatov. Compn.-temp. diagrams (x-t) plotted up to 1125°C were obtained for both samples and there were breaks in the curves in the intervals 185-270°C and 380-430°C corresponding to the decompn. of 2 hydrates of a definite compn. The thermal irreversible inactivation of the catalyst, which started at 480-550°C, was due not to any change in their inner structure, but chiefly to other factors, probably to the elimination of a definite amt. of chemically bound H_2O.

1799. CASTRO Y RAMOS, R. DE. **Highly adsorbent silica gels. II. Gels made from copper silicate.** *Anales fís. y quím. (Madrid)* **43**, 245-60 (1947).—*C.A.* **41**, 6376*b*.

Activity of the gel increased with cold HCl and diminished with boiling HCl. Adsorbent capacity varied inversely with HCl and Na-silicate concn. and increased with temp. of soln. and quantity of $CuSO_4$. Time of washing the gel was inversely proportional to HCl concn. used to produce the gel. The adsorbing surface was calcd. from the heat of moistening and varied between 733 and 1713 m^2/g.

1800. KISELEV, A. V.; AVGUL, N. N. MIKOS; ROMANCHUK, M. A., AND SHCHERBAKOVA, K. D. **Thermodynamic properties of adsorption films on silica gel.** *J. Phys. Chem. (U.S.R.R.)* **21**, 1223-36 (1947) (in Russian).—*C.A.* **42**, 2489*a*.

The adsorption and desorption isotherms at 14-20°C were detd. for a silica gel for H_2O, MeOH, and n-heptane. The heat of wetting by the evacuated gel was 15.7, 16.7 and 6.5 cal/g for H_2O, MeOH, and heptane, resp. The area of the gel was 180-330 m^2/g according to the B.E.T. method and assuming the adsorbed film to have the usual surface tension at the start of the hysteresis loop. The most frequent radius of the pores was calcd. to be 40-60A.

1801. KRISHNAPPA, T.; RAO, K. SUBBA, AND RAO, B. SANJIVA. **Hysteresis in sorption. XI. Permanence of sorption-desorption hysteresis.** *Proc. Indian Acad. Sci.* **25A**, 162-73 (1947).—*C.A.* **41**, 5358*d*.

Silica gels were pptd. by interaction of Na silicate soln. and AcOH at 25° and 100°C by preheating the solns. and by autoclaving for 3 hrs at 120°C; TiO_2 gels pptd. from a soln. 0.5 *N* in $TiCl_4$ and 0.2 *N* in HCl by a 2% excess of 0.7 *N* NH_4OH at 25°C and boiling; Al_2O_3 gels pptd. from 0.5 *N* $Al_2(SO_4)_3$ soln. with excess of 0.5 *N* NH_4OH at 25°C and boiling. The sorption-desorption cycles for H_2O at 30°C were detd. after degassing to 0.001 mm pressure. Equil. was reached in 6 hrs for silica gel, 4 hrs for TiO_2, and 3 days for Al_2O_3. The hysteresis loops were smaller in area for the gels pptd. at the b.p.

1802. KRISHNAPPA, T.; RAO, K. SUBBA, AND RAO, B. SANJIVA. **Hysteresis in sorption. XII. Influence of the temperature of activation of silica gel on the hysteresis effect.** *Proc. Indian Acad. Sci.* **25A**, 174-80 (1947).—*C.A.* **41**, 5358*g*.

Silica gel pptd. at 25°C was activated by heating in a stream of dry air at 35°, 70°, 140°, 300°, 500°, 750°, and 1000°C. From 35° to 140°C there was a decrease in sorptive capacity with H_2O from 84.2 g to 63.1 g per 100 g of gel at satn. pressure, with a small decrease in the area of the hysteresis loop. Above 500°C there was a marked decrease in sorption and at 1000°C the capillary vol. had decreased to ⅓ the vol. at 500°C.

1803. Krishnappa, T.; Rao, K. Subba, and Rao, B. Sanjiva. **Hysteresis in sorption. XIII. Mode of preparation of silica gel and its influence on hysteresis.** *Proc. Indian Acad. Sci.* **25A**, 181-5 (1947).—*C.A.* **41**, 5358*h*.

Transparent and opaque silica gels were activated at 450°C for 4 hrs, after which the residual H_2O was 5.2% and 5.57%, resp. Sorption-desorption cycles on H_2O at 30°C requiring 1 month per cycle, were detd. after degassing. At low vapor pressures, the gels showed about the same sorption. The hysteresis loops were permanent and reproducible, but the method of prepn. of the gel had a profound effect on their shape and size.

1804. Milligan, W. O. and Rachford, Henry H., Jr. **The effect of heat-treatment on the sorption-desorption hysteresis characteristics of silica gel.** *J. Phys. & Colloid Chem.* **51**, 333-59 (1947).—*C.A.* **41**, 2625*d*.

Com. silica-gel samples, conditioned 6 weeks in air satd. with water vapor attained a const. wt. The samples were heated for 2 hrs to temps. of 30° to 930°C and allowed to come to equil. with water vapor at 12°C. The samples were thoroughly evacuated and the sorption and desorption isotherms were taken for each temp. From a no. of pore-distribution curves for silica gel taken at different temps. it is concluded that the heat-treatment of the original gel did not appreciably modify the distribution or size of the pores, but appeared to diminish their no.

1805. Neĭmark, I. E. and Khatset, F. I. **Effect of the surface tension of the coagulant on the formation of the internal structure of silica gels.** *Kolloid. Zhur.* **9**, 289-96 (1947).—*C.A.* **47**, 947*g*.

Acids having different surface tensions γ were added to a Na silicate soln., d. 1.12. The pore vol. V of the silica gels obtained was, for example, 0.618 for $\gamma = 77$ and 0.726 for $\gamma = 47$ dynes/cm. The max. (liquid) vol. v of adsorbed C_6H_6 vapor was 0.53 and 0.75 for $\gamma = 77$ and 47, resp. The max. adsorption of AcOH (from CCl_4) was 3.59 and 3.00 millimol./g; the calcd. surface was 522 and 436 m^2/g for $\gamma = 77$ and 47, resp. The most frequent pore radius was 25 μ and 35 μ for $\gamma = 77$ and 60, resp.

1806. Plank, C. J. and Drake, L. C. **Differences between silica and silica-alumina gels. I. Factors affecting the porous structure of these gels.** *J. Colloid Sci.* **2**, 399-412 (1947).—*C.A.* **42**, 436*i*.

The particle d. by Hg displacement and surface area by N_2 adsorption were detd. for a series of gels made by different methods. For silica gels, surface area and particle d. decreased with increasing pH of the hydrosol, solids content of the hydrosol, and pH of the base-exchange medium used to remove Na ions from the gel. In the case of SiO_2-Al_2O_3 gels, particle d. decreased but surface area increased with increasing pH and solids content.

1807. Plank, C. J. and Drake, L. C. **Differences between silica and silica-alumina gels. II. A proposed mechanism for the gelation and syneresis of these gels.** *J. Colloid Sci.* **2**, 413-27 (1947).—*C.A.* **42**, 437*b*.

The extremely rapid gelation of SiO_2 and SiO_2-Al_2O_3 hydrosols under certain conditions and the sensitivity of gelation time to pH was demonstrated experimentally. It was proposed that the intermicellar bonds were H-bonds, whose rupture in acid media led to the formation of smaller particles of higher d. and higher surface area. In SiO_2-Al_2O_3 gels, the H-bonds joining silica and alumina groups were most important. Alumina groups must occupy a terminal position on the silica chain.

1808. Rosenblum, A. A. **Silica aerogels.** *Australia, Dept. Munitions, Inform. Circ.* **8**, 14 pp (1947).—*C.A.* **43**, 4789*g*.

Silica hydrogel is a light-wt microporous material, slightly hygroscopic, but capable of being made hydrophobic by coating with a mol. film of H_2O-repellent silicone. It is an effective, non-shattering, blast-proof material, its air spaces being sufficient to pick up a shock-wave, but small enough to provide a large solid interspace to deflect and cancel the shock.

1809. Rushmore, Donald. **Drying instrument air with silica gel.** *Chem. Eng.* **54**, No. 6, 120 (1947).—*C.A.* **41**, 6083*c*.

Two tanks were used alternately; each was equipped with steam coils for drying the silica gel.

1810. Shepard, Martin. **Rapid determination of small amounts of carbon monoxide. Preliminary report on the NBS colorimetric indicating gel.** *Anal. Chem.* **19**, 77-81 (1947).—*C.A.* **41**, 1952*d*.

The min. information necessary for prepg. silica gel was given. As little as 0.001% CO by vol. could be detected and detd. in 1 min. The procedure would detect less than 0.022 p.p.m. The purified silica gel was about 4 times as sensitive as gel used before 1941 in England.

1811. Balandin, A. A. and Rode, T. V. **Application of thermal analysis to the study of catalysts.** *Problemy Kinetiki i Kataliza* **5**, 135-44 (1948).—*C.A.* **46**, 10821*i*.

Thermograms were detd. for 2 samples of silica gel. Sorbed H_2O in one sample was progressively eliminated up to 115°C until a compn. $6SiO_2.H_2O$ was reached. Between 115° and 185°C, practically no H_2O was eliminated. It was decompd. between 185° and 270°C to a hydrate $9SiO_2.H_2O$ which was stable up to 380°C and loses H_2O progressively between 380° and 1125°C. The thermograms confirmed the view that part of the H_2O in silica gels was bound, not by adsorption, but by chem. forces. Further thermograms showed distinct differences between different samples of Cr_2O_3 catalysts.

1812. BORESKOV, G. K.; BORISOVA, M. S.; DZHIGIT, O. M.; DZIS'KO, V. A.; DREVING, V. P.; KISELEV, A. V., AND LIKHACHEVA, O. A. **Effect of the conditions of preparation on the structure of silica gels.** *J. Phys. Chem. (U.S.S.R.)* **22**, 603-16 (1948).—*C.A.* **42**, 7132*d*.

Glassy silica gels (prepd. by adding a K silicate soln. to acid, ripening the gel formed, washing, and drying) were relatively unidispersed; e.g., a gel whose most frequent pore radius was 15-20 A. had almost no pores wider than 30 A. The total pore vol. varied between 0.28 and 0.83 cc/g. Chalk-like silica gels (prepd. by adding $FeCl_3$ to a K silicate soln., filtering, and treating the ppt. with H_2SO_4) were polydispersed. The surface area of the glassy gels was 360 to 600, and of the chalk-like gels about 500 m^2/g as detd. from adsorption of MeOH and H_2O vapors. Adsorption of BuOH, lauric acid, and stearic acid from solns. in CCl_4 were also detd.

1813. BORESKOV, G. K.; BORISOVA, M. S.; DZIS'KO, V. A.; KISELEV, A. V.; LIKHACHEVA, O. A., AND MOROKHOVETS, T. N. **Effect of the temperature of firing on the structure of various types of silica gels.** *Doklady Akad. Nauk S.S.S.R.* **62**, 649-52 (1948).—*C.A.* **43**, 1628*d*.

Three samples were investigated in adsorption and desorption of MeOH vapor, after heating 12 hrs between 115-1000°C. I was a vitreous fine-pore gel, pore radius, r, under 20 A.; II mainly coarse-pore, $r = 35$-40 A.; III of mixed pore size, r from 15 to 80 A. The adsorption isotherm of I heated to 300°C, was typical of fine-pore adsorbents, leveling off to const. adsorption at p/p_s (relative pressure) 0.6. The isotherm for II (300°C) rose steeply at high p/p_s and showed marked hysteresis. The isotherm of III rose rapidly at high p/p_s. The B.E.T. surface area remained approx. const. up to about 400°C for II, then fell rapidly, to about 70 m^2/g at 900°C; in the case of III, it decreased regularly to about 150 m^2/g at 100°C.

1814. BURTT, BENJAMIN P. AND KURBATOV, J. D. **Mixed adsorption of radon and argon on silica gel.** *J. Am. Chem. Soc.* **70**, 2278-82 (1948).—*C.A.* **42**, 6603*b*.

Adsorption isotherms were obtained for air, A, and CO_2 on silica gel at 25°C. Adsorption isotherm for radon in air followed Henry's law and substantiated the Langmuir theory of mixed adsorption as applied to low concns. The adsorption of radon was slightly suppressed in CO_2. The isotherms of radon in A showed that the adsorption of radon was enhanced in the presence of A even though a very small fraction of the total surface of silica gel was covered by the radon. The heats of adsorption of radon in air and in A were estimated from the data obtained to be of the order of magnitude of 9000 cal per mole.

1815. FLAGG, JOHN F. AND LOBENE, RALPH. **A rapid method for the determination of nitrogen oxides in air.** *J. Ind. Hyg. Toxicol.* **30**, 370-2 (1948).—*C.A.* **43**, 1686*g*.

NO_2 was adsorbed on silica gel, treated with diphenylamine, and the color compared with standards, The method was suitable for air-gas mixts. contg. 1-50 p.p.m. NO_2. The advantages included sensitivity, speed, and simple app. and reagents; the disadvantage was its limited accuracy. It was assumed that in air NO was converted to NO_2.

1816. KIRSHENBAUM, ISIDOR AND GROVER, RICHARD K. **Low-temperature nitrogen adsorption studies of silica gel.** *J. Am. Chem. Soc.* **70**, 1282-3 (1948).—*C.A.* **42**, 4019*h*.

A Davison silica gel, activated at 650°C and having a surface area of 655 m^2/g, on grinding from 80 +μ to a powder contg. about 40% 0-80-μ particles had an area of 599 m^2/g (8.6% decrease). A gel contg. 64% H_2O showed a decrease in surface area of 6.7% on grinding. Little or no effect was observed on the av. Kelvin pore radius on grinding.

1817. KURBATOV, L. N. **Dielectric properties of adsorbed vapors.** *Doklady Akad. Nauk S.S.S.R.* **63**, 557-60 (1948).—*C.A.* **43**, 2831*g*.

The dielec. consts. of adsorbates were detd. as a function of the vol. (v) of the vapor adsorbed on 1 g of silica aerogel using resonance measurements of the capacities (C) of a cylindrical condenser filled with the aerogel. Simultaneous weighings were made on an adsorption balance. The capacity of the condenser was calibrated with C_6H_6 after removal of the aerogel with alkali. Exptl. plots of ΔC against v, for Me_2CO vapor, at 30.0°, 51.5°, and 72°C, coincided and consisted of 2 linear portions of different slopes. The breaking point corresponded to the vol. v_m of a unimol. layer.

1818. MILLIGAN, W. O. AND RACHFORD, HENRY, H. JR. **Sorption-desorption hysteresis characteristics of the system SiO_2-H_2O below the bulk freezing point of water.** *J. Am. Chem. Soc.* **70**, 2922-4 (1948).—*C.A.* **43**, 1237*f*.

Sorption-desorption isotherms for H_2O vapor on several silica gels were measured at -5°C. The sorption characteristics of the same samples previously detd. at 12°C permitted a comparison showing the effect of freezing. When the sorption was plotted against the relative satn., the isotherms at the two temps. coincided only if the satn. pressure was taken to be the experimentally detd. value for supercooled water at that temp.

1819. NEĬMARK, I. E.; KHATSET, F. I., AND SHEĬNFAĬN, R. YU. **Sorption properties and structure of silica gels.** *Doklady Akad. Nauk S.S.S.R.* **61**, 1057-60 (1948).—*C.A.* **43**, 824*h*.

Samples of silica gels of different microporosities had different adsorption isotherms for MeOH vapor. With micropore vol., the adsorption equil. was reversible, the sorption and desorption branches coincided, indicating absence of capillary condensation. Medium porous and large pore vol. showed hysteresis. The B.E.T. equation was not applicable to micropore vol., but did apply to medium porous and large pore vol. up to relative pressures $p/p_s = 0.35$-0.40.

1820. OHTA, NOBUTO. **Effect on aging on the dehydration activity and proton-donating intensity on silica-gel catalysts.** *J. Chem. Soc. Japan, Ind. Chem. Sect.*, **51**, 17-18 (1948).—*C.A.* **44**, 9224*i*.

The activity of silica gel, hitherto regarded as a weak catalyst of proton-donor type, can be increased, if during its prepn. precautions are taken to prevent aging of the gel. This may be done by shortening the period of contact of undried gel with electrolytes and by drying under 500°C.

1821. OHTA, NOBUTO. **A table of proton-donating intensities of solid catalysts of the proton-donating type and effect of added substance on activity (particularly PD-intensity) of catalysts.** *J. Chem. Soc. Japan, Ind. Chem. Sect.*, **51**, 139-41 (1948).—*C.A.* 44, 9226*a*.

The addn. of alkalies decreased the activity values, especially in silica gel as contrasted to Al_2O_3 gel, because cations on the catalysts removed the active protons. The stronger the alky., the more effective was the poisoning. Addn. of acids slightly decreased the activity, because of the formation of compds. with the active centers (OH radicals).

1822. REUTHER, HELLMUT. **Stability of aerosols.** *Kolloid-Z.* **110**, 221-40 (1948).—*C.A.* 43, 5255*g*.

The stability of an aerosol depended on the size and size distribution of the particles as well as on the changes of these characteristics with age of the sol. Sedimentation, particle growth, isothermal distn., elec., magnetic and other forces effected changes in aerosol systems. Non-hygroscopic materials (naphthalene, anthracene, phenanthrene and 2-naphthol) had a strong coagulational effect on certain org. (bituminous or wax) aerosols. The coagulation was caused by the chain-forming properties of these additive substances.

1823. SHAPIRO, I. AND KOLTHOFF, M. **Aging of precipitates and coprecipitation XLI. The bulkiness and porosity of silica powder.** *J. Phys. & Colloid Chem.* **52**, 1020-33 (1948).—*C.A.* 42, 6607*i*.

Particle size, true and apparent d. of individual gel particles, and bulk d. of gel powder were detd. The internal surface area of 300 m^2 per g (B.E.T.) and the external surface area of 0.1 m^2 per g were detd. Below a critical particle diam., d. interparticle void vol. increased rapidly with decreasing diam. Above d. the void vol. was const. The percent porosity, 34.5% for particles greater than d. was fairly close to the theoretical value of 26% for spheres; hence, particles had a low degree of irregularity.

1824. SHULL, C. G.; ELKIN, P. B., AND ROESS, L. C. **Physical studies of gel microstructure.** *J. Am. Chem. Soc.* **70**, 1410-14 (1948).—*C.A.* 42, 6603*a*.

Ten amorphous silica and silica-alumina gels were studied for adsorption of N_2 at low temps., porosity, and small-angle x-ray scattering. Good correlations were found between (1) the mean pore diam. calcd. from specific micropore vol. and specific surface and that calcd. according to the capillary condensation theory of isotherm analysis (2) av. particle size and specific surface, and (3) pore: particle-size ratio and porosity factor.

1825. VELDHEER, P. A. **A new method for the determination of acetylene in liquid oxygen.** *Chem. Weekblad* 44, 499-501 (1948).—*C.A.* 43, 2894*i*.

Silica gel adsorbed C_2H_2 quantitatively at a low temp. Evap. 500 cc. liquid O_2 in an insulated conical flask leading the gas through an adsorption tube filled with silica gel placed in Dewar vessel contg. liquid air. After complete evapn. of the O_2 rinse the entire app. with N_2, remove the adsorption tube from the liquid air. Drive out the C_2H_2 adsorbed by the silica gel with N_2, converting it into actylene-copper. This method dets. C_2H_2 contents of 1-5 p.p.m.

1826. BRUSSET, H. **X-ray study of particle size in silica gels.** *Bull. soc. chim. France* **1949**, 319-23.—*C.A.* 43, 6335*i*.

From low-angle scattering measurements av. radii were detd. in a com. silica gel desiccant, a com. aerogel, and gels made in the lab. The radius observed in the com. gel changed little during adsorption of H_2O but the intensity of scattering decreased markedly. The scattering elements were small pores in relatively large particles. Aerogel contained clusters of nearly identical small particles.

1827. CRESPI, S. **Dynamic adsorption and desorption of water vapor on silica gel.** *Chaleur & ind.* **30**, 53-8, 93-102 (1949).—*C.A.* 43, 6034*d*.

Dynamic adsorption and desorption studies were made with water vapor and a microporous SiO_2 gel of d. about 0.7. The efficiency of adsorption was defined as the ratio of the quantity of H_2O adsorbed to that supplied, and the adsorptive power as the weight of water adsorbed per unit weight of dry gel. Dry gel was defined as gel heated to const. weight in an oil bath at 210-220°C. With increasing velocity of the stream (within limits) at const. humidity, the break point concn. of the gel increased. The efficiency of adsorption remained at 100% up to a limiting velocity, after which the efficiency fell rapidly to about 35%. The desorption curves were similar to the adsorption curves, but had two inflection points at low moisture concns.

1828. DICKEY, FRANK H. **Preparation of specific adsorbents.** *Proc. Natl. Acad. Sci. U. S.* **35**, 227-9 (1949).—*C.A.* 43, 6489*c*.

Silica gel formed in the presence of methyl, ethyl, propyl, and butyl orange was 4 to 20 times as effective in adsorbing the particular dye as a control gel. The adsorbent was prepd. by the addn. of 30 ml of aq. Na silicate ($d_{20} = 1.401$), 275 ml of H_2O, and 30 ml of glacial AcOH to 0.4 g of finely divided dye. After the mixt. had been dried at room temp., ground and sieved, the fraction between 48- and 200-mesh was extd. with MeOH.

1829. DOBAY, DONALD G. **Adsorption of aliphatic amine vapors by silica gel.** *Univ. Microfilms Pub. No.* **1138**, 139 pp (microfilm $1.74, paper enlargements $13.90); Microfilm Abstracts **9**, No. 1, 22-3 (1949).—*C.A.* **43**, 4922*h*.

1830. DUBININ, M. M. AND ZUEV, A. G. **Adsorptive properties and structure of silica gels and alumina gels.** *Doklady Akad. Nauk S.S.S.R.* **69**, 209-12 (1949).—*C.A.* 44, 2324*a*.

Finely porous gels gave a reversible adsorption isotherm for C_6H_6 vapor at 20°C, showing practically completed adsorption at the relative pressure of 0.4. The coarse gel showed a broad hysteresis loop, and completed adsorption at about $p/p_s = 0.8$. With the mixed-type gel the hysteresis loop was considerably narrower. B.E.T. surface areas (265-670 m^2/g for the silica gels, 100-205 for the Al_2O_3 gels) gave a mean thickness of the adsorbed film of 3.8 A. for silica and 5.9 for the Al_2O_3 gels. A general increase of the pore size due to development of intermediate porosity resulted also in an increase of the dimensions of micropores. Comparisons were made with finely-porous active carbons, the finely-porous silica and the Al_2O_3 gels.

1831. Fogo, James K. and Popowsky, Milton. **Conversion of sulfur compounds to hydrogen sulfide in air, fuel gas, or mixtures.** *Anal. Chem.* 21, 734-7 (1949).—*C.A.* 43, 6112*f*.

Org. compds. contg. S can be removed by adsorption on silica gel at about 25 °C, desorbed at 500 °C, and hydrogenated over a quartz catalyst. The H_2S formed was preferably detd. by the methylene blue method.

1832. Gyani, B. P. **Adsorption of vapors on silica gel at low pressures.** *J. Indian Chem. Soc.* 26, 307-12 (1949).—*C.A.* 44, 3332*c*.

The adsorption of EtOH and CCl_4 at 25 °C on silica gel was detd. at low pressures with a sensitive manometer. The slopes of the log (x/m)-log p curves showed that CCl_4 in the adsorbed state was confined to a 2-dimensional space. Langmuir's adsorption isotherm at low pressures was discussed to show that Henry's law need not apply in these circumstances.

1833. Harle, G. A. **An accurate determination of the adsorption-relative humidity relations of silica gel and alumina.** *Australian J. Sci.* 11, 172-4 (1949).—*C.A.* 43, 6881*i*.

The water vapor pressure in equil. with a solid desiccant was detd. at const. temp. over a complete range of adsorptions. The adsorption-relative humidity curves for silica gel and alumina were similar in form. At low humidities the water content of alumina was higher; at high humidities that of silica gel was higher.

1834. Karyakin, A. V. **Quenching by oxygen of the fluorescence of anthraquinone derivatives. I. In the vapor state. II. In the adsorbed state.** *Zhur. Fiz. Khim.* 23, 1332-44, 1345-56 (1949).—*C.A.* 44, 2853*cf*.

The maxima of absorption in 10^{-4} M alc. solns. and of fluorescense in the vapor state were detd. for some anthraquinone derivs. The max. of fluorescence of vapors adsorbed by SiO_2 was also detd. Compds. where the latter was less than 500 mμ showed fluorescence reversibly quenched by O_2 and also afterglow, while the fluorescence of the other compds. was not quenched by O_2 and ceased when irradiation ceased. The lifetime of excited adsorbed mols. was $1\text{-}8 \times 10^{-8}$ sec.

1835. Karyakin, A. V. and Galanin, M. D. **Life of the excited state in molecules of anthraquinone derivatives in the vapor state and in adsorbates.** *Doklady Akad. Nauk S.S.S.R.* 66, 37-40 (1949).—*C.A.* 43, 6085*d*.

The life of the excited state, detd. by quenching of the fluorescence by O_2, was of the order of 10^{-8} sec for the substances adsorbed on silica gel and sealed in glass tubes, but of the order of the 10^{-9} sec when measured in the vapor state.

1836. Karyakin, A. V. and Kalenichenko, Ya. I. **Infrared luminescence of adsorbates of anthraquinone derivatives.** *Doklady Akad. Nauk S.S.S.R.* 66, 191-3 (1949).—*C.A.* 43, 6085*h*.

In adsorption on silica gel covered with paramagnetic Cu^{++} ions and at the temp. of liquid air an intense emission band (excitation by Hg 360 mμ, with the infrared radiation filtered out), with a max. around 880 mμ was observed with α- and β-aminoanthraquinone, 1,5- and 1,4-diaminoanthraquinone, and 1,2,5,8-tetrahydroxyanthraquinone, but not with anthraquinone itself.

1837. Karyakin, A. V. and Terenin, A. N. **The extinction of luminescence and metastable triplet states.** *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* 13, 9-17 (1949).—*C.A.* 43, 7829*h*.

Quenching of fluorescence by O_2 was studied in 24 compds. derived from anthraquinone. Fourteen of these compds. were listed with the max. of the emission spectra of their vapors, the quenching of vapors and adsorbed material (on silica gel) and the calcd. duration of the excited state.

1838. Karyakin, A. V.; Terenin, A. N., and Kalenichenko, Ya. I. **Quenching of the fluorescence of vapors and adsorbates of anthraquinone derivatives by nitric oxide.** *Doklady Akad. Nauk S.S.S.R.* 67, 305-8 (1949).—*C.A.* 43, 7828*c*.

Strong quenching by NO both in the vapor phase and in the adsorbed state on silica gel was observed for anthraquinone and 4 derivs. which were likewise quenched by O_2. A substantial difference between the actions of NO and O_2 was in the efficiency of quenching. This was very nearly 1 at low pressures of NO, both in the vapor phase and in the adsorbed state, and fell with increasing pressure, the variation being reproducible upon reversal.

1839. Konchar-Durdević, Slobodan. **Adsorption under fixed hydrodynamic conditions.** *Bull. soc. chem. Belgrade* 14, 233-47 (1949). (English summary).—*C.A.* 46, 4317*i*.

A mixt. of 0.4 g SiO_2 gel, 7.5 ml acetone and 2.5 ml 10% cellulose nitrate in acetone was repeatedly sprayed on Al plates to form a 0.1-mm film. By exposing the coated plates to a stream of 0.00025% aq. methylene blue soln. of varying conditions of flow, different colored patterns were obtained, from which qual. conclusions as to dynamic adsorption, diffusion, and fluid flow could be drawn. The film could be detached from the plate and kept for record.

1840. Kurbatov, L. N. and Neuimin, G. G. **Infrared absorption spectra of vapors adsorbed on silica aerogels.** *Doklady Akad. Nauk S.S.S.R.* 68, 341-4 (1949).—*C.A.* 44, 435*f*.

Silica aerogel (600 m^2/g) in the form of plates 10 × 15 × 2 mm (outgassed in vacuo 3-4 hrs at 400 °C) showed an intense narrow absorption band at 1.37 μ. On gradual adsorption of $CHCl_3$ vapor, its intensity decreased, and a new band, 0.02 μ farther in the long-wave direction appeared. Another band, at 1.69 μ, increased in intensity regularly as the vapor pressure increased. With Me_2CO and PhOH, the 1.37 μ band showed a sharp drop of intensity even at the lowest vapor pressures; bands of the adsorbed substances appeared only at very much higher pressures. The 1.37 μ also disappeared without adsorption, after heating for 12 hrs *in vacuo* at 900 °C.

1841. Meissner, H. P. and Mickley, H. S. **Removal of mists and dusts from air by beds of fluidized solids.** *Ind. Eng. Chem.* 41, 1238-42 (1949).—*C.A.* 43, 6471*b*.

Mists composed of H_2SO_4 droplets were filtered from air at atm. temp. and pressure by passing the air up through a fluidized solid bed. Porous materials like com. microspheres, silica gel, and Al_2O_3 picked up over 5% by wt of acid before sticking destroyed fluidization. Nonporous materials showed impractically short lives.

1842. Munro, L. A.; McNab, J. G., and Ott, W. L. **Elastic properties of silica gels.** *Can. J. Research* 27B, 781-90 (1949).—*C.A.* 44, 6237*a*.

The elastic properties of acid and alk. silica gels were examd. In the range of concns. studied (3.3-6.6%), Young's modulus for acid (pH 3.6) and alk. (pH 8.2) gels was not independent of load, and it increased with the age of the gel as well as concn. Increased temp. increased the modulus of acid gels (pH 5.6) but decreased the modulus of alk. gels (pH 8.2) at the same silica concn.; the alk. gels, however, showed a higher modulus at room temp. and a lower elastic recovery.

1843. Reyerson, L. H. and Wertz, John E. **Adsorption of the oxides of nitrogen. I. The adsorption of nitrogen dioxide-nitrogen tetroxide by rutile and silica gel; preliminary magnetic susceptibility measurements of the adsorbed layers.** *J. Phys. and Colloid Chem.* 53, 234-51 (1949).—*C.A.* 43, 6034*h*.

The adsorption of a NO_2-N_2O_4 mixt. was studied for silica gel at 30.05° and 49.16 °C and for rutile at -15°, 10.39°, 30.42°, and 49.21 °C. Reversible adsorption was obtained for both adsorbents. The adsorption of N_2O_4 on silica gel appeared to form a multilayer; for rutile, a monolayer satn. value existed extending up to 0.97 or 0.98 relative pressure. The isosteric heat of adsorption appeared to be 11,000 cals per mol. on silica, and had a value that increased from 5,000 to 9,000 cals with increased adsorption on rutile.

1844. Slyusareva, R. L. and Tesner, P. A. **Measurement of the moisture content of a gas.** *Zavodskaya Lab.* 15, 647-9 (1949).—*C.A.* 44, 483*f*.

A 5% soln. of $CoCl_2$ adsorbed on Al_2O_3 or silica gel and dried at 180-200 °C was a convenient indicator of moisture. Silica-gel changed color at 3 g/m^3 of H_2O in air, while the Al_2O_3-type changed at 1 g/m^3; these corresponded to dew points of -4° and -15 °C, resp. The use of reactive gases, such as SO_2 or Cl_2, was contra-indicated.

1845. White, Locke Jr. and Schneider, Charles H. **Physical adsorption from mixtures of gases. II. Oxygen-argon on silica gel at 0 °C.** *J. Am. Chem. Soc.* 71, 2945-6 (1949).—*C.A.* 44, 7615*g*.

The vol. of either O_2 or A adsorbed was a linear function of its partial pressure, and was independent of the presence or absence of the other component. With forced circulation of O_2-A mixts. through the sample used, the compn. of the adsorbed phase was not greatly affected by the order in which the 2 gases reach the gel surface.

1846. Yoroslavskii, N. G. and Terenin, A. N. **Infrared absorption spectra of adsorbed molecules.** *Doklady Akad. Nauk S.S.S.R.* 66, 885-8 (1949).—*C.A.* 43, 7343*i*.

The adsorption of C_6H_6 and $PhCH_3$ vapors at room temp., on vitreous silica gel, showed (initially only O-H bands) peaks corresponding to the C-H frequencies of the ring, and (in the case of $PhCH_3$) to CH_3 in positions identical to those found with CCl_4 soln.; at the same time, the narrow O-H peak became increasingly weaker. In the adsorption of $PhNH_2$ the gradual disappearance of the O-H peak set in long before the appearance of the C-H and N-H peaks of the adsorbed mols. At the stage of greater surface coverage, th N-H peak at 1.52 μ shifted 0.01 μ to longer wave lengths relative to the peak of assocd. NH groups. The effects observed with $PhNH_2$ were even more pronounced in C_5H_5N. In the adsorption of PhOH, the O-H peak of the adsorbent remained narrow and disappeared much more slowly than with $PhNH_2$. In the range of capillary condensation, there appeared broad maxima characteristic of assocd. OH groups.

1847. Bartell, F. E. and Dobay, Donald G. **The adsorption of aliphatic amine vapors by silica gel.** *J. Am. Chem. Soc.* 72, 4388-93 (1950).—*C.A.* 45, 3681*f*.

The adsorption isotherms (relative pressures of 0.002 to satn.) for Et_2NH, $BuNH_2$, and Bu_2NH on silica gel were detd. at 25 °C. The completion of the monolayers occurred at the very low relative pressure of about 0.01 The three-const. B.E.T. equation was applicable in the approx. relative pressure range of 0.002-0.4. The const. n was less than 3 in all cases. Highly concordant values for the capillary radius of the gel were obtained by the application of the Kelvin equation.

1848. Běhounek, F. and Ĵech, Č. **Emanating power and the age of complex silica gels.** *Nature* 166, 792-4 (1950).—*C.A.* 45, 4148*b*.

Silica gels prepd. in 1934 included various electrolytes and some Ra. The activity of these samples was measured by means of the Rn escaping. The intensity of this emanation varied depending on the treatment of the gel. Those samples kept dry showed only a slight decrease in emanating power, but those heated to dryness showed a marked decrease.

1849. Dumanskiĭ, A. V. and Kurilenko, O. D. **Relation between the dielectric constant of disperse systems and surface phenomena.** *Kolloid. Zhur.* 12, 326-30 (1950).—*C.A.* 45, 937*g*.

Silica gel was ground, passed through a sieve having 10,000 openings/cm^2, heated, and suspended in 50 parts H_2O. The dielec. consts. ϵ of the suspensions, for the wave length λ 800 m were 85, 99, 86, and 88 after 300°, 550°, 1000°, and 1200 °C resp. The ϵ of similar suspensions in a picric acid soln. in C_6H_6 also had a max. after 550 °C. The ϵ of the "bound" H_2O could not be very low. The ϵ of disperse systems was affected by adsorption and by deformation of the elec. double layer and could not be expressed as a function of the ϵ of the components.

1850. Dzhigit, O. M.; Kiselev, A. V.; Avgul, N. N. Mikos, and Shcherbakova, K. D. **Poisoning and regeneration of the surface of silica gel in the adsorption of vapors.** *Doklady Akad. Nauk S.S.S.R.* 70, 441-4 (1950).—*C.A.* 44, 4304*i*.

Adsorption-desorption isotherms at 20°C and differential heats *Q* in adsorption and desorption were detd. for MeOH vapor on a homogeneously finely porous silica gel heated 12 hrs at 450°C. *Q* in adsorption and desorption were identical only in the range of capillary condensation. To eliminate the last amts. of MeOH, pumping was done over active charcoal, cooled in liquid N_2, with the gel heated to 65°C; this left a residue of 0.5 milli-mole MeOH/g adsorbed. On repeated adsorption, after heating to 400°C, the *Q* evolved in adsorption were smaller than in the 1st run, and the isotherm lay lower. A further lowering of *Q* and of the amt. adsorbed occurred in a 3rd run.

1851. Dzis'ko, V. A.; Vishnevskaya, A. A., and Chesalova, V. S. **Effect of heating on the catalytic activity of silica gel.** *Zhur. Fiz. Khim.* 24, 1416-19 (1950).—*C.A.* 45, 4123*f*.

Three silica gel catalysts were prepd. with the following pore vols., area (m^2/g) and mean pore diam.: (*A*) 0.24, 400, 10; (*B*) 0.85, 450, 27; (*C*) 1.05, 540, 20. The effect of heating on the H_2O content of the gels was studied between 115° and 1000°C. Assuming that the structural H_2O was held as OH groups on the surface (15×10^{-16} cm^2/OH), the fraction of surface, θ, covered by OH was detd. at all temps. The H_2O content followed the decrease in surface area. The decrease in surface area due to heating corresponded to the evolution structural H_2O, and as a consequence θ remained approx. const. The hydrolysis dropped only slightly in the case of *A* which was not temp. resistant, but in the case of *B* and *C*, it increased between 600° and 1000°C.

1852. Ewles, J. **Luminescence of silica.** *Nature* 165, 812-13 (1950).—*C.A.* 44, 7151*h*.

Finely divided silica became luminescent after being wetted by water and MeOH or EtOH or by being exposed to H_2. This luminescence exhibited an intense spectral band from about 2400 to 2900 A. with a max. at about 2650 A. The luminescence was attributed to OH carriers and active sites of Si monoxide in the SiO_2. A mixt. of Si and SiO_2 heated in vacuo to 1250°C produced luminescent material.

1853. Freĭdlin, L. Kh.; Neĭmark, I. E.; Fridman, G. A.; Sheinfaĭn, R. Yu., and Khatset, F. I. **Relation between the type of the porosity of a silica gel and its catalytic properties.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* **1950**, 521-30.—*C.A.* 45, 3238*b*.

Only nondehydrated silica gel was active; consequently, the active centers lay at the OH groups of the silica gel. However, the catalytic activity was governed not only by the d. of these centers but by the vol. if the micropores, which detd. the surface area, and the amt. of intermediate pores necessary for the transport of reactants and products. Yields of PhOH and of HCl, from PhCl and H_2O under controlled conditions were detd. for 6 types of silica gel catalysts of B.E.T. area (m^2/g): 390; 450; 560; 490; 420; 325.

1854. Gyani, B. P. **Adsorption of alcohol on silica gel.** *J. Indian Chem. Soc.* 27, 577-85 (1950).—*C.A.* 45, 7844*i*.

Isotherms of EtOH on various silica gels were detd. gravimetrically at 35°C. Evacuation above a certain temp. (300-350°C) increased adsorption at all pressures. Aging of a gel increased adsorption at higher pressures but decreased it at lower pressures. Hysteresis occurred, if in its prepn. gel was evacuated above a certain temp., usually well over 300°C. About 2% of adsorbed EtOH was irreversibly retained at highest temp. and vacuum used.

1855. Haul, R. **Measurement of the surface diffusion of adsorbed molecules.** *Angew. Chem.* 62, 10-16 (1950).—*C.A.* 44, 3766*b*.

The diffusion of MeOH, C_5H_{12}, C_7H_{16}, and toluene in silica gel and active carbon was studied at low temps. A direct-weighing method was developed to measure the diffusion.

1856. Higuchi, Izumi. **Dielectric properties of substances in the sorbed state. II. The freezing phenomenon of nitrobenzene sorbed on silica gel.** *Science Repts. Tohoku Univ.* 33, 174-81 (1950).—*C.A.* 45, 12*i*.

Nitrobenzene (1.82 g) was held at satn. by 1 g of gel, the apparent d. of the powd. gel being 0.27 g/cc. The dielec. polarization was detd. with frequencies of 3.0, 1.5, 0.870, and 0.373 *Mc.* over a temp. range from 70 to -75°C. The sorbed substance showed a f.p. depression, and the temp. at which the sorbate froze tended to the normal m.p. with increasing amt. of the sorbate. The dielec. consts. for nitrobenzene were larger, the larger the pore size in which the sorbate was held.

1857. Higuchi, Izumi. **A supplement to the previous paper on the freezing phenomena of highly dispersed substances.** *J. Chem. Soc. Japan, Pure Chem. Sect.*, 71, 141-2 (1950).—*C.A.* 45, 4526*f*.

The values of liquid d. and the heat of condensation ought to be those at the temp. of condensation to adsorb liquid. The correction for this point was applied based on the first law of thermodynamics. The theoretical formula agreed with the exptl. values on nitrobenzene in the whole temp. range down to -60°C.

1858. Hubbard, Byron R. and Silverman, Leslie. **Rapid method for the determination of aromatic hydrocarbons in air.** *Arch. Ind. Hyg. Occupational Med.* 2, 49-55 (1950).—*C.A.* 44, 8285*e*.

C_6H_6 and homologs in air can be detd. in the field by passing the air through tubes contg. silica gel impregnated with a H_2SO_4-HCHO reagent, assembled in a hand-size sampling unit. Concns. of 20-200 p.p.m. are indicated with an accuracy of 15% by the length of the reddish brown stain produced in the treated gel.

1859. Imelik, Boris and Carteret, Yvette. **Diffusion of the x-ray beam by silica gel.** *Compt. rend.* 231, 280-2 (1950).—*C.A.* 45, 1866*g*.

Porosity of silica gel and absorption of dense vapors by it can be followed by measuring the diffusion of x-rays. The effect of pore size is not easily interpreted quantitatively.

1860. Johnson, Marvin F. L. and Ries, Herman E. Jr. **Effect of wetting on the nitrogen adsorption-desorption isotherm of silica aerogel.** *J. Am. Chem. Soc.* 72, 4289 (1950).—*C.A.* 45, 2285*f*.

Large-pore SiO_2 aerogel contracted on treatment with H_2O to form a small-pore xerogel structure with an insignificant change in surface area. N_2 adsorption-desorption isotherms nearly coincided in the lower-pressure region ($p/p_0 = 0.05$ to 0.45) indicating similar B.E.T. areas, 796 and 813 sq m/g, and the pore vols. obtained were 3.90 and 0.66 cc./g for the aerogel and xerogel, resp.

1861. Juza, Robert and Tentschert, Hans. **Magnetochemical investigation of the sorption of nitrogen dioxide on active silica and charcoal.** *Z. anorg. Chem.* **262**, 165-74 (1950).—*C.A.* 44, 7616*i*.

The sorption and magnetic susceptibility of NO_2 on silica and charcoal were measured. The partial susceptibility of NO_2 was detd. for various amts. sorbed. The susceptibility of NO_2 was taken as 39×10^{-6} e.m.u. and of N_2O_4 as -0.28×10^{-6} e.m.u., and the degree of dissocn. of N_2O_4 on the adsorbents was calcd. On SiO_2 the degree of dissocn. varied from 0.7% at a concn. of 0.02 g N_2O_4 per g SiO_2 to 0% at 0.65 g per g. On charcoal, NO_2 was found to be chemisorbed up to a concn. of 0.025 g per g. Above this concn. it was physically sorbed largely as N_2O_4, the degree of dissocn. varying from 1.2 to 7.0%.

1862. Kurbatov, L. N. **Oxyluminescence and cathodic luminescence of silica gels.** *Zhur. Fiz. Khim.* 24, 913-23 (1950).—*C.A.* **45**, 1426*d*.

In the oxyluminescence arising during the catalytic oxidation of MeOH, EtOH, AcH, and Et_2O over silica gel, the luminescence carrier was believed to be excited mols. of HCHO. The catalyst did not participate in the luminescence. Cathodic luminescence of silica gel was observed in the presence of adsorbed H_2O.

1863. Mills, F. A. and Hindin, S. G. **Chemical characterization of catalysts. II. Oxygen exchange between water and cracking catalysts.** *J. Am. Chem. Soc.* 72, 5549-54 (1950).—*C.A.* 45, 5394*h*.

Water contg. O^{18} was used to detn. the rate by which this compd. exchanged O with solid oxides such as silica gel, active silica-alumina cracking catalyst, kaolin, bentonite, and acid-activated bentonite, at temps. of 100°C, and in a few cases, at 565°C. These solids having high specific surfaces exchanged rapidly 10 to 25% of all their oxide oxygens, followed by a slow further exchange that led, at 105°C, to exchange of an addnl. 10 to 60% of the oxide oxygens over a period of one month. No exchange could be observed with natural kaolin or bentonite. During contact with water, all the oxides other than the clays showed substantial changes of specific surface area, pore-size distribution, moisture content, and x-ray diffraction patterns.

1864. Mizuno, Shigeru; Toshima, Shinobu, and Shiratori, Hajime. **Anomalous dispersion and absorption of electromagnetic waves in microheterogeneous systems. II. The factors affecting anomalous dispersion. III.** *J. Electrochem. Soc. Japan* **18**, 301-2, 334-5 (1950).—*C.A.* 45, 8310*h*.

Dielec. const. and tan δ of various dispersed systems were measured at 500-10,000 cycles. The effect of strength of elec. field, temp., grain size, and concn. on anomalous dispersion and absorption were very small. A remarkable anomalous dispersion was observed in the case of silica gel, contg. considerable water, dispersed in liquid paraffin, and in the case of strongly active carbon dispersed in liquid paraffin.

1865. Neimark, I. E. and Khatset, F. I. **The phase state of a substance in the adsorbed layer.** *Doklady Akad. Nauk S.S.S.R.* 74, 751-4 (1950).—*C.A.* 45, 1838*c*.

Three types of silica gel, (I) finely porous, (II) medium-porosity, and (III) coarsely porous, preliminarily heated to 400°C, were exposed to mixed vapors of $C_6H_6 + CCl_4$; the substance adsorbed was desorbed at 400°C until const. wt, and its compn. was detd. On type I, the compn. (at high surface coverage) was found to correspond to that of the vapor, on III mainly to the liquid phase, whereas on II it is intermediate between the two. At low surface coverages, the adsorbed substance was gaseous in all cases. C_6H_6 was selectively adsorbed on silica gels of type I from a mixt. $C_6H_6 + C_7H_{16}$, i.e. a mixt. of mols. of distinctly different sizes. The view ascribing all phys. adsorption to capillary condensation was erroneous.

1866. Shapiro, I. and Kolthoff, I. M. **Aging of precipitates and coprecipitation XLIII. Thermal aging of precipitated silica gel.** *J. Am. Chem. Soc.* 72, 776-82 (1950).—*C.A.* 44, 4305*h*.

Silica gel was subjected to different thermal treatments up to 1050°C and the moisture, dye adsorption, and apparent d. (Hg displacement) were detd. Some doubt was cast on the usefulness of the 2 adsorption methods for following the aging process. A surface differential aging process below 700°C resulted in a perfection in arrangement of elementary units; in this region, the porosity decreased slightly, but the surface area decreased considerably. A bulk differential process at higher temp. involved sintering and increased particle-to-particle contacts.

1867. Srivastava, Arvind M. **Ultrasonic investigation of gels.** *Z. Physik* **128**, 614-16 (1950).—*C.A.* **45**, 5489*g*.

An ultrasonic pulse method was used to measure wave speed in Fe silicate gels as a function of frequency in the range $0.6\text{-}2.5 \times 10^6$ cycles/sec, gel age, and temp. With increasing gel age the shear wave speed and the shear modulus increased and approached a const. value.

1868. Voorthuijsen, J.J.B. van Eijk van and Franzen, P. **The influence of silicon dioxide on the activity of nickel catalysts.** *Rec. trav. chim.* 69, 666-7 (1950).—*C.A.* 44, 10473*f*.

Under appropriate conditions $Ni(OH)_2$ and silica gel can form two compds.: $Ni_3(OH)_4Si_2O_5$ (nickel antigorite) and $Ni_3(OH)_2(Si_2O_5)_2$ (nickel montmorillonite). These two compds. together with $Ni(OH)_2$ were present in the pre-reduction stage of

Ni-on-silica catalysts depending on the Ni/Si ratio. Their properties were a determining factor for the activity of the catalysts prepared from them by reduction.

1869. Yaroslavskiĭ, N. G. **Infrared absorption spectrum of microporous adsorbents of the silica gel type.** *Zhur. Fiz. Khim.* 24, 68-81 (1950).—*C.A.* 44, 4786*g*.

The spectrum (between 1 and 2.4 μ) of porous glass (porosity = 27%) was detd. after different treatment of the glass. A very sharp line 1.356 μ was given by glass heated in a vacuum at 300 °C which disappeared at 1000 °C and on keeping the glass in moist air. A line at 1.39-1.40 μ appeared when the glass was stored in air and disappeared on heating. The line 1.46 μ was present in moist glass. A line 1.90 μ behaved like 1.39-1.40 μ and also was attributed to adsorbed H_2O. The state of H_2O in the glass could thus be detd. by optical means.

1870. Avgul, N. N. Mikos; Dzhigit, O. M.; Kamakin, N. M.; Kiselev, A. V.; Luk'yanovich, V. M.; Neĭmark, I. E., and Sheĭnfaĭn, R. Yu. **Investigation of the structure of an adsorbent by independent methods.** *Doklady Akad. Nauk S.S.S.R.* 76, 855-8 (1951).—*C.A.* 45, 4995*f*.

A silica gel of the homogeneous coarse-pore type was prepd. by dehydration of the hydrogel. Adsorption-desorption isotherms of C_6H_6, C_7H_{16}, and MeOH, showed that some 90% of the vapor sorbed was accompanied by a broad, exactly reproducible hysteresis loop. The surface area of the skeleton and of the adsorption film were 330 and 320 m²/g, resp.; the vol. of liquid sorbed at satn. was found = 1.72 cc./g, equal for all 3 substances. The dimensions of 645 pores on an electron-microscope picture of a sample ground under water, and shaded with Au (8-10 A), gave a distribution curve very close to that obtained from the desorption isotherms.

1871. Avgul, N. N. Mikos; Dzhigit, O. M.; Dreving, V. P.; Gur'ev, M. V.; Kiselev, A. V., and Likhacheva, O. A. **Absolute adsorption isotherms of vapors on quartz and on silica gels of different structures.** *Doklady Akad. Nauk S.S.S.R.* 77, 77-80 (1951).—*C.A.* 45, 5483*g*.

Adsorption isotherms were referred to unit surface area using previous exptl. data for finely ground cryst. quartz, coarse-pore (200 A.) silica gel "E", and coarse-pore (90 A.) silica gel "K". The surface area for the quartz was 5.7 m²/g by the B.E.T. method and 6.6 by the Harkins method. The area of silica gel E was detd. by adsorption of C_7H_{16}, C_6H_6, and MeOH vapors at 20 °C and the results were 330, 330, and 300, av. 320 m²/g. Silica gel K was 440 m²/g (B.E.T.) and 430 m²/g (Harkins), by adsorption of C_7H_{16} at 20 °C, 390 m²/g, and by adsorption of H_2O vapor at 18.2 °C, 410; mean 420 m²/g. Referred to unit surface area, adsorption isotherms of MeOH vapor coincided very exactly for the three adsorbents up to the beginning of the hysteresis loop (relative pressure $p/p_s \sim 0.6$).

1872. Buckley, R. A. and Altpeter, R. J. **Vapor-phase catalytic esterification rates.** *Chem. Eng. Progress* 47, 243-50 (1951).—*C.A.* 45, 5461*f*.

Rates for the vapor-phase esterification of AcOH and EtOH with a silica gel catalyst were limited by the rate at which AcOH was activatedly adsorbed when the mole fraction of AcOH in the feed was less than 0.7 at temps. between 200° and 260 °C and under total pressures of 1 to 2.33 atm. The rate of adsorption of AcOH was found to be dependent on the water content of the silica gel. A rate equation was based on a function having the form of an adsorption isotherm relating the partial pressure of water vapor in the reacting stream to the total no. of active available sites.

1873. Cremer, E. and Müller, R. **Separation and determination of substances by chromatography in the gas phase.** *Z. Elektrochem.* 55, 217-20 (1951).—*C.A.* 45, 9335*a*.

A quant. sepn. of acetylene and ethylene, of CO_2 and acetylene, and of ethylene and propylene, was achieved. Detection of a gaseous component without complete sepn. was possible by observing the breakthrough time characteristic of a substance. This was possible only if the breakthrough time was independent of concn., which was true, e.g., for acetylene and ethylene on finely divided silica gel, but not for the same substances on coarse silica gel.

1874. Dreving, V. P.; Kiselev, A. V., and Likhacheva, O. A. **Adsorption of nitrogen vapors on silica gel at low temperature.** *Zhur. Fiz. Khim.* 25, 710-18 (1951).—*C.A.* 47, 4164*d*.

A silica-gel adsorbent, prepd. by hydrolysis of $SiCl_4$, evacuated at 300 °C and of homogeneous porosity as detd. by desorption of H_2O in the region of capillary condensation, was used in 8 series of adsorption and desorption runs at −195.7 °C with N_2 at relative pressures between 10^{-6} and 0.5. The B.E.T. equation was obeyed for $0.035 < x < 0.33$; that of Harkins and Jura for $0.075 < x < 0.58$. The surface area (m²/g) of the adsorbent was 440 (B.E.T.) or 430 (H.J.). The monolayer part of the isotherm was not fitted by the equations of Langmuir, Williams, or Freundlich.

1875. Fialkovskaya, O. V. and Terenin, A. N. **Photoreaction of pyridine in the adsorbed state.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim, Nauk* 1951, 226-41.—*C.A.* 45, 9374*g*.

Pyridine adsorbed from the vapor *in vacuo* on dry outgassed granular silica gel, in an amt. well below complete coverage exposed 2 hrs, to a Zn spark (ultraviolet 3000-2000 A.) showed no visible changes. On a plate of vitreous silica aerogel, exposure of 2 hrs of the pyridine adsorbate produced a light-brown spot, which did not disappear on heating to 500 °C *in vacuo*. A different colored product was formed when pyridine was illuminated while adsorbed on silica gel contg. Tl^+ ions. There was no photoreaction with pyridine adsorbed on sublimed films of TlCl, not supported on silica gel; consequently, the reaction hinged on the presence of Tl^+ *ions* distributed in the silica gel. Adsorbates of pyridine on films of $ZnCl_2$ and $SnCl_2$ on quartz gave no photoreaction, nor was a reaction observed with KCl, CsCl, $BiCl_3$, and $AlCl_3$.

1876. Foster, A. Graham. **Sorption hysteresis. I. Some factors determining the size of the hysteresis loop.** *J. Phys. & Colloid Chem.* **55**, 638-43 (1951).—*C.A.* **45**, 6894*h*.

The adsorption isotherms were detd. for propylamine, tert-butylamine, and amylamine on a sample of silica gel. The size of the hysteresis loop decreased with increasing temp. and with increasing mol. diam. of the adsorbate. The observed facts could not be readily explained by the "ink-bottle theory," whereas they were explained by the open-pore theory.

1877. Foster, E. Gordon and Daniels, Farrington. **Recovery of nitrogen oxides by silica gel.** *Ind. Eng. Chem.* **43**, 986-92 (1951).—*C.A.* **45**, 6353*f*.

Basic data were presented for the dehydration and adsorption of 1 to 1.5% NO produced in fixation of atm. N_2. The feasibility of the process was discussed. Silica gel had practically no adsorption capacity for NO. Although dry silica gel contg. adsorbed NO_2 catalyzed the oxidation of NO to NO_2, silica gel satd. with water vapor did not catalyze the oxidation. Silica gel had a much higher adsorption capacity for water vapor than for NO_2, and the rate of adsorption was much greater than for NO_2. The different silica gels examd. were not similar in their behavior in the various steps of the process, some being better for the dehumidification and others better for the adsorption and catalysis.

1878. Freymann, Marie and Freymann, Rene. **Microwave absorption and hydroxyl bond; water of crystallization and water of adsorption.** *Compt. rend.* **232**, 401-3 (1951).—*C.A.* **45**, 6013*g*.

Ice at or below 0°C does not absorb at 3.15 cm, whereas the presence of 10% or more of liquid water produces absorption. Water adsorbed on alumina or silica gel is partially "liquid," but the absorption is less than for the same amt. of water added to sucrose and NaCl. Water in hydrated alumina is "solid," but if dehydrated and rehydrated becomes "liquid."

1879. Hauser, Ernst A.; LeBeau, D. S., and Pevear, P. P. **Surface structure and composition of colloidal siliceous matter.** *J. Phys. & Colloid Chem.* **55**, 68-79 (1951).—*C.A.* **45**, 2745*c*.

Since the surface of siliceous matter is found by infrared absorption and by differential thermal analysis to be composed primarily of OH ions, the internal crystal structure does not govern its reactivity or colloidal behavior. Evidence of the release of O from newly exposed surfaces of many types of silicate, as indicated by the use of α,α-bis (*p*-dimethylaminophenyl) toluene, indicates the type and extent of alteration of the internal structures to form the surface structure.

1880. Higuchi, Izumi and Shimizu, Michie. **Dielectric properties of substances in the sorbed state. IV. Freezing phenomenon of *o*-nitrophenol sorbed on silica gel.** *J. Chem. Soc. Japan*, Pure Chem. Sect., **72**, 536-9 (1951); *J. Phys. Chem.* **56**, 198-201 (1952).—*C.A.* **46**, 5384*c*.

The dielec. polarization of *o*-nitrophenol on silica gel was detd. in the range 0-110°C. The dielec. consts. of the sorbate were detd. as a function of temp. The f.p. depression was detd. as a function of the capillary core.

1881. Imelik, Boris and Carteret, Yvette. **Silica gels.** *Bull. soc. chim. France* **1951**, 864-7.—*C.A.* **46**, 4325*e*.

Gels prepd. by the action of HCHO on Na silicate were studied with respect to the mechanism of formation, scattering of x-rays, and structure alteration by heat-treatment. Gels formed most rapidly with 50 cc. of 30% HCHO, 30 cc. Na silicate (d. 1.39, 360 g SiO_2 per liter) and 20 cc. H_2O at 100°C. CH_3CHO gave similar results. The greater the amount of Na silicate in the gel, the less the scattering of x-rays and the less linear the relation $\log I = f(\epsilon)^2$. When 5 cc. Na silicate and 45 cc. H_2O were added to 50 cc. of 30% HCHO, the gel which formed gave a linear scattering effect.

1882. Imelik, B.; Teichner, S., and Carteret, Y. **Comparative study of the texture of silica gel by small-angle x-ray diffraction and low-temperature nitrogen adsorption.** *J. chim. phys.* **48**, 438-46 (1951).—*C.A.* **46**, 4325*b*.

Two gels, *A* and *F*, were used in this study. The B.E.T. area of *A* was 385 m²/g, that of *B*, 386 m²/g. *A* was a compact rigid mass full of pores of uniform shape. *F* was composed of a mass of uniform spherical particles about 0.0001 mm in diam. The particles did not form a homogeneous mass but contained cavities of variable shape and size. Evidence points to the existence of two main types of gels, the classical type typified by *A* and the silica gels called aerogels consisting of small uniform spherical particles 50 to 100 A. in diam. surrounding large empty spaces. Gel *F* is intermediate between the two main types.

1883. Iwakami, Yoshimoto. **The melting point of benzene in the sorbed state.** *J. Chem. Soc. Japan, Pure Chem. Sect.*, **72**, 259-62 (1951).—*C.A.* **46**, 802*h*.

The capillary size distribution was computed for active charcoal and silica gel by detg. the adsorption isothermal of C_6H_6 at 0°C. From the detn. of the heat capacity, the silica gels plus adsorbed C_6H_6 showed abnormal sp. heat. This was attributed to the m.p. lowering of adsorbed C_6H_6.

1884. Iwakami, Yoshimoto. **Freezing-point depression of carbon tetrachloride in the sorbed state.** *J. Chem. Soc. Japan*, Pure Chem. Sect., **72**, 707-10 (1951).—*C.A.* **46**, 1329*i*.

The heat capacity of CCl_4 sorbed in various amts. on silica gel with the known distribution of pore sizes was measured from − 190 to − 20°C. An abnormally large heat capacity was found at a certain temp. below the normal m.p., T_o. The radii of capillary pores, in which the sorbate melts at T_m, was computed from the distribution of capillary pores. The observed f.-p. depression, of the sorbate in the capillary pore of radius r agreed with that calcd.: $\Delta T/T_0 = 2\gamma M/\rho r\Delta H$, where γ was the surface tension, ρ the d. of liquid, M mol. wt, and ΔH the heat of melting.

1885. Kiselev, A. V. and Kamakin, N. M. **Absolute adsorption isotherms of vapors on silica and alumina-silica gels of different structures.** *Doklady Akad. Nauk S.S.S.R.* **80**, 393-6 (1951).—*C.A.* **46**, 316*i*.

Adsorption isotherms of MeOH vapor were detd. on 5 hydrated SiO_2-Al_2O_3 gels of different porosity types. The surface areas of the skeleton, and of the adsorption film in m^2/g, were (I) 520, 0; (II) 425, 40; (III) 255, 110; (IV) 415, 220; (V) 425, 355. The adsorption referred to unit surface area (detd. from the same adsorption isotherms of MeOH) coincided for all 5 samples between $p/p_s = 0$ and 0.3. Phys. adsorption of MeOH was little sensitive to the nature of the atoms lying underneath the OH groups; in particular it was indifferent whether these atoms were Si or Al.

1886. Le Bot, Jean and Le Montagner, Serge. **The dielectric properties in the centimeter-wave region of water fixed on silica gel.** *Compt. rend.* **233**, 862-3 (1951).—*C.A.* **46**, 1829*d*.

The variation of ϵ' and ϵ'' of hydrated silica gel at frequencies between 2800 and 26,000 megacycles was measured at 20°C. The gel lost part (18%) of its hydrated H_2O in a reversible fashion when heated to 100-110°C. The remainder (10%) was eliminated in an irreversible manner by heating above 600°C. The dielec. const. of samples heated to 110° showed a max. at 17,000 megacycles which was attributed to the H_2O removed at 600°C.

1887. McIntosh, R.; Rideal, E. K., and Snelgrove, J. A. **The dielectric behavior of vapors adsorbed on activated silica gel.** *Proc. Roy. Soc.* (London) **A208**, 292-301 (1951).—*C.A.* **46**, 5384*g*.

The increase in capacity of a test cell contg. a porous activated silica on the admission of adsorbates such as water, Et chloride, and butane was measured. Two types of film were established for the adsorbates butane and Et chloride. The computation of dielec. consts. of adsorbed matter in such systems was discussed. The d. of the adsorbed state may be detd. through dielec. studies. In the case of butane, the procedure gave a value of the d. of the adsorbed state in agreement with that which might be expected if He were used. The arrangement of the adsorbed mols. remained unaltered with increasing satn. of the surface, until a crit. satn. was reached, at which point a more dil. type of film began to form and persisted until no further adsorption.

1888. Nakagaki, Masayuki. **The mechanism of evaporation in vacuum. I. Evaporation of silica gel.** *Bull. Chem. Soc. Japan* **24**, 206-9 (1951) (in English).—*C.A.* **46**, 8931*a*.

Silica gel prepd. by tenfold diln. of water glass, followed by addn. of an excess of *N* HCl, drop by drop, filtration and washing, then shaping into rods, 4 mm in diam., was used to prep. replicas for electron micrographs. Films 200 and 250 A. thick were used. Preheating prior to evapn. of SiO_2 served to complete the dehydration. Comparison of silica gel and quartz indicated that the gel evapd. with greater ease than did quartz. The results were compared with data for Pt, Au, Cr, and Al.

1889. Neimark, I. E.; Freidlin, L. Kh.; Sheinfain, R. Yu., and Fridman, G. A. **Poisoning of the silica-gel catalyst by inorganic impurities and by the reactants.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* **1951**, 311-16.—*C.A.* **45**, 9350*b*.

Poisoning of com. Silica gel with 1% HCO_2Li caused a decrease of the micropore vol. from 0.21 to 0.11 ml/g, and of the surface area from 398 to 161 m^2/g. In another sample, the same addn. caused a decrease of the total pore vol. from 0.46 to 0.40 ml/g, of the micropore vol. from 0.26 to 0.19 ml/g, and of the surface from 450 to 309 m^2/g. There was also a decrease of the catalytic activity in the gas-phase hydrolysis $PhCl + H_2O \rightarrow PhOH + HCl$. The poisoning was reversible. Adsorption of H_2O vapor on the SiO_2 gels was not detected at either 300° or 450°. At 450°, PhCl was adsorbed without decompn., but PhBr and PhI underwent decompn.

1890. Osawa, Fumio and Satô, Hisanao. **Adsorption of mixture of gases** *Busseiron Kenkyû (Researches on Chem. Phys.)* No. **36**, 35-40 (1951).—*C.A.* **46**, 6896*a*.

Statistical thermodynamics for multicomponent systems (McMillan and Mayer) was applied to the adsorption of mixed gases. The adsorbed amt. of one gas was increased by the presence of another if the intermol. potential of force was greater in the first gas than that in the second. This conclusion agreed for mixed adsorption of CO and CO_2 on silica at 100°C. An application of the theory to adsorption in solns. was suggested.

1891. Rolland, Marie Thérèse and Bernard, Raoul. **Absorption in the range of kilometer wave lengths by adsorbed water.** *Compt. rend.* 232, 1098-9 (1951).—*C.A.* 45, 6491*d*.

Water adsorbed on silica gel showed a variation of adsorption as a function of temp. There was a strong absorption at 0°C, displaced from +12° to −40°C depending on the concn. of adsorbate, and a 2nd absorption at −100°C, which was relatively independent of temp. The former was attributed to assocd. water, the latter to water dissocd. by adsorption.

1892. Ross, W. L. and McLaughlin, E. R. **Dynamic characteristics of a solid adsorbent.** *Refrig. Eng.* 59, 167-73 (1951).—*C.A.* 45, 7725*e*.

An equil. chart was given for silica gel and water vapor at temperatures between 0 and 250°F. The factors investigated were: ambient dry-bulb temp. 40, 70, 100°F; ambient relative humidity, 20, 35, 55, and 90%; desiccant bed thickness 2, 4, 8 in.; adsorption air flow desorption heater power and desorption air flow. Type and grain size of silica gel, shape of bed, and dry wt of desiccants were controlled.

1893. TERENIN, A. N. AND KARYAKIN, A. V. **Effect of adsorption of water on the quenching of the fluorescence of adsorbates.** *Zhur. Eksptl. Teoret. Fiz.* 21, 107-13 (1951).—*C.A.* 45, 7882*g*.

Anthraquinone adsorbed on purified silica gel from the vapor at about 240°C was held firmly. Fluorescence was investigated in excitation with ultraviolet. Quenching by O_2, as a function of its pressure p, followed the linear law $I_0/I_p = 1 + kp$, where k contained the probability of quenching on collision between adsorbate and O_2. At −180°C the quenching became exceedingly strong; thus, under $p = 1$ mm, the intensity of the fluorescence fell to 50%, and was suppressed altogether on further slight increase of p, whereas at −70°C, 60 mm O_2 was needed to decrease the intensity by 50%. At −180°C, the original intensity was restored only upon prolonged evacuation of the O_2. The fluorescence spectrum of the H_2O-treated adsorbate remained unchanged, but quenching by O_2 was enhanced.

1894. UTSUGI, HIROSHI. **Adsorption of vapors in the low-pressure region.** *J. Chem. Soc. Japan*, Pure Chem. Sect., 72, 812-15 (1951).—*C.A.* 46, 1306*d*.

The adsorption isotherms of EtOH on a number of silica gels were measured at 10°, 15°, 20°, and 25°C. No discontinuous increase of the amt. adsorbed was found in the whole range examd. The B.E.T. plots of exptl. results showed a number of straight portions. The differential heat of adsorption first decreased rapidly with increasing amt. of the adsorbate.

1895. VAN NORDSTRAND, ROBERT A.; KREGER, WM. E., AND RIES, HERMAN E. JR. **Adsorption studies of two silica gels and a gel-type catalyst.** *J. Phys. & Colloid Chem.* 55, 621-38 (1951).— *C.A.* 45, 9992*g*.

Changes in structure caused by sintering and grinding were followed by low-temp. N_2 adsorption isotherms for a silica aerogel, a silica xerogel, and a silica-alumina bead-type cracking catalyst. Sintering *in vacuo* caused a proportionate decrease in adsorption at all pressures for the silica xerogel and the catalyst. NH_3 adsorption on the catalyst was similar to N_2 adsorption.

1896. AVGUL, N. N. MIKOS; DZHIGIT, O. M.; KISELEV, A. V., AND SHCHERBAKOVA, K. D. **Adsorption of various vapors on silica gel.** *Zhur. Fiz. Khim.* 26, 977-85 (1952).—*C.A.* 47, 3079*c*.

The adsorption of pentane, MeOH, and water was measured on a silica gel adsorbent. Whereas the isotherms showed a reproducible hysteresis at high values of relative pressure for all 3 vapors, an irreversible hysteresis was observed at low relative pressures for MeOH and water. The loop of the latter was more marked if adsorption had been carried out to higher pressures. The B.E.T. area of the gel was 435 m^2/g from N_2 adsorption. The B.E.T. area from pentane and MeOH were, resp., 440 and 430, assuming 64 and 25 A^2. as area per mol.

1897. BARTELL, F. E. AND BOWER, JOHN E. **Adsorption of vapors by selica gel of different structures.** *J. Colloid Sci.* 7, 80-93 (1952).—*C.A.* 46, 6896*b*.

The free surface energy changes were detd. during adsorption of vapors on silica gels. Surface areas of the gels were detd. with MeOH, EtOH, PrOH, C_6H_6, C_6H_{14}, CCl_4, H_2O, and N_2 as adsorbates. Similar values were obtained with the different adsorbates, and the results agreed with those obtained by the B.E.T. method.

1898. BARTELL, F. E. AND DONAHUE, DANIEL JOSEPH. **Preferential capillary adsorption of water from solutions of alcohols by silica gel.** *J. Phys. Chem.* 56, 665-70 (1952).—*C.A.* 46, 7397*d*.

The adsorption of water from *n*-butyl, *n*-amyl, *n*-hexyl, and heptyl alcs. at 0°, 25°, and 45°C were detd. and the amts. adsorbed were plotted against the reduced concns. The B.E.T. equations was applied to the adsorption data, and the phys. significance of the consts. examd. A process analogous to capillary condensation in gases must have occurred, causing an apparently large increase in the amt. adsorbed, resulting from the sepn. of a water-rich phase in the capillaries.

1899. BORESKOV, G. K. AND KARNAUKHOV, A. P. **The adsorption method of measurement of the surface of platinum in platinized silica gels.** *Zhur. Fiz. Khim.* 26, 1814-23 (1952).—*C.A.* 47, 5758*g*.

A glassy silica gel was platinized with 0.2% or 0.5% Pt. The adsorption isobar of H_2 was detd. on the original gel between 0° and 450°C; the min. adsorption occurred at 250°C. From the MeOH isotherm and from adsorption isotherms of A. and N_2 at −183°C, the surface area was 340-400 m^2/g. The platinized gels at 250°C adsorbed 2-6 times more H_2. Adsorption of H_2 by a Pt sponge (0.17 m^2/g) also was detd. at 250°C. From adsorption isotherms of A at −183°C and of MeOH at 20°C the areas of platinized gels were: 300-310 m^2/g for 0.2% Pt and 280-290 m^2/g for 0.5% Pt.

1900. BOWER, JOHN E. **Adsorption of vapors by silica gels of different structures. Free-surface-energy changes which occur during adsorption by porous adsorbents.** *Univ. Microfilms* (Ann Arbor, Mich.), *Pub.* No. 3720, 220 pp. (microfilm $2.75, paper enlargements $22.00).—*C.A.* 47, 1457*a*.

1901. BROWN, MARJORIE J. AND FOSTER, A. GRAHAM. **Melting point of adsorbed liquids.** *Nature* 169, 37 (1952).—*C.A.* 46, 5929*a*.

The vapor pressure-temp. curve of ethylenediamine adsorbed on silica gel at an equil. pressure of 5.41 mm at 25°C corresponding to a relative pressure of 0.403 and a pore radius of 25 A., showed a discontinuity at 3.2°. Similar curves for pure ethylenediamine or for silica gel satd. with an excess of ethylenediamine showed a discontinuity at 10°C; this fact indicated a lowering of the m.p. of 6.8°C.

1902. BROWN, MARJORIE J. AND FOSTER, A. GRAHAM. **The sorption of amines by silica gels.** *J. Phys. Chem.* 56, 733-7 (1952).—*C.A.* 46, 8459*c*.

Sorption isotherms were detd. at 25°C of ethyl-, propyl-, butyl-, tert-butyl-, hexyl-, heptyl-, and cyclohexylamines, ethylenediamine, and pyridine on 2 silica gels. One gel showed no hysteresis with the lower amines, whereas higher amines and the other gel with all amines, showed typical hysteresis loops. The point of hysteresis inception corresponded to a pore radius of 2 to 3 times the mol. diam. The satn. vols. were essentially const.

1903. Chesalova, V. S. and Boreskov, G. K. **Specific catalytic activity of metallic platinum.** *Doklady Akad. Nauk S.S.S.R.* **85**, 377-9 (1952).—*C.A.* **46**, 9961*a*.

Six catalyst prepns. were made: (1) silica gel, (original surface area 350 m^2/g, most frequent pore diam. 80 A.) with 0.2% Pt; (2) ditto with 0.5% Pt; (3) spongy Pt, made by sintering Pt black in vacuo; (4) Pt wire of 0.2 mm diam.; (5) Pt net from a 0.09 mm wire; (6) Pt foil 0.2 mm thick. The sp surface areas of (1) and (2) (by activated adsorption of H_2) were 30 and 73 m^2/g, resp. The sp area of (3), measured by adsorption of A, was 0.17 m^2/g, (4), (5), and (6) had surface area of $(0.5\text{-}2) \times 10^{-3}$ m^2/g. The catalytic activity was detd. in the flow-system oxidation of SO_2 in a mixt. of 3% SO_4 – 97% air between 360° and 515°C.

1904. Donahue, Daniel Joseph. **Preferential capillary adsorption of water from solutions of alcohols by silica gel.** *Univ. Microfilms* (Ann Arbor, Mich.), *Pub.* No. **3740**, 138 pp. (microfilm $1.73, paper enlargements $13.80).—*C.A.* 47, 1457*b*.

1905. Dreving, V. P.; Kiselev, A. V., and El'tekov, Yu. A. **Dependence of the adsorption of isopentane vapor on the pore dimensions of silica gels.** *Doklady Akad. Nauk S.S.S.R.* **86**, 349-52 (1952).—*C.A.* 47, 2011*b*.

Adsorption isotherms were detd. by the method of evapn. of liquid from a calibrated capillary, permitting an accuracy of 0.5 micromoles with a 1-mm capillary (better by a factor of 10-100 than the McBain balance method). Silica gels were characterized by the effective pore diam. (*D*), pore vol. and surface area. With decreasing *D*, the range of capillary-condensation hysteresis decreased; on the fine-pore gel the pores were filled in the primary adsorption process and there was no capillary condensation at all.

1906. Dzis'ko, V. A. and Krasnopol'skaya, V. N. **Effect of the chemical nature of adsorbent on the adsorption of methyl alcohol.** *Zhur. Fiz. Khim.* **26**, 1841-3 (1952).—*C.A.* 47, 5758*i*.

Assuming that the adsorption of N_2 at -183°C gave the true surface area, the area per mol. of MeOH was (from adsorption at 20°) 25-28 $A.^2$ on silica gels, 16-19 $A.^2$ on Al_2O_3 gels, 16-17 $A.^2$ on MgO, and 15 $A.^2$ on Ni. Before MeOH could be used for detg. surface areas of adsorbents, its mol. cross section for each adsorbent material had to be detd.

1907. Gyani, B. P. **Adsorption of organic vapors on silica gel and heats of adsorption.** *J. Indian Chem. Soc.* **29**, 83-91 (1952).—*C.A.* 47, 20*g*.

The adsorption of acetal, HCOOH, AcOH, propionic acid, $CHCl_3$, CCl_4, CS_2, H_2O, and EtOH on silica gel was measured at 35°C. Hysteresis was observed in some of the isotherms. Anomalies were observed in detg. the specific area of the adsorbing surface by the B.E.T. method. The heats of adsorption and the entropy changes accompanying desorption were detd. in some cases.

1908. Gyani, B. P. **Adsorption of alkyl halides on silica gel.** *J. Indian Chem. Soc.* **29**, 317-22 (1952).—*C.A.* 47, 5759*d*.

Adsorption of CCl_4, PrBr, PrI, BuCl, and BuBr was measured at 35°C on freshly prepd. silica gel evacuated for 2 hrs. at 320°C. The isotherms were roughly parabolic to a relative pressure of 0.25 and reach satn. at 0.35 except for PrBr. There was a hysteresis region in a limited pressure range towards satn. pressures. CCl_4 was not retained by the gel at low pressures.

1909. Harvey, Edmund N. Jr. **Sorption studies on silica aerogel.** *Univ. Microfilms* (Ann Arbor, Mich.), *Pub.* No. **2963**, 138 pp. (microfilm $1.73, paper enlargements $13.80).—*C.A.* 46, 8928*f*.

1910. Kurosaki, Shigehiko. **Dielectric properties of sorbed water. IV. Sorbed water in silica gel.** *J. Chem. Soc. Japan*, Pure Chem. Sect. **73**, 606-10 (1952).—*C.A.* 47, 3652*b*.

Sorption of water by silica gel was studied by measuring wt increase, dielec. const. and dielec. loss. For relative humidity less than 40% the sorption isotherm obeyed the B.E.T. formula, the effective area of the gel was approx. 143 m^2/g. The sorption of water took place in three steps, decreasing in the heat of condensation, increasing in specific polarization and increasing in dielec. loss.

1911. Milligan, W. O. and Whitehurst, Harry B. **Magnetic properties of adsorbed vapors.** *J. Phys. Chem.* **56**, 1073-7 (1952).—*C.A.* 47, 3635*h*.

Water, propanol, acetic acid, salicylaldehyde, and heptane were used as adsorbates on silica gel. Adsorption isotherms at 25°C were given for each of the adsorbates, and plots of x/m vs. (1) apparent magnetic susceptibility (χ), and (2) F/m, where x = wt of adsorbed vapor, m = sample wt, and F = force exerted by magnetic field on the sample. The variations in χ observed for less than monolayer coverage was due to the disruption of H-bonds which were present in the bulk liquids and which exert appreciable effect on magnetic susceptibility.

1912. Papee, Denis. **Adsorption of water vapor by alumina and silica.** *Compt. rend.* **234**, 952-4 (1952).—*C.A.* 46, 10773*h*.

The first adsorption isotherm on a silica or alumina gel consists of chem. and phys. adsorption. After evacuation at room temp. subsequent adsorption and desorption isotherms are reproducible and consist only of phys. adsorption. These later isotherms serve to measure surface area of the gels.

1913. Patterson, Gordon D. Jr. and Mellon, M. G. **Determination of sulfur dioxide by color-changing gels.** *Anal. Chem.* **24**, 1586-90 (1952).—*C.A.* 47, 71*e*.

Place the gel containing NH_4VO_3 in a glass tube and draw air through it. As little as 10 p.p.m. of SO_2 can be detd. H_2S and HCl also produce color effects which interfere, and NH_3 has a bleaching effect.

1914. Robert, Louis. **The determination of the covolume of molecules adsorbed on silica gel.** *Compt. rend.* 234, 2066-7 (1952).—*C.A.* 46, 9369*h*.

From a detn. of the surface area of a silica gel column and of the amt. of material adsorbed from a heptane or cyclohexane solvent, the area occupied per mol. was detd. EtOH and Me_2CO show the usual 18-23 $A.^2$ cross section of a perpendicularly adsorbed mol. The value of 26-27 $A.^2$ for aniline and nitrobenzene was considered to be the cross sectional area of a vertical benzene mol., whereas the value of 50 sq A. for benzene represents the horizontal area.

1915. Sabatier, G. **Crystallization of mixtures of amorphous silica and oxides of magnesium, zinc, and copper by heating.** *Bull. soc. franc. minéral. et crist.* 75, 506-26 (1952).—*C.A.* 47, 5643*i*.

Mixts. of SiO_2 with MgO, ZnO, and CuO are prepd. by the copptn. of SiO_2. Solidification takes place after the NaCl is removed at 110°C. Differential thermal analysis up to 1000°C is used to det. the crystn. temps., which vary depending upon the % of metal salt added.

1916. Utsugi, Hiroshi. **Adsorption of vapors in the low-pressure region. IV. Differential molar entropy of adsorption.** *J. Chem. Soc. Japan, Pure Chem. Sect.* 73, 917-20 (1952).—*C.A.* 47, 3651*f*.

Differential entropy of adsorption was calcd. from the expts. on the adsorption of n-butane, EtOH, and N_2 on various adsorbents. For *n*-butane adsorbed on glass powder, carbolac, and silica gel, the agreement between theory and expt. was good. In the case of EtOH and N_2 the exptl. differential entropy did not agree with the theoretical value.

1917. Waarden, M. van der and Scheffer, F. E. C. **The adsorption of nitrogen, hydrogen, and their mixtures on silica gel.** *Rec. trav. chim.* 71, 689-98 (1952) (in English).—*C.A.* 46, 10773*e*.

Adsorption isotherms were detd. for H_2 and N_2 between 300° and −195°C and at pressures up to slightly above 1 atm. The adsorption of mixts. of the 2 under a pressure of 1 atm. was detd. at 0, −78, and −183°C. At 0° and −78°C N_2 increased the adsorption of H_2, and H_2 decreased the adsorption of N_2. At −183°C N_2 greatly decreased the adsorption of H_2, but H_2 had almost no effect on the adsorption of N_2. The higher-temp. isotherms were linear.

1918. White, David; Chou, Chien, and Johnston, H. L. **Heat conduction and isotherms of adsorbed helium on silica gel.** *J. Chem. Phys.* 20, 1819-20 (1952).—*C.A.* 47, 4685*c*.

Temp. drops were measured, as a function of heat input, at various points along a silica-gel-filled tube (2 mm diam. x 12 cm long) for different amts. of adsorbed He at a series of temps. below the λ-point. The data for the isotherms of He adsorbed on silica gel above and below the λ-point fell on the same curve; the isotherms did not show the S-shape characteristic of multilayer adsorption on silica gel.

1919. Haul, R. A. W. **Measurement of activated diffusion of adsorbed molecules.** *Nature* 171, 519 (1953).—*C.A.* 47, 7287*c*.

Rates of adsorption of butane in porous SiO_2 plugs were measured by a gravimetric method over a temp. range of −14° to −80°C, a porosity range of 0.72 to 0.53, and a surface coverage range of 0.37 to 6.9 statistical layers. At −14.4°, −44.2°, and −79.5°C, 70, 80, and 94%, resp., of the total transport was due to the mobility of adsorbed mols. on the surface. The activation energy for surface diffusion was 3 kcal/mol.

1920. Pimentel, Geo. C.; Garland, Carl W., and Jura, Geo. **Infrared spectra of heavy water adsorbed on silica gel.** *J. Am. Chem. Soc.* 75, 803-5 (1953).—*C.A.* 47, 5253*a*.

A technique was developed for the detn. of the infrared absorption spectrum of D_2O adsorbed on silica gel. In the 1900-3400-cm-region, the spectra of samples with surface coverages from 0.35 to 1.8 monolayers were similar to the spectrum of D_2O in the liquid phase. Exchange of the adsorbed D_2O with the H_2O in the gel was observed.

1921. Snelgrove, J. A.; Greenspan, H., and McIntosh, R. **The dielectric behavior of vapors adsorbed on silica gel.** *Can. J. Chem.* 31, 72-83 (1953).—*C.A.* 47, 5746*g*.

The sudden change of the dielec. const. of adsorbed butane, EtCl, and H_2O on activated silica gel was detd. to 3.7 Mc. per sec. No Debye-type dispersion was observed for the polar adsorbates down to −30°C. Mixts. of EtCl-H_2O and C_4H_{10}-H_2O were measured at 0.1 , the quantity of H_2O being varied up to 250 cc. at N.T.P.

1922. Stitt, Fred and Tomimatsu, Yoshio. **Removal and recovery of traces of ethylene in air by silica gel.** *Anal. Chem.* 25, 181-3 (1953).—*C.A.* 47, 3184*f*.

Ethylene was detd. with HgO as an oxidizing agent and Se-sensitized paper strips. Expts. with com. silica gel (14-20 mesh) and a sample contg. 5 p.p.m. C_2H_4 in com. tank O_2 showed that all C_2H_4 was adsorbed by the gel at −78°C and released at 150°C; oxidizable impurities in the O_2 were adsorbed at −78°C and were not completely released at 150°C.

I-11. Gases on Other Porous Oxides

1923. Strese, H. and Hofmann, U. **Synthesis of magnesium silicate gels with two-dimensional regular structure.** *Z. anorg. allgem. Chem.* **247**, 65-95 (1941).—*C.A.* **36**, 5074^1.

Mg silicate gels, obtained by boiling together solns. of $MgCl_2$ and hydrated SiO_2 with KOH and $Ca(OH)_2$, showed Rontgen interferences, and all those that were characteristic for the Si layers of the clay minerals (in contradiction to analogously pptd. Al silicates). It was possible to get gels of the compn. of montmorillonite, $Mg_3(OH)Si_4O_{10} + nH_2O$. These gels consisted of single Mg silicate layers. The detn. of d., n, base exchange, thermal decompn. and water absorption affirmed the structure detn.

1924. Suzuki, Shin-ichi. **Titanium compounds. XVII. Titania gel.** *J. Japan Ceram. Assoc.* **49**, 409-15 (1941).—*C.A.* **44**, 10282*d*.

Titania gels were prepd. by heating sols which were made by hydrolyzing $TiCl_4$ contg. chlorides of Ca, Mg, Al, Fe, or Mn. The decreases in wt caused by heating the gels from room temp. to 1000°C were detd. Dehydration took place rapidly at 350°-500°C and then slowly from 500° to 700°C.

1925. Abe, Shiro. **Study of the alumina gels. IV.** *Bull. Inst. Phys. Chem. Research (Tokyo)* **21**, 424-6 (1942).—*C.A.* **43**, 2080*d*.

Active Al_2O_3 gel was prepared from solns. of $Al(NO_3)_3.9H_2O$ and NH_4OH of concns. between 5-45 and 4-35% resp. The hydrogel of $Al(OH)_3$ was decanted and centrifuged. The gel was then filled in molds, dried by air at 70°C, and heated in an elec. furnace at not above 400°C. Glassy active Al_2O_3 gel, each particle having a vol. of 0.0726 cc., was produced.

1926. Besson, Jean. **Action of carbon tetrachlorida vapors on beryllium oxide.** *Compt. rend.* **214**, 861-3 (1942).—*C.A.* **38**, 3559^9.

The rate of the reaction of CCl_4 vapors with BeO was studied. In general, the activity of BeO was reduced by previous heating to high temps. The reaction velocity (measured by detg. the percentage of BeO changed to $BeCl_2$ upon heating the CCl_4 at a definite temp. for a definite time) increased between 300° and 400°C, remained practically const. between 400° and 500°C, and then increased rapidly up to 900°C. Up to 500°C, $COCl_2$ was formed; above 500°C, the $COCl_2$ reacted with the BeO giving $CO_2 + 2BeCl_2$.

1927. Funaki, Koemon. **The properties of aluminum hydroxide and alumina I.** *J. Electrochem. Assoc. Japan* **10**, 103-11 (1942).—*C.A.* **44**, 9844*i*.

Dehydration curves up to 800°C were given for various samples of $Al(OH)_3$ obtained (1) by treating Na aluminate with H_2O, or (2) with CO_2 gas, (3) by treating solid $Al_2(SO_4)_3$ in soln. with NH_4OH, or (4) by treating $Al_2(SO_4)_3$ in soln. with NH_4OH. Two types of Al $(OH)_3$ prepd. below 80°C were very unstable and gradually became similar to bayerite, while that prepd. above 80°C was of the boehmite type, and that obtained at 150-200°C had the exact compn. $Al_2O_3.H_2O$.

1928. Higuchi, Izumi. **The dielectric properties of substances in the sorbed state. II. Anomalous dispersion of isoamyl alcohol sorbed on titania gel.** *Bull. Inst. Phys. Chem. Research* **21**, 1138-46 (1942).—*C.A.* **42**, 8556*b*.

The change of capacitance due to the isoamyl alc. sorbed on titania gel packed in a cylindrical Ni condenser was detd. between 70° and 80°C. There were 2 types of contribution to the capacitance; one was due to the surface sorption, that is, to the electronic and at. polarization of the sorbate, and the other to the capillary condensation of the sorbate. The dielec. const. of the condensed liquid increased with the quantity sorbed.

1929. Katsurai, Tominosuke. **Preparation of superheated aluminum hydroxide sol.** *J. Soc. Chem. Ind., Japan* **45**, Suppl. binding, 217 (1942) (in English).—*C.A.* **45**, 1842*i*.

A very stable $Al(OH)_3$ sol. was prepd. by heating $Al(OH)_3$ contg. a small amt. of Cl at 190°C in an autoclave for 1 hr. The sol. thus obtained is designated as superheated $Al(OH)_3$ sol. This sol. *adsorbs pure diastase* as well as the *Shigadysentery toxin* to a great extent.

1930. Luyckx, A.; Rens, G., and Bodart, J. **Adsorption of hydrogen activated by mercury resonance radiation.** *J. chim. phys.* **39**, 139-51 (1942).—*C.A.* **38**, 4516^9.

H_2 irradiated with the Hg resonance line was adsorbed on ThO_2 at ordinary temp. in about the same vol. as in thermal adsorption. By continued irradiation for several hrs one can produce a complete vacuum. At. H formed in the gas phase was held on the surface. There was a crit. pressure of a few mm Hg above which there was no photo-activation. Above this threshold, which varied with the adsorbent, a protective layer of H_2 was formed.

1931. Briner, E. and Lowy, E. **The adsorption of nitrogenous gases by alumina gel and by beryllium and calcium hydroxides.** *Helv. Chim. Acta* **26**, 1054-64 (1943).—*C.A.* **38**, 2253^4.

Air contg. 2% by vol. of NO was passed over Al_2O_3 at -70°, -15°, 0° and 100°C. Gels satd. at -15° and -70°C gave up, resp., 30 and 76% of the adsorbed gas after desorption for 1 hr at 0°C. In all cases the desorbed gas was entirely N_2O_4. The behavior of Al_2O_3 gel was similar to that of silica gel, but the recovery of N_2O_4 from the former was not so efficient. With $Ca(OH)_2$ no significant adsorption was found below 300°C. With $Be(OH)_2$ gel a small amt. of gas was retained by reversible adsorption, but most was absorbed by chem. union with water on the hydroxide.

1932. Capell, R. G.; Amero, R. C., and Moore, J. W. **New data on activated bauxite desiccants.** *Chem. & Met. Eng.* **50**, No. 7, 107-10 (1943).—*C.A.* **37**, 5802^5.

Dehydration of org. gases and liquids with an activated bauxite desiccant, Florite, was described. Equil. dryness obtainable, H_2O-adsorption capacity, regeneration and effects of pressure drop and fluid velocity were discussed.

1933. Chowdhury, J. K. and Datta, R. M. **Recovery of elementary sulfur from gases containing hydrogen sulfide.** *J. Indian Chem. Soc.* **20**, 253-60 (1943).—*C.A.* **38**, 2457⁶.

Fe_2O_3 showed an increase in wt of 25.54% due to adsorption of H_2S and pure Al_2O_3 only 0.36%, but a mixed adsorbent contg. 25.11% Al_2O_3 showed 56.98% increase in wt. MnO_2 also increased the activity of the adsorbent. The recovery of S and revivification of the adsorbent were satisfactory.

1934. Hedvall, J. A. and Günther, T. **The influence of the gas atmosphere on the surface structure and the adsorptivity of ferric oxide.** *Z. anorg. allgem. Chem.* **251**, 305-14 (1943).—*C.A.* **37**, 6515⁸.

Fe_2O_3 was prepd. by decompn. of dehydrated $Fe_2(SO_4)_3.(NH_4)_2SO_4.24H_2O$ in a N_2 and O_2 stream, resp. The surface area in cm^2/g was calcd. on the assumption of cubes with smooth surfaces. The ratios of the areas of the N_2-treated to the O_2-treated samples were 0.79, 0.88, 0.80 for the 3 temps., resp. The adsorptivities for fast red H, di-Na salt of 7-(4 sulfo-1-naphthylazo)-1-naphthol-4-sulfonic acid, were detd. and the ratios for the 2 samples were 0.53, 0.83, 0.31 for the 3 temps., resp.

1935. Hedvall, J. A. and Lundberg, A. **The effect of the gaseous atmosphere on the preparation, the chemical activity and the surface formation of powdered substances.** *Kolloid-Z.* **104**, 198-203 (1943).—*C.A.* **38**, 1419⁴:

Pure Fe_2O_3 was prepd. from $Fe(NH_4)(SO_4)_2.12\ H_2O$ *in vacuo* and in CO_2-free air and CaO from pure $Ca(OH)_2$ *in vacuo* and in CO_2-free air. The CaO reacted with SiO_2 (ratio 2:1) and with Fe_2O_3 (ratio 1:1) at 600°C for 1 hr both *in vacuo*, and in air. The amt. of CaO that had reacted was invariably greater *in vacuo* than in air. The effects observed were ascribed to the soln. of the gases.

1936. Ku, Chen Chun; Huntington, R. L., and Reid, L. S. **Selective adsorption of hydrocarbon and water vapor on alumina at atmospheric pressure.** *Am. Inst. Mining Met. Engr., Tech. Pub.* No. **1628**, 13 pp. (1943).—*C.A.* **38**, 1345⁶.

The simultaneous adsorption of H_2O and hydrocarbon vapor from natural gas by 3 grades of Al_2O_3 was studied at atm. pressure and temp. The presence of H_2O vapor in the gas inhibits the adsorption of hydrocarbon vapor, although the presence of the latter has no pronounced effect on the adsorption of H_2O vapor. Both theory and exptl. data can be applied to design and operation of com. dehydration plants.

1937. Mignolet, J. **Investigations on adsorption at present in progress.** *Rev. universelle mines* **19**, 111-13 (1943).—*C.A.* **38**, 5719¹.

The adsorption of H_2 on catalysts of MoO_2 base was investigated. This oxide was not stable in the presence of H_2. A slow reduction of the MoO_2 was observed and the reduced form stable under conditions suitable for the technical use of MoO_2 was sought. The app. used in the expts. was described.

1938. Montoro, Vincenzo. **The water of constitution of hydrated aluminas.** *Gazz. chim. ital.* 73, 43-8 (1943).—*C.A.* **40**, 3067⁹.

Distinguishing between hydroxides and hydrated oxides of Al, which sometimes is not possible by x-ray examn., can be effected by detns. of d., porosity, and contraction on calcination, and by comparison with the d. values calcd. from the mol. wt. In the freshly prepd. hydrated alumina, H_2O was in the mol. state, and Al_2O_3 in the γ-form.

1939. Morita, Noriyoshi. **The catalytic exchange of isotopes of gaseous oxygen. XIII. The exchange reaction of oxygen atoms between oxygen and water vapor on the surface of various catalyzers of iron oxides.** *Bull. Chem. Soc. Japan* **18**, 242-7 (1943).—*C.A.* 41, 4366*a*.

Light O_2 and heavy water vapor were passed together over α-Fe_2O_3, γ-Fe_2O_3, $2Fe_2O_3 + Bi_2O_3$, and Bi_2O_3, resp., at various temps. From the decrease of the vapor density, the exchange percentage of O-isotopes was calcd. The 3 kinds of iron oxides have nearly the same catalytic activity, but Bi_2O_3 is far less active. The activity of pure iron oxides was reduced to a const. value through repeated use, whereas that of $2Fe_2O_3 + Bi_2O_3$ showed a const. value from the beginning. The activity decreased remarkably when the oxides were heated beforehand to 800°C for 24 hrs.

1940. Sakai, Wataru; Kurimura, Rokuro, and Okuno, Toshiro. **Catalytic powers of manganese oxides. IV-V. Adsorption equilibrium of oxygen by manganese oxides.** *J. Soc. Chem. Ind. Japan* **46**, 1011-16 (1943).—*C.A.* **43**, 1624*a*.

To Mn oxide, previously heated *in vacuo* to 175-80°C, a definite quantity of O_2 was introduced at 0-70°C and the quantity adsorbed by the oxides is calcd. The equil. condition was expressed by the formula $a = kp^m$, where a was the quantity of O_2 adsorbed, p the pressure, and k and m const., m being always greater than 1.

1941. Schneider, W. G. and Thorvaldson, T. **The hydration of the aluminates of calcium. III. The hydration of the 5:3, 1:1 and 3:5 calcium aluminates.** *Can. J. Research* **21B**, 34-42 (1943).—*C.A.* **37**, 3997².

The hydration of the aluminates of Ca in satd. steam at 150° and 105°C was studied. At 150°C when conditions favoring rapid hydrolysis were avoided, the 1:1 and 3:5 Ca aluminates were apparently transformed almost quantitatively to the cubic hexahydrate of tricalcium aluminate and hydrated alumina approaching the compn. of the monohydrate. The steam-treated 5:3 Ca aluminate gave lower water absorption and higher content of combined alumina than called for by the above end products.

1942. Brauer, Peter and Muller, F. Horst. **Gas adsorption on cuprous oxide and its electrical properties.** *Kolloid-Z.* **107**, 129-31 (1944).—*C.A.* **31**, 10⁶.

The elec. properties of the electron-semiconducting Cu_2O were changed reversibly through the action of active gases, such as H_2O and NH_3. The very small quantity of H_2O taken up by the Cu_2O crystals and measured quantitatively at room temp. corresponded to a unimol. adsorption layer.

1943. Faivre, René and Chaudron, Georges. **The zeolitic nature of the water in calcium sulfate hemihydrate and the effect of its removal upon the transformation of soluble anhydrite into insoluble anhydrite.** *Compt. rend.* **219**, 29-30 (1944).—*C.A.* **40**, 4942^9.

By almost complete dehydration of the hemihydrate below 200°C, the sol. anhydrite was obtained. This had the same x-ray spectrum as the hemihydrate. The contraction when sol. anhydrite was transformed into the insol. was obtained by dilatometric thermal analysis. The transformation was not complete below 400°C and until the last traces of water were removed.

1944. Kohata, Katricko. **The sorption of water vapor by slaked lime.** *Bull. Inst. Phys. Chem. Research, (Tokyo) Chem. Ed.* **23**, 274-80 (1944).—*C.A.* **42**, 5300*a*.

A static study was made on the sorption equil. at 15°, 25°, 35°C at just below the satn. pressure of steam. Freundlich's equation held both at higher and lower pressures. An exptl. formula was given for the sorption equil. at const. temp.: in the lower region, $\log a = (0.65108 + 0.2003 \log P) + (0.02174 - 0.01329 \log P)t$, where a = amt. of sorption (mg); in the higher region, $\log P = [9.23987 - (2441.1/T)] - [0.34932 - (168.4/T)] \log a$. From these, the differential heat of sorption was calcd.

1945. Tachiki, Kenkichi. **Adsorption of chlorine by magnesium oxide I.** *J. Chem. Soc. Japan* **65**, 50-2 (1944).—*C.A.* **41**, 3342*g*.

The adsorption equil. of Cl_2 by porous MgO was studied at 25°, 35°, and 45°C in the pressure range 20-700 mm. The results are summarized.

1946. Borgstrom, L. H. **Sintering of iron ore upon reduction with carbon.** *Finska Kemistsamfundets Medd.* **54**, 39-52 (1945).—*C.A.* **41**, 3411*e*.

Mixts. of magnetite or hematite with coke, lampblack, or graphite were heated. The greatest sintering (up to 40% linear shrinkage) occurred with the most finely powd. ore mixed with less than the equiv. amt. of carbon. With a 2-5% excess of carbon, the product was loose and powdery. Below 1000°C sintering rarely occurred. It increased from 1000° to 1300°C. There was an appreciable increase of sintering upon addn. of 3-13% quartz or limestone.

1947. Bradley, W. F. **Diagnostic criteria for clay minerals.** *Am. Mineral.* **30**, 704-13 (1945).—*C.A.* **40**, 2089^8..

The advantages of utilizing the glycol-complexes of clay minerals for characterization are emphasized, esp. for montmorillonite and halloysite. Mixed layer minerals that involve intergrowths of montmorillonite and illite can be studied anew, as the illite does not undergo structural changes when treated with glycol. The characteristic 17 A. glycol complex was also obtained with most beidellites and nontronites.

1948. Burbo, P. Z. **Drying air with inorganic adsorbents.** *Khimicheskaya Prom.* **1945**, No. 11, 11-14.—*C.A.* **40**, 3028^9.

The efficiency of removing H_2O from air in the production of liquid air, liquid O_2, or liquid rare gases was compared by freezing the H_2O out or by adsorption. $CaCl_2$, anhyd. $CaSO_4$, NaOH, KOH, silica gel, activated Al_2O_3, and BaO were compared. While BaO was most effective, the use of silica gel or Al_2O_3 was more advisable.

1949. Fricke, R. and Weitbrecht, G. **The effect of small amounts of silica on the primary particle size and lattice distortion of γ-alumina.** *Z. anorg. Chem.* **253**, 30-6 (1945).—*C.A.* **43**, 3685*d*.

More than 2% SiO_2 hindered the crystn. of γ-Al_2O_3 below 800°C. At 900°C 0.5% SiO_2 aided the crystn. It is probable that the SiO_2 was between the primary particles.

1950. Raychaudhuri, S. P. and Datta, N. B. **Comparison of the properties of freshly precipitated and heated aluminosilicates and alumina and silica gels and of clay minerals.** *J. Phys. Chem.* **49**, 21-32 (1945).—*C.A.* **39**, 1584^5.

Nine kinds of aluminosilicates were prepd. by mixing silicic acid and $Al(OH)_3$ sols in the respective proportions 2:1, 3:1, 4:1 and in 3 different ways: by slow addn. of the hydroxide to an excess of the acid sol., by reversing the procedure, and by mixing the 2 components dropwise. Chem. compn., electroösmotic charge, capacity of combination with bases, moisture contents at 50% humidity and buffer curves were detd. The gels were electrodialyzed. The third method of mixing favors the formation of mineral structures.

1951. Weitbrecht, G. and Fricke, R. **Particle size, lattice distortion, and secondary structure of γ-alumina and its starting material.** *Z. anorg. Chem.* **253**, 9-29 (1945).—*C.A.* **43**, 3685*b*.

γ-AlOOH was prepd. by pptn. and by autoclaving boehmite with H_2O above 370°C. γ-Al_2O_3 was prepd. by heating either species of γ-AlOOH. The various prepns. were examd. by x-ray diffraction and under the electron microscope for particle size, lattice distortion, and shape.

1952. Belcher, Ronald. **Efficiency of desiccants.** *Analyst* **71**, 236-7 (1946).—*C.A.* **40**, 3943^7.

The efficiency of desiccants was concerned chiefly in their use in drying trains. For the purposes of gravimetric analysis, it was more important to keep the crucible covered and to weigh promptly. Then reignition to const. wt was important.

1953. Broad, D. N. and Foster, A. G. **Sorption of vapors by ferric oxide gel. II.** *J. Chem. Soc.* **1946**, 446-50.—*C.A.* **40**, 6931^6.

Adsorption-desorption data were detd. for a Fe_2O_3 gel with the adsorbates CCl_4, $CHCl_3$, EtI, cyclohexane, dioxane, hexane, morpholine, octane, diisopropyl ether, toluene, and triethylamine. All gave isotherms with a large hysteresis area. The capillary radii calcd. by means of the Kelvin equation from the point of inflection of the desorption curves and corrected for primary adsorption were in agreement, at 31-32°A.

1954. Emmett, P. H. and Cines, Martin R. **Adsorption of hydrogen and nitrogen on chromium oxide gel.** *J. Am. Chem. Soc.* **68**, 2535-6 (1946).—*C.A.* **41**, 1139*i*.

The chemisorption of 3.57 cc. of H_2 per g of Cr_2O_3 gel had substantially no effect on the phys. adsorption of H_2 at -195° and -78°C, and of N_2 at 0°C. The difference between these results and the marked inhibition of phys. sorption previously reported was attributed to differences in the pore sizes.

1955. Fichter, R. **Infrared absorption of aluminum oxide layer.** *Helv. Phys. Acta* **19**, 21-40 (1946).—*C.A.* **40**, 3682^9.

The spectral region extended from 0.90 to 12.0μ. Part of the observed bands could be attributed to H_2O and others to Al_2O_3. Presence of the deformation vibration of H_2O indicated that the latter was present as such in the oxide layer and not in the form of a true hydroxide.

1956. Forestier, Hubert and Perbet, Noel. **The effect of adsorbed water on the velocity of reaction between ferric oxide and nickel oxide.** *Compt. rend.* **223**, 575-6 (1946).—*C.A.* **41**, 6458*a*.

The rate of the reaction $Fe_2O_3 + NiO \rightarrow Ni(FeO_2)_2$ was studied magnetically. The reactants were prepd. by pptn., dried, and heated to 415° for 15 min. under various conditions. The velocity of the reaction was least for material heated in a vacuum, intermediate for heating in air, and greatest for heating in the presence of water vapor.

1957. Hée, Arlette. **Comparison of results obtained by the method of emanation power and by the thermomagnetic method upon the modifications in structure of iron sesoxide.** *Compt. rend.* **223**, 749-51 (1946).—*C.A.* **41**, 5770*i*.

Near the Curie point of Fe_2O_3 and Fe_3O_4, diffusion of adsorbed radioactive atoms increased notably. The increased emanation power of Fe_3O_4 and Fe_2O_3 near the Curie point either was directly connected with a mol. field, or was related to contractions and deformations due to disappearance of orientation in the Weiss elementary regions.

1958. Jura, George; Loeser, Edward H.; Basford, Paul R., and Harkins, Wm. D. **Surfaces of solids. XV. First-order phase changes of adsorbed films on the surfaces of solids: the film of heptane on ferric oxide.** *J. Chem. Phys.* **14**, 117-23 (1946).—*C.A.* **40**, 3323^2.

Two-dimensional first-order changes, in which a gaseous film of heptane was transformed into another phase of lower mol. area with evolution of heat, were discovered on subphases of Fe_2O_3, Ag, and graphite. All of the crit. phenomena observed in 3-dimensional systems were duplicated. For heptane on Fe_2O_3 the crit. consts. are: σ_c (area) 900 A.^{2} per mol.; π (film pressure) 0.45 dyne per cm; and T_c, 29°C. The crit. consts. depend on the nature of the solid as well as on that of the vapor.

1959. Murata, Kiku and Kakudo, Akiyo. **Preparation of adsorbent, active alumina and a method for its recovery.** *Rept. Osaka Minicipal Research Inst. Domestic Sci.* **17**, No. 1, 199-201 (1946).—*C.A.* **41**, 4897*i*.

Into 1 kg of concn. H_2SO_4 was sprayed 500 g of Al_2O_3 at 80-5°C, while the acid was being slowly stirred until it became a pasty mass. It was left alone for 2.5 hrs. Into the mass was dropped 17 g of $K_2Cr_2O_7$, dissolved in 260 cc. of water. After continuously stirring for 5 hrs at 80-5°C, 2 liters of water were added, and after stirring, it was left alone overnight, washed in water, dried, and finally calcined to become adsorbent, active alumina. The degree of adsorption was detd. colorimetrically with the standard solns. made from the coloring matter formed by adding Prebulda's reagent to 60γ vitamin B_1, the color appearing in 2 cc. of the 5 cc. xylene fraction of the matter being rated as 10.

1960. Powers, T. C. and Brownyard, T. L. **Studies of the physical properties of hardened portland cement paste. II. Studies of water fixation.** *J. Am. Concrete Inst.* **18**, 249-336 (1946).—*C.A.* **41**, 843^h.

Exptl. methods and app. used in water-vapor sorption measurements of cement pastes and mortars were described. Age and original water-cement ratio influenced the shape of isotherms only above a relative humidity of about 0.40.

1961. Puri, Amar Nath; Rai, Balwant, and Rahman, M. A. **Relative vapor pressures and moisture contents of activated alumina and silica.** *J. Indian Chem. Soc.* **23**, 85-98 (1946).—*C.A.* **40**, 6931^9.

The moisture-adsorption capacities of a no. of activated Al_2O_3, SiO_2, and Fe_2O_3 samples prepd. in a variety of ways were studied. Data for various org. vapors on activated Al_2O_3 were also obtained. The mechanism of moisture adsorption by Al_2O_3 and SiO_2, and by soils in general, was briefly discussed. Various silica samples were also compared as to activity in bleaching crude vegetable oils.

1962. Thibon, Honore; Maillard, Albert, and Savon, Louis. **Activated alumina: prepatation, properties, nature.** *Chimie & industrie* **57**, 117-25 (1946).—*C.A.* **41**, 6030*a*.

For dynamic adsorption of water vapor from air, activation by heating hydrated Al_2O_3 for 30 min. at 310°C gave better adsorption than heating for 30 min. at 360°C. A micro- or ultramicroporous silica gel adsorbed more water vapor than an equal wt of activated Al_2O_3; equal vols. of the 2 adsorbents and approx. the same adsorbing power. Reactivation could be accomplished at 155°C, unless there had been prolonged contact (several weeks) with water vapor, in which case heating to 300°C was required for reactivation. In dynamic adsorption of $C_2H_2Cl_4$, C_2HCl_3, and $C_2H_2Cl_2$ from air, the satn. capacity of activated Al_2O_3 on a vol. basis approached SiO_2. Max. adsorptive capacity was obtained by heating for a time which decreased with increase in activating temp. In the adsorption of As_2O_3 from alk. aq. sol., the max. adsorptive capacity was the same for all activating temps. Adsorption of I_2 dissolved in aq.

KI soln. was extremely slow (0.5% I_2 on the wt of Al_2O_3 at the end of 14 hrs). Adsorption of Congo red, As_2O_3, or I_2 cannot be a quick reliable test to control the adsorptive capacity of activated Al_2O_3.

1963. WHALLEY, H. K. **The preparation of an active absorbent of hydrogen sulfide from waste oxide of iron.** *J. Soc. Chem. Ind.* **65**, 217-24 (1946).—*C.A.* **41**, 837*g*.

Impure Fe oxide, which was a by-product in the extn. of Al_2O_3 from bauxite, was valueless as an absorbent for H_2S. Partial reduction in coal gas, followed by oxidation with air gave 3 groups of oxides which showed good absorbing properties. Group I oxides were prepd. by reduction at 550°C and oxidation at 250-300°C in air and steam. Group II oxides were prepd. by reduction at 550°C for 4-6 hrs and oxidation in air alone at or above 400°C. Group III oxides were prepd. by reduction at 550°C for 4-6 hrs and oxidation in air alone below 400°C. Group I was shown to be better than all of a no. of com. absorbents, except for bog ore admixed with peat.

1964. BRINTZINGER, HERBERT AND MOLLERS, ANNEMARIE. **Preparation of active oxides and oxide hydrates by decomposition of metal salts with superheated steam.** *Z. Anorg. Chem.* **254**, 343-6 (1947).—*C.A.* **43**, 2533*i*.

The following were prepd.: BeO, La_2O_3, $La_2O_3.3H_2O$, $3La_2O_3.4H_2O$, Al_2O_3, $3Al_2O_3.H_2O$, ThO_2, and $ThO_2.H_2O$. BeO and La_2O_3 are dehydration catalysts. Al_2O_3/La_2O_3 (10:1) gives 100% conversion of 1,4-butanediol to tetrahydrofuran without side reactions at 400°C; Al_2O_3/ZrO_2 (10:1) gives a 90% conversion. Al_2O_3/ThO_2 (10:1) gives a 95% conversion.

1965. COOKE, P. W. AND HARESNAPE, J. N. **Effect of steam on some alumina transitions.** *Trans. Faraday Soc.* **43**, 395-8 (1947).—*C.A.* **42**, 1481*g*.

Rates of transformation of γ-Al_2O_3 and of boehmite to α-Al_2O_3, and the rate of crystal growth of γ-Al_2O_3 increased on increasing the H_2O pressure at a fixed temp. Below 450°C and pressures below 240 lb/in², none of these reactions were appreciable. After 14 hrs at 500°C and a H_2O pressure of 600 lb/in², crystal growth of γ-Al_2O_3 was extensive, but formation of α-Al_2O_3 was inappreciable. Steam behaved as a catalyst with regard to these transformations by providing a medium in which the phases could dissolve and transform.

1966. DANIL'CHENKO, P. T. **Determination of stoichiometrically combined water in hydrogels and other finely dispersed systems by a method of third component.** *Zhur. Anal. Khim.* **2**, 299-308 (1947).—*C.A.* **43**, 6943*c*.

Chemically bound H_2O in hydrogels and similar systems was detd. by a method referred to as a third-component method. The third-component content was detd. in its own equil. soln. and in a mixt. of such soln. with the investigated material (gel or finely dispersed substance).

1967. DEKKER, A. J. AND GEEL, W. C. VAN. **The amorphous and crystalline oxide layers of aluminum.** *Philips Research Repts.* **2**, 313-20 (1947).—*C.A.* **42**, 438*b*.

By anodic oxidation, Al could be covered with either an amorphous or a cryst. oxide layer. The amorphous layer, which was porous, was obtained in aq. solns. of a borate, succinate, or citrate, and had pronounced *insulating properties*. When a cryst. layer was formed on a surface that had been coated with an amorphous layer, the cryst. layer formed in the pores of the amorphous layer until these were filled.

1968. DONGES, E. **The oxidation of carbon monoxide by oxygen-containing cobalt or nickel sulfide and by atmospheric oxygen in the presence of cobalt sulfide.** *Z. anorg. Chem.* **254**, 133-6 (1947).—*C.A.* **43**, 2076*i*.

Damp pptd. Co(III) and Ni(III) sulfides were able to oxidize CO slowly to CO_2 at room temp.; the CO:sulfide ratio was approx. 1:1. This was owing to the existence of basic CoS(OH) and NiS(OH). If these sulfides were dried over P_2O_5 or cooled to 0°C no oxidation of CO occurred.

1969. EISCHENS, ROBERT P. AND SELWOOD, P. W. **Structure studies of chromium-aluminum oxide and related catalyst systems.** *J. Am. Chem. Soc.* **69**, 2698-702 (1947).—*C.A.* **42**, 1793*d*.

Magnetic susceptibility isotherms, x-ray diffraction, and surface-area studies were made of catalysts prepd. by impregnation, pptn., and copptn. and contg. Cr, Mo, W, and U, generally supported on γ-Al_2O_3, but in certain cases on α-Al_2O_3, silica gel, TiO_2, and ThO_2.

1970. EUCKEN, A. **A model for the hindered chemical adsorption of hydroxyl compounds on γ-alumina.** *Naturwissenschaften* **34**, 374 (1947).—*C.A.* **44**, 2357*d*.

Dehydration of OH compds. on γ-Al_2O_3 required the presence of chemically adsorbed H atoms. It was significant that in γ-Al_2O_3 1/9 of the lattice locations for metal were unoccupied; hence, these "faults" had abnormal neg. fields and could readily hold H atoms. A heat of activation of up to 10 kcal. was required to lift a H atom sufficiently out of the fault location to permit OH to approach it. This was followed by dehydration.

1971. GARNER, W. E. **The reduction of oxides by hydrogen and carbon monoxide.** *J. Chem. Soc.* **1947**, 1239-44.—*C.A.* **42**, 1110*i*.

The reduction of metallic oxides by H_2 and CO proceeded through a no. of intermediate stages to yield hydroxides and carbonates which decomp. to produce the lower oxide or metal. There was considerable mobility of ions in the oxide lattice at the temp. of reduction. Reversible chemisorption of CO occurred in metal-rich oxides with neg. holes, and irreversible chemisorption on oxides with pos. holes. The two types of chemisorption were not readily interconvertible. The reversible adsorption of CO on ZnO and the adsorption of CO_2 on the oxides of the transition elements occurred without appreciable activation energy.

1972. KONDRAT'EVA, E. I. AND KONDRAT'EV, V. **Active centers in the acetylene flame.** *J. Phys. Chem. (U.S.S.R.)* **21**, 761-8 (1947) (in Russian).—*C.A.* **42**, 2162*c*.

A thermocouple coated with ZnO, and Cr_2O_3 and introduced into an C_2H_2-O_2 flame showed a temp. higher by ΔT than that of an uncoated thermocouple. When the ratio $O_2 = C_2H_2$ was less than 2.5, the introduction of a coated couple extinguished the flame and ΔT was zero. The max. ΔT observed was about 45°C. The main reaction products were CO and H_2O.

1973. KONDRAT'EVA, E. I. AND KONDRAT'EV, V. **Active centers in the combustion of carbon monoxide.** *J. Phys. Chem. (U.S.S.R.)* **21**, 769-76 (1947) (in Russian).—*C.A.* **42**, 2162*e*.

The coated thermocouple was hotter than an uncoated couple in burning moist $CO + O_2$ mixts. ΔT was proportional to the rate of combustion when the temp. varied between 610° and 717°C, the pressure between 12 and 23 mm Hg, and the rate of gas flow between 0.55 and 3.55 cc/sec. The highest ΔT was 60°C.

1974. KRATKY, O. **The structure of amorphous bodies.** *Monatsh.* **76**, 311-18 (1947).—*C.A.* 41, 6111*d*.

The two types of Al_2O_3 gels previously proposed can be explained as weak hexagonal and cubic packing.

1975. MAKAROV, S. K. AND KALIKO, M. A. **Poisoning of alumina-silica catalyst by water vapor.** *Neftyanoe Khoz.* **25**, No. 2, 42-6 (1947).—*C.A.* **41**, 6697*d*.

A Houdry-type alumina-silica catalyst normally capable of producing a 40% yield of gasoline, gave only a 35% yield after storage in open air. The deactivation was due partly to adsorption and capillary condensation of water vapor from the air. At 500-600°C enough absorbed moisture remained in the catalyst to cause subsequent deactivation at higher temps. Exothermic effects exhibited in the absorption and desorption isotherms at 400-600°C were apparently due to catalytic action of moisture on the process of recrystn. of the catalyst.

1976. MOISEEV, P. S. **Fibrous alumina.** *Kollid. Zhur.* **9**, No. 1, 53-6 (1947).—*C.A.* **41**, 4729*e*.

Heating curves and x-ray pictures were obtained for fibrous Al_2O_3, obtained by the action of a 1% $HgCl_2$ soln. on Al. The product, of d. 1.77, on heating at 80-100°C crystallized to either bauxite dihydrate $(Al_2O_3.H_2O).2H_2O$ (d. 1.89) or hydragillite (d. 2.24), depending on the treatment of the original material. Further heating (4 hrs at 500°C) drove off H_2O of crystn., and gave an amorphous product of d. 2.03.

1977. OWEN, J. R. **Correlation of surface area and dehydrogenation activity for a chromia-alumina catalysts.** *J. Am. Chem. Soc.* **69**, 2559-60 (1947).—*C.A.* **42**, 442*b*.

In the dehydrogenation of butane, the data showed that there was a definite correlation between surface area and dehydrogenation activity for the CrO_3-Al_2O_3 catalyst.

1978. RIES, H. E. JR.; VAN NORSTRAND, R. A., AND KREGER, W. E. **Adsorption-desorption isotherm studies of catalysts. II. Comparisons of low-temperature isotherms of ammonia and nitrogen.** *J. Am. Chem. Soc.* **69**, 35-40 (1947).—*C.A.* **42**, 807*a*.

Adsorption isotherms were measured with NH_3 as the adsorbate on a pelleted supported Co catalyst at liquid-NH_3 temp. The isotherms were compared with N_2 isotherms obtained for the same adsorbent at liquid-N_2 temp. Contrary to that of N_2, the NH_3 adsorption was not instantaneous but required at least 24 hrs before stationary values were reached. Furthermore, the desorption branch of the NH_3 isotherm did not completely join the adsorption branch. In spite of the slowness of adsorption, reproducible isotherms were obtained by a standardized procedure. The B.E.T. area of the adsorbent was 217 m^2/g and if calcd. from the NH_3 isotherms 238 m^2/g.

1979. ROGINSKIĬ, S. Z. AND TSELLINSKAYA, T. F. **Effect of the free energy of the process of preparing pyrolytic nickelous oxide on activated adsorption.** *J. Phys. Chem. (U.S.S.R.)* **21**, 919-26 (1947) (in Russian).—*C.A.* **42**, 2500*i*.

$NiCO_3$ was heated at a CO_2 pressure of either 3×10^{-3} mm or 2-10 mm Hg until NiO was obtained. The adsorption isotherms of CO_2 at 23°C on both types of NiO were similar, and the surface areas were about 5×10^5 and 4×10^5 cm^2/g. However, the rate of activated adsorption of CO was greater for the 1st sample than for the 2nd. The ratio of these rates increased with the amt. (q) adsorbed, but was smaller the higher the temp. (23-160°C). NiO took up O_2 also; q increased between 60° and 180°C and the rate of adsorption was greater for the 1st than for the 2nd type.

1980. RUSSELL, ALLEN S. AND STOKES, JOHN J. **Sorption of hydrogen on alumina.** *J. Am. Chem. Soc.* **69**, 1315-19 (1947).—*C.A.* **41**, 5771*d*.

Between 400° to 900°C and 9 to 620 mm Hg, the adsorption of H_2 on alumina increased with a decrease in temp. and increased as the one-fourth power of the H_2 pressure. The adsorption was slow, difficult to reproduce, and covered no more than a few % of the total surface of the alumina.

1981. SINGER, FELIX AND THURNAUER, HANS. **Sinter alumina.** *Metallurgia* **36**, 237-42, 313-15 (1947).—*C.A.* **42**, 727*h*.

The temp. of sintering was about 0.8 to 0.9 that of melting. Crystallites in sintered alumina were not completely homogeneous. They contained gas bubbles which were definitely within the crystals and not at the junctures between sep. crystallites. As the gas bubbles were completely enclosed, there was no effect on the apparent porosity of the material. Sintered alumina was characterized by its extreme chem. inertness. It was resistant to solns. and melts of alkalies, HF, and nearly every acid. It was not attacked by steam at high pressure, or Cl_2 and CO_2 at high temp.

1982. STALEY, H. R. AND GREENFELD, S. H. **Surface areas of high-calcium quicklimes and hydrates.** *Am. Soc. Testing Materials, Proc.* **47**, 953-64, discussion, 965-6 (1947).—*C.A.* **42**, 6508*d*.

When slaked with excess water, lime hydrates produced from hard burned quicklimes had higher surface areas than those made from soft burned quicklimes. The surface area of lime hydrates made from either type quicklime increased with slight excess water of slaking but with increasing amts. of excess water the surface areas dropped rapidly to const. values. Quicklimes made in the presence of NaCl under relatively low-temp. conditions were similar to hard burned quicklimes but gave a low surface area upon hydration. Ethanol and sucrose solns. produced high surface area wet hydrates but had no appreciable effect on the dry-hydrating properties.

1983. TRAVERS, A. AND CLAUSE, F. **The nature of precipitated alumina.** *Bull. Soc. Chim. France* **1947**, 209-10.--*C.A.* **41**, 6125*b*.

The Baeyer process was discussed as a two-step time reaction: (1) pptn. of bohmite and (2) hydration of bohmite to baeyerite. Phenol added to sodium aluminate soln. gave instantly a fine easily filterable ppt. yielding $Al_2O_3.2.2H_2O$ after vacuum drying.

1984. WALKENHORST, W. **Structureless carrier films of aluminum oxide.** *Naturwissenschaften* **34**, 373 (1947).—*C.A.* **44**, 2317*f*.

Carrier films of Al_2O_3 were prepd.: Aluminum foil of 10 μ thickness was cleaned in hot dil. HNO_3 at 80°C, washed with water, and anodically oxidized in 3% ammonium citrate soln. This oxide layer grew to a max. thickness, it was then cleaned in distd. water and the metallic Al dissolved away by allowing the film to float on a 0.25% $HgCl_2$ soln. The thickness of the oxide film varied linearly, with the potential used, it was 275 mμ for 200 v. Films of Al oxide so prepd. showed no structure in the electron microscope and can be heated in vacuum ovens to 600°C without structural change.

1985. WICKE, E. **The separation of gas mixtures by flow through adsorbents.** *Angew. Chem.* **B19**, 15-21 (1947).--*C.A.* **41**, 4349*e*.

Several sets of exptl. data were reported. With a 57.5 cm high column of ignited German bauxite (grain size 5 to 1.2 mm) contained in a U glass tube of 0.56 cm² cross section, and after proper pretreatment of the adsorbent, 60 cc. of 50-50 propane-propylene mixt. could be sepd. into the pure components in a single pass.

1986. ANDERSON, J. S. **Primary reactions in roasting and reduction processes.** *Discussions Faraday Soc.* **1948**, No. 4, 163-73.--*C.A.* **43**, 4988*f*.

The cond. of simple oxides (ZnO, Fe_2O_3, Cr_2O_3) and spinel-type double oxides ($ZnFe_2O_4$, $ZnCr_2O_4$) were measured up to 1000°C and pressures between 1 atm. and 10^{-4} mm. The reduction to the metal took place in 3 stages: (1) chemisorption of the reducing gas whereby lattice defects were created at the surface; (2) migration of the lattice defects from the surface; and (3) satn. of the crystal lattice with the defect with consequent appearance of a new phase (metal, or lower oxide).

1987. BORK, A. KH. AND MARKOVA, O. A. **Dependence of relative adsorption coefficients on temperature and the extent and nature of the catalyst surface.** *Zhur. Fiz. Khim.* **22**, 1381-4 (1948).—*C.A.* **43**, 2498*c*.

Water-EtOH mixts. were passed over Al_2O_3 or ThO_2, and the yield C_2H_4 was detd. From the relation between the yield and the H_2O content, the relative adsorption coeff. H_2O:EtOH was calcd. to be 0.66 for 2 samples of Al_2O_3 and 2 samples of ThO_2 between 330 and 398°C.

1988. BORK, A. KH. **Properties of catalytically active surfaces on the basis of the kinetics of unimolecular reactions.** *Zhur. Fiz. Khim.* **22**, 1385-9 (1948).—*C.A.* **43**, 2498*d*.

The relative adsorption coeff. α was 0.66 for H_2O:EtOH on Al_2O_3 and ThO_2 and 0.4 on Cu and for xylene:dimethycyclohexane I.0 on Ni+Al_2O_3 independently of temp., the relative concns. of the components, and the amt. of the catalyst. The heats of adsorption of the two components on the active surface were equal.

1989. CARTER, P. T. **Physical chemistry of sulfur removal in steelmaking.** *Discussions Faraday Soc.* **1948**, No. 4, 307-16.--*C.A.* **43**, 4936*a*.

The data showed that CaO, MgO, MnO, and FeO could all desulfurize molten Fe with about equal power. When these oxides combined with acidic oxides to form compds., the desulfurizing power was diminished. Probably combination states are $2MO.SiO_2$, which was either undissocd. or slightly dissocd., $3MO.P_2O_5$, $MO.Al_2O_3$, and $MO.Fe_2O_3$.

1990. EISCHENS, ROBERT P. AND SELWOOD, P. W. **Structure and activity of the chromium-aluminum oxide catalyst system.** *J. Am. Chem. Soc.* **70**, 2271-3 (1948).—*C.A.* **42**, 8598*b*.

Surface areas of catalysts with a Cr content of 1.9% to 34.5% Cr, made by the impregnation of γ-Al_2O_3 and bohemite, decreased linearly with increase in Cr concn. At the "λ" point of the magnetic susceptibility curve corresponding to the inflection point from a low to a high rate of change of the susceptibility with Cr diln., only 1/9 of the Al_2O_3 surface was covered with Cr_2O_3 and the av. Cr atom was in a crystallite 3 atom layers thick.

1991. GONCHAROV, V. V. **Effect of some admixtures on the hydration of magnesium oxide and magnesite.** *Ogneupory* **13**, 266-73 (1948).--*C.A.* **43**, 5919*h*.

Cylindrical samples of (1) calcined magnesite and Fe_2O_3 and (2) MgO and CaO, SiO_2, Al_2O_3, and Fe_2O_3 individually and in combinations were used to study the effects of various admixts. on the hydration of pure MgO and magnesite. The samples were fired at 1400, 1500, and 1600°C. The hydration was increased by increasing CaO from 1 to 3%; with addn. of 2% SiO_2, the hydration tendency dropped sharply while an increase of SiO_2, to 5% caused a less rapid drop in hydration. Addn. of Al_2O_3 reduced the hydration considerably less than SiO_2. In the presence of 1% Fe_2O_3 the hydration of MgO dropped sharply but with increasing content of Fe_2O_3 the reduction became less.

1992. HAASSER, CHARLES AND FORESTIER, HUBERT. **Effect of adsorbed water vapor and compression on reactions in the solid state.** *Compt. rend* **227**, 123-5 (1948).—*C.A.* **42**, 8586*f*.

Fe_2O_3+NiO mixts. pptd. separately, dried at 100°C in vacuum of 10^{-5} mm Hg and mixed for an hr in a pulverizer vibrator, were studied at 300-700°C. The reaction to form ferrite started slowly at 100°C, increased rapidly after 450°C, diminished towards 600°C. Water vapor increased the speed of reaction decidedly between 350° and 625°C. Anologous results were obtained with ferrites of Mg and Pb. Water vapor affects the reaction itself rather than the diffusion phenomena.

1993. Hüttig, Gustav F. and Dreithaler, Herbert. **The dehydration of gypsum and chromium oxide hydrate gel in the presence of inert gases.** *Festskr. J. Arvid Hedvall* **1948**, 285-90.—*C.A.* 42, 6216*c*.

$CaSO_4.2H_2O$ contg. 20.91% H_2O was ground to 800 mesh before use. $Cr_2O_3.xH_2O$ was prepd. and sifted through an 800 mesh screen. Tank N_2, O_2, CO_2, SO_2, NH_3, CH_4, and acetone-free CH_3OH were passed individually over 1.000 g of sample in a small boat at a rate of 4 liters/hr, and the loss of H_2O was measured by direct weighing. The results were very reproducible in the case of $CaSO_4$ but less so with Cr_2O_3. The dehydration of $CaSO_4.2H_2O$ at 100°C occurred most rapidly in H_2, and only slightly less rapidly in O_2, N_2, CO_2, SO_2, and C_2H_4; 85-90% of the H_2O being removed in 3 hrs. After 4 hrs, NH_3 had removed only approx. 5% of the H_2O and CH_3OH approx. 15%. The rate of dehydration with NH_3 increased very rapidly in the range 100°-150°C, more than 90% of the water being removed at 150°C in 1 hr.

1994. Hüttig, Gustav F. and Pietzka, G. **The adsorptive binding of methanol and ethanol on the oxides of silicon, titanium, zirconium, and thorium.** *Monatsh.* **78**, 185-92 (1948).—*C.A.* 42, 7598*c*.

Adsorption isotherms for MeOH, EtOH, and CCl_4 were detd. on SiO_2, TiO_2, ZrO_2, and ThO_2. The data were plotted according to the Huttig equation for multilayer adsorption. For a given adsorbent, the vol. of gas required to form a monolayer was independent of the temp. of the adsorbent. The vol. of MeOH required to form a monolayer was always larger than the vol. of EtOH.

1995. Hüttig, Gustav F. and Zagar, L. **The activated state of desorbed gas molecules.** *Monatsh* **79**, 581-5 (1948).—*C.A.* 43, 4088*a*.

O_2 and CO were mixed after passing through concentric tubes in a furnace at 280°C. No CO_2 was formed in the absence of a catalyst. With Al_2O_3 or platinized asbestos in both tubes, much CO_2 was formed even though the gases travel 1.5 cm beyond the catalyst before mixing. If only the O_2 passed over the catalyst, scarcely less reaction occurred; but if only the CO passed over the catalyst, no CO_2 formed.

1996. König, Hans. **The lattice constants of γ-alumina.** *Naturwissenschaften* **35**, 92-3 (1948).—*C.A.* 44, 2320*e*.

All Al_2O_3 films that were in contact with Al at 800°C gave a lattice const. of 7.89 A. ±0.01 regardless of their previous history. On the other hand, films that were heated at 800°C in air or O_2 without Al support had consts. of more than 8.00 A.; the highest value of 8.06 was obtained by heating in O_2 at 800°C. High consts. can be lowered by heating at 800°C *in vacuo* for several hrs or by vaporizing Al onto them.

1997. Milligan, W. O.; Whitehurst, Harry B., and Bushey, G. L. **Sorption-desorption characteristics of hydrous oxide pigments.** *Official Digest Federation Paint & Varnish Production Clubs* No. **283**, 601-9 (1948).—*C.A.* 42, 8491*c*.

Red iron oxide pigments consisted essentially of crystals of Fe_2O_3. Surface areas varied from 10 to 21 m^2/g. Black iron oxide pigments consisted essentially of Fe_3O_4 crystals, together with a possible trace of Fe_2O_3. The surface areas from 57 to 105 m^2/g paralleled the relative size of the primary particles. The brown iron oxide possessed the relatively large surface area of 620 m^2/g. The 2 yellow iron oxide pigments (Fe_2O_3-H_2O) examd. formed a pair of pigments covering a wide range of properties. One had a low surface area of 24 m^2/g whereas the second had a large surface of 425 m^2/g.

1998. Miyahara, Yutaka and Sano, Isamu. **Adsorption of water vapor by zinc oxide.** *J. Chem. Soc. Japan, Pure Chem. Sect.* **69**, 90-1 (1948).—*C.A.* 44, 9223*d*.

The adsorption of water vapor at 4.6 mm Hg at 30-400°C was detd. gravimetrically. There were 2 types of adsorption, phys. adsorption ending at about 200°C and activated adsorption beginning at 200°C. The mechanism of catalytic action was discussed.

1999. Norton, F. H. **Fundamental study of clay. VIII. A new theory for the plasticity of clay-water masses.** *J. Am. Ceram. Soc.* **31**, 236-41 (1948).—*C.A.* 42, 7949*i*.

A new mechanism of plasticity was suggested, called the "stretched-membrane theory," in which it was postulated that the particles in the plastic mass were always acted on by two forces in equil.; one, the repulsion between the particles; the other, a compressing together of the particles by the capillary force of the water film, or membrane, on the surface of the mass. This capillary force was calcd. as being 75-2400 lb/in^2 with variations in particle size 8.0-0.25μ.

2000. Rotinyan, A. L. **Velocity of the reaction between hydrogen sulfide and certain metal oxides** *Zhur. Priklad. Khim. (J. Applied Chem.)* **21**, 807-9 (1948).—*C.A.* 43, 8817*i*.

The kinetics of the reaction between gaseous H_2S and solid HgO, MnO_2, or PbO_2 (in grains of 1.5-2.0 mm) were derived from published exptl. data. A 1st-order chem. reaction, of rate const. k, was assumed at the surface of the grains, followed by further reaction between the H_2S diffusion with a diffusion coeff. D, through a sulfide rind of growing thickness, and the progressively shrinking oxide core of the grain. The rate of consumption of gaseous H_2S from the space was calculated.

2001. Schröder, Wilhelm. **Investigations of the changes in the thermal transformation series γ-AlOOH → γ-Al_2O_3 → α-Al_2O_3 by Otto Hahn's emanation method and X-rays.** *Z. Ekektrochem.* **52**, 133-9 (1948).—*C.A.* 43, 5300*d*.

γ-AlOOH upon heating at low and high temp. was subject to chem. and allotropic transformations as well as changes of active states of the surface area. The results were supported by both analytical and X-ray investigations. The crystal type and the av. size of the primary particles were detd.

2002. Schröder, Wilhelm. **The influence of the Tammann exchange temperature and loss of adsorption water on emission-power curves, obtained by the Otto Hahn method, for variously prealtered oxides.** *Z. Elektrochem.* **52**, 166-9 (1948).—*C.A.* **43**, 8822*c*.

The Tammann exchange temp. (0.52 × m.p. °K) coincided with pronounced min. in plots of percentage emission power *vs.* T in the Hahn emission method. The minima in the hydroxide curves, corresponding to the loss of water, formation of the oxide, and the Tammann exchange temp. were as follows: For $Be(OH)_2 \rightarrow BeO$, 1185°C, for γ-$FeOOH \rightarrow \alpha$-Fe_2O_3, 685°C, for titanic acid $\rightarrow TiO_2$, 792°C. For α-$AlOOH \rightarrow \alpha$-Al_2O_3 there appeared no influence of the exchange temp. (932°C) on the emission power.

2003. Sweep, W. R. **Determination of the activity of fresh iron oxide.** *Het Gas* **68**, 72-3 (1948).—*C.A.* **42**, 6515*h*.

The Seil method for detn. of activity of gas-purification oxide was described with slight variations.

2004. Zawadzki, J. **The action of gaseous acidic oxides on solid metal oxides. The decomposition of carbonates, sulfates and sulfites.** *Festskr., J. Arvid Hedvall* **1948**, 611-34.—*C.A.* **42**, 7648*g*.

The extent of decompn. of calcite contained in a narrow tube decreased with increasing distance below the surface. This was a result of the fact that CO_2 formed in the deeper layers cannot diffuse away fast enough so that its pressure approached the equil. pressure (p_o) more closely than at the surface. With a layer of $ZnCO_3$ so thin that slow diffusion of CO_2 through the solid was not a complication, the velocity was related to the decompd. part of the carbonate. At 440°C CO_2 was adsorbed by ZnO after its evolution from the $ZnCO_3$, an effect which increased with increase in temp. The final product at 440°C contained 9% CO_2 and, when examd. by x-rays, showed the faintly marked cryst. lattice of the oxide but no evidence of $ZnCO_3$.

2005. Zomosa, R. Abdon. **Determination of critical humidities in drying.** *Rev. ing. quim., Univ. Conception* **7**, 121-8 (1948).—*C.A.* **43**, 3246*c*.

In the drying of spheres of Fe_2O_3 (10 mm diam.) in a circulating air drier with const. heat input, the material was weighed every 10 min. until drying was very slow, and then at 15-, 25-, and 30-min. intervals. Results were plotted as wt loss vs. time. The point at which the initial straight line started to curve was the crit. humidity.

2006. Abe, Ryûji; Yoshioka, Ei, and Uyeda, Ryozi. **Mechanism of iron-rust formation.** *Science* (Japan) **19**, 472 (1949).—*C.A.* **45**, 5496*d*.

Several kinds of iron rusts were examd. by electron diffraction. Green rust of Fe has the formula $2FeO.Fe_2O_3.H_2O$ and decompd. into FeO and Fe_3O_4 (magnetite) when heated *in vacuo*. Although the crystal of $Fe(OH)_3$ was not recognized, the substance β-$Fe_2O_3.H_2O$ was probably present.

2007. Allen, J. A. and Lauder, I. **Oxygen exchange with oxides.** *Nature* **164**, 142-3 (1949).—*C.A.* **43**, 8821*i*.

Preliminary results were reported for the exchange between O_2 and CuO, Co_3O_4, CoO, and NiO, obtained by the use of O_2 contg. 1.4% O^{18}. The temp.-percentage exchange relation at 4 hrs reaction time was investigated between 400-1000°C for each of the 4 oxides. The rate of the exchange, and the effect of pressure, were investigated at 700° and 800°C for Co_3O_4 only.

2008. Brey, Wallace S. Jr. and Krieger, K. A. **The surface area and catalytic activity of aluminum oxide.** *J. Am. Chem. Soc.* **71**, 3637-41 (1949).—*C.A.* **44**, 2709*i*.

Al_2O_3 prepd. by heating in vacuum and in H_2O vapor at 500° to 1000°C were measured for the dehydration of EtOH at reaction temps. of 350° and 400°C. Both total activity and specific activity decreased as the prepn. temp. increased above 600°C. Heating with H_2O vapor induced an addnl. loss of area and activity as compared with heating in vacuum, but the specific activity of the surface was nearly independent of the presence of H_2O. Changes of activity with use were the result of changes in the H_2O content of the surface, rather than in surface area.

2009. Danil'chenko, P. T. **Application of physicochemical analysis to the study of amorphous hydrated oxides (dehydration on the solid-liquid interphase).** *Izvest. Sektora Fiz.-Khim. Anal., Inst. Obshchei i Neorg. Khim., Akad. Nauk S.S.S.R.* **19**, 227-34 (1949).—*C.A.* **45**, 427*i*.

The hydrogels were dehydrated under solns. of various pressure under such condition that formation of a meniscus for capillary adsorption was precluded. The chemically bound H_2O was differentiated from the other kinds of H_2O by detg. it through the 3rd-component method. The curves x, p and x, t obtained under these circumstances were steplike, as were the curves for cryst. hydroxides, where x = compn., $p = H_2O$ pressure, t = temp.

2010. Dent, F. J. and Moignard, L. A. **The purification of town gas by means of iron oxide. I. The hardening of oxide in purifiers. II. Preliminary experiments on the extraction of sulfur from spent oxide.** *Gas Research Board copyright Pub.* No. **GRB 52**, 39 pp. (1949); *Gas World* **130**, 1932-7 (1949); **131**, 119-25 (1950).—*C.A.* **44**, 3237*a*.

Hardening of oxide depended upon the migration of Fe oxide and S, in the presence of moisture, towards the points of contact between the particles. Next, a continuous, cellular structure developed, covered with a dense skin of Fe sulfide assuming a high activity, but the subsequent formation of the dense skin gave rise to hardening. Hardening can be prevented or delayed by maintaining H_2O in the oxide, by controlling the use of revivification air, and by avoiding over-heating in the boxes.

2011. Di Giulio, Giacomo. **Active alumina.** *Chimica e industria* (Milan) **31**, 360-2 (1949).—*C.A.* **46**, 662*e*.

Different types of active Al_2O_3 were prepd., and their dehydrating action was studied by a dynamic method. The satn. point is defined as the point at which total dehydration of air ends. Silica gel can adsorb much more water than Al_2O_3 but its satn. point is lower than that of Al_2O_3.

2012. Dominé-Bergès, Marthe. **The oxide CrO_2.** *Compt. rend.* **228**, 1435-7 (1949).—*C.A.* **43**, 7363*c*.

The thermal decompn. of hydrated Cr_2O_3 in air results in simultaneous dehydration and oxidation to CrO_2, which was stable in the temp. interval 320-400°C, but not at higher temps. The heating of hydrated Cr_2O_3 in a P_2O_5 vacuum resulted in a continuous wt loss with increasing temp., even in the interval 320-400°C, whereas heating in air produced a product of const. wt thought to be CrO_2.

2013. Forestier, Hubert; Haasser, Charles, and Longuet-Escard, J. **Reaction in the solid state at low temperature. Influence of the state of the surface and of the water vapor adsorbed.** *Bull. soc. chim. France* **1949**, Mises au point D146-521.—*C.A.* **43**, 6059*h*.

Magnetic detection of ferrites was used to study the rate of reaction between solid Fe_2O_3 and oxides of Ni, Pb, and Mg at temps. low enough for diffusion to be neglected. For Ni and Pb, reaction can be detected at 200°C; for Mg, only above 400°C. Starting mixts. were prepd. in 3 ways: (A) copptn. followed by drying at 100°C *in vacuo*; (B) sep. pptn. and drying followed by mixing, (C) sep. pptn. and drying at 750°C followed by grinding. The rate and extent of reaction at a given temp. (up to 700°C) are $A>B>C$. The presence of water vapor even in trace amts. considerably increased the rate of reaction for A and B and had a small effect for C.

2014. Forestier, Hubert and Kiehl, Jean Pierre. **Effect of gaseous adsorption on the velocity of reaction of metallic oxides.** *Compt. rend.* **229**, 47-9 (1949).—*C.A.* **44**, 403*g*.

Yields of ferrite from powd. Fe_2O_3 and NiO heated in H_2O, CO_2, O_2, air, N_2, Ne, A, and He at 600°, 650°, and 700°C plotted as isotherms against abs. temp. of liquefaction of the gases gave smooth curves except for N_2. Yields decreased with particle size. The gases were most readily-adsorbed in the order named and adsorption swelled the particles till they shattered.

2015. Forestier, Hubert and Kiehl, Jean Pierre. **The reactions between solid oxides in vacuo.** *Compt. rend.* **229**, 197-9 (1949).—*C.A.* **43**, 8930*f*.

The velocity of the reaction $NiO + Fe_2O_3 \rightarrow NiO.Fe_2O_3$ was a linear function of the log of the pressure, and approached zero as the pressure approached zero. Samples of the oxides copptd. to minimize diffusion showed that adsorbed gases had a marked effect on the rate of reaction. At low temp. with a gas present the reaction occurred between small amts. of the solids dissolved in the layer of gas adsorbed on the solid surface.

2016. Frederikse, H. P. R. **The specific heat of adsorbed helium.** *Physica* **15**, 860-2 (1949).—*C.A.* **44**, 3322*g*.

Sp heats of He adsorbed on jeweller's rouge, measured from 1.0 to 2.5°K, were strongly dependent on the thickness of the films. With decreasing film thickness from approx. 12 to 3 layers the max. of the sp-heat curve was flattened and shifted towards lower temps. Above 1.6°K the sp heats were smaller, but at 1.0°K larger than those of liquid He.

2017. Fricke, R. and Kubach, J. **Investigation of conversion processes in the reaction series $Cu(OH)_2 \rightarrow CuO \rightarrow Cu \rightarrow CuO$ with pure substances and on kieselguhr as a carrier with the emanation method of Otto Hahn, with a few notes on the "copper tower."** *Z. Elektrochem.* **53**, 76-82 (1949).—*C.A.* **43**, 6063*g*.

Thermal decompn. of pure $Cu(OH)_2$ was followed by wt loss and by the emanation method at 150-160°C. Since all the H_2O was not lost, a Cu hydroxide contg. less than one H_2O per mol. was indicated. The reduction of CuO and CuO on kieselguhr with H_2 gave pyrophoric Cu in both cases, but the Cu from CuO recrystallized whereas that on kieselguhr did not. Kieselguhr suppressed the tendency for cryst. rearrangements in these compds.

2018. Gard, C. D. **Utilization of carbon monoxide extracted from natural gas in the production of Dry Ice. I. Extraction of hydrogen sulfide and carbon dioxide from natural gas. II. The manufacture of Dry Ice.** *Gas* **25**, No. 2, 30-6 (1949).—*C.A.* **43**, 2711*g*.

A 20% soln. of ethanolamine in water was used to remove the CO_2 with a min. amt. of H_2S. The natural gas was further purified by scrubbing with a suspension of iron oxide in Na_2CO_3 soln. to remove H_2S. This soln. was reactivated by air agitation in long troughs, and the iron oxide returned to the system, any losses being made up with $FeCl_3$. The gas leaving this scrubber had a H_2S content of 3.4 grains, readily removed by dry purifier boxes; about 1100 lb of S was recovered per day. Before liquefaction, H_2O was removed with activated Al_2O_3.

2019. Givaudon, Jean; Nagelstein, Ernest, and Leygonie, Robert. **Formation of chromic anhydride from chromic oxide at 520°.** *Compt. rend.* **228**, 1868-9 (1949).—*C.A.* **43**, 8296*f*.

Cr_2O_3 deposited on Al_2O_3 and submitted to the action of a current of air at 520°C formed CrO_3; this can be reduced to Cr_2O_3 by H_2.

2020. Higuchi, Izumi. **Dielectric properties of substances in the sorbed state.** *Science Repts., Tôhoku Univ.* **33**, 99-107 (1949).—*C.A.* **44**, 7105*e*.

The apparent dielec. const. of substances sorbed on titania gel increased with successive addn. of propyl alc. and isoamyl alc. over a range from 60 to 70°C. In a lower range of concn. the polarization of the sorbed substance showed very different behavior from the ordinary liquid. At higher concn. the sorbed substance showed behavior analogous to that of the free liquid in respect to the dielec. polarization.

2021. Hutchison, Clyde A. and Malm, John G. **The volatilization of beryllium oxide in the presence of water.** *J. Am. Chem. Soc.* 71, 1338-9 (1949).—*C.A.* 43, 5431*h*.

BeO reacted with water vapor at 1250°C or greater to form an unidentified volatile substance. This substance condensed with decompn. to BeO.

2022. Jayaraman, A. and Srikantan, B. S. **System [Al_2O_3-H_2O] in relation to the dehydrating properties of alumina.** *J. Indian Chem. Soc.* 26, 63-6 (1949).—*C.A.* 43, 8833*h*.

Dehydration of $Al(OH)_3$ from 100° to 400°C showed that the prepn. (I) from Na_3AlO_3 by pptn. with CO_2 exhibited a transition at 220°C between systems having the limiting compns. $Al_2O_3.3H_2O$ and Al_2O_3-H_2O. Prepns. (II) from $Al(NO_3)_3$, $Al(OAc)_3$, or ammonium alum by pptn. with NH_4OH give continuous desorption curves. The ability of Al_2O_3 to hold H_2O in zeolitic condition gave a more active catalyst than either chem. or lattice-type binding.

2023. Kiselev, A. V. and Smirnova, I. V. **Peculiarities of the sorption of water by active alumina.** *Zhur. Fiz. Khim.* 23, 1018-24 (1949).—*C.A.* 44, 899*h*.

Adsorption and desorption isotherms of MeOH and EtOH vapors on Al_2O_3 ignited at 550°C were reproducible; there was hysteresis above the relative vapor pressure $p/p_s = 0.5$, whereas at p/p_s less than 0.5 both isotherms coincided. Adsorption of H_2O by these Al_2O_3 specimens increased after every adsorption-desorption cycle until 1 g of the sorbent contained 5-7 millimol. H_2O; then ad- and desorption became reproducible with hysteresis above $p/p_s = 0.5$. The (liquid) vol. of H_2O adsorbed was, at small p/p_s, 2-3 times that of MeOH or EtOH. A mixt. of SiO_2 and Al_2O_3 behaved like Al_2O_3.

2024. Kolarow, Nikola. **Reduction of some oxides with hydrogen. II.** *Compt. rend. acad. bulgare sci., math. et natur.* 2, 45-8 (1949). (in German).—*C.A.* 44, 1353*a*.

For CuO, MnO_2 and, PbO_2, the temp. of initiation of H_2 reduction was raised 10-25°C by previous heating in O_2, N_2, or CO_2, or by treatment with 20-30% H_2O_2.

2025. Lecuir, René. **Sintering of pure oxides.** *Bull. soc. chim. France* 1949, D227-30.—*C.A.* 43, 7205*e*.

MgO particles were heated to 150°C in a mech. mixer in the presence of urea and after being cooled the mass was passed through a 100-mesh sieve. It was sintered at a min. pressure of 200 kg/cm^2 by raising the temp. to 1420°C at a rate of 74° per hr and maintaining it for 8 hrs. Satisfactory results were obtained by this general method with MgO, BeO, and Al_2O_3. Al_2O_3 compacts prepd. in the presence of urea had much higher strengths than those prepd. in the absence of org. material.

2026. Mansfield, R. **The electrical properties of bismuth oxide.** *Proc. Phys. Soc. (London)* 62B, 476-83 (1949).—*C.A.* 44, 1299*f*.

The cond. and thermoelec. power of Bi_2O_3 was detd. from 680° to 150°C, and at O_2 pressures from 76 to 10^{-4} cm Hg. The variations with O_2 pressure were less than 10%, except at pressures less than 10^{-3} cm Hg when the sign changes above 550°C. Bi_2O_3 becomes an excess or intrinsic semiconductor. The cond. in Bi_2O_3 is due to an excess of O_2 or lattice defects produced by the absence of Bi^{+++} ion, and cond. is by pos. holes.

2027. Miyahara, Yutaka and Sano, Isamu. **Adsorption of water vapor by zinc oxide. II.** *J. Chem. Soc. Japan, Pure Chem. Sect.* 70, 3-4 (1949).—*C.A.* 45, 2741*f*.

The adsorption isotherm of water vapor on ZnO was measured at 234°C. The isotherm belongs to the Langmuir type. The heat of adsorption was calcd. to be 10 kcal. from the previous isobar data and the present data, and calcd. to be 27 kcal. from the data from the chem. const. of water.

2028. Pappas, Alexis C. **Use of porous materials to store dissolved acetylene in bottles.** *Chimie & Industrie* 61, 25-8 (1949).—*C.A.* 43, 7212*c*.

For the transportation of C_2H_2 dissolved in Me_2CO, porous absorbent masses were used, such as (1) ceramic materials (e.g. pumice, kieselguhr, asbestos) with binders, (2) powd. or granulated materials without binder, and (3) fibrous materials. Ceramic masses gave the best results.

2029. Selwood, P. W. **The structure of solid catalysts and the phenomenon of valence induction.** *Bull. soc. chim. France* 1949, D167-9.—*C.A.* 43, 6897*e*.

The magnetic properties of the oxides of transition metals, adsorbed in small concn. on inert supports, are approx. those of paramagnetic ions that have been magnetically dild. This effect is utilized to study the state of dispersion and oxidation of catalysts with promoting action, such as Cr_2O_3-Al_2O_3 mixts. Mn on a γ-Al_2O_3 support assumes a trivalent state, but on finely divided TiO_2 the Mn assumes the tetravalent state.

2030. Selwood, P. W.; Ellis, Marylinn, and Wethington, Kathryn. **Supported oxides of iron.** *J. Am. Chem. Soc.* 71, 2181-4 (1949).—*C.A.* 43, 8831*g*.

Susceptibility isotherms for iron oxides contg. up to 7.1% Fe, supported on high-area γ-alumina and on rutile at -171°, -87°, and 25°C are of the same general shape as those reported for other transition-group oxides. Partial covalent bonds between adjacent atoms causes Fe(III) on γ-alumina to be almost midway between slight diminution of moment as found for Cr and the almost complete loss noted in Mo and Rh.

2031. Staley, H. R. and Greenfeld, S. H. **Surface areas of quicklimes.** *Ind. Eng. Chem.* 41, 520-2 (1949).—*C.A.* 43, 3988*g*.

The calcining characteristics of a high-calcium limestone were studied in the residual atm. of a muffle furnace and the surface areas detd. by the adsorption of liquid N_2. In general, once CO_2 had been liberated completely the surface area decreased from 2.01 m^2/g for 1 hr of burning at 1800°F to 0.15 m^2/g for 16 hrs of burning at 2400°F.

2032. STANLEY, ALAN AND MEAD, JOSEPH C. **Sintering characteristics of minus sixty-five and twenty mesh magnetite.** *J. Metals* 1, No. 7, Trans. 435-40 (1949).—*C.A.* 43, 6553*e*.

The best quality and quantity of sinter were obtained with the following mix: 4.0% coal, 25.0% return fines (-10-mesh +0) (at least 18.75% -10-mesh plus 35-mesh); 70.3% magnetite (-65-mesh size), 0.7% slaked lime. The av. production with the above "mix" was 246 lb/hr/ft^2 of grate area. A more accurate metallurgical control on overall operation will be necessary for sintering -65-mesh magnetite than is needed in present plant operation for sintering -20-mesh magnetite.

2033. STEPHANOU, S. E.; SCHECHTER, WILLIAM H.; ARGERSINGER, W. J. JR., AND KLEINBERG, JACOB. **Absorption of oxygen by sodium peroxide; preparation and magnetic properties of sodium superoxide.** *J. Am. Chem. Soc.* 71, 1819-21 (1949).—*C.A.* 43, 7363*f*.

Sodium superoxide (NaO_2) was prepd. from O_2 and Na_2O_2 at elevated temps. and pressures; a max. yield of 92% was obtained in 100 hrs at 490°C and 298 atm. NaO_2 was a yellow, hygroscopic powder, decompg. quantitatively to O_2 and Na_2O_2 when treated with 20% HOAc in CCl_4. It was paramagnetic.

2034. VARGA, JÓZSEF AND POLINSZKY, KÁROLY. **Dehydration of Hungarian bauxites.** *Magyar Kém. Lapja* 4, 589-92 (1949).—*C.A.* 45, 993*h*.

Six bauxite samples were treated at 5-350 atm. pressure in gas-heated rotating autoclaves. Hydrargillite begins to change into böhmite at about 240°C as the first step in the loss of water. The second step occurs at about 470°C when böhmite changes into corundum and another portion of water evaps. The effect of dehydration on the decompn. of bauxite by means of alkalies was also investigated. Dehydration at 20 atm. pressure for 30 min. had no adverse effects. Dehydrated bauxite did not contain more than 1.5-3.0% hygroscopic H_2O after storing for 1 month.

2035. WHITE, LOCKE, JR. AND SCHNEIDER, CHARLES H. **Physical adsorption from mixtures of gases. I. Oxygen-nitrogen and Oxygen-argon at -185.6°.** *J. Am. Chem. Soc.* 71, 2593-600 (1949).—*C.A.* 44, 2819*b*.

Cr_2O_3 gel was activated at 150°C to 0.001 mm Hg. Adsorption pressures were attained in 30 to 45 min. independent of which gas was adsorbed first. The total gas adsorbed from a mixt. at any set of conditions tends to agree with Hill's equation. With allowance for capillary condensation, the theoretical and exptl. isotherms agree semi-quantitatively.

2036. WICKE, E. **Oxide contacts and their behavior in dehydrogenation and dehydration.** *Z. Elektrochem.* 53, 279-85 (1949).—*C.A.* 44, 2356*i*.

The chemisorption of H_2 and H_2O on ZnO and γ-Al_2O_3 and the catalytic decompn. of alcs. on these oxides take place on regular crystallographic surface points and not on accidental lattice defects or other irregularities. With ZnO H-bonding takes place on faces carrying Zn ions at the outside resulting in hydride-like adsorption compds., or in dehydrogenation reactions, whereas crystal faces carrying O ions at the outside yield hydroxide-like adsorption compds. and dehydration reactions by means of H-exchange. With γ-Al_2O_3 the active centers are normally vacant Al sites, at which surface OH groups are formed, and at which dehydration of alcs. occurs.

2037. WILLIAMS, A. E. **Activated alumina.** *Can. Chem. Process Inds.* 33, No. 1, 41-3 (1949).—*C.A.* 43, 2379*i*.

Activated Al_2O_3 is being used increasingly in a variety of industries, including gas drying, liquid drying, dehydration of solids, and as a catalyst. Its regenerative property permits repeated use.

2038. ANTIPINA, T. V. AND FROST, A. V. **Connection between the kinetics of a heterogeneous reaction and adsorption on catalysts.** *Zhur. Fiz. Khim.* 24, 860-70 (1950).—*C.A.* 45, 937*d*.

The kinetics of the catalytic dehydration of EtOH and also the adsorption of H_2O and EtOH vapors on Al_2O_3 were expressed by equations that assume a uniformity in both catalyzing and adsorption surfaces. The adsorption coeffs. of the products of the dehydration of EtOH were detd. by studying the rate of the heterogeneous catalytic reaction from the absorption data. The adsorption and catalyzing centers are different.

2039. ANTIPINA, T. V. AND FROST, A. V. **Relation between the kinetics of heterogeneous reactions and the adsorption on catalysts. I. Determination of the adsorption coefficient of water on aluminum oxide from kinetic data.** *Vestnik Moskov. Univ.* 5, No. 3, *Ser. Fiz.-Mat. i Estest. Nauk* No. 2, 81-6 (1950).—*C.A.* 45, 4540*i*.

The rate of the dehydration $EtOH \rightarrow C_2H_4 + H_2O$ in a flow system was detd. at 380°C on (alkali and alkaline-earth metal free) Al_2O_3. These data were used to det. b_i (adsorption coeff. multiplied by the total pressure and the stoichiometric coeff.) of H_2O, on the basis of the Langmuir isotherm.

2040. CIRILLI, VITTORIO. **Solid solutions of γ-Fe_2O_3 and γ-Al_2O_3.** *Gazz. chim. ital.* 80, 347-51 (1950).—*C.A.* 45, 1828*c*.

By treatment of a solid soln. of Al_2O_3-Fe_2O_3 (50:50) with hot aq. NaOH, most of the Al_2O_3 can be removed. After treatment with NaOH, the products were washed thoroughly, dried at 110-20°C, and examd. With increase in Fe_2O_3, the magnetic susceptibility increased to a max. at a content of Fe_2O_3 of 90.4%, then decreased abruptly for higher Fe_2O_3 contents. The expts. show that Fe_2O_3 and Al_2O_3 were mutually sol. in all proportions, even close to room temp. The magnetic susceptibility of the solid soln. contg. 90.4% Fe_2O_3 was high compared with that of normal Fe_2O_3, but low compared with that of γ-Fe_2O_3, because of the size of the microcrystals. Solid solns. of Fe_2O_3-Al_2O_3 are catalysts of the thermal decompn. of N_2O above 300°C.

2041. DEMIDOVA, L. D. AND GONCHAROV, V. V. **"Active oxides" in dead-burned magnesite.** *Ogneupory* 15, No. 2, 66-9 (1950).—*C.A.* 44, 6587*h*.

The concept of active oxides in dead-burned magnesite was without significance because it was impossible to differentiate or to sep. one portion of the total MgO and CaO from another in the hydration process of magnesite. The magnitude of hydration (loss during calcination) of dead-burned magnesite increased continuously with extent of aging. Although the hydration proceeded faster during the first than in the subsequent periods of aging, this was more plausibly explained by the development, during the second period of hydration, of the protective action of $Mg(OH)_2$ which envelops the grains of MgO (periclase).

2042. Dunoyer, J. M. **A kinetic study of the reaction between a gas and a pulverized solid substance.** *J. chim. phys.* 47, 290-302, discussion 302-3 (1950).—*C.A.* 44, 7631*a*.

The importance of diffusion of the gas into a granular solid was treated mathematically. The reduction of MoO_3 to MoO_2 by flowing H_2 was studied at 365, 372, 383, 394, 405, and 445°C by a gravimetric method. The raction was unimol. and first-order, and the energy of activation was 46,000 cal/mole.

2043. Forestier, Hubert and Kiehl, Jean P. **Effect of adsorbed gases on the rate of reaction between metallic oxides.** *J. Chim. phys.* 47, 165-73 (1950).—*C.A.* 44, 7128*c*.

The rate of formation of ferrite from Fe_2O_3 and NiO increased logarithmically with the partial pressure of H_2O over the pressure range 10^{-5} to 760 mm at 500 to 700°C. Extrapolation indicated zero reaction rate at 10^{-9} mm. The order of decreasing efficiency of gases in speeding up the reaction in the temp. range 600° to 700°C was H_2O, CO_2, A and O_2, air, N_2, Ne and He.

2044. Frederikse, H. P. R. and Gorter, C. J. **Investigations on the adsorption of helium at very low temperatures.** *Physica* 16, 402-18 (1950) (in English).—*C.A.* 45, 1837*f*.

Adsorption isotherms of He were measured on jewelers rouge and steel between 1.3 and 2.3°K. The isotherms were sigmoid shaped. N_2, O_2, and A were also adsorbed at higher temp. for comparison purposes. The no. of He mols. adsorbed in the 1st layer on the adsorbents was about 4 times the no. of N_2, O_2, or A mols. The adsorption potentials were not independent of the temp. for He. At $T = 2.182$°K and when the amt. of gas adsorbed in the 1st layer $= 40 \times 10^{-10}$ mol./cm^2, the entropy was 3.5 cal/mol. degree when the total amt. of gas adsorbed was 26.54×10^{-10} mol./cm^2, 7.0 at 25.63×10^{-10}, and 11.4 at 22.56×10^{-10}, resp.

2045. Gachkovskii, V. F. **Fluorescence of magnesium phthalocyanine and of chlorophyll in different states. Effect of oxygen on the fluorescence of magnesium phthalocyanine and of chlorophyll in the adsorbed state.** *Doklady Akad. Nauk S.S.S.R.* 70, 51-4 (1950).—*C.A.* 45, 3720*c*.

Absorption and fluorescence spectra of Mg phthalocyanine adsorbed on MgO (from EtOH soln., and outgassed *in vacuo*) showed, as in soln., mirror-like disposition of the bands. In the adsorbed state, the whole band system was shifted to shorter waves as compared with the soln. Desorption of O_2 at 20°C resulted in an increase of the intensity of the fluorescence up to the max., but on further desorption the intensity remained at the max., unless the O_2 was removed by outgassing at the previous outgassing temp. The intensity-increasing effect of O_2 (and the org. compds. mentioned) might be explained by a dedimerization of the adsorbed mols.

2046. Ghosh, J. C.; Sastri, M. V. C., and Vedaraman, S. **Adsorption studies on methanol-synthesis catalysts. I. Adsorption of carbon monoxide and hydrogen on zinc oxide-chromium oxide mixture.** *Current Sci. (India)* 19, 342 (1950).—*C.A.* 45, 7406*g*.

The range studied was 50° to 200°C for CO and up to 250°C for H_2. The adsorption isobars of CO at pressures below 1 atm. showed 2 max., one at 52°C and the other at 178°C. The activation energy was 5 to 8.5 kcal, and the heat was 6 kcal. for 0.9 cc. adsorption/g. Activated adsorption was observed for H_2 at the lowest temp.; the heat was 10 kcal. for 1.30 cc. adsorption/g and the energy of activation was 8.5 kcal for 1.19 cc. adsorption/g at 37 cm pressure.

2047. Johnson, P. D. **Behavior of refractory oxides and metals, alone and in combination, in vacuo at high temperatures.** *J. Am. Ceram. Soc.* 33, 168-71 (1950).—*C.A.* 44, 6092*b*.

Changes in bulk d., shrinkage, and wt were detd. for carbon and for dry-pressed specimens of BeO, MgO, ZrO_2, ThO_2, Mo, and W after firing for 2, 4, and 8 min. in vacuo, at 100° intervals from 1500° to 2300°C. The limiting factor for many refractories was not the m.p., but stability when in contact with other substances, and the rate of volatilization. BeO was the most stable in contact with carbon, ZrO_2 most stable in contact with Mo, and ThO_2 most stable in contact with W. The most stable oxide mixts. were ZrO_2 with ThO_2 and MgO with ThO_2.

2048. Kuczyński, W. and Zagórski, Z. **Adsorption of benzene on several kinds of activated alumina.** *Roczniki Chem.* 24, 211-17 (1950) (English summary).—*C.A.* 46, 5398*e*.

The adsorption of C_6H_6 vapor at 25°C at relative pressures up to 0.4 was investigated. $Al(OH)_3$ was pptd. from the soln. of $Al_2(SO_4)_3$ by means of variable amts. of NH_4OH. The ppts. obtained were subjected to heat-treatment at the max. temp. of 400°C. For the concns. of C_6H_6 vapor investigated the acid gel showed the smallest adsorption; the two other kinds adsorbed almost equally in those circumstances, but the basic gel was somewhat superior in this respect.

2049. Lomer, P. D. **Electric strength of alumina films.** *Nature* 166, 191 (1950).—*C.A.* 44, 10423*i*.

Thin films of amorphous Al_2O_3 increased in elec. strength if the film thickness was less than 10^{-5} cm. The oxide was formed by "anodic oxidation" of Al evapd. in a vacuum on a glass optical flat.

2050. Lomer, P. D. **The dielectric strength of aluminum oxide films.** *Proc. Phys. Soc. (London)* 63B, 818-20 (1950).—*C.A.* 45, 5992*b*.

Dielec. strength was reported for films of thickness up to 1500 A measured interferometrically.

2051. Mesnard, Guy and Uzan, Roger. **Optical emissivity of thorium dioxide.** *Le Vide* 5, 844-52 (1950).—*C.A.* 45, 31*h*.

ThO_2 was deposited by cataphoresis on 0.10-mm W wire. The emissivity at 0.65 μ was obtained by comparing the brightness temps. of the coated and uncoated W wires. Emissivity increased with temp.

in nonactivated cathodes and decreased with temp. in activated cathodes. The thickness of the deposit and the time had a considerable influence on the emissivity, whereas the nature of the base material does not seem important.

2052. Miyahara, Yutaka. **Adsorption of water vapor by zinc oxide. IV.** *J. Chem. Soc. Japan, Pure Chem, Sect.*, 71, 536-8 (1950).--*C.A.* 45, 6454*g*.

The adsorption isotherm was detd. for the adsorption of water vapor by ZnO at 200-400°C. An equation was proposed that represented the exptl. data fairly well.

2053. Rijnders, G. W. A. and Schuit, G. C. A. **Adsorption of ammonia on surfaces of oxides.** *Rec. trav. chim.* **69**, 668-70 (1950).—*C.A.* **44**, 10444*a*.

The adsorption of NH_3 as a function of temp. and pressure on some oxides and oxide mixts. was studied. All observed adsorptions were within the monolayer, and NH_3 was not adsorbed by van der Waals forces but by chemisorption. The packing of the NH_3 mol. was strongly dependent on the nature of the surface.

2054. Roĭter, V. A.; Korneĭchuk, G. P.; Leperson, G.; Stukanovskaya, N. A., and Tolchina, B. I. **Experimental study of macrokinetic phenomena on porous catalysts.** *Zhur. Fiz. Khim.* **24**, 459-67 (1950).—*C.A.* **44**, 8214*g*.

A tube was sepd. in two by a membrane, about 1 cm thick, made of MnO_2 and asbestos. Through one half of the tube air contg. 0.002-0.008 ml/ml C_2H_2, and through the other half pure air was circulated. The C_2H_2 which diffused through the membrane was pptd. as Ag_2C_2 and detd. as Ag, and the CO_2 formed by oxidation of C_2H_2 was absorbed in $Ba(OH)_2$ and detd. The effective diffustion coeff. of C_2H_2 was 0.10 for the most porous and 0.01 cm^2/sec for the densest membrane used and was const. between 0° and 70°C.

2055. Schulek, Elemér and Pungor, Erno. **Titrimetric gas analysis. I. Determination of oxygen.** *Magyar Kém. Folyóirat* **56**, 250-5 (1950).—*C.A.* **46**, 378*g*.

For detg. O_2 content in gas samples contg. above 0.1 vol. %, the method was based on the absorption of O_2 by MnO at 200-50°C. This reagent was produced by heating $MnCO_3.2H_2O$ in N_2 to 300°C. The temp. was decreased to 200-50°, the gas sample passed through the app., the granulated glass (contg. Mn oxide) washed with HCl contg. KI and starch, and then titrated with 0.1 *N* $Na_2S_2O_3$. When analyzing gas samples with O_2 below 0.1 vol. %, the freshly pptd. $Mn(OH)_2$ was suitable for absorbing traces of O_2 in the gas sample.

2056. Schweckendiek, Otto E. **The behavior of iron oxide aerosols.** *Z. Naturforsch.* **5a**, 397-9 (1950).—*C.A.* **45**, 1840*h*.

$Fe(CO)_5$ was burned in air. Samples of aerosols taken after 120 min. and observed with the electron microscope showed considerable flocculation. The flocculates were primarily of a long-chain type. Under the influence of a slow, weak alternating elec. field, the chains were observed to twist in an S-shape in response to the field. The chains were primarily Fe_2O_3.

2057. Selwood, P. W. and Lyon, Lorraine. **Structure of oxide catalyst systems.** *Discussion Faraday Soc.* **1950**, No. 8, 222-9.—*C.A.* **45**, 9988*h*.

Magnetic-susceptibility isotherms were detd. for: vanadia + alumina; vanadia + rutile; chromia + rutile; copper oxide + magnesia; copper oxide + rutile; ruthenia + alumina; and Cu, Ni, Cr, and Fe oxides supported silica. Catalyst activity might be predicted in some cases from susceptibility measurements, especially when these were considered together with surface-area measurements.

2058. Shekhter, A. B. and Moshkovskii, Yu. Sh. **Physical structure and catalytic properties of zinc oxide.** *Doklady Akad. Nauk S.S.S.R.* **72**, 339-42 (1950).—*C.A.* **44**, 7132*i*.

ZnO was prepd. by decompn. of $ZnCO_3$ in vacuo at 350°C (samples *K*) or by oxidation of Zn dust in an elec. arc (samples *D*). By X-ray examn., heating from 350° up to 1000°C caused no change of either the deviation from lattice perfection or the grain size *S* with the *D* samples, whereas the *K* samples showed uniform increase of *S* and decrease of the degree of lattice perturbation with increasing temp. The surface area of $K_{(350°)}$ (80 m^2/g) fell to less than 4 for $K_{(700°)}$; for the *D* samples, it remained unchanged, 13-14 m^2/g between 350° and 1000°C. The catalytic activity in the decompn. of MeOH showed no connection with either the color of the luminescence or the X-ray structure.

2059. Tamele, M. W. **Chemistry of the surface and the activity of alumina-silica cracking catalyst.** *Discussions Faraday Soc.* **1950**, No. 8, 270-9.—*C.A.* **45**, 9989*i*.

The catalyst owed its activity primarily to a no. of acid sites located in the catalyst surface, which were formed in the prepn. by the condensation of the surface OH groups of the incompletely polymerized silica hydrogel with the OH of the hydrolyzed Al ions. The formation of acid was due to the tendency of the Al atom to acquire a pair of electrons, enhanced by the displacement of electrons in the Al-O-Si bonds toward the Si atom carrying 4+ charges. The electron pair was donated by H_2O, the OH became part of the structure, and the H^+ was held by electrostatic attraction.

2060. Tatievskaya, E. P.; Chufarov, G. I., and Antonov, V. K. **The rates of reduction of iron oxides.** *Zhur. Fiz. Khim.* **24**, 385-93 (1950).—*C.A.* **44**, 8209*d*.

Fe_2O_3, Fe_3O_4, and FeO were reduced by H_2 at similar rates. The surface areas (from N_2 adsorption at -195°C) were 0.85, 0.86, and 0.60 m^2/g, resp. The oxides were heated in H_2, the H_2O formed was frozen out, and the rate v of reaction was calcd. from the decrease in pressure p. At reductions below 10%, v was proportional to p_0^n, and the const. n was at 400° and 450°C, 0.68, and 0.83 for Fe_2O_3, 0.68 and 0.76 for Fe_3O_4, and 0.5 and 0.65 for FeO.

2061. Topchieva, K. V. and Ballod, A. P. **Poisoning and regeneration of the surface of adsorbents.** *Doklady Akad. Nauk S.S.S.R.* **75**, 247-50 (1950).—*C.A.* **45**, 2760*c*.

On an aluminosilicate catalyst (Al_2O_3 30%, SiO_2 70%), part of the vapor-phase-adsorbed MeOH was found to be adsorbed irreversibly, i.e. not to be desorbed on prolonged pumping without heating.

The fraction of MeOH adsorbed irreversibly increased by 30% with the relative pressure p/p_s increasing from 0.1 to 1. With a medium-porosity Al_2O_3 gel, of surface area 255 m^2/g, the original wt was restored after a few hrs at 400°C, whereas the wt of a coarse silica gel, of surface area 530 m^2/g, was not restored even after 3 days. With regard to stability of the bond of MeOH with the solid surface, the aluminosilicate catalyst evidently is intermediate between the Al_2O_3 and silica gels.

2062. WHALLEY, E. AND WINTER, E. R. S. **The exchange reactions of solid oxides. II. The exchange of oxygen between water vapor and certain metallic oxides.** *J. Chem. Soc.* **1950**, 1175-7.—*C.A.* **44**, 9220*c*.

Preliminary results were reported on the exchange of O^{18} between O_2-D_2O vapor and γ-Al_2O_3, ThO_2, and TiO_2. As in the exchange of O_2 with these substances there was an initial rapid reaction followed by a slow exchange. The rapid step may be due to exchange with surface oxide ions and part or all of the water contained in the Al_2O_3; the slow process may be due to exchange with O ions in the second layer of the lattice.

2063. WINTER, E. R. S. **The exchange reactions of solid oxides. I. The exchange of oxygen isotopes between gaseous oxygen and certain metallic oxides.** *J. Chem. Soc.* **1950**, 1170-5.—*C.A.* **44**, 9220*a*.

The exchange of O^{18} between O_2 and γ-Al_2O_3, ZnO, ThO_2, and TiO_2 was investigated at 360-600°C. The initial rapid reaction was followed by a slow reaction. For γ-Al_2O_3 the rapid exchange was first order and independent of O_2 pressure. The rate-detg. step of the initial rapid reaction was the exchange of adsorbed O^{18}-enriched gas and surface O ions, although it may be either adsorption or desorption. The subsequent very slow exchange may be due to (a) reaction with less active parts of the surface or (b) slow diffusion of O ions from the second layer to the surface.

2064. WINTER, E. R. S. **The use of O^{18} in studies of the reactivity of solid oxides.** *Discussions Faraday Soc.* **1950**, No. 8, 231-4, discussion 234-7.—*C.A.* **45**, 9981*i*.

O^{18} exchange between solid oxides and O_2 was followed continuously with a mass spectrometer. The apparent E for exchange was 27 ± 0.5 kcal for thorium oxide between 440° and 540°C. With Cr_2O_3 two processes were operative: (1) below 410°C, $E = 29.5 \pm 0.5$ kcal, (2) above 410°C, $E = 1 \pm 4$ kcal. The high value of E was ascribed tentatively to a limiting process governed by the rate of desorption of O_2 from the oxide surface.

2065. ANTIPINA, T. V. AND FROST, A. V. **Relation between the kinetics of heterogeneous reactions and the adsorption on catalysts. III. Temperature dependence of the adsorption coefficient of water on aluminum oxide.** *Vestnik Moskov. Univ.* 6, No. 10, *Ser. Fiz.-Mat. i Estestven. Nauk* No. 6, 79-87 (1951).—*C.A.* **46**, 8487*i*.

Flow expts. of dehydration of EtOH on Al_2O_3 were evaluated with the aid of the equation $v_0 \ln [1/(1-y)] = \alpha + \beta v_0 y$, where v_0 = space velocity in millimoles/min./cc. catalyst, y = degree of conversion, and α and β were functions of the temp. only, independent of v_0 and of y. The expts. were made in the presence of H_2O or of argon as diluent. The adsorption coeffs. b ($atm.^{-1}$) were detd. from the slopes of the linear graphs of $1/\alpha$ as a function of δ with H_2O and with argon; the values of b for H_2O, at 380, 415, and 350°C were 17.2, 14.5, and 12.2, and for C_2H_4, 16.0, 12.2, and 11.5.

2066. BLUE, R. W. AND ENGLE, C. J. **Hydrogen transfer over silica-alumina catalysts.** *Ind. Eng. Chem.* **43**, 494-501 (1951).—*C.A.* **45**, 2759*d*.

The transfer of H from *cis*-decahydronaphthalene, *trans*-decahydronaphthalene, and tetrahydronaphthalene to 1-butene and isobutene was studied. The reaction was of 1st order and occurred most rapidly over a catalyst compn. of 60-90% SiO_2. As a H donor, the *cis* compd. was about 10 times as active as the *trans*, and tetrahydronaphthalene more active than the *cis* compd. Isobutene was more active as H acceptor than 1-butene. The cause of catalyst deposit was studied by using 1-butene-$4C^{14}$, and largely attributed to the H-donor.

2067. BRAUER, G. AND HOLTSCHMIDT, U. **Cerium oxides. I.** *Z. anorg. u. allgem. Chem.* **265**, 105-16 (1951).—*C.A.* **46**, 7920*i*.

With com. pure CeO_2, measurable reduction by H_2 occurred at 500°C. The slightest impurity of Pr (0.005% Pr_2O_3) increased the reducibility.

2068. BREWER, LEO AND SEARCY, ALAN W. **The gaseous species of the aluminum-alumina system.** *J. Am. Chem. Soc.* 73, 5308-14 (1951).—*C.A.* **46**, 1855*g*.

The vapor pressures of Al (1383-1468°K) and of Al_2O_3 (2309-2605°K) were measured by the Knudsen effusion method. Al-Al_2O_3 mixts. were heated in Al_2O_3 containers, and changes in volatility of Al_2O_3 in the presence of Al were detd. in expts. from 1466 to 1853°K. The results indicated the importance of 2 gaseous oxides of Al. Al_2O gas was evolved when Al_2O_3 was heated with Al or another reducing metal. AlO appeared to be the principal Al species when Al_2O_3 was volatilized alone.

2069. CREMER, E. AND GRUNER, R. **Measurement of the adsorption of ammonia on ferric oxide from the thinnest coating to a multimolecular layer.** *Z. physik. Chem.* **196**, 319-28 (1951).—*C.A.* **45**, 8846*f*.

Adsorption isotherms of NH_3 were detd. on Fe_2O_3 prepd. in various ways; the pressure range was 0.001 to 700 mm Hg. Between 293° and 333° K the isotherms were consistent over the entire concn. range with the equation developed previously. At 253° K and high pressures there were deviations in the direction of thicker layers. An adsorption formula contained, in addn. to the usual factors, a const. characteristic of the system and having the dimensions of a temp. The value of this const. in the present case (approx. 1250) was almost independent of the temp. at which the adsorbent was prepd.

2070. GLAESER, RACHEL. **Organic-montmorillonite complexes in vapor phase. Desorption isotherms of acetone-montmorillonite and 2-propanol-montmorillonite.** *Mem. services chim. etat* 36, No. 1, 69-76 (1951).—*C.A.* 46, 11054*f*.

Ca montmorillonite and Na montmorillonite were treated with either anhyd. acetone or 2-propanol until no more H_2O was extd. The montmorillonite, covered with the org. compd., was placed over a soln. of the org. compd. in castor oil and allowed to come to equil. in vacuo (about 15 days), and then desorbed in vacuo over P_2O_5 at 40 °C or 20 °C. Both formed bimol.-layer complexes which, on desorption, changed to unimol.-layer complexes.

2071. GREGORY, J. N. AND MOORBATH, S. **Diffusion of thoron in solids. I. Investigations on hydrated and anhydrous alumina at elevated temperatures by means of the Hahn emanation technique.** *Trans. Faraday Soc.* 47, 844-59 (1951).—*C.A.* 46, 2367*b*.

Phase changes and recrystn. processes were clearly indicated in the heating of hydrated γ-Al_2O_3 in the range 100° to 1200 °C. Variation of O_2 partial pressure above α-Al_2O_3 showed how the diffusion of the inert gas depends on lattice defect equilibria. The diffusion consts. of Th in Al_2O_3 were calcd. by means of simple relations together with an approximation for mean particle size.

2072. HAUFFE, KARL AND PETERS, HORST. **Mechanism of reduction of cerium dioxide.** *Z. anorg. u. allgem. Chem.* 266, 345-8 (1951).—*C.A.* 46, 7854*g*.

The reduction proceeds by the migration of O atoms to the surface leaving unoccupied O sites in the lattice and quasifree electrons. The addn. of Pr_2O_3 to the CeO_2 lattice creates O vacancies, and should increase the ease of reduction, whereas the addn. of ThO_2 does not create defects and should not affect the reduction. Application of the mass-action law indicates that the elec. cond. should be proportional to $(p_{H_2}/p_{H_2O})^{1/3}$. The concn. of O vacancies is calcd. to be about 10^{-4} in the pure CeO_2 phase at 1000 °C.

2073. HINDIN, S. G.; MILLS, G. A., AND OBLAD, A. G. **Hydrogen exchange between cracking catalyst and the butanes.** *J. Am. Chem. Soc.* 73, 278-81 (1951).—*C.A.* 45, 6371*i*.

The procedure was either to bring the paraffin into contact with a silica-alumina cracking catalyst that had been enriched with D or to bring the silica-alumina cracking catalyst contg. H_2 into contact with the monodeuteriated hydrocarbon. The reaction time and temp. was 1 hr at 150 °C. At 150 °C extensive H_2 exchange occurred between catalyst and isobutane, while under the same conditions the exchange with n-C_4H_{10} was lower by more than an order of magnitude. The addn. of air or of olefin to the iso-C_4H_{10}-catalyst system accelerated the exchange reaction only to a relatively minor extent. The effect of the H_2O content of the catalyst was critical. By drying to higher temp. the ability of the catalyst to catalyze exchange was almost eliminated.

2074. HOLM, V. C. F. AND BLUE, R. W. **Hydrogen-deuterium exchange activity of silica-alumina catalysts.** *Ind. Eng. Chem.* 43, 501-5 (1951).—*C.A.* 45, 2759*e*.

Catalysts in the range 0 to 7.5% SiO_2 were most active. The H-D exchange and H transfer involve different mechanisms and require different characteristics in a catalyst. Catalysts pretreated at 800° instead of 400 °F were 1000 times more active in the H-D exchange.

2075. HOYOS, ANGEL DE CASTRO AND RODRIGUEZ, JULIO. **Surface changes of an acid bentonite on thermal treatment.** *Anales real soc. espan. fis. y quim.* 47B, 504-14 (1951).—*C.A.* 46, 5747*b*.

After being heated to 300 °C, bentonite could be rehydrated; the higher it was heated above this temp., the less able it was to be rehydrated. The specimens heated to 600° or 700 °C were able to recover partly the loss of reticular water, but this recovered water was lost at 300° and 400 °C. This was not associated with the loss of OH groups. The decrease of hydrating capacity and the change of hydrating surface were proportionally greater for the first reticular water losses.

2076. IMELIK, BORIS. **The rehydration of alumina and its significance in interpretation of the isothermal absorption of water.** *Compt. rend.* 233, 1284-6 (1951).—*C.A.* 46, 4318*i*.

Samples of Al_2O_3 prepd. by heating a gel with the boehmite structure between 400 and 900 °C were exposed to air satd. with H_2O vapor at 37 °C. After one week the sample ignited at the lowest temp. showed x-ray evidence for the presence of boehmite and hydrargillite. With exposure up to 5 weeks all samples showed this change in compn. This change in Al_2O_3 structure explains the irreversible character of the isothermal adsorption of H_2O.

2077. JURA, GEORGE AND POWELL, RICHARD E. **Kinetics of gas adsorption as a method of area determination.** *J. Chem. Phys.* 19, 251-2 (1951).—*C.A.* 45, 3681*b*.

If there is a significant change in the rate of adsorption when a monolayer is completed, a detn. of gas-adsorption kinetics gives a value for the area of a solid. This is the case for NH_3 adsorbed on a SiO_2-Al_2O_3 cracking catalyst at 0° and for H_2O on anatase at 25 °C; the area of the former is 290 and of the latter 8.6 m^2/g.

2078. MILLIGAN, W. O., SIMPSON, WARREN C.; BUSHEY, GORDON L.; RACHFORD, HENRY H. JR., AND DRAPER, ARTHUR L. **Precision multiple sorption-desorption apparatus.** *Anal. Chem.* 23, 739-41 (1951).—*C.A.* 45, 8320*h*.

A precision multiple sorption-desorption app., based on wt changes on SiO_2-spring balances, was constructed capable of 15 isotherms or isobars simultaneously. Equil. points were obtained in the temp. range -20° to 60 °C and at pressures from 10^{-6} to 400 mm of Hg. The app. is especially designed for the examn. of *hydrous oxide-water systems*.

2079. Milligan, W. O. and Weiser, Harry B. **Orientation effects in alumina films.** *J. Phys. & Colloid Chem.* **55**, 490-6 (1951).—*C.A.* **45**, 5995*h*.

Transparent films of alumina (γ-$Al_2O_3.H_2O$ or γ-AlOOH) were prepd. by evapg. a highly thixotropic alumina sol to dryness at room temp. A film of γ-AlOOH remained transparent after being transformed into γ-Al_2O_3 by heating to 600-800 °C. Films of either on various surfaces show a behavior which suggests that the orientation process is closely connected with the strain which results when the gel is dried.

2080. Moshkovskiĭ, Yu. Sh. **Influence of the method of preparation of zinc oxide on its sintering.** *Doklady Akad. Nauk S.S.S.R.* **80**, 215-16 (1951).—*C.A.* **46**, 3822*c*.

ZnO prepd. by decompn. of $ZnCO_3$ at 350 °C begins to sinter at 500 °C, whereas ZnO obtained by oxidation of Zn evapd. in an elec. arc sinters only at 1000 °C. Deep defects with energy levels of the order of 1.4 e.v. will hold electrons firmly, and their caputre by the holes left vacant by evapd. O atoms will be difficult; under these conditions, the transfer of matter necessary for sintering, must be inhibited. In the presence of only slight defects, with energy levels no deeper than 0.4-0.6 e.v., the electron can remain at the points vacated by O atoms, and diffusion and sintering should be easier. The effect of promoters, such as Cr_2O_3, on ZnO, may consist in the creation of energy levels deep enough to inhibit sintering.

2081. Rienäcker, G. and Birckenstaedt, M. **The reduction of cerium dioxide, especially at 250-350 °C.** *Z. anorg. u. allgem. Chem.* **265**, 99-104 (1951).—*C.A.* **46**, 7922*a*.

CeO_2 was reduced about 12% by H_2 at 250-350 °C. Reduction was accompanied by a color change from yellowish white to gray-blue. With increasing temp. the percentage of reduction increased (with various color changes) until at 1250 °C, Ce_2O_3 was the product.

2082. Rodier, Georges. **The study of catalysts by the determination of nuclear reaction times.** *Compt. rend.* **232**, 513-15 (1951).—*C.A.* **45**, 5472*b*.

The magnetic susceptibility of Al_2O_3 was detd. by nuclear resonant techniques. Two distinct curves of relaxation time *vs.* Fe concn. were reported for the 2 samples.

2083. Roiter, V. A.; Yuza, V. A., and Kuznetsov, A. N. **Mechanism of reduction of iron oxides by hydrogen, carbon monoxide, and their mixtures.** *Zhur. Fiz. Khim.* **25**, 960-70 (1951).—*C.A.* **46**, 9391*d*.

The kinetics of the reduction of pure pelletized Fe_2O_3 (from Fe_2O_3 gel) was investigated in a circulating system with removal of reduction products between 200° and 300 °C. H_2 was a much slower reducing agent than CO. In all cases, the rate curves consisted of two parts: the 1st corresponding to the practically quant. reduction of Fe_2O_3 into Fe_3O_4 was nonautocatalytic; the 2nd was autocatalytic and relative to the reduction of Fe_3O_4 to Fe. All curves for H_2-CO mixts. lay between the curves for pure H_2 and CO but showed a striking nonadditive action of the reducing gases.

2084. Romwalter, A. and Hauer, A. **New possibilities for the application of activated aluminum.** *Acta Tech. Acad. Sci. Hung.* **2**, No. 1, 43-58 (1951).—*C.A.* **46**, 10711*h*.

Active Al is Al amalgam. Its reaction rate with liquid H_2O varied irregularly, owing to a scablike oxide layer, causing Hg losses, and resulting first in an increase, then in a decrease, of activity until finally Hg-free Al remains Activated Al is suitable for the *desiccation* of gases, org. liquids, and for the careful *dehydration* of adsorbing gels (SiO_2 or Al_2O_3).

2085. Selwood, P. W.; Lyon, Lorraine, and Ellis Marylinn. **Magnetic susceptibilities of Cr_2O_3-Al_2O_3 and of Fe_2O_3-Al_2O_3 solid solutions.** *J. Am. Chem. Soc.* **73**, 2310-11 (1951).—*C.A.* **45**, 9943*i*.

Magnetic-susceptibility measurements from 90 to 300 °K were made for the solid solns. Cr_2O_3-Al_2O_3 and Fe_2O_3-Al_2O_3. At infinite magnetic diln. the Cr^{3+} ion has a magnetic moment of 3.8 Bohr magnetons. The Weiss const. is 0. The Fe^{3+} ion under similar conditions has a moment of 5.9 and a Weiss const. of 0. The moment of the Fe^{3+} ions decreases rapidly with increasing magnetic concn.

2086. Thibon, Honoré; Charrier, Jacques, and Tertian, Robert. **Thermal decomposition of alumina hydrates.** *Bull. soc. chim. France* **1951**, 384-92.—*C.A.* **45**, 10023*g*.

The anhyd. aluminas showed a continuity of crystal lattice throughout the calcination process. Calcination of hydrargillite (20-30 μ monocrystals) to 1400 °C produced, successively, boehmite, κ'-, κ-, and α-Al_2O_3. Hydrargillite of very high sp surface underwent changes to χ-, η, and θ-Al_2O_3. Up to 5% CaF_2, AlF_3, or NaF in the calcining mixt. resulted in increased crystal sizes and lowered temp. at which the hydrargillite underwent the above changes.

2087. Wartenberg, H. v. **Water absorption by melting oxides.** *Z. anorg. u. allgem. Chem.* **264**, 226-9 (1951); *Z. Elektrochem.* **55**, 445-6 (1951).—*C.A.* **46**, 3358*i*.

BeO, Al_2O_3, and La_2O_3 absorb H_2O when melted and release it with eruption upon solidification. The technique for the manuf. of artificial rubies prevents H_2O from interfering with the process in this manner. The same phenomenon occurs slightly with ZrO_2, but not at all with a mixt. of Pr_2O_3, Nd_2O_3, and Yb_2O_3 or with CaO, MgO, or ThO_2. Al_2O_3 is more volatile in the presence of H_2O vapor than in dry air, so gaseous $Al(OH)_3$ is also stable.

2088. Zabor, Robert C. and Emmett, Paul H. **The adsorption of normal paraffins on cracking catalysts.** *J. Am. Chem. Soc.* **73**, 5639-43 (1951).—*C.A.* **46**, 2786*i*.

Adsorption of butane, heptane, and octane on a silica-alumina cracking catalyst (Houdry S-46) at temps. from 40° to 531 °C was detd. by volumetric and gravimetric methods. The adsorption appeared to be phys. in nature up to about 150 °C. Above this temp., and even at cracking temps., the adsorption was very small, about 0.005 millimole per g of catalyst.

2089. Antipina, T. V. and Frost, A. V. **A new form of the pressure dependence of adsorption.** *Doklady Akad. Nauk S.S.S.R.* **84**, 985-7 (1952).—*C.A.* **46**, 9377*d*.

Adsorption isotherms for EtOH vapor were detd. at 108°, 150°, and 188°C, and for Et_2O vapor at 188°C, on Al_2O_3 (prepd. by gas-phase hydrolysis of pure $AlCl_3$). Plots of the reciprocal $1/x$ of the amt. adsorbed as a function of the reciprocal pressure $1/p$ show, at higher p, a portion parallel to the $1/x$ axis. The same is found in the sorption of H_2O vapor at 310°C.

2090. Antipina, T. V. and Frost, A. V. **Relation between the kinetics of heterogeneous reactions and adsorption on catalysts. IV. Determination of the adsorption coefficient of water on aluminum oxide from adsorption measurements.** *Vestnik. Moskov. Univ.* **7**, No. 8, 111-16 (1952).—*C.A.* **47**, 2026*a*.

One portion of Al_2O_3 was heated 4 hrs at 550°C and used directly for the adsorption measurements; another portion, after the same treatment, was used repeatedly in dehydrogenation of EtOH, until it reached a const. max. catalytic activity. Both had the same surface area but different pore distributions. Adsorption isotherms of H_2O vapor at 340°, 380°, and 415°C on both up to 16-10 mm Hg, showed the typical leveling off. Plots of the reciprocal adsorbed amt. $1/a$ as a function of the reciprocal pressure were linear at all 3 temps., with different slopes for both; i.e. the adsorption obeyed Langmuir's law.

2091. Boreskov, G. K.; Dzis'ko, V. A.; Borisova, M. S., and Krasnopol'skaya, V. N. **Effect of heat on the structure and catalytic activity of alumina.** *Zhur. Fiz. Khim.* **26**, 492-9 (1952).—*C.A.* **47**, 957*h*.

Three Al_2O_3 catalysts were heated at 450°, 600°, 800°, 1000°, and 1200°C. Pore structure, surface area, activity for decompn. of EtOH and x-ray pattern were detd. after each heat-treatment. All powders consisted of γ-Al_2O_3 except that treated at 1200°C which showed the α-form. Heating at 600°C during 24 hrs did not modify the surface area nor the pore structure of samples previously treated at 450°C. After a heating period at 1200°, the pore vol. decreased by a factor of 2 but the surface area by a factor of 60. After a heat-treatment at 1200°, the sp activity decreased markedly and the catalysts became mainly dehydrogenating.

2092. Brown, Marjorie J. and Foster, A. Graham. **Sorption of vapors by ferric oxide gel. III. Aliphatic amines.** *J. Chem. Soc.* **1952**, 1139-44.—*C.A.* **46**, 10775*b*.

Isothermals of sorption on a ferric oxide gel included Et, Pr, Bu, Am, hexyl heptyl, tert-Bu, cyclohexyl amines and ethylenediamine and pyridine. Volumes adsorbed at satn. were const. for all vapors. For normal amines the amt. required for a monolayer was proportional to mol. wt; this indicated an oriented monolayer with area per mol. of 31 A^2.

2093. Calvet, Édouard. **Thermokinetic study of adsorption. Soluble bodies and macromolecular substances.** *J. Polymer Sci.* **8**, 163-71 (1952) (in French).—*C.A.* **46**, 9931*f*.

A microcalorimeter of the Tian-Calvet type can be used for detn. of the surface area and the approx. rate of expansion of the surface film, and for the study of the activated fraction of the surface of insol. powders. The amts. of H_2O adsorbed by different samples of Al_2O_3 at the point of formation of a unimol. film are: hydrargillite 0.3%, boehmite 0.20%, and activated Al_2O_3 4.9%.

2094. Dumbrowski, Henry S. **Residual equilibrium saturation of porous media.** *Univ. Microfilms* (Ann Arbor, Mich.), *Pub.* No. **3581**, 171 pp. (microfilm $2.14, paper enlargements $17.10).—*C.A.* **46**, 8931*b*.

2095. Glemser, Oskar; Hauschild, Ulrich, and Lutz, Gertrud. **Preparation of hydroxides by the action of atomic hydrogen on oxides.** *Z. anorg. u. allgem. Chem.* **269**, 93-8 (1952).—*C.A.* **47**, 438*b*.

Atomic H, generated by elec. discharge, was allowed to react directly with powd. metallic oxides. An intermediate, MnOOH, is formed in the reduction of MnO_2 to $Mn(OH)_2$. Prolonged reaction results in the formation of MnO. Atomic H reduces Na_2O_2 to NaOH. Reaction with WO_3 gives $H_{0.1}$ WO_3 and $H_{0.33}$ WO_3. Reaction with MoO_3 gives $Mo_4O_{10}(OH)_2$, which can be reduced further to $Mo_2O_4(OH)_2$, and to $Mo_5O_7(OH)_8$ by prolonged exposure.

2096. Gyani, B. P. and Sinha, A. P. B. **Sorption of water vapor by alumina gel.** *J. Indian Chem. Soc.* **29**, 582-8 (1952).—*C.A.* **47**, 2567*i*.

Adsorption of H_2O vapor on Al_2O_3 gel was measured at -3.5°, 0°, 10°, and 25°C. Hysteresis extended over the entire temp. range. There was a tendency to show fictitious satn. much before the true value. The anomalies persisted after numerous flushings with H_2O vapor and evacuations to remove gaseous impurities. The curves for the isosteric heats of adsorption and desorption are flat W curves and approach 10,500 cal per mole with increase in the amt. of adsorption.

2097. Harwood, J. H. **Recent technological applications of activated alumina.** *Ind. Chemist* **28**, 16-23 (1952).—*C.A.* **46**, 4145*f*.

2098. Iwase, Eiichi and Nishiyama, Seijiro. **Cramer's alkalinity of activated alumina.** *J. Sci. Research Inst.* (Tokyo) **46**, 181-4 (1952).—*C.A.* **47**, 4246*c*.

Cramer's test is more precise if the end point is indigo. Max. inner surface and max. alky. were obtained when $Al_2O_3.3H_2O$ was heated to $Al_2O_3.H_2O$ at 300-350°C.

2099. Kamakin, N. M. and Kiselev, A. V. **Hysteresis in the pressing of mercury into porous substances.** *Doklady Akad. Nauk S.S.S.R.* **83**, 589-92 (1952).—*C.A.* **46**, 10744*c*.

Detns. of the vol. of Hg taken up by porous aluminosilica gel as a function of the pressure P (up to 1500 kg/cm^2) gave results very close to those derived from adsorption-desorption isotherms of MeOH. On 2 different samples, the Hg "porometer" gave, under $P = 1500$, pore vols. of 67 and 43%, as against 63 and 43% by the adsorption isotherms. Hysteresis was observed on gradual relaxing of the pressure, with 25-50% of the Hg retained in the pores. A possible factor could be a mol. penetration of Hg into the skeleton of the sample.

2100. Milligan, W. O. and Whitehurst, Harry B. **Apparatus for the simultaneous determination of adsorption isotherms and magnetic susceptibility.** *Rev. Sci. Instr.* 23, 618-20 (1952).—*C.A.* 47, 3046*c*.

An app. for the simultaneous detn. of adsorption isotherms and magnetic susceptibility is similar in many respects to a previously fabricated app. for detg. adsorption only. The amt. of adsorption is measured by means of a fused silica spring (50 turns; 1 cm in diam.; sensitivity 3 mm/mg; max. load, about 100 mg).

2101. Papée, Denis. **Relation between the speed of adsorption and the isotherm.** *Compt. rend.* 234, 437-9 (1952).—*C.A.* 46, 6896*e*.

Adsorption expts. with H_2O vapor on 2 types of Al_2O_3 and 2 types of SiO_2 gel show that each substance has a specific adsorption curve whether such expts. are done statically or dynamically, whether the adsorbant is in pellets or in powder form in the static expts., and also throughout a variation in flow rate of 7-25 liter/hr in the dynamic expts.

2102. Papée, Denis. **The retention of water vapor by alumiua and silica.** *Compt. rend.* 234, 2536-8 (1952).—*C.A.* 46, 10773*i*.

The permanent adsorption of H_2O vapor by alumina and silica samples was that quantity, *m*, of water which was not desorbed at 25 °C after a cycle of adsorption-desorption. By heating of silica to elevated temps. both *in vacuo* and at atm. pressure, it was shown that permanent adsorption varied with structural changes as well as with the surface area. For boehmite, *m* increased from 100 to 400 °C; this showed that its decompn. increased with temp. Silica lost residual water at about 250 °C, but gave the same values of *m* when remoistened.

2103. Puri, Balwant Rai and Bhushan, Vidya. **Hygroscopic properties of metallic oxides prepared by different methods.** *J. Sci. Ind. Research* (India) 11B, 504-5 (1952).—*C.A.* 47, 4686*f*.

Co(II) oxide prepd. by heating the (1) carbonate, (2) nitrate, (3) oxalate, and (4) acetate; and Zn (II), Ni(II), and Cr(III) oxides prepd. by heating the (*a*) carbonate, and (*b*) nitrate, and by pptn. of hydroxides from the (*c*) sulfate, and (*d*) nitrate, were placed in humidistats contg. H_2SO_4 of various concns. The increase in wt at various relative humidities was noted. The hygroscopicity appears to depend on the acid radical, the carbonates giving the most hygroscopic oxides and the nitrates the least.

2104. Rubinshtein, A. M.; Vasserberg, V. E., and Pribytkova, N. A. **Effect of the dimensions of the elementary crystallites on the porosity and the activity of alumina catalysts in the dehydration reaction.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* 1952, 323-33.—*C.A.* 46, 9961*e*.

Three Al_2O_3 prepns. of different grain sizes were made by fractional sedimentation of a ppt. from a boiling soln. of a 50 g $Al(NO_3)_3.9H_2O$ in 3 liters H_2O with 5% NH_4OH. Catalytic activities were detd. in dehydration of 77.5% HCO_2H and of 96% EtOH. The absence of AlOOH lines in x-ray patterns proved that the residual H_2O in the catalyst was not constitutive, but that the H_2O was adsorbed on the surface, preferentially in micropores, and thus blocked active centers or inhibited diffusion thereto. The surface areas, detd. by the B.E.T. method by adsorption of MeOH vapor at 25°C were the same for all 3 catalysts, 286 m^2/g. The surface area detd. by adsorption of C_5H_{12} were 182, 179, 264 m^2/g resp.

2105. Tran, Huu-The and Prettre, Marcel. **The thermicity of the dehydration reactions of gibbsite.** *Compt. rend.* 234, 1366-8 (1952).—*C.A.* 46, 6553*d*.

The dehydration of $Al_2O_3.3H_2O$ was followed by thermogravimetry and differential thermal analysis. Thermal analysis showed that the 1st reaction, giving the boehmite phase, was endothermic, but the 2nd, leading to γ-Al_2O_3, was exothermic.

2106. Utsugi, Hiroshi. **Adsorption of vapor in the low-pressure range.** *J. Chem. Soc. Japan,* Pure Chem. Sect. 73, 232-4 (1952).—*C.A.* 47, 377*i*.

The adsorption isotherms of EtOH on the gel of $3Ti_2O_2.2Fe_2O_3$ activated at 150°, 250°, 350°, and 450°C, resp., were studied at 0-90°C. The quantity adsorbed increased discontinuously for the gels activated at 250° and 350°C. A point of inflection was observed in the isotherms above 60° for the gel activated at 450°C at 2×10^{-3}-1.5×10^{-2} mm Hg.

2107. Utsugi, Hiroshi. **Adsorption of vapors in the low-pressure region. III. Influence of solid surface on the discontinuity of isotherms.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 73, 450-3 (1952).—*C.A.* 47, 3651*d*.

The isotherm for the adsorption of EtOH on the mixed gel $3TiO_2$-$2Fe_2O_3$ showed a discontinuity in the low-pressure range. If the two-dimensional pressure of the adsorbed phase was plotted against the area per mol., which was calcd. from the amt. adsorbed and the B.E.T. area, isotherms very similar to those for the condensation of imperfect gas are obtained. Hence the discontinuity can be regarded as a phase change of 2-dimensional adsorbed phase.

2108. Deisler, Paul F., Jr. and Wilhelm, Richard H. **Diffusion in beds of porous solids. Measurement by frequency response techniques.** *Ind. Eng. Chem.* 45, No. 6, 1219-27 (1953).—*C.A.* 47, 9125*b*.

Diffusion within the pores of catalytic particles and diffusion between particles were measured simultaneously. The results of expts. led to individual diffusion consts. and adsorption capacitances. The H-N, C_2H_4-N, and C_2H_6-N systems were studied with porous spherical pellets and spherical glass beads. Exptl. variables were total gas flow rate and changes in phase angle and amplitude of varying gaseous compn. waves sent through the bed.

2109. EAGLETON, L. C. AND BLISS, HARDING. **Drying of air in fixed beds.** *Chem. Eng. Progress* **49**, 543-8 (1953).—*C.A.* **48**, 5*b*.

The rate of drying of air in fixed beds of activated alumina, Florite, and silica gel was studied. Effluent concn. as a function of time was measured at several values of inlet concn., bed length, flow rate, and temp. It was found that the rate was governed by diffusion, both through the air film and within the particles.

2110. HAUL, R. A. W. **Measurement of activated diffusion of adsorbed molecules.** *Nature* **171**, 519 (1953).—*C.A.* 47, 7287*c*.

Rates of adsorption of butane in porous SiO_2 plugs were measured by a gravimetric method over a temp. range of -14° to -80°C, a porosity range of 0.72 to 0.53, and a surface coverage range of 0.37 to 6.9 statistical layers. At -14.4, -44.2, and -79.5°C it was calcd. that 70, 80, and 94%, resp., of the total transport was due to the mobility of adsorbed mols. on the surface. The activation energy for surface diffusion was 3 kcal/mol.

2111. SUTHERLAND, K. L. AND WINFIELD, M. E. **Transient rates of gas sorption. III. Pore structure, adsorption isotherms, and calculated rates at constant volume.** *Australian J. Chem.* **6**, 244-56 (1953).—*C.A.* **48**, 21*i*.

Pore structure of Al_2O_3 and thoria and Henry's law consts. for adsorption of H_2O vapor were detd. Exptl. rates of gas uptake by Al_2O_3 can be accounted for by Knudsen flow accompanied by rapid adsorption on the pore walls. None of the equations can account for the dependence of the rate of uptake by thoria on the 2nd (or higher) power of mass of the bed. Dependence of rate on mass or total surface area (*S*) at const. bed cross-section was a useful criterion of limiting step in gas uptake.

2112. WINFIELD, M. E. **Transient rates of gas sorption. I. Measurement of rapid gas uptake by oxide catalysts.** *Australian J. Chem.* **6**, 221-33 (1953).—*C.A.* **48**, 21*f*.

App. for admitting gas within about 0.001 sec to a porous solid and following subsequent rapid changes in rate of gas uptake in a const.-vol. system was described. The app. may be used up to 210°C and at pressure up to 20 mm. The sensitivity of pressure measurement was 0.001 mm. At 1.5-4 mm initial pressure, times for half-adsorption varied from 0.002 to 70 sec. Rates of sorption of H_2O and alcs. by Al_2O_3 and thoria at 110-200°C were 1st order with respect to initial pressure and had neg. temp. coeff.

2113. YOUNG, D. M.; BEEBE, R. A., AND BIENES, H. **Adsorption of heptane on solids at low pressure.** *Trans. Faraday Soc.* **49**, 1086-9 (1953).—*C.A.* **48**, 5595*b*.

Isotherms were detd. on graphite, Fe_2O_3, and on reduced Ag at low pressures. The first increment of heptane required approx. 2 hrs to attain equil. at both 25° and 30°C. Subsequent doses came to equil. within 15 min. or less. On Fe_2O_3 at 15°C, the 1st increment of vapor required 4 hrs 15 min. to come to equil., and the 2nd required 2 hrs 45 min., subsequent doses decreasing until only 10 min. was required at the 15th dose.

I-12. Gases on Clays and Soils

2114. YAROSHEVSKII, A. V. **The theory of drying ceramic products.** *Ogneupory* **8**, 451-6 (1940)—*C.A.* **37**, 4214⁵.

The theory that the drying process represented a series of sharply defined steps was discussed. The decrease in moisture followed a curve which rose regularly and later fell. An exptl. formula was offered for such a curve.

2115. ALTEN, F., AND LOOFMANN, M. **The adsorption of air by soils and soil constitutents and its influence upon the determination of the pore space and the specific gravity of cultivated soils with the pressure-air pycnometer.** *Bodenkunde u. Pflanzenernahr* **26**, 1-13 (1941).—*C.A.* **37**, 2859⁹.

The adsorption of air was detd. by mixtures of practically pure German bentonite and quartz sand (0.3-0.2 mm particle size) in the ratio of 1:3, 1:1, 3:1; upon quartz flour (0.1-0.06 mm); kaolin from Selb, Bavaria; micalike clay from Saraspatok; and silica gel. Adsorption was proportional to the pressure and to the amount of soil component in the colloidal state. Adsorption of air was 0.0014 moles per 100g of bentonite at 1 atm.

2116. BUSWELL, A. M. AND DUDENBOSTEL, B. F. **Spectroscopic studies of base-exchange materials.** *J. Am. Chem. Soc.* **63**, 2554-8 (1941).—*C.A.* **35**, 7829⁹.

Films of H^+, Li^+, K^+, NH_4^+, Ca^{++}, Mg^{++} and Ba^{++} montmorillonites were prepd. by evapn. of a suspension on microscope cover slips floating on Hg. Infrared absorption was detd. on films hydrated for various time periods over distd. H_2O. The montmorillonites satd. with various cations (Ca^{++}, Mg^{++}, Li^+, K^+, Ba^{++}, H^+, Na^+ and NH_4^+) could be placed in 4 classes with respect to water uptake. The first class, one of extreme absorption, consisted of the Ca^{++} and Mg^{++} montmorillonites. The second, of appreciable absorption, consisted of the Li^+, K^+ and Ba^{++} montmorillonites; and the third class, H^+ and Na^+ montmorillonites, was one of slight absorption. The fourth, consisting of NH_4^+ montmorillonite, showed almost no change on attempted hydration.

2117. DITTLER, EMIL. **The nature of clay.** *Tonind.-Ztg.* **65**, 515, 528 (1941).—*C.A.* 42, 5381*g*.

The electron microscope and a new ultramicroscope showed that the constituents of clays were not amorphous but possessed a cryst. character and that the clay mineral allophane was for the most part halloysite. Adsorption and base exchange were important properties of clay; the former was largely dependent on the latter.

2118. DITTLER, EMIL. **The nature of clays.** *Keram. Rundschau* **49**, 307-9 327-9 (1941).—*C.A.* 42, 5381*h*.

Research on clays was reviewed: the different clay minerals and their idenification by the electron microscope, base exchange and adsorption, and the synthesis of the clay minerals in the lab. and in nature.

2119. ISHIMURA, KOSHIRO. **The catalytic action of Japanese acid earth. XI. The isomerization of aldehydes to ketones and the explanation of the migration of the radicals from the standpoint of the electronic theory.** *Bull. Chem. Soc. Japan* 16, 196-209, 252-62 (1941). —*C.A.* 36, 4487[4].

When a mol. of a disubstituted acetaldehyde approached the surface of the acid earth, an unshared electron pair of the carbonyl O was attracted by the earth, enhancing the single bond character of the C-O link and leaving the C atom with an open sextet of electrons; an anion from the adjacent α-C atom moved toward the C atom with the open sextet of electrons, and a proton split from the carbonyl C and united with the O atom, forming the enolic form of a ketone. If the protons and anions pass outside the force field of the rearranging mol., they may combine to form hydrocarbons (benzene and toluene have been found in the reaction products from some of the isomerization expts.).

2120. ISHIMURA, KOSHIRO. **The catalytic action of Japanese earth. XII. The relation between the catalytic activity and adsorption. II. The adsorption isotherms of water and acetonitrile for the earth.** *Bull. Chem. Soc. Japan* 16, 349-55 (1941).—*C.A.* 41, 4368*b*.

In adsorption of water and acetonitrile by Japanese acid earth, studied by McBain's sorption balance, a marked hysteresis was observed.

2121. CHAPEK, M. V. **Thin water layers.** *Kolloid-Z.* 101, 209-13 (1942).—*C.A.* 38, 4491[7].

Swelling and splitting apart of small prisms of quartz and kaolin were investigated by evapg. suspensions of quartz with an av. diam of 5×10^{-4} cm and of kaolin with an av. diam of 5 to 7×10^{-5} cm. Particles were not in contact, but were sepd. by adsorbed water interlayers. These layers occurred at relative vapor pressures of 0.32-0.55 at which capillary condensation was unlikely. Degree of swelling and adsorbed vapor were detd. simultaneously at relative pressures of 0 to 1.0. Results for clay and kaolin corresponded to each other. Splitting apart was caused by adsorption layers, the thickness of which amounted to a few A units.

2122. JOHNSON, A. L. AND NORTON, F. H. **Fundamental study of clay. III. Casting as a base-exchange phenomenon.** *J. Am. Ceram. Soc.* 25, 336-44 (1942).—*C.A.* 36, 5623[5].

Specimens of com. casting slip were cast in plaster molds, porous bisque molds, and porous bisque molds treated with either $CaCl_2$ or $AlCl_3$. Detection of the ion serving in the exchange position was possible by the evaluation of the yield value of the cast specimen. Casting may be carried out by mech. water removal by the porous mold, by an exchange reaction between the ions of the slip and those of the mold, or by a combination of the two.

2123. JOHNSON, A. L. AND LAWRENCE, W. G. **Fundamental study of clay. IV. Surface area and its effect on exchange capacity of kaolinite.** *J. Am. Ceram. Soc.* 25, 344-6(1942).—*C.A.* 36, 5623[6]

Six monodisperse fractions of kaolinite (mean particle size 10.0, 4.4, 2.5, 0.95, 0.52, 0.28 μ, by calcn.) were prepd. and the exchange capacity was detd. from the viscosity relations on addns. of NaOH to the electrodialyzed fractions. A linear relationship was found between surface area and base-exchange capacity.

2124. YAMAMOTO, KENICHI. **Contact action of aluminum silicate catalysts.** *Waseda Applied Chem. Soc. Bull.* 19, 17-32 (1942).—*C.A.* 44, 8754*e*.

Acid clay contained noncryst. $mSiO_2.nH_2O$ mixed variously with cryst. $Al_2O_3.4SiO_2.H_2O$ covered by a colloidal film of noncryst. hydrous Al silicate gel whose quality and quantity detd. the activity. An increase of the silicate gel means greater activation. The activity of various natural and synthetic active clays varied generally in parallel to the adsorption considered as a function of the capacity factor, i.e., surface area and intensity.

2125. BERKELHAMER, LOUIS H. **Rehydration study of clays.** *J. Am. Ceram. Soc.* 26, 120-6 (1943).—*C.A.* 37, 2898[3].

At 30 °C, 20 different clays in a water-satd. atmosphere, (first dehydrated at 300 °C to const. wt) were studied. Montmorillonite-type clays were distinctly different from other types. One halloysite acted like the montmorillonites for the first 50 hrs, then the rehydrating slowed down and satn. was complete at about 1000 hrs. All other clays tested still adsorbed water at the end of over 1500 hrs in some instances. A rapid dehydration-rehydration test was developed. Duplicate samples were dehydrated at 300 °C for 2 hrs; one was rehydrated for 2 hrs at 65 °C, and the other dehydrated for 2 hrs more at 600 °C. The test could be made in 5 hrs.

2126. CHISHOLM, R. D. AND KOBLITSKY, L. **Sorption of methylbromide by soil in a fumigation chamber.** *J. Econ. Entomol.* 36, 549-51 (1943).—*C.A.* 38, 447[6].

The effect of excess moisture and type of soil on the concn. of MeBr in the atm. of a fumigation chamber was studied. MeBr in an empty chamber contg. an excess of moisture decreased at the same as the rate of decrease in an empty dry chamber. Dry sand, clay and peat soils sorbed more MeBr than the resp. wet soils; sorption for the peat soil was 4.5 times and for the clay soil 2.75 times as much as sand.

2127. CORNET, I. **Sorption of ammonia on montmorillonitic clay.** *J. Chem. Phys.* 11, 217-26 (1943).—*C.A.* 37, 3990[1].

When the pressures of NH_3 were plotted against the quantity of NH_3 sorbed, typically parabolic or hyperbolic sorption isotherms were obtained with ammonium bentonite, potassium bentonite and finely ground hydrogen bentonite. Sorbed NH_3 occupied base-exchange-reactive spots; phys. trapping of NH_3 mols. in the interplanes would not account for the lattice expansion. Both lattice OH ions and polarization of H_2O mols. may give rise to base-exchange capacity on grinding some clay minerals.

2128. Kulkarni, B. S. and Jatkar, S. K. Kulkarni. **The activation and clarifying properties of fuller's earth. VII. Activation of fuller's earth.** *Proc. Natl. Inst. Sci. India,* **9,** 111-16 (1943).—*C.A.* **42,** 7945*h*.

A thick paste was formed by grinding fuller's earth with 100 g of concd. H_2SO_4 per 100 g earth. This was heated 2 hrs at 150 °C, powd., and washed free of acid. The activity of the earth was raised considerably, at the cost of a 10.6% loss of earth.

2129. Leonida-Zamfirescu, Elisa. **Study of the Rumanian decolorizing earths.** *Inst. geol. Roumaniei, Studii tech. econ. Ser B.,* **22,** 92 pp. (1943).—*C.A.* **42,** 8428*e*.

Decolorizing earths in Rumania, were acceptable to the chem. and oil industries either in their natural form or after activation. Bentonites from Rugi and Talmaciu in Transylvania and Carali in Dobrogea were excellent. Kaolin, bentonite, and infusorial earth samples from various parts of Rumania were evaluated. Chem. analyses indicated that the best decolorizing earths are hydrosilicates, contg. MgO and more than 20% H_2O.

2130. Nutting, P. G. **Some standard thermal dehydration curves of minerals.** *U. S. Geol. Survey, Professional Papers No.* **197E,** 197-216 (1943).—*C.A.* **37,** 5339^1.

From about 250 curves previously obtained, 73 of the more significant were given.

2131. Page, J. B. **Differential thermal analysis of montmorillonite.** *Soil Science* **56,** 273-283, 1943.

The variations in the type of curves given by the different samples were caused by differences in the amount of substitution in the lattices. The characteristics of the curves might be used to indicate the nature and extent of these substitutions and thus aid in arriving at a better understanding of soil colloids.

2132. Zuev, L. A. and Gapon, E. N. **The adsorption of water vapor by Al silicates.** *Pedology (U.S.S.R.)* **1943,** No. 8, 13-18 (in English 19).—*C.A.* **38,** 3528^8.

Bentonite was electrodialyzed to pH 5.5 and then treated with 90 milliequiv. of N and 90 and 45 milliequiv. Ca. The adsorption isotherm of water vapor by H-, Na-and Ca-bentonites was then compared with that of kaolin and humic acid. The bentonite and humic acid gave an S-shaped curve; whereas the kaolin did not and the quantity of adsorption was small. At low vapor pressures the bentonites in their effect on adsorption can be arranged as follows: Na bentonite < H bentonite < Ca bentonite.

2133. Kawashima, Chihiro and Shiraki, Yoichi. **Fundamental studies on Japanese diatomaceous earths and their industrial applications. XIV, XV, XVI, XVII.** *J. Japan, Ceram. Assoc.* **52,** 81-7, 125-9, 174-9, 212-16 (1944).—*C.A.* **45,** 7481*h*.

The particle-size distribution of 13 samples of Japanese earths and 3 samples of American diatomaceous earths was detd. The distributions agreed with those detd. by microscopic observation. The hygroscopicity of 30 specimens of Japanese earths was detd. at 18 °C. The values found were 5.50 to 12.13%. Hygroscopicity decreases on heating at 500° to 600° and tends to zero at 900 °C. Water absorption was detd. by dropping, suction, or immersion method.

2134. LaLande, W. A., Jr.; McCarter, W. S. W., and Sanborn, J. B. **Bauxite as a drying adsorbent.** *Ind. Eng. Chem.* **36,** 99-109 (1944).—*C.A.* **38,** 1612^9.

The mechanism of the thermal decompn. and activation of 2 U.S., 1 French and 1 South American bauxite was discussed on the basis of differential thermal analysis and x-ray diffraction and with particular reference to the production of highly efficient drying adsorbents. The surface area increased with the activation temp. to 650°-700 °F and decreased at higher temps. The total amt. of water which can be removed from a fluid attained a max. value (18-19%) at activation at 850°-900 °F. Activated bauxite may be regenerated by heating at 300°-500 °F and the efficiency remains with 5% of the initial value. The capacity to produce dry gas decreased with decreasing humidity, but not in direct proportion, with increasing gas velocity and with increasing temp. of the adsorbent. Removal of Fe from bauxite contributed to longer life and higher efficiency.

2135. Marsh, C. E. **Beneficiation of alumina clays.** *Light Metal Age* **2,** No. 2, 22-4 (1944).—*C.A.* **38,** 2908^3.

Expts. indicated that a kaolin product contg. 35% Al_2O_3 could be produced from the residual clays of Eastern Washington and Idaho that would compete with transported clays and were lower in Fe. A clean (97 +%) silica sand could be produced from these residual clays for possible use as a filter aid in the alumina-leaching operations or for other uses.

2136. Sandford, Folke. **Effect of inert gases on the changes of ceramic products in moist air.** *Trans. Chalmers Univ. Technol., Gothenburg, Swed. No.* **36,** 3-58 (1944).—*C.A.* **40,** 2278^7.

Ceramic substances γ-Al_2O_3, α-Al_2O_3, quartz, cristobalite, clay, kaolin, and feldspar were heated in a Pt boat in 3 mm layers to 800°, 1000°, and 1200 °C. N_2, O_2, CO_2, 10%CO +90%N_2, and H_2O were passed at a rate of flow of 2 liters/hr for 2 hrs. The samples were then cooled to 100 °C, transferred into a weighing glass, and weighed at room temp. H_2O vapor had a stronger inactivating effect than the other gases, except on γ- and α-Al_2O_3 and feldspar pretreated at 1200 °C and α-Al_2O_3 and quartz pretreated at 1000° and 800 °C.

2137. Areshidze, Kh. I. and Tavartkiladze, E. K. **Georgia bentonite clays as dehydrating catalysts. I. Ascanite as a dehydrating catalyst.** *J. Applied Chem. (U.S.S.R.)* **18,** 271-2 (1945).—(English summary).—*C.A.* **40,** 3239^2.

Bentonite clay from the Ascana district (Georgian S.S.R.) was tried at 300 °C as a dehydrating catalyst on EtOH, PrOH, BuOH, and AmOH and the i-isomers. In all cases the corresponding olefins were obtained in appreciable (but not detd.) yields. The hydrocarbons were not identified.

2138. Broughton, D. B. **The drying of solids. Prediction of critical moisture content.** *Ind. Eng. Chem.* 37, 1184-5 (1945).—*C.A.* 40, 7769.

The crit. av. moisture concn., the drying conditions, and the nature of the material were studied. The derivation was based on the assumption that the water distribution in the slab follows the diffusion equation and that the surface moisture concn. gradient at the crit. point was a function only of the nature of the material. The method was tested by using data on the drying of 3 clays.

2139. Shaaban, M. A. **Investigation of the drying of solid granular materials.** *J. Imp. Coll. Chem. Eng. Soc.* **1**, 32-8 (1945).—*C.A.* **41**. 4973*b*.

Investigation on the air drying of whiting, contg. approx. 30% moisture and classified by particle size, were carried out with great precision, with a balance to record the drying rate. It was discovered that the so-called "constant-rate" period was only approx. const., there being a slight decrease in drying rate with decreasing moisture content of the cake.

2140. Tsitsishvili, G. V. and Arevadze, I. Z. **Investigating the sorption properties of natural adsorbents—Georgian bentonite.** *J. Applied Chem. (U.S.S.R.)* **18**, 572-5 (1945).—*C.A.* 41, 20^{a}.

The adsorptive properties of bentonite (askanite, gumbin, and askangel) were detd. with benzene, toluene, xylene, benzine, ether, acetone, and ethyl alc. For comparison, activated charcoal was also used as an adsorbent. The results indicated a certain adsorption equil. which decreased with increasing concn. Acetone, alc., and ether were adsorbed by bentonite material much better than the other reagents mentioned.

2141. Altinli, E. and Irmak, Lütfiye Rüstü. **Diatomaceous earth from Geyikeçeli-Kayseri Vilâyeti, Turkey.** *Rev. faculté sci. univ. Istanbul. Ser. B,* **11**, No. 2, 131-4 (1946). (in English).— *C.A.* **41**, 2354*h*.

The d. was 0.48 g/cc. by pycnometer. Sp resistance in plate forms was 2-10 megaohm cm for 250-600-v. d.c., and 1.5-6.5 megohm cm for 300-600-v. a.c. Four specimens tested showed a decrease in the coeff. of the water permeability with time from 4.9 to 11.7 × 10^{-3} g/atm.- sec cm to subsequent values of 3.3 to 9.5 × 10^{-3}.

2142. Bezborodov, M. A. **Sintering temperature range for clays as a function of their alumina to silica ratio.** *Compt. rend. acad. sci. U.R.S.S.* 52, 605-7 (1946) (in English),—*C.A.* 41, 2543*i*.

The sintering range (Δt) can be expressed: $\Delta t = 456\,°C - (420°/(1+a))$, where $a = Al_2O_3$ to SiO_2 ratio, which showed that the dependence between Δt and a was expressed by a hyperbolic curve. On passing from the two-component Al_2O_3-SiO_2 to clays, the relation between sintering range and chem. compn. became very complicated.

2143. Brindley, G. W.; Robinson, K., and MacEwan, D. M. C. **The clay minerals halloysite and metahalloysite.** *Nature* **157**, 225-6 (1946).—*C.A.* 40, 3073^{9}.

Halloysite consisted of the same layers which occurred in kaolinite and metahalloysite, with intervening layers of H_2O mols. (or org. compds.). In halloysite (and in its org. compds.) c_o was increased. When metahalloysite was formed from halloysite by low-temp. dehydration, the H_2O layers were expelled with subsequent collapse of the randomly oriented kaolinite layers. Heat-treatment of metahalloysite caused a decrease in its capacity for combining with ethylene glycol: this was probably due to an increase in the no. of effective linkages between the kaolinite sheets.

2144. Fisk, Henry G. **Bentonite: test methods and results of tests of Wyoming bentonites.** *Natural Resources Research Inst., Bull. No.* **2**, 39 pp. (1946).—*C.A.* 42, 733*e*.

The color and values for grit content, colloidally subdivided material, viscosity (Stormer), gel strength (Stormer), wall-building test, green and dry bonding power, and bleaching tests were given for 65 samples of Wyo. bentonites in comparison with Black Hills bentonites.

2145. Heredia, Pedro A. **Physicochemical study of Argentine clays. II.** *Univ. nacl. Tucumán, Pub.* **400**, *Cuadernos min. y geol.* **4**, c. 3, No. 15, 208-10 (1946).—*C.A.* **41**, 1532*i*.

Chem. analyses and phys. properties were tabulated for two kaolin samples, one from Tasna, Yavi department, Jujuy, and the other from Agua de Dionisio, Belén department, Catamarca province, Argentina.

2146. Ledoux, Edward. **Reactivation of adsorbent desiccants.** *Chem. & Met. Eng.* 53, No. 1, 127-8 (1946).—*C.A.* **40**, 1977^{5}.

Rate of reactivation increased with wt rate of gas flow, with efficiencies of vapor and heat transfer, and with vapor-pressure difference between gas and adsorbate. Performance curves were given for removal of water from bauxite.

2147. MacEwan, D. M. C. **The identification and estimation of the montmorillonite group of minerals, with special reference to soil clays.** *J. Soc. Chem. Ind.* **65**, 298-304 (1946).—*C.A.* 41, 7320*i*.

A method for detg. montmorillonite in amts. as low as 1% in mixts. of other clay minerals, including chlorites and vermiculites, was described. This was possible with a single x-ray powder photograph on a clay treated with glycerol. Ethylene glycol was less ideal because of higher volatility and less sepn. of its montmorillonite-complex diffraction line (17.1 A.) from chlorite. Neither the position nor intensity of the line was affected by the degree of base satn. of the clay as was for example the hydrated montmortillonite diffraction line whereby a Ca-satd. complex had to be used to produce a sharp line at 15 A.

2148. Mering Jacques. **The hydration of montmorillonite.** *Trans. Faraday Soc.* **42B**, 205-19 (1946).—*C.A.* 42, 7669*d*.

Detailed analyses of hydration isotherms for Na and Ca montmorillonites were correlated with their x-ray diffraction characteristics. A comparison of the isotherms for raw clays with those of specimens preheated to temps. up to about 550 °C was utilized properly to differentiate between mol. and OH group water. X-ray dimensions were utilized to partition the mol. water into interparticle (crystn.) water and inter-particle surficial water. Surficial water made up from about 1/5 at 30% relative humidity to about 4/5 at satn. mol. water was essentially reversibly regained after mild heating, and partial dehydroxylation was followed by some reconstitution. Reconstitution of OH groups was about 60% around 300 °C and decreased to zero by about 850 °C. From about 550 °C to 800 °C all individual layers were inactivated by dehydroxylation.

2149. Peterson, J. B. **Water stability of bentonite films.** *Soil Sci. Soc. Am., Proc.* **11**, 53-6 (1946) (Pub. 1947).—*C.A.* 42, 1682*d*.

The order of effectiveness of cations in increasing the water stability of bentonite clay on glass slides was H > C > Na. Pectin increased the stability of the Na-clay films, and gelatin showed even a greater favorable effect on water stability than did pectin. The relationships found between water stability of clay films and the structural properties of clay suspensions may be taken as an indication that the same forces which contribute to the water stability of clay films also contribute to structure in suspensions. The effect of pectin and of gelatin may be due to the types of linkages which they can produce in water systems.

2150. Shiraki, Yoichi and Kawashima, Chihiro. **Special porcelains of porous bodies. V. Relation between the texture and water permeability of porous bodies.** *J. Japan. Ceram. Assoc.* 54, 37-41 (1946); *J. Am. Ceram. Soc.* **32**, No. 3, *Ceram. Abstracts Sect.*, **86**, (1949).—*C.A.* 44, 7502*e*.

Water permeability of porous bodies of the system diatomaceous earth-Kibushi clay-cullet, fired at 600°-1300 °C, was measured with a water pressure of 20-100 cm. The test piece was a disk 100 mm in diam. and 7 mm thick. Water permeability of the test piece decreased as the time of immersion increased and reaches a const. value at about 24 hrs. Water permeability of samples high in clay was low and did not change with the firing temp., while the permeability of test pieces high in flux was great; it increased as the firing temp. rose and fell again as the temp. reached 1200°-1300 °C.

2151. Sveshnikova, V. N. and Kuznetsov, V. G. **Structural relations between zeolites and natural kaolin and their transformations on heating.** *Izvest. Akad. Nauk. S.S.R. Otdel Khim. Nauk* **1946**, 25-36.—*C.A.* 42, 6200*d*.

Thermography of cryst. aluminosilicate zeolite showed an endothermal effect of dehydration beginning at 100 °C and ending at 350 °C and 2 exothermal effects at 895° and 960 °C. Amorphous zeolite and electrodialyzed cryst. aluminosilicate gave the same endothermal effect 100-350 °C, max. at 160 °C, and an exothermal effect around 960 °C. Kaolin lost H_2O between 380° and 650 °C, max. at 565 °C, and had 2 exothermal effects at 960° and at 1200 °C. Thus, artificial zeolites gave up H_2O at a considerably lower temp. than kaolin.

2152. Yusupova, S. M. **The characteristics of montmorillonite.** *Compt. rend. acad. sci. U.R.S.S.* **51**, 631-4 (1946) (in English).—*C.A.* 41, 1955*e*.

Montmorillonite subjected to special thermal conditions over a period of 2 yrs showed gradual change in adsorptive properties, swelling capacity, and lattice structure (toward halloysite). Conversion of montmorillonite to halloysite was accompanied by desilicification and crystn. of SiO_2. Changes created above 350 °C were not reversible by any treatment. Weathering conditions affected adsorptive properties of clay minerals in takyrs, loesses, and clays.

2153. Bhola, K. L. **Bentonite in India.** *Quart. J. Geol., Mining Met. Soc. India* **19**, 55-77 (1947).—*C.A.* 42, 6281*g*.

The distribution of bentonite in India and the chem. analyses were given. Physical-chem. properties discussed were: sp gr, exchangeable base at pH 7, base satn. capacity, pH with 2 and 6% suspension, swelling water absorbed, setting time for 6% suspension, and viscosity of drilling mud.

2154. Butterworth, B. **The absorption of water by clay building bricks and related properties. III. The rate of absorption of water by partly saturated bricks.** *Trans. Brit. Ceram. Soc.* **46**, 72-6 (1947).—*C.A.* 41, 6683*b*.

The rate of absorption of water by 5 makes of brick was measured in the dry state and at a no. of different degrees of satn. The times required for the absorption of 1 g/cm² and for penetration to a fixed height were calcd. The former increased while the latter decreased as the degree of satn. of the bricks increased.

2155. Caillère, Simonne and Hénin, Stéphane. **Formation of a phyllite of the kaolinite type by treatment of montmorillonite.** *Compt. rend.* **224**, 53-5 (1947).—*C.A.* 41, 2539*i*.

Samples of kaolin-free, montmorillonite, were treated in the cold for 3-4 days with: 20% $CaCl_2$, 5% Na_3AlO_3, 10% $Al(NO_3)_3$, then pptd. with HCl or NH_4OH. The new curve, in which Δt was plotted against t, was characterized by the development of a peak at 600 °C with a temp. drop of 50-100 °C, and with the shrinkage or suppression of the peak at 750 °C. In contrast, there was often an exothermic inflection near 950 °C. The curve resembled that obtained with a mixt. of kaolinite and montmorillonite.

2156. Caillère, Simonne. **Experimental transformation of montmorillonite to a phyllite with a stable spacing of 14 A.** *Compt. rend.* **224**, 842-3 (1947).—*C.A.* 41, 4990*c*.

Heating curves were given (0-1000 °C) for (1) montmorillonite, (2) montmorillonite treated cold 4 days with 20% $MgCl_2$, then with concd. NH_4OH, and (3) a sheridanite from Comberousse. The treated montmorillonite showed an endothermic region at 550-600 °C, and one near 750 °C followed immediately by an exothermic region. An irregularity near 450 °C showed the presence of brucite. The x-ray diagram indicated an important interlayer distance of 14 A. Treatment with glycerol, water, or drying at 350 °C causes this 14 A. distance to disappear.

2157. Dominikiewicz, Mieczyslaw. **The theory of the building of kaolin nucleus.** *Arch. mineral. soc. sci. Varsovie* **17**, 191-281 (in Eng. 238-81) (1947).—*C.A.* **43**, 1291*c*.

A review of the formation of "kaolinitic" compds. of Na, K, NH_4, and Ag was given.

2158. Edelman, C. H. **Relations between the properties and the structure of several clay minerals.** *Verre Silicates ind.* **12**, No. 6, 3-6 (1947).—*C.A.* **42**, 5631*g*.

Kaolinite was characterized by Al-OH groups, and it properties were similar to those of $Al(OH)_3$. The colloidal-chem. properties of kaolinite and $Al(OH)_3$ were analogous; only the transition pH and the isoelec. point were different. The radical $Si_2O_5^{--}$, which constituted a characteristic part of clay minerals, had very little influence on the phenomena of absorption. Diazomethane, which reacts with hydroxyl ions in a dry medium reacted with montmorillonite and silicic acid, but not with kaolinite, $Al(OH)_3$, or quartz.

2159. Kister, E. G. **The swelling of clays.** *Neftyanoe Khoz.* **25**, No. 12, 23-7 (1947).—*C.A.* **42**, 7512*i*.

The kinetics of the combined process of water absorption and swelling of various clays in distd. water were detd. In kaolin-type clays the process was almost completed within 30-60 sec, the max. absorption being 220-510 vol. % after 24-72 hrs. In bentonite-type clays it ranges from 6 days and a max. of 1220 vol. % for Gilyabi clay to 25 days and 2440 vol. % for Aquagel.

2160. Kuzovlev, A. D. **Identification of clay minerals of the montmorillonite group.** *Razvedka Nedr* **13**, No. 6, 69 (1947).—*C.A.* **43**, 2129*i*.

Minerals of this group (montmorillonite, beidellite, nontronite) were readily identified in the field by their swelling with water. Take a lump of the material, shave clean one or more flat spots until the microstructure is revealed, and place on this spot a few drops of H_2O. If the sample is one of the above minerals, the wetted area will instantly stand out.

2161. Marshall, C. E. and Caldwell, O. G. **The colloid chemistry of the clay mineral attapulgite.** *J. Phys. & Colloid Chem.* **51**, 311-20 (1947).—*C.A.* **41**, 2627*c*.

Hydration and dehydration of attapulgite was compared with zeolites. Its d. was 2.3 and it was extremely sensitive to coagulation. In the electron microscope the particles appeared lath-like, of a size of 0.1 to 0.5 micron. The electrodialyzed attapulgite had a pH of 3 to 4, it was the strongest colloidal acid among the clays. Its structure, stability, and cation exchange properties were discussed and the characteristics of attapulgite films were compared with those of other clay films.

2162. Teichner, Stanislas. **Substitution of ions in montmorillonite.** *Compt. rend.* **225**, 1337-9 (1947).—*C.A.* **42**, 2895*f*.

Retention of adsorbed H_2O and specific surfaces were detd. of natural montmorillonite and of Na-substituted montmorillonite, obtained with dil. acid and neutralized with soda. Both lose adsorbed H_2O with rising temp., all adsorbed H_2O having been given off at 180°C. Up to 280°C no H_2O of crystn. was given off *in vacuo*. The specific surfaces of the 2 substances were detd. by N_2 adsorption. At dehydration temps. of 20° and 180°C, resp., specific surfaces in m^2/g were 48, 52, 13.6 and 88. The H_2O adsorbed on natural montmorillonite appeared not to interfere with N_2 adsorption, while that on Na-substituted montmorillonite prevented adsorption of N_2 at centers where H_2O was located.

2163. Thiessen, Peter A. **Characteristics of various effects at ultramicroscopic boundaries.** *Z. anorg. Chem.* **253**, 161-9 (1947).—*C.A.* **43**, 6489*e*.

Ultramicroscopic observations of crystals of kaolinite and mica treated with pos. or neg. Au sols. showed that edges of crystals exert nonspecific adsorption effects.

2164. Anon. **Methods used in evaluating adsorbent clays.** *U.S. Bur Mines, Inform. Circ., No.* **7475** 29 pp. (1948).—*C.A.* **42**, 9098*h*.

A description of the procedures and app. that were accepted as standard by the industry, and an outline of other methods that had been found particularly suitable for the clay lab.

2165. Barrer, R. M. **Syntheses and reactions of mordenite.** *J. Chem. Soc.* **1948**, 2158-63.—*C.A.* **43**, 5323*d*.

Mordenite ($Na_2O.Al_2O_3.10SiO_2$) identified with the polarizing microscope and by diffraction patterns was crystd. by heating suspensions prepd. by adding $NaAlO_2$ soln. to SiO_2 gel suspension at 265-295°C under pressure. With nitrates or chlorides cation exchange decreased in the order Ca, Ba, K, NH_4, Na, and Li, in accordance with the open molecular-sieve character of mordenite. The products when dehydrated were good sorbents for gas.

2166. Bell, W. C. **Reheat shrinkage characteristics of silica and clay mixtures.** *N. Carolina State Coll. Record* **47**, No. 10. 5-32 (1948).—*C.A.* **43**, 828*i*.

A time-temp. study of refractory mixts. with fine SiO_2 (finer than 100 mesh), coarse SiO_2 (coarser than 100 mesh), and plastic fire clays contg. most of the fusible impurities showed no appreciable vol. change up to 2400°F.

2167. Bichler, Antonin. **A new method for producing bentonite.** *Hutnicke Listy* **3**, 203-5 (1948).—*C.A.* **43**, 3580*i*.

The ability of montmorillonitic raw materials of Czechoslovakia to absorb water depended upon the expansion of the lattice and upon the presence of adsorbed ions. By varying the mixt. of anions and cations the original water-absorbing power was increased to 1 to 3 fold.

2168. Blake, George R. and Page, J. B. **Direct measurement of gaseous diffusion in soils.** *Soil Sci. Soc. Am., Proc.* **13**, 37-42 (1948).—*C.A.* **44**, 2681*i*.

The diffusion of CS_2 through field soils showed a straight-line relation between diffusion rate and porosity. Characteristics of the curve may vary between different soils. Diffusion rates varied with the cropping system being followed and a fair correlation was found between diffusion rates and corn yields.

2169. CHARRIN, VICTOR. **The kieselguhrs of Touraine.** *Génie civil* **125**, 412-13 (1948).—*C.A.* **43**, 1292*i*.

The low Ca-content of these radiolarites gave them a marked superiority in certain fields. Moisture, amounting to 25 to 40%, must be removed before crushing. At the Cavaliers plant, near Chateauroux, the powder was bolted to pass through a 300 sieve or finer.

2170. DETAILLE, HECTOR. **Organic matter in clays.** *Trans. Intern. Ceram. Congr.* **1948**, 111-31 (in French).—*C.A.* **46**, 6346*c*.

The effect of carbonaceous matter upon the behavior of clay during firing was studied by successive quant. analyses of the gases evolved during the firing of pieces of white and gray clay. The relative amts. of gas and its compn. were shown to depend upon the amt. of org. matter present in the clay, whereas the H_2O content varied very little.

2171. ENDELL, K. AND HOFMANN, U. **The adhesion of inorganic binding material and the plasticity of clay.** *Monatsh.* **78**, 258-72 (1948).—*C.A.* **42**, 8432*d*.

Solids adhered together if the distances between mols. in their surfaces approached those in the body of the solid and if sufficiently strong forces between the mols. or atoms were active. These forces differed depending on the nature of the material. An explanation was advanced for the difference between the wet and dry strengths of the materials considered.

2172. FORSLIND, ERIK. **Clay-water system. I. Crystal structure and water adsorption of clay minerals.** *Svenska Forsknings-inst. Cement Betong vid Kgl. Tek. Högskol. Stockholm Medd.* No. **11**, 20 pp. (1948) (in English).—*C.A.* **46**, 5804*e*.

H_2O layers adsorbed on the montmorillonite lattice may be regarded as having the structure of ice, the state of order being disturbed by foreign ions entering the system. The dehydrated state corresponds to an intercryst. distance of about 10.6 A. Electron-microscopical pictures, diffraction photographs, and diagrams of theoretical and observed intensities for different crystals are given.

2173. FRANCIS-BOEUF, C. **Oxygen adsorption of estuary muds.** *Rev. inst. franc. petrole et Amn. combustibles liquides* **3**, 119-33 (1948).—*C.A.* **43**, 916*c*.

Muds taken from river estuaries were equal to proper marine muds in reducing properties, adsorbing O_2 dissolved in the supernatant external water phase. Delta muds could not sat. themselves with O_2 even when exposed to the air, because their surface consisted of a film of several mm thickness of bacteria and algae, which prevented diffusion of O_2.

2174. GLAESER, RACHEL. **Formation of the montmorillonite-acetone complex.** *Compt. rend.* **226**, 935-7 (1948).—*C.A.* **42**, 6261*d*.

The vapor-phase absorption of acetone by montmorillonite was studied as a function of the relative pressure of acetone and of the state of hydration of the mineral. By means of x-ray diagrams the depths of the elementary spaces occupied by org. mols. could be detd. Preliminary hydration was necessary for the formation of a complex with acetone.

2175. GRIM, RALPH E. AND BRADLEY, W. F. **Rehydration and dehydration of the clay minerals.** *Am. Mineral.* **33**, 50-9 (1948).—*C.A.* **42**, 5809*c*.

Samples of montmorillonite, illite, kaolinite, and halloysite were dehydrated at various temps. up to 800 °C, allowed to stand at room temp. for varying periods of time, and were then studied by differential thermal analysis. Montmorillonite and illite slowly regained some water as hydroxyl, in addn. to adsorbed H_2O.

2176. MARSHALL, C. E. AND AYERS, A. D. **The electrochemical properties of mineral membranes. VI. Clay membranes for the determination of calcium.** *J. Am. Chem. Soc.* **70**, 1297-1302 (1948).—*C.A.* **42**, 5301*c*.

Membranes prepd. from H- and Ca-bentonite and H- and Ca-Putnam clay were examd. as to their suitability for the detn. of Ca by the potentiometric method. A comparison of the effect of preheating on the sensitivity showed that at 300-415 °C H-bentonite was satisfactory, but above 450 °C became insensitive; at 300-550 °C, Ca-bentonite was suitable. Membranes of H-Putnam clay were somewhat inferior even at 600 °C compared with 600 °C Ca-bentonite.

2177. MARSHALL, C. E. AND EIME, L. O. **VII. Clay membranes for the determination of magnesium.** *J. Am. Chem. Soc.* **70**, 1302-5 (1948).—*C.A.* **42**, 5301*e*.

Clay membranes prepd. from H- and Ca-bentonite and H- and Ca-Putnam clay were used for the detn. of Mg by a potentiometric method. The effect of preheating the clay over a range of 300-600 °C was studied as related to its sensitivity. For solns. contg. only Mg ions, the 400° H-bentonite and 550° Ca-bentonite membranes could be used with activities from 0.008 to 0.0003, and the 600 °C H-Putnam from 0.004 to 0.0001.

2178. MIZUNO, SHIGERU; KUSABA, IKURO, AND IKEDA, HACHIRO. **Activated earth. I. The change of long-period sorption of water and xylene vapor by activated clay with heat.** *Bull. Tokyo Inst. Technol.* **13**, 77-82 (1948).—*C.A.* **44**, 10442*i*.

The rates of sorption of water vapor by clay activated at 100-700°C were found to be represented by an equation of the form $x = a \log t + b$, where x is the amt. of adsorption, t is time, and a and b were constants which vary with time. Resistance to sorption was greater the higher the activation temp. and increased abruptly above 700 °C.

2179. MIZUNO, SHIGERU; KUSABA, IKURO, AND IKEDA, HACHIRO. **Activated earth. II. The change of the rates of short-period sorption of water and heptane vapor by activated clay with heat.** *Bull. Tokyo Inst. Technol.* **13**, 83-8 (1948).—*C.A.* **44**, 10443*a*.

Rates of short-period sorption of water vapor were studied for clay heat-treated at 100-1000 °C by sorption balance and of heptane by those treated at 450-800 °C by a flow method. The early part of the sorption of water vapor was controlled by the equation $x = kt^n$, where k and n were constants. Rate of sorption of heptane was greater for clays activated at lower temps.

2180. MIZUNO, SHIGERU AND KUSABA, IKURO. **Activated earth. III. The fall in catalytic activity of activated clay with heat and the changes of physico-chemical properties accompanied by it.** *Bull. Tokyo Inst. Technol.* **13**, 89-93 (1948).—*C.A.* 44, 10443*c*.

Exptl. results were given showing the effect of heat-treatment of activated clay catalyst on activity of contact cracking, bulk d., true and apparent sp. gr., porosity, size, and compressive strength. Dehydration curves were given. The dehydration curves showed marked dehydration at 200-300°, 450°, and 600-700°C. The first two were thought to be reversible; the latter was irreversible.

2181. MIZUNO, SHIGERU AND KUSABA, IKURO. **Activated earth. IV. Activation of catalysts of fallen activity with heat by steaming.** *Bull. Tokyo Inst. Technol.* **13**, 94-7 (1948).—*C.A.* 44, 10443*d*.

Catalysts spent by heating below 600°C were activated by steaming. The reactivation was caused by water associating with the clay at 450°C owing to the reversible nature of the sorption at that temp.

2182. MIZUNO, SHIGERU AND KUSABA, IKURO. **Activated earth. V. Selection of activated clay catalysts.** *Bull. Tokyo Inst. Technol.* **13**, 98-101 (1948).—*C.A.* 44, 10443*e*.

Cracking activity, bulk d., and electrophoretic-velocity measurements were made on various screen sizes of clay. Activity was about the same for the different sizes but the smaller sizes lost activity more rapidly with temp. The ratio of SiO_2 to Al_2O_3 of both the activated and original clay was greater for the smaller sizes.

2183. NAGASAWA, MAKOTO. **Sorption of gases with activated bentonite. I. Sorption of sulfur dioxide.** *J. Electrochem. Soc. Japan* **16**, 62-6 (1948).—*C.A.* 44, 9770*a*.

Com. bentonite from Iwanai, Nokkaido, was activated with 20% HCl (3 times the wt of the sample) 4 hrs at 104-5°, and treated 2 hrs at 180°C. Sorption of SO_2 with this bentonite at 40, 25, 0, and -10°C obeyed Freundlich's isotherms at lower pressures.

2184. TEICHNER, STANISLAS. **Effect of thermal treatment on the texture and the structure of a montmorillonite.** *Compt. rend.* **227**, 392-3 (1948).—*C.A.* 43, 463*h*.

Surface measurements on montmorillonites of Ca, Na, and H showed that dehydration of Na and H at 450°C under high vacuum caused a diminution of surface area. Rehydrated Na montmorillonites showed the same surface area as untreated Na even though the former contained 25% less H_2O. The surface area in m^2/g measured by N_2 adsorption at -195°C were between 24-240. The area measured by butane at 0°C was between 27 and 87 m^2/g. All adsorption isotherms had an S-shape corresponding to a multimol. adsorption free of capillary condensation.

2185. TEICHNER, STANISLAS. **Surfaces of montmorillonites activated by acid treatment.** *Compt. rend.* **227**, 427-9 (1948).—*C.A.* 43, 464*c*.

Surface measurements with N_2 and butane on a montmorillonite and on samples of montmorillonite treated with 10% H_2SO_4, for 2 hrs and 4 hrs, resp., showed a marked increase in area for the treated samples. The N_2 isotherms, taken from 20° to 450°C, were all of the type II, whereas some of the butane isotherms showed a second point of inflection characteristic of adsorption with capillary condensation.

2186. DART, J. C.; SAVAGE, R. T., AND KIRKBRIDE, C. G. **Regeneration characteristics of clay cracking catalyst.** *Chem. Eng. Progress* **45**, 102-10 (1949).—*C.A.* 43, 3181*e*.

The primary variables in the regeneration of clay cracking catalysts were instantaneous carbon content, combustion temp., and oxygen partial pressure. The burning rate indicated sec-order dependency on carbon content at carbon contents less than 2 wt % on catalyst and first-order dependency on oxygen partial pressure. A single algebraic equation was developed which involved only the 3 primary variables to obtain the instantaneous C burning rate at any design condition. From the relationship between the fraction of H-burned and the fraction of C-burned the coke-burning rate could be calcd.

2187. FERRANDIS, VICENTE ALEIXANDRE. **Differential thermal analysis of some Spanish clays and kaolins.** *Anales edafol. y fisiol. vegetal (Madrid)* **8**, 33-58 (1949).—*C.A.* 43, 8590*c*.

The data were chem. compn., plots of the curves of dehydration and water absorption, differential thermal analysis, and base exchange. The kaolin had the characteristics of kaolinite. The bentonite of Maaza loses water at 100°C and between 400° and 500°C and the curve of thermal analysis indicated that it was composed of hydrated haloysite and beidellite. The base-exchange capacity and the plasticity were in agreement with this.

2188. GONZALEZ, F. GARCIA. **The effect of heat-treatment on the hydration capacity of montmorillonite.** *Anales real soc. españ. fís. y quím.* **45B**, 1183-1210 (1949).—*C.A.* 44, 9209*i*.

Alkali and alk. earth montmorillonites were heated at 100°, 200°, 300°, 400°, and 800°C, until const. wts were reached. The amt. of water lost by wt was detd., and the samples were rehydrated by exposure to an atm. satd . with water vapor for 8 days. In samples with intense electrostatic fields, the laminas became fixed without the reticular water becoming affected.

2189. GRENALL, ALEXANDER. **Montmorillonite cracking catalyst-demonstration of presence of hydrogen ion in heated Filtrol clay catalysts.** *Ind. Eng. Chem.* **41**, 1485-9 (1949).—*C.A.* 44, 2211*h*.

The presence of H^+ in Filtrol clay catalyst over the entire range of cracking temps. was established by a physico-chem. titration method with a 5% soln. of NaCl. The H-ion content was a linear function of the temp. at which the catalyst was heated in air. The effect of steam treatment of H-ion content of the catalyst was nonlinear. Isothermally, with increasing steam concn., an apparent equil. point dependent upon the isotherm temp. was reached for removal of the H ion. Increasing the temp. at which the catalyst was heated at const. steam concn. resulted in lowered H-ion contents.

2190. HAMMER, A. J. **Factors affecting the determination of soluble salts in ceramic clay. I.** *Ceram. Age* **54**, 140-2, 144 (1949).—*C.A.* **43**, 9404*b*.

In the detn. of sol. salts in clay the following factors exert considerable influence: prepn. and condition of the sample; choice of solvent; clay-water ratio; time and temp. of digestion of the sample; method of filtration; and time and temp. of drying the residue.

2191. ISACHSEN, FRIDTJOV AND ROSENQVIST, IVAN TH. **Weathering loam and fuller's earth from Karmöy.** *Norsk Geol. Tids.* **27**, 175-86 (1949) (in Norwegian).—*C.A.* **43**, 8320*f*.

For mineral-oil bleaching and regeneration a montmorillonite occurrence near Vigsnes (Norway) was of a particular economical importance since previously bleaching earths must be imported. A practical staining test with methylene blue in comparison with many typical bleaching earths, in suspensions with pH = 2 and 7, gave a satisfactory result for the suitability of the Vigsnes material as a fuller's earth for the mineral-oil regeneration.

2192. MISRA, M. L. AND HENRY, E. C. **Nature of some Indian clays.** *Am. Ceram. Soc. Bull.* **28**, 187-92 (1949).—*C.A.* **43**, 5559*f*.

Four typical white clays of India were studied. Judged by the morin dye test, the Kasimbazar clay was least stable, the Rajmahal clay most stable, with the other 2 intermediate. All 4 clays showed little base-exchange capacity.

2193. MURRAY, P. AND WHITE, J. **Kinetics of the thermal dehydration of clays.** *Trans. Brit. Ceram. Soc.* **48**, 187-206 (1949).—*C.A.* **43**, 6799*d*.

More knowledge of the reactions involved in the thermal dehydration of clay was needed. Especially, the endothermic peak on the thermal analysis curve must depend on the rate of reaction.

2194. OLIVER, T. R. AND NEWITT, D. M. **The mechanism of the drying of solids. II. The measurement of suction potentials and moisture distribution in drying granular solids.** *Trans. Inst. Chem. Engrs.* (London) **27**, 9-18 (1949).—*C.A.* **46**, 6871*c*.

Granular solids in which capillary forces are responsible for movement of moisture show drying-rate curves in which there are 3 fairly well-defined periods, the crit. points becoming less clearly marked as the particle size decreases. Solids in which the moisture movement is mainly by vapor diffusion exhibit drying rates showing a gradually increasing gradient as drying proceeds. Wood soap, and some clays have drying-rate curves of this latter type. For other classes of metals, such as vegetable products, clays, and granular metals comprised of porous granules, some modification of the vaporization mechanism may occur owing to changes in the phys. properties of H_2O when occupying very fine capillary spaces.

2195. GUTIÉRREZ RÍOS, E. AND VIVALDI, J. L. MARTIN. **Silicates of laminar structure. I. Hydration.** *Anales real soc. españ. fís. y quím.* **45B**, 291-342 (1949).—*C.A.* **43**, 8233*a*.

Dehydration curves from 20° to 900 °C were reported for 2 samples of bentonite in which the exchangeable cations were replaced by Li, Na, K, Rb, Cs, Mg, Ca, Sr, or Ba and for kaolin with replacement by Li, Na, K, Mg, Ca, or Ba. The hydration water H (in g per g of dry material) was calcd. for samples that had reached equil. at 1.30, 6.50, and 13.15 mm water vapor pressure. There was essentially no difference between the behavior of Li and the other alkali ions. The behavior of kaolin was similar to that of the alk. earth bentonites except for a factor arising from the inaccessibility in kaolinite of the intralaminar layers and the interior cations to hydration.

2196. SCHOFIELD, R. K. **Calculation of surface areas of clays from measurements of negative adsorption.** *Trans. Brit. Ceram. Soc.* **48**, 207-13 (1949).—*C.A.* **43**, 6799*b*.

Gouy's theory of ionic equil. in the diffuse component of the elec. double layer was combined with measurements of neg. adsorption and estimates made of the surface area of a sample of bentonite. The montmorillonite in this bentonite had sepd. almost completely into sep. 10A "leaflets." Preliminary measurements with a sample of kaolin gave an estimate of surface area in close agreement with values previously calcd. from particle size and N_2 adsorption.

2197. TAYLOR, STERLING A. **Oxygen diffusion in porous media as a measure of soil aeration.** *Soil Sci. Soc. Am., Proc.* **14**, 55-61 (1949).—*C.A.* **45**, 1709*f*.

The change in partial pressure of O_2 with time was studied. A new soil parameter λ was proposed which is a relative measure of the rate of diffusion of gases through the soil. It can be interpreted physically as the length of a tube of unit cross section through which free diffusion is allowed to take place which will supply O_2 to a point at the same rate as it is supplied by the soil.

2198. ALONSO, J. I. FERNANDEZ; GASCO, L., AND HIDALGO, A. **Physicochemical study of ceramic clays of Eastern Spain. I. Chemical analyses, cationic exchange, and particle-size analysis.** *Anales real soc. españ. fís. y quím.* **46B**, 187-96 (1950).—*C.A.* **44**, 10279*e*.

Analyses and phys. properties of 12 samples were given. Titration graphs resembled weak dibasic acids. Methods and errors of particle size detn. were discussed.

2199. CAILLÈRE, SIMONNE. **Action of heat on clay minerals.** *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* **3**, 54-63 (1950) (in French).—*C.A.* **47**, 1011*e*.

The wt of a sample was detd. as a function of the temp. at which it was held. Results were compared to the wt of H_2O that was driven off and absorbed in H_2SO_4. The temp. at which a loss of H_2O occurred depended on the rate of heating. Another method of detg. changes of mineral samples with heat was based on dilatometric measurements which were compared to a standard. Generally the curves obtained were inclined from 0° to around 700 °C where abrupt changes occurred.

2200. CORNET, I. **Expansion of the montmorillonite lattice on hydration.** *J. Chem. Phys.* **18**, 623-6 (1950).—*C.A.* **44**, 10438*a*.

When exposed to water vapor, water, or some nonaq. solvents, montmorillonitic clays expand. Based on the assumption that the expansion on hydration was a uni-dimensional swelling phenomenon, a thermodynamic analysis indicated that for lattice expansions of 3 or 4A. from the dehydrated contracted state, the force between montmorillonite lattice layers was substantially const.; but for greater expansions the force diminished in a complex manner.

2201. DOMINGO, W. R. **Irreversibly dried, difficultly wettable soils.** *Landbouwkund. Tijdschr.* **62**, 252-60 (1950); *Soils and Fertilizers* **13**, 261 (1950).—*C.A.* **46**, 4714*h*.

Irreversible drying of some soils is related to low ground-water level, type of org. matter, high Fe content, adsorbed air, and presence of fatty substances. Irreversibly dried soils regain the capacity for swelling after exposure to NH_3 for 24 hrs; NH_3 displaces adsorbed air and thus facilitates absorption of water and swelling.

2202. DYAL, R. S. AND HENDRICKS, S. B. **Total surface of clays in polar liquids as a characteristic index.** *Soil Sci.* **69**, 421-32 (1950).—*C.A.* **44**, 10979*e*.

Total surface, external surface, and, by difference, internal surface of clays were detd. by retention of ethylene glycol in an evacuated system. External surface could be detd. by retention of ethylene glycol by a sample heated to 600°C. The difference between these two detns. divided by 3.10×10^{-4} expressed the approx. extent to which the clay had montmorillonite interlayer swelling.

2203. EAST, WALTER H. **Fundamental study of clay. X. Water films in monodisperse kaolinite fractions.** *J. Am. Ceram. Soc.* **33**, 211-18 (1950).—*C.A.* **44**, 8076*f*.

The influence of Ca, Na, and H exchangeable ions on kaolinite films was studied and solid-liquid interface energy was computed by means of heat of wetting. The H_2O film averaged less than 100 A. at low forming pressures and was continuous from crystal surface to total equil. thickness. Exchangeable ions were believed to be adsorbed on all crystal surfaces and influenced the films both by characteristic ion hydration and by polarization, the latter causing unique particle orientation.

2204. ERIKSSON, ERIK. **The water-pressure relationship in bentonite gels.** *Kgl. Lantbruks. Högskol. Ann.* **17**, 17-23 (1950) (in English).—*C.A.* **45**, 5348*f*.

The water held by montmorillonite can be described mathematically in terms of the pressure by a soln. of the Poisson-Boltzmann differential equation between 0.1 and 1.0 atm. The specific plane surface of montmorillonite was calcd. to be 5.3×10^6 cm^2/g.

2205. ESCARD, J. **Adsorption of nitrogen at low temperatures by montmorillonite; influence of residual water and exchangeable cations.** *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* **3**, 71-4 (1950) (in French).—*C.A.* **46**, 7397*g*.

Na and Ca montmorillonites were prepd. by purification of a natural montmorillonite, transformation to the H-form, and exact satn. with Na or Ca. The B.E.T. surface of a montmorillonite freed from all the H_2O bound there, with the exception of the constitution H_2O (5%) had a value of 82 m^2/g. This stage of dehydration was obtained by heating to 300°C *in vacuo*. Practically complete removal of the adsorption H_2O was obtained in a Ca montmorillonite by very slow, gentle dehydration, e.g., 700 hrs at 20°C, then 300 hrs at 45°C.

2206. FERRANDIS, VICENTE ALEIXANDRE AND VERDUCH, ANTONIO GARCIA. **Relations between some physical, chemical, and technical properties of clays. I.** *Anales edafol. y fisiol. vegetal* (Madrid) **9**, 537-65 (1950).—*C.A.* **45**, 6360*d*.

Based on chem. analyses, detns. of base-exchange capacity, adsorption capacity for methylene blue, mech. analyses, dehydration curves, differential thermal analysis, plasticity, rate of loss of water, rate of loss of water through the mass, and contraction on burning, the clays were classified into kaolins, illites, kaolin-illites, and quartzose. The adsorption capacity for methylene blue followed in a general way the exchange capacity.

2207. GLAESER, RACHEL. **Organic-montmorillonite complexes in vapor phase. Desorption isotherms of acetone-montmorillonite and 2-propanol-montmorillonite.** *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* **3**, 65-71 (1950) (in French). *Mém. services chim. état* **36**, No. 1, 69-76 (1951).—*C.A.* **47**, 806*b*; **46**, 11054*f*.

Ca montmorillonite and Na montmorillonite were treated with either anhyd. acetone or 2-propanol until no more H_2O was extd. The montmorillonite, covered with the org. compd. was placed over a soln. of the org. compd. in castor oil and allowed to come to equil. *in vacuo* (about 15 days) and then desorbed *in vacuo* over P_2O_5 at 40°C for acetone clay, and 20°C for 2-propanol clay. The acetone-clay and 2-propanol-clay formed bimollayer complexes with Ca montmorillonite and Na montmorillonite which, on desorption, changed to unimol.-layer complexes.

2208. GONZALEZ, F. GARCIA. **The influence of heat-treatment on the hydration capacity of montmorillonite. II.** *Anles real soc. españ. fís. y quím.* **46B**, 89-100 (1950).—*C.A.* **44**, 10609*e*.

Samples of montmorillonite satd. with Li or Mg were heat-treated. In contrast to alk. and alk. earth samples, they suffered a strong reduction in hydration capacity before the reticular area was affected. Treatment with distd. water failed to modify the new structural system created by the heat-treatment.

2209. GONZÁLEZ, F. GARCÍA. **The determination of reticular water in silicates of the montmorillonite group.** *Anales real soc. españ. fís. y quím.* **46B**, 151-60 (1950).—*C.A.* **44**, 8830*f*.

The loss in wt of Li, K, Mg, Ca, Sr, and Ba montmorillonites from Spanish Morocco over the temp. range 300-850°C was investigated for untreated samples and samples that had been heated to 100°, 200°, 300°, and 400°C, and then rehydrated. The inflection point at 300°C did not always represent the point at which loss of hydration water balanced loss of OH-group water. Previous thermal treatment below 300°C and subsequent hydration may cause some hydration water to become strongly bonded, appearing as OH-group water in the 300-850°C zone.

2210. Granquist, W. T. **Adsorption of methane on fuller's earth.** *Ind. Eng. Chem.* **42**, 2572-5 (1950).—*C.A.* **45**, 1837*h*.

The adsorption isotherm of CH_4 at 112°K was detd. for both crude and extruded fuller's earth. Adsorption isotherms at other temps. (112°-123°K.) and the *isosteric heat of adsorption* were calcd. by the method of Polanyi.

2211. Hoyos, Angel de Castro and Rodriguez, Julio. **Influence of thermal treatment on some physicochemical properties of bentonite.** *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* **2**, 75-7 (1950).—*C.A.* **46**, 4756*i*.

The bentonite, from Spanish Morocco, first was transformed into acid bentonite with 0.5 *N* AcOH. Exptl. values of the rehydration, obtained from dehydration curves, showed that up to 300°C the adsorbed H_2O was entirely recovered in the rehydration; above 300°C the amt. of adsorbed H_2O diminished with rising temp. There was a small diminution of the exchange capacity in passing from the equil. sample to that at 100°C; as the temp. increased the exchange capacity remained const. until the samples began to lose reticular H_2O (about 400°C) and then a great diminution began.

2212. Hyslop, J. F. and Gworek, J. **Heat treatment and contraction of a fireclay.** *Trans. Brit. Ceram. Soc.* **49**, 80-2 (1950).—*C.A.* **44**, 4214*i*.

Heating a dehydrated, oxidized Scottish fireclay to equil. gave two contraction periods connected with major changes in the constitution of the clay. The first, at 850°C, was due to the formation of γ-Al_2O_3 and the second, at 1000°C, was assocd. with the formation of mullite. The main derived contraction curve was a composite one of the curves for metakaolin, γ Al_2O_3, and mullite.

2213. Jasmund, K. **The siliceous clay minerals.** *Angew Chem.* **62**, 181-2 (1950); *Beiheft No.* **60**, 128 pp.—*C.A.* **44**, 8289*c*.

The phys.-chem. properties and behavior of the clay minerals were summarized extensively. The minerals covered were: (1) kaolinite, (2) montmorillite, (3) pyrophyllite and mica-like minerals, and (4) clay minerals possessing alternating layer structure.

2214. Longuet-Escard, J. (Mme). **The effect of progressive dehydration on the area of the surface of montmorillonites.** *J. chim. phys.* **47**, 113-17 (1950).—*C.A.* **44**, 7617*i*.

A Na-montmorillonite contg. 10.3% H_2O dried at 20°C had a surface area of 14 m^2/g. On being dried at successively higher temps. the area increased to a max. of 90 m^2/g with a water content of 5.2%. The area and content of H_2O then decreased to about zero as the sample was dried at successively higher temps. in the range 300 to 900°C. A Ca montmorillonite with a surface area of 38 m^2/g and a water content of 13% at 20°C increased in area to a max. of 75 m^2/g after drying at 70°C to a 10.8% water content. Desorption isotherms for N_2 at -195°C showed hysteresis and an abrupt decrease at a relative pressure of 0.5.

2215. Longuet-Escard, J. (Mme.); Mering, J., and Perrin-Bonnet, I. **Activation of montmorillonite.** *J. chim. phys.* 47, 234-7 (1950).—*C.A.* 44, 7617*g*.

X-ray and gas-adsorption studies with N_2 were made. When montmorillonite was treated with H_2SO_4, the specific surface tended towards a max. and then decreased as increasing amts. of the Al, Fe, and Mg oxides were removed from this siliceous mineral. The variation of the specific surface was attributed to the formation of an amorphous SiO_2 and division of the silicate particles.

2216. McCarter, W.S.W.; Krieger, K. A., and Heinemann, H. **Thermal activation of Attapulgus clay.** *Ind. Eng. Chem.* **42**, 529-33 (1950).—*C.A.* **44**, 4214*f*.

The main constituent of the fuller's earth found near Attapulgus, Ga. was a hydrous Mg-Al silicate, a distinct clay mineral, the structural scheme of which distinguished it from mica and montmorillonite. Water-adsorption properties were correlated with changes in structure during activation as expressed by differential thermal analysis and x-ray diffraction patterns. The effect of thermal cleavage upon surface area and water adsorption, the importance of cleavage for rates of adsorption and diffusion, and the role of extrusion in maintenance of surface area at high activation temp. were discussed.

2217. Mills, G. A.; Holmes, James, and Cornelius, E. B. **Acid activation of some bentonite clays.** *J. Phys. & Colloid Chem.* **54**, 1170-85. (1950).—*C.A.* **45**, 3221*h*.

Fourteen bentonite clays were acid-treated at 93°C in 5-20% H_2SO_4 at acid to clay ratios of 0.2 to 0.8 for times up to 16 hrs. The chem. compns. were detd. and the phys. and catalytic properties measured after the samples were pelleted and calcined at 565°. Increased severity of acid treatment gave a continuous increase in surface area and porosity and a decrease in the d. of the pellet. Certain clays were apparently incapable of being activated for catalytic cracking, even though their phys. properties were substantially identical to other clays that were "activable." High extrusion pressures on the acid-activated bentonites were found to increase pellet d. at the expense of large pores.

2218. Nagasawa, Shin. **Sorption of gases by active bentonite. V. Sorption velocity of water vapor.** *J. Electrochem. Soc. Japan* **18**, 391-3 (1950).—*C.A.* **45**, 8320*c*.

The sorption velocity of water vapor by the activated bentonite was detd. under the satd. vapor. pressure at 25° and 35°C. During the first 13 hrs, surface adsorption and simple capillary condensation took place. In the next 15 hrs water vapor condensed into smaller capillaries, and from that time onward, water vapor penetrated slowly into extremely fine spaces. The desorption process was also measured.

2219. Ono, Sôzaburo and Watanabe, Takehiko. **Colloidal properties of bentonite. I. Influence of heat-treatment and ultrasonic treatment on the degree of swelling of bentonite.** *J. Chem. Soc. Japan, Pure Chem. Sect.*, **71**, 574-7 (1950).—*C.A.* **45**, 6457*i*.

The degree of swelling of bentonite from Niigata Prefecture was reduced by heat-treatment. It could be restored almost reversibly by irradiation with supersonics as long as the heating temp. was below 450 °C. The restoration could hardly be observed when the heating temp. was greater than 800 °C.

2220. SANDFORD, FOLKE. **Investigations on clay. III.** *Trans. Chalmers Univ. Technol., Gothenburg No.* **93**, 31 pp. (1950).—*C.A.* 44, 11050*i*.

The phys. and chem. properties of clay minerals in particular were discussed. The theory of ceramic firing processes was given with a special discussion of the effects of the furnace atm., and their action on the constitution of the ceramic end product.

2221. SIDOROVA, A. I. **Ionization of aromatic amines in the vacuum adsorption on active clays.** *Doklady Akad. Nauk S.S.S.R.* 72, 327-30 (1950).—*C.A.* 44, 7147*g*.

Spectral absorption curves were recorded for the colored adsorption-complexes of Ph_2NH vapor on bentonite, CeO_2, and $BiCl_3$, as compared with the absorption curve of the Ph_2NH^+ ion obtained by photoxidation in soln. The absorption maxima at 500 and 680 $m\mu$, very marked on bentonite, are faint on CeO_2. The semi -quinone-ion maxima at 500 and 680 $m\mu$, on bentonite, weakened increasingly on exposure to air; after 3 days, the 680 max. disappeared completely, the 500 max. almost completely, and a new max. appeared at 600 $m\mu$. An intense rose color was obtained by vacuum adsorption of $p\text{-}Me_2NC_6H_4NH_2$ on bentonite.

2222. TEICHNER, S. **Comparison of adsorption isotherms for nitrogen and for butane on various adsorbents.** *J. chim. phys.* 47, 118-21 (1950).—*C.A.* 44, 7617*e*.

Both N_2 and C_4H_{10} yielded S-shaped (type II) adsorption isotherms at -195° and 0°C, resp., on a sample of montmorillonite. After acid activation the sample yielded a type-II adsorption isotherm for N_2 but a type-IV isotherm for C_4H_{10}.

2223. TEICHNER, S. **Kieselguhrs of the type utilized as support for catalysts.** *J. chim. phys.* 47, 229-32 (1950).—*C.A.* 44, 7635*c*.

Kieselguhr, kieselguhr treated with HCl and HNO_3, and calcined kieselguhr were studied: loss in wt after etching Na_2CO_3, d., and specific surface as detd. by adsorption of N_2 and CO at -195°C and of butane at 0°C. The kieselguhr treated with acids had approx. 50% greater specific surface than the raw kieselguhr and that of the calcined kieselguhr was only 11% as great. Treatment with 5% Na_2CO_3 reduced slightly the surface area of the raw kieselguhr, but the same treatment decreased by 50% the surface area of the kieselguhr treated with acids.

2224. TEICHNER, S. **Analogies of texture between activated montmorillonites and certain catalysts.** *J. chim. phys.* 47, 244-52 (1950).—*C.A.* 44, 7635*g*.

A large amt. of adsorbed water could be removed from Ca- and Na-montmorillonites by vacuum treatment at 20 °C, and practically all of the water except the combined water was removed by vacuum treatment at 180 °C. The surface area increased for samples dehydrated by vacuum treatment at 180 °C. Vacuum treatment at 450 °C reduced the surface area. Adsorption studies with N_2 and hydrocarbons were made of 6 Fischer-Tropsch catalysts. The difference between the total adsorption of N_2 and CO at -195 °C was utilized to det. the fraction of metal exposed at the surface.

2225. VENTRIGLIA, UGO. **Plasticity of clays.** *Periodico Mineral.* **19**, 51-100 (1950).—*C.A.* **45**, 319*i*.

The different methods for the detn. of plasticity were discussed, and some fundamental phys. and chem. factors described. The results of x-ray studies on the layer structure of the clay minerals on these theoretical deductions were shown by a detailed description of the modern electrostatic theory of adsorption and ionic base exchange on the surface of the clay particles, with particular emphasis given to the Hendricks-Jefferson theory of H bonds in adsorbed water films on the clay minerals.

2226. ZUL'FUGAROV, Z. G. **Transformation of the vapor of the amylene-hexylene fraction of the overhead benzene product by the action of natural Azerbaijan aluminosilicates (cinders and clays).** *Zhur. Priklad Khim.* **23**, 767-74; *J. Applied Chem. U.S.S.R.* **23**, 811-18 (1950).(Engl. translation).—*C.A.* 46, 4206*g*.

Vapors of an unsatd. $C_5\text{-}C_6$ hydrocarbon fraction of benzene light oil are adsorbed in varying amts. by samples of volcanic ash and natural or activated bentonites suspended in a container above the liquid. Activated Khanlar bentonite adsorbs as much as 6.06 g of hydrocarbons per g of the clay in 23 days to form a colored liquid condensate having a higher d. and *n* and a much lower I no. Polymerization takes place during the adsorption process.

2227. BAGCHI, S. N. **Minerals present in H-clays from Indian soils, kaolins, and bentonites. I. X-ray studies. II. Thermal and optical studies.** *Indian Soc. Soil Sci. Bull.* No. **6A**, 19-41, 42-66 (1951).—*C.A.* 47, 6077*f*.

Detailed account was given of the application of the powder diffraction method and of temp.-dehydration studies by intermittent heating in confirming the mineralogical character of the clay minerals of the various H-clay fractions.

2228. BYKOV, V. T. AND KUADZHE, M. I. **Sorption and catalytic properties of some bleaching earths.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* **1951**, 487-99.—*C.A.* **46**, 3841*b*.

A no. of earths from different regions of the U.S.S.R. were studied from the point of view of sp gr., bulk wt, swelling in H_2O, pH of the aq. ext., chem. compn., and by thermography, electron microscopy, and x-ray diffraction. The catalytic properties were investigated in flow runs of redistribution of H in a gasoline fraction b. 100-150 °C, cracking of cumene, and dehydration of EtOH. Some of the native earths show high catalytic activity without any treatment. The bleaching properties are better, the closer the B.E.T. area to the surface area of the adsorption film, i.e. the greater the vol. of intermediate pores.

2229. BYKOV, V. T. **Sorption and bleaching properties of native sorbents.** *Izvest. Akad. Nauk S.S.S.R., Otdel Khim. Nauk* **1951**, 678-85.—*C.A.* 46, 3827*c*.

On various native bleaching clays, the sorption of C_6H_6 vapor at 20°C at the point of beginning hysteresis attained 0.5-0.7 millimole/g, corresponding to a vol. of liquid sorbed of 0.05-0.08 cc/g, as against 0.10-0.15 on coarse, and 0.17-0.35 on fine silica gels, but comparable to Al_2O_3 gels, 0.05-0.09 cc/g. At satn., the liquid vol. sorbed attained 0.10-0.50 cc/g, comparable to the best Al_2O_3 and fine silica gels, and inferior only to coarse silica gels. There was good linear relation between the bleaching factor and the vol. of intermediate pores.

2230. Egawa, Tomiji. **A method of measuring the sorption of water vapor by the soil.** *J. Sci. Soil Manure* **21**, 175-8 (1951).—*C.A.* **45**, 10453*b*.

The adsorption and desorption of H_2O vapor by soil samples were directly detd. From sigmoid curves thus obtained there is no satn. point in the adsorption which increases when the vapor pressure approaches satn.

2231. Glaeser, Rachel. **Retention of organic molecules on montmorillonite.** *Compt. rend.* **232**, 1496-8 (1951).—*C.A.* **45**, 8321*b*.

Some volatile org. compds. were retained indefinitely in a vacuum as unimol. layers on Ca- but not usually on Na- montmorillonite. The thickness and ds. of the layers were discussed.

2232. Gonzalez, F. Garcia. **The influence of thermal treatment on the hydration capacity of montmorillonite. III.** *Anales real soc. espan. fis. y quim.* **47B**, 357-62 (1951).—*C.A.* **46**, 4963*e*.

Montmorillonite from Tidinit was heated to just below the temp. at which the crystn. lattice was destroyed, then rehydrated both in steam and water. When samples satd. with small exchangeable cations (such as Li and Mg) were dehydrated by thermal treatment, fixation occurred and a micalike structure formed. This, however, did not occur in samples satd. with cations Si and Ba. The samples of montmorillonite contg. K and Ca retained their rehydration capacity unchanged upon thermal treatment.

2233. Hauth, W. E. Jr. and Davidson, Donald T. **Clay fraction in engineering soils. I. Identification by thermal analysis.** *Iowa Eng. Expt. Sta., Engr. Rept.* No. **10**, 449-58 (1951-1952).—*C.A.* **46**, 9755*h*.

Special sample prepn. becomes necessary when only a small per cent of the soil is clay or when other materials are present whose reactions tend to mask those of the clay minerals. The clay concn. may be increased by extg. and analyzing either the soil fraction passing a 270-mesh sieve or the particles less than 1 μ in diam. Interfering materials can be eliminated by proper treatment, e.g. the removal of org. material from a soil by the use of H_2O_2.

2234. Holmes, James and Mills, G. A. **Aging of a bentonitic cracking catalyst in air or steam.** *J. Phys. & Colloid Chem.* **55**, 1302-20 (1951).—*C.A.* **46**, 7749*h*.

Changes in the cracking activity, surface area, and pore structure of filtrol, an acid-treated bentonitic clay, were measured in the range 510-1135°C. The 10-hr air treatment produced a thermal deactivation which became noticeable at 775°C. Nearly complete deactivation occurred at 850°C, which was characterized by a loss in surface area and a marked decrease in bulk d. Steam produced a pronounced lowering of activity at 550°C after treatment for several hours at atm. pressure. Nearly complete deactivation occurred at 790°C. No overall correlation was found between cracking activity and surface area for all heat-treated samples.

2235. Hoyos, Angel de Castro and Rodriquez, Julio. **Surface changes of an acid bentonite on thermal treatment.** *Anales real soc. espan. fis. y quim.* **47B**, 504-14 (1951).—*C.A.* **46**, 5747*c*.

After being heated to 300°C, bentonite could be rehydrated. The specimens heated to 600° or 700°C were able to recover partly the loss of reticular water, but this recovered water was lost at 300° and 400°C. This was not associated with the loss of OH groups.

2236. Keenan, A. G.; Mooney, R. W., and Wood, L. A. **The relation between exchangeable ions and water adsorption on kaolinite.** *J. Phys. & Colloid Chem.* **55**, 1462-74 (1951).—*C.A.* **46**, 2874*h*.

Adsorption of H_2O at 20°C was detd. for the alkali and alk.-earth salts of kaolinite. Kaolinite, natural gradation and fractionated by sedimentation (0.5μ), was electrodialyzed and converted to the desired salt by treatment with hydroxide soln. except for Rb for which the carbonate was used. The clay suspensions were dried at 70°C to const. wt. Equilibration was rapid, being 85-90% complete in a few min. The presence of 1 mm of air increased the time to reach equil. three-fold. The adsorption was reversible, though hysteresis was noted with clays dried at 90°C. The B.E.T. theory appeared to be justified, though the significance of the H_2O monolayer is not clear.

2237. Mering, Jacques. **Process of hydration of montmorillonite.** *Mem. services chim etat* **36**, No. 1, 43-64 (1951).—*C.A.* **46**, 11055*a*.

2238. Newitt, D. M. **Drying characteristics of china clay.** *Ind. Chemist* **27**, 555-9 (1951).—*C.A.* **46**, 6801*h*.

To have equal vaporization of moisture at all depths at any instant, $(p-p_a)/R$ must be a const. for any point in the body; p is the vapor pressure of the moisture at any point, $(p-p_a)$ is the difference in vapor pressure between that point and a point in the drying air, and R is the resistance to vapor flow from the point under consideration to the air stream.

2239. Roquet, Juliette. **Isothermal residual magnetism of magnetite in small dispersed particles.** *Compt. rend.* **232**, 946-8 (1951).—*C.A.* **45**, 5472*c*.

The magnetic properties were measured on kaolin samples contg. particles of synthetic magnetite whose mean dimensions were 0.1 micron. Magnetic susceptibility, the variation of the isothermal residual magnetism and the demagnetizing field as a function of the magnetizing field were detd.

2240. Sandford, Folke. **The catalytic effect of kiln atmosphere on adsorption and moisture expansion of fired whiteware bodies.** *J. Am. Ceram. Soc.* **34,** 179-83 (1951).—*C.A.* **45,** 7324*d*.

The compns. of a vitreous china body, an earthenware body, and a calcareous earthenware body were, resp.: china clay 30, 35, 21; ball clay 18, 20, 20; quartz 23, 40, 37; feldspar 29, 15, 12; limestone 0, 0, 10%. The kiln atms. were N_2, O_2, CO_2, CO 10 + N 90%, air, and steam. After firing for 5 hrs at 1000, 1100, and 1200°C, the samples were ground to pass a 120-mesh sieve. The samples were weighed before and after exposure, at 25°C, over H_2SO_4-H_2O solns., at 10 different relative humidities from 9.3 to 94.4%. All data were tabulated and sorption isotherms reproduced. The wide variation in the data emphasized the importance of kiln atm.

2241. Sudô, T.; Minato, H., and Nagasawa, K. **Special kaolinitic clay from Shichinohe, Aomori Prefecture.** *J. Geol. Soc. Japan* **57,** 473-80 (1951).—*C.A.* **46,** 9024*f*.

Shichinohe clay showed an isotropic appearance under the microscope, and its x-ray powder pattern agrees with that of hydrated halloysite. Chem. analysis, differential thermal analysis curve, and electron micrograph showed slight difference from typical hydrated halloysite thus far reported. Specifically the water content, and the ratio of silica to alumina were greater.

2242. Vivaldi, J. L. Martín and Gonzalez, F. Garcia. **Characterization and properties of a bentonite from Almería. II.** *Anales edafol. y fisiol. vegetal* (Madrid) **10,** 561-84 (1951).—*C.A.* **46,** 11054*h*.

Bentonite was sepd. into 2 fractions by dispersion in aq. medium with NH_3 and subsequent sedimentation; 44.2% had an apparent particle diam. of less than 1.12μ. Chem. analyses, cation-exchange capacities, water-absorption capacities, dehydration curves, thixotropies, differential thermal and x-ray analyses, and electron-microscope examns. are reported for both fractions. Fibrous aggregates in the coarse fraction cannot be explained on the basis of chem. analysis. Both fractions show a high replacement of Al^{+++} in octahedral coördination by Fe^{+++} and Mg^{++}.

2243. Williamson, W. O. **The physical relations between clay and water.** *Trans. Brit. Ceram. Soc.* **50,** 10-34 (1951).—*C.A.* **45,** 6814*d*.

The formation of water films is initiated by adsorption processes, but the total film thicknesses are not produced thereby. The clay flakes tend to take up equil. positions in a force network and the intervening spaces are filled by water. Equil. is never obtained throughout the whole system, which thus remains mechanically metastable and produce the shear-hardening and other peculiar properties of plastic clay. The effect that adsorbed cations and anions may have on the structure and d. of water at the clay-water interface is assessed.

2244. Woodruff, C. M. **Water retention by clays.** *Soil Sci. Soc. Am., Proc.* **15,** 54-6 (1950) (Pub. 1951).—*C.A.* **46,** 205*g*.

The dehydration curves of kaolinite, beidellite, and montmorillonite were detd. over the p_F range from 0 to 7. Three different mechanisms retain water in a clay system under a moisture stress: adsorption of water on the clay surface. structural formation in the clay, and surface tension where particles come in contact and shrinkage ceases.

2245. Yagi, Skae; Kunii, Daizo, and Katsuki, Sanae. **Infrared drying characteristics of granular or powdery materials. I and II.** *Chem. Eng. (Japan)* **15,** 108-16; 117-24 (1951).—*C.A.* **45,** 7389*f*.

Sand, porcelain clay, dye, and basic Mg carbonate were dried by an infrared projector (9000 kcal./m²/hr). In the const.-rate period drying states of these materials were almost identical with free water. Humidity and velocity of air had only slight effects on the drying rate.

2246. Balduin, H. and Wieden, P. **Discoloration of active clays by treatment with organic vapors.** *Kolloid-Z.* **125,** 173-4 (1952).—*C.A.* **46,** 6460*e*.

Bleaching earth (acid-activated clays) absorbs xylene vapor at 105°C and takes on a rose to red color in 2-5 weeks. Toluene reacts the same as xylene, and tetralin in a much reduced degree. Under the same conditions no color changes were observed with vapors of C_6H_6, cyclohexane, decalin, aniline, MeOH, EtOH, isoamyl alc., or H_2O. The coloration indicates the presence in the clay of side chains which combine with aromatic hydrocarbons. Desorption of the colored product at 105°C results in deepening the color tone to a dark violet-to-gray.

2247. Bering, B. P.; Dreving, V. P.; Kiselev, A. V.; Serpinskii, V. V.; Surova, M. D., and Shcherbakova, K. D. **Adsorption properties of montmorillonite clays.** *Kolloid. Zhur.* **14,** 399-407 (1952).—*C.A.* **47,** 3080*c*.

The total porosity (detd. from the desorption of MeOH vapor), the heat Q of wetting by H_2O and MeOH, and the limiting adsorption a of palmitic acid from CCl_4 were: 0.41 cc./g, 12.7 cal/g, 11.9 cal/g, and 0.15 millimole/g, resp. On heating the clay at 550°C, the Q (for H_2O) was 5. The surface calcd. from adsorption and desorption of 2-methylbutane and n-octane, was 50 m²/g. MeOH was adsorbed very slowly (days instead of min.), but the max. adsorbed amt. corresponded to a surface of 320 m²/g. An even greater surface (350 m²/g) seemed to be accessible to H_2O vapor. The surface occupied by H_2O at the start of the capillary condensation was approx. 55 m²/g.

2248. Budnikov, P. P.; Khiterovich, M. I., and Blokh, G. S. **Effect of sulfite-alcohol wash water on the rate of drying of clay.** *Doklady Akad. Nauk S.S.S.R.* **82,** 127-9 (1952).—*C.A.* **47,** 4570*g*.

Plastic and semiplastic clays were mixed with 0.05 and 0.2% by wt of sulfite-alc. wash water and dried at 110°C. The admixts. increased the rate of drying during the first 2.5 hrs. The effect was more pronounced on plastic than on semiplastic clay.

2249. Bykov, V. T. **Natural sorbents of the Far East. II. Sorption of benzene vapors by natural sorbents and structure of the sorbents.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* **1952,** 583-91;—*C.A.* 47, 940*g*.

The porosity of 30 natural sorbents of different types, including fresh and weathered tuffs, diatomites, and bleaching earths, was investigated by adsorption-desorption of C_6H_6 vapors. The tabulated data include the point of beginning hysteresis, the vol. of C_6H_6 sorbed (cc./g) at that point and at the relative pressures $p/p_s = 0.25$, 0.50, 0.95, and at satn., and the sp. surface area of the skeleton and of the adsorption film.

2250. Colegrave, E. B. and Rigby, G. R. **The decomposition of kaolinite by heat.** *Trans. Brit. Ceram. Soc.* **51,** 355-67 (1952).—*C.A.* 47, 1351*e*.

Dehydrated kaolin was purely amorphous in character. The exothermic reaction, which occurred at about 960-1000°C, was the sudden crystn. of γ-Al_2O_3 from the amorphous phase, which was prevented at lower temp. by the SiO_2 in intimate contact with it. The SiO_2 in dehydrated kaolin, although insol. directly in aq. Na_2CO_3, had been found to be completely sol. in this reagent after previous removal of the Al_2O_3 by acid extn. The form of the SiO_2 residue after $HClO_4$ treatment of the dehydrated kaolin showed that the Al_2O_3 and SiO_2 were not in chem. combination.

2251. Evans, E. J. and Jackson, M. L. **Chemical determination of sorbed water and structural hydroxyl in colloidal minerals of soils and sediments.** *Soil Sci. Soc. Am., Proc.* **16,** 364-8 (1952).—*C.A.* 47, 5596*e*.

The sorbed water was extd. with methanol. The structural hydroxyl was detd. by heating the sample in a silica tube oven, passing a gas through the tube, and collecting the liberated water in methanol. The water contents of the methanol solns. were detd.

2252. Greene-Kelly, R. **A test for montmorillonite.** *Nature* **170,** 1130-1 (1952).—*C.A.* 47, 5847*i*.

Montmorillonite satd. with small ions, such as Li, and dried at moderate temp., is distinguished from other montmorillonoids by the difficulty of rehydration and marked decrease in exchange capacity. Montmorillonite, as oriented flakes or powder, if satd. by 3 washings with 3*M* LiCl, excess salt being removed with warm 80% alc., retains its structure and remains aggregated. After being dried (at 100°), Li-montmorillonite is treated with glycerol, its x-ray diffraction pattern shows *d*(001) corresponding to 17.7 *kX*.

2253. Hoyos, Angel de Castro and Rodriguez, Julio. **Surface changes of an acid bentonite on thermal treatment. II. Imbibition.** *Anales edafol. y fisiol. vegetal* **11,** 125-40 (1952).—*C.A.* 46, 9231*i*.

2254. Linseis, M. **Critical discussion of tests for clay raw materials.** *La Ceramica* 7, No. 5, 49-52 (1952).—*C.A.* 46, 9817*h*.

For kaolinite the precise chem. analysis gives a good basis for discussion of a clay deposit, but only modern phys.-chem., colloid-phys., and x-ray methods are suitable for the identification of montmorillonite clays. The electron microscope may be an important help, e.g. for the identification of halloysite. Differential thermal analysis is very important in combination with x-ray analysis, although the latter cannot give reliable identification of low feldspar contents of pegmatite clays.

2255. Lopez-Gonzalez, Juan de Dios and Deitz, Victor R. **Surface changes in an original and activated bentonite.** *J. Research Natl. Bur. Standards* **48,** 325-33 (1952)(Research Paper No. 2319).—*C.A.* 46, 10779*i*.

The changes in B.E.T. surface area at different temps. were related to the quantity of adsorbed water and the no. of constitutional hydroxyl groups. The surface area is a measure of only the external boundary (nonswelling surface) of the bentonite, and this is increased significantly by the activation process with HCl. The ratio of surface areas (activated to original) is about 4. A max. in the surface area formed when all of the adsorbed water was eliminated. However, the surface area decreased with the removal of water formed by decompn. of the constitutional hydroxyl groups.

2256. Newitt, D. M. and Coleman, M. **The mechanism of drying of solids. III. Drying characteristics of China clay.** *Trans. Inst. Chem. Engrs.* **30,** 28-42, discussion 42-5 (1952).—*C.A.* 47, 4570*i*.

The mechanism of drying was postulated as resulting from forces other than capillarity. A mechanism in which the clay surface dissoc. to produce diffusible cations which imbibe water osmotically was tested by suction potential detns. with a pressure app. consisting of a permeable thimble through which water from the clay slip was expressed by air pressure. By taking equil. readings of pressure at various amts. of water expressed, the moisture content of the bed at various pressures was detd. Osmotic imbibition was used to explain the effect of Na_2SiO_3 and Na_2CO_3 on the fluidity of clay slips.

2257. Palmer, L. S. **The dielectric constant of the water in wet clay.** *Proc. Phys. Soc.* (London) **65B,** 674-8 (1952).—*C.A.* 46, 10729*a*.

Clay consists of closely packed water-coated clay particles in an air matrix, when the clay is relatively dry. Wet clay consists of clay particles uniformly distributed in a water matrix, the assocd. water having a dielec. const. which varies from that of bound water (3) to that of free water (80) as the water content is increased.

2258. Skempton, A. W. and Northey, R. D. **The sensitivity of clays.** *Geotechnique* **3,** 30-53 (1952).—*C.A.* 47, 1461*g*.

The sensitivity of a clay was the ratio of its undisturbed to its remolded strength. Common values were 2-4, but the range was from about 1 to over 100. Moderate sensitivities had been induced in the lab. by mildly consolidating clays near their liquid limits in 1% salt soln. followed by leaching under the consolidating load for 2 or 3 weeks.

2259. Stone, Robert L. **Differential thermal analysis of kaolin group minerals under controlled partial pressures of water.** *J. Am. Ceram. Soc.* **35**, 90-9 (1952).—*C.A.* **46**, 6350*d*.

American kaolins, one English kaolin, dickite, halloysite, and diaspore were studied under dynamic conditions in atms. contg. H_2O vapor of partial pressures 5-760 mm. First signs of dehydration in all the kaolins appeared at about 400 °C, in halloysite at 320 °C, in dickite at 500 °C, and in diaspore at 465 °C., all in dry air. In steam atms. the starting temps. were 470°, 485°, 585°, and 510 °C,, resp. The results showed that the decompn. reactions of the kaolin group of minerals was reversible at equil. temp.

2260. Tschapek, M. **Influence of high temperatures on the adsorptional properties of clays.** *Comun. inst. nacl. invest. cienc. nat. anexo museo argentino cienc. nat. "Bernardino Rivadavia" Ser.: Cienc. geol.* **1**, No. 7, 1-12 (1952).—*C.A.* **47**, 3764*h*.

Samples with heterogeneous porosity were the most heat-resistant, and the least resistant were vitreous silicates with small pores. At 1000 °C the adsorption capacity of most clays was zero. The loss in adsorption capacity was due as much to a change in the properties of the surface coating as to the decrease in the specific surface. As the crystals were calcined, the OH groups on the surface were the first to decomp., being replaced by metallic cations, and then finally the internal OH groups were replaced. When all OH groups were replaced, the adsorption capacity became zero.

2261. Wieden, P. and Balduin, H. **Gas adsorption on bentonites.** *Kolloid-Z.* **127**, 30-2 (1952).—*C.A.* **46**, 8928*g*.

The adsorptive capacity of bentonite pretreated at 100 °C, for NH_4, SO_2, CO_2, and N_2 decreased in the order given. As the thermal pretreatment increased (6 steps up to 600 °C), the adsorptive capacity for N_2 decreased. As the thermal pretreatment was increased to 850 °C, the adsorptive capacity for CO_2 almost disappeared with the greatest loss between 100° and 150 °C.

2262. Bridger, G. L. and Sinner, R. D. **Adsorption of ammonia on fuller's earth and gas-adsorbent carbon.** *Ind. Eng. Chem.* **45**, 581-2 (1953).—*C.A.* **47**, 5757*i*.

Adsorption isobars for the two adsorbents at atm. pressure and at temps. near the condensation temp. of NH_3 were given. The fuller's earth isobar increased sharply, whereas the isobar for gas-adsorbent charcoal approached a const. value.

I-13. Gases on Organic Materials

2263. Rayleigh, Lord. **The passage of argon through thin films of India rubber.** *Phil. Mag.* 49, 220-1 (1900).

A passed the India rubber film more readily than N_2, but not in such a degree as to render the diffusion process a useful one for concn. of A.

2264. Lester, J. H. **The hygroscopic nature of cotton.** *J. Soc. Chem. Ind.* **21**, 388 (1902).

Absorption of moisture by cotton was not entirely due to cellulose. While the water extract may amount to only about 2%, the matters composing the extract were largely responsible for the hygroscopic nature of cotton.

2265. Masson, Orme. **The wetting of cotton by water and by water vapour.** *Proc. Roy. Soc. (London)* **74A**, 230-54 (1904).

The rise of temp. which cotton underwent when immersed in H_2O and its subsequent slow fall followed the same course as the similar change resulting from its exposure to air satd. with H_2O vapor. Both were affected in the same way by previous moisture and other conditions. The heating was a direct result of the absorption of the vapor by the cotton.

2266. Grunmach, L. **Experiment of the diffusion of CO_2 through rubber.** *Physik. Z.* **6**, 795-800 (1905).

The rate of diffusion of CO_2 through rubber increased with increasing pressure (generally with increase of differences in partial pressure), but proportionality between rate of diffusion and difference in pressure was not consistant. Rate of diffusion decreased with increase in thickness.

2267. Masson, Orme and Richards, E. S. **The hygroscopic action of cotton.** *Proc. Roy. Soc. (London)* **78A**, 412-28 (1906).

The quantity of hygroscopic moisture required to put a given quantity of cotton in equilibrium with a given humidity (below satn. value) was detd. by taking the mean of the apparent equilibrium values reached by absorption and evaporation. Vapor tension of any sample of cotton containing a definite quant. of moisture was, at different temp., the same fraction of that of H_2O.

2268. Trouton, F. T. and Pool, Miss B. **The vapour pressure in equilibrium with substances holding varying amounts of moisture. Measurement of the vapour pressure of water at different temperatures in equilibrium with a fabric wetted with a constant quantity of water.** *Proc. Roy. Soc. (London)* **A77**, 292-314 (1906).

The weight of water absorbed or held by a given fabric (cotton or wool) under different conditions of moisture and temperature of the atmosphere, appeared to depend only on the ratio of actual vapor pressure to the maximum possible. As the atmosphere varied from saturation, the temperature remaining the same, the amount of water held followed some parabolic law giving much greater reduction in weight for a given change in vapor pressure when near saturation than was subsequently obtained.

2269. Masson, Orme and Richards, E. S. **The hygroscopic action of cotton.** *Proc. Roy. Soc. (London)* **A78**, 412-429 (1907).

The amount of H_2O vapor absorbed by a given quantity of cotton in atmospheres of known humidity were detd. True equilibrium values were approached from both sides, by absorption and by evaporation. Neither process became really complete in a practicable time, though each led in a few hours to what might be mistaken for true equilibrium.

2270. Travers, M. W. **The absorption of water by cotton and wool.** *Proc. Roy. Soc. (London)* **A79**, 204-5 (1907).
The absorption of water on cotton and wool was detd. The absorption of vapors by amorphous substs. involved formation of solid solutions or "rigid" solns.

2271. Reychler, A. **The action of sulfur dioxide on wool.** *Bull. soc. belg. chim.* **23**, 471-5 (1909).--*C.A.* **4**, 934.
Description of an app. for measuring the SO_2 absorbed by wool by measuring the pressure under const. vol.

2272. Wright, A. M. **Absorption of moisture from the atmosphere by wools.** *J. Soc. Chem. Ind.* **28**, 1020 (1909).—*C.A.* **4**, 1384.
The amt. of moisture which a wool could absorb from the atm. depended upon: (1) The relative humidity, (2) non-wool constituents (pure wool fiber was not sufficient to account for all of the moisture absorbed by the dry normal wool fiber), (3) natural wool fat present in greasy wool, (4) the wool perspiration present in greasy wools and in slipe wools (about 2% was very hygroscopic and could absorb 60-67% of its own of moisture when exposed to the atm.), (5) fatty matter other than natural wool fat.

2273. Reychler, A. **Adsorption of sulphur dioxide by rubber and by wool.** *J. chim. phys.* **8**, 3-9 (1910).—*C.A.* **4**, 1256.
Para rubber, d. 0.95, was used in the form of a sheet 0.3 mm in thickness. The wool fiber was well washed and dried in air; at 105-110°C it lost 11.4% H_2O. Absorption of SO_2 in rubber was simply a soln. phenomenon. With wool 0.88 mol. of SO_2 was combined chemically and the remaining amt. was dissolved.

2274. Rakovskii, A. V. **Adsorption. I. Chemical hysteresis.** *J. Russ. Phys.-Chem. Soc.* **43**, 170-86 (1911).—*C.A.* **6**, 19.
Wheat starch, St. Vincent arrowroot, and potato starch were gradually dehydrated by keeping them successively in atmospheres of successively diminishing H_2O vapor tension until the wts remained const. under a given vapor tension. The completely dehydrated samples were then hydrated. The magnitude of hysteresis was considerably less than for inorganic colloids.

2275. Rakovskii, A. V. **Study of adsorption. IV. Thermodynamics of irreversible processes and chemical hysteresis.** *J. Russ. Phys.-Chem. Soc.* **43**, 1762-84 (1911).—*C.A.* **6**, 1246.
Potato starch contg. 36.98% H_2O was alternately placed in 2 desiccators in which the vapor tensions were 9 and 11 mm, resp. The transfer from one desiccator to the other was made every 24 hrs, and the starch was weighed before each transfer. When the H_2O content reached 19.6% the loss during 24 hrs became very small, but the amt. of H_2O was always higher at the higher tension.

2276. Austerweil, M. G. **Passage of hydrogen through the rubber walls of balloons.** *Compt. rend.* **154**, 196 (1912).—*C.A.* **6**, 1234.
The loss of H_2 from the envelope was not due to simple diffusion but to "colloidal" diffusion accompanied by the phenomenon of H_2 adsorption. The % of H_2 adsorbed increased during the period of inflation.

2277. Bancroft, W. D. **The action of water vapor on gelatin.** *J. Physic. Chem.* **16**, 395-406 (1912).—*C.A.* **6**, 2874.
When gelatin which had been soaked in water was exposed to satd. vapor it lost water, because the vapor pressure of the water inside the walls of the gelatin cells was greater (because of the curved surface) than the v.p. from the plane surface of the water. Dry gelatin exposed to satd. vapor adsorbed water in the cell walls, but the interior of the cell did not fill with water.

2278. Steinitzer, F. **The behavior of rubber towards carbon dioxide.** *Gummi-Ztg.* **26**, 1626-8 (1912).—*C.A.* **6**, 2693.
The absorptive power was found by exposing the material to be tested for 8 days to pure dry CO_2 at a pressure of 1.5 kg/cm^2. Under these conditions rubber can absorb more than its own vol. of CO_2; the less mineral matter present the more CO_2 was absorbed.

2279. Bryant, E. G. **Moisture in cloth.** *Chem. News* **108**, 85 (1913).—*C.A.* **7**, 3666.
The moisture contents of tweed cloths were detd. by drying samples to const. wt at 70°C, with the following % losses: control sample, 13.37; exposed sample, outside of roll, 12.55; middle of roll, 13.44; innermost layer, 13.37.

2280. Leprince-Ringuet, F. **Adsorption of gas by coal.** *Compt. rend.* **158**, 573-6 (1914).—*C.A.* **8**, 1864.
Fire-damp, CO_2, air, O_2 and CH_4 at pressures from 0.25 to 80 atms. were adsorbed by coal to a much less extent than by charcoal. The adsorption in both cases was similar; a state of equil. existed for each temp. and pressure, and the adsorption decreased considerably as the temp. rose. Adsorption increased rapidly at first with increase of pressure but gradually tended to a limit.

2281. Rakovskii, A. V. **Adsorption. XI. Hysteresis of the degree of hydration of cellulose.** *J. Russ. Phys.-Chem. Soc.* **47**, 18 (1915).—*C.A.* **9**, 1567.
The water retained *in vacuo* by cotton, paper, flax, and hemp showed that the max. of hysteresis for cellulose (1.8% H_2O) was slightly lower than for starches.

2282. Dewar, James. **Diffusion of gases through india rubber.** *Proc. Roy. Inst.* **21**, 813-26 (1918); *J. Chem. Soc.* **114**, II, 186-7 (1918).—*C.A.* **12**, 2275.
The relative rates of diffusion through Para rubber membranes 0.01 mm thick at 1 atm. pressure, and 15°C were: air, 1.0; N_2, 0.69; CO, 0.94; He, 1.75; A, 1.28; O_2, 2.0; H_2, 5.6; CO_2, 14.0. The abs. rate for air was 2.0 cc. per cm^2 per day. The relative rate varied with temp. The order of diffusibility was not associated with any chem. or

physical property. The diffusion of H_2O through a membrane, one side of which was immersed in H_2O, showed that the vol. rate at 15°C of the diffusion of H_2O vapor was 163 times that of air.

2283. ODDO, B. **Cellulose and nitrocellulose. Absorbing power for gases and constitution.** *Gazz. chim. ital.* **49**, II, 127-39 (1919).--*C.A.* **14**, 1529.

Cellulose was capable of fixing acid gaseous products like dry HCl in such proportions as correspond to 1 mol. for the quadruple mol., i.e., C_{24}. Of the other gases only NH_3 showed this relation approx. All the gases were absorbed by cellulose in the same relation in which they were dissolved by H_2O. Of the gases tested the order of decreasing absorption by vol. by cellulose was as follows: NH_3, HCl, SO_2, CO_2, O_2, H_2.

2284. DAYNES, H. A. **The process of diffusion through a rubber membrane.** *Proc. Roy. Soc. (London)* **97A**, 286-307 (1920).—*C.A.* **14**, 2573.

The diffusion of H_2 through rubber membranes depended upon both diffusion and absorption phenomena. The mean value for the diffusion const. for the 3 films considered was 11.4×10^{-6} cm/sec at 20°C. The mean value of the absorption coeff. was 0.035 at 20°C and normal pressure. The absorption coeff. had a low temp. coeff. 0.5%/1°C (approx.).

2285. NELSON, O. A. AND HULETT, G. A. **Moisture content of cereals.** *J. Ind. Eng. Chem.* **12**, 40-5 (1920).--*C.A.* **14**, 578.

A description of a method of detg. the H_2O content of cereals and other colloidal org. substances by heating the material in a high vacuum for definite periods of time. The H_2O liberated was condensed in a tube surrounded by solid CO_2, and weighed.

2286. BOIJA, J. **Drying cellulose and determining its water content.** *Svensk Pappers Tid.* **24**, 298-9 (1921).—*C.A.* **16**, 644.

Six curves showed the % of H_2O in the pulp at each set of rolls in the drying machine, the drop in the H_2O content as cellulose was dried at 105°C, the absorption of H_2O by absolutely dry cellulose, the loss of H_2O by cellulose at 15°C, the comparison of the actual with the detd. H_2O content, and the H_2O content of cellulose at varying amts. of moisture in air. The H_2O content of cellulose was about 0.7% higher than tests usually showed.

2287. MUNRO, A. D. **The occlusion of gases in coal.** *J. Soc. Chem. Ind.* **41**, 129T-132T (1922)

Two hypotheses were considered: (1) mechanical holding of the gases and (2) solution of the gases in the coal matter. Only the second could explain reversible nature of the phenomena.

2288. VENABLE, C. S. AND FUWA, TYLER. **The solubility of gases in rubber and rubber stock and effect of solubility on penetrability.** *J. Ind. Eng. Chem.* **14**, 139-42 (1922).—*C.A.* **16**, 1164.

The soly. of He, H_2, N_2, CO, O_2, CH_4, CO_2, C_2H_4, H_2S, NH_3 and SO_2 was detd. When rubber absorbed a gas, true soln. took place, not merely adsorption. The soly. decreased rapidly with increase in temp. The relative solubilities of the gases showed a general relation between soly., d. and rate of penetration.

2289. WILSON, ROBT. E. AND FUWA, TYLER. **Humidity equilibria of various common substances.** *J. Ind. Eng. Chem.* **14**, 913-8 (1922).—*C.A.* **16**, 3803.

The % H_2O content on a dry basis for 50% and 90% relative humidity, resp., for a group of substances were given.

2290. DE VRIES, O. **Investigations on the rate of drying of rubber.** *Arch. Rubber-cultuur* **7**, 95-123 (1923).—*C.A.* **17**, 2796.

The rate of drying may be increased by keeping the freshly rolled sheet in alc. or dil. formalin (1:10 or 1:100). Keeping in 10% AcOH or 5% alum soln. slightly decreased the time of drying but this may be ascribed to a loss of wt by contraction. The rate of drying was decreased by keeping in water.

2291. FARROW, F. D. AND SWAN, ENOCH. **Absorption of water by dried films of boiled starch.** *J. Textile Inst.* **14**, 465-74T (1923).—*C.A.* **18**, 907.

The absorption was estd. by weighing the specimens from time to time. In other expts. a known amt. of H_2O was permitted to evap. on to a starch film contained in an evacuated vessel. Wet starch persistently retained more H_2O than it would have absorbed if introduced dry into the same atm. Prolonged heat treatment reduced the capacity which starch possessed of absorbing water.

2292. FISHER, E. A. **Moisture relations of colloids. I. Comparative study of the rates of evaporation of water from wool, sand and clay.** *Proc. Roy. Soc. (London)* **103A**, 139-61 (1923).—*C.A.* **17**, 2528.

The rates of evapn. of H_2O from wool fabric, quartz sand, silty soil, and heavy clay subsoil, and the factors affecting the rates were studied. The shrinkage of clay had a characteristic effect on the curve, which might have been allowed for in the equation of rate. This effect was absent in wool, sand and silt; hence the so-called *shrinkage of wool* on drying was really a deformation and not a vol. shrinkage. The absorption of H_2O by wool was attributed to a filling up of fine pores of various shapes and sizes.

2293. FUWA, TYLER AND GODBOUT, A. P. **Equilibrium moisture of cotton.** *Textile World* **64**, 3023-5 (1923).—*C.A.* **18**, 331.

The equil. moisture of Arizona, Egyptian and Peeler cotton yarns and Arizona and Egyptian cotton yarns baked for 5 days at 160°C was studied. The equil. points were obtained by progressive dehydration of the satd. cotton to dryness, and then by hydration to the original point of satn. The equil. moisture for cotton was not a single curve but was best expressed by a narrow hysteresis loop.

2294. KUJIRAI, T.; KOBAYASHI, Y., AND TORIYAMA, Y. **Studies on insulating materials. I. Absorption of moisture by fibrous insulating materials.** *Rikwagaku Kenkyujo Iho* **2**, 105-27 (1923); *Sci. Papers Inst. Phys. Chem. Res.* **1**, 79-93 (1923).—*C.A.* **17**, 2758.

Nine fibrous insulating materials were suspended from a beam of a chem. balance by Pt wire and put in a hydrostat containing H_2SO_4 of desired concn. at 30°C. A considerable difference was observed in the quantity of moisture absorbed, whether the humidity varied from dry to wet or wet to dry.

2295. Masucci, Peter and Moffat, Margaret I. **The diffusion of phenol and tricresol through rubber.** *J. Am. Pharm. Assoc.* **12**, 117-20 (1923).—*C.A.* **17**, 3906.
Aging expts. covering 18 months showed that rubber-capped biological products contg. 0.3% tricresol or 0.5% C_6H_5OH lost a part of their preservative by diffusion through the rubber. The loss was 50-70% for tricresol and 20-40% for C_6H_5OH.

2296. Meunier, L. and Latreille, H. **Commercial chlorination of wool.** *Chimie et industrie* **10**, 636-42 (1923).—*C.A.* **18**, 331.
Treatment with Cl_2 of wool contg. moisture caused damage in proportion to the amt. of H_2O, which was not due to the formation of chloramines but to the oxidation of the protein matter in the presence of H_2O. Dry chlorination decreased the contact surface tension between wool and H_2O, so that capillary phenomena took place more rapidly. On the other hand, the swelling power of the chlorinated fiber was reduced.

2297. Rector, T. M. **The absorption of war gases by rubber and rubberized fabric.** *Ind. Eng. Chem.* **15**, 1132-4 (1923).—*C.A.* **18**, 482.
Small amts. of chloropicrin and $COCl_2$ in air were absorbed rapidly by a relatively large surface area of rubber. Absorption of $COCl_2$ was less rapid initially than that of chloropicrin, but subsequently became greater and, unlike that of chloropicrin, was almost complete after some hrs.

2298. Shorter, S. A. **The moisture content of wool—its relation to scientific theory and commercial practice.** *J. Soc. Dyers Colourists* **39**, 270-6; *Am. Dyestuff Rep.* **12**, 797-803 (1923).—*C.A.* **18**, 473.
The low vapor pres. of the H_2O in wool of low regain indicated that the H_2O was distributed in mol. With higher conditions, the vapor pres. increased, not merely absolutely but also relatively to the amt. of H_2O present, and at a condition far removed from satn. the vapor pres. became nearly equal to that of pure H_2O. From this point onwards the vapor pres. increased more and more slowly as satn. was approached.

2299. Andrews, D. H. and Johnston, John. **The rate of absorption of water by rubber.** *J. Am. Chem. Soc.* **46**, 640-50 (1924).—*C.A.* **18**, 1403.
The wt increased rapidly at first and then more and more slowly as it approached a value corresponding to a satn. concn. The general low of diffusion was thus followed. This ultimate concn. was independent of the thickness, though the fractional satn. of the mass as a whole after a definite time of immersion t was a function of t/a^2, where a was 0.5 the thickness of the mass.

2300. Brimley, R. C. **Absorption of vapors of various liquids by cotton.** *Nature* **114**, 432 (1924).—*C.A.* **19**, 757.
The percentage gain in wt of dry cotton at equil. with the satd. vapor at room temp. was: H_2O, 19; glacial AcOH, anhyd. alc., 3; CS_2, 2; C_6H_6, 2; Et_2O, 7; $PhNO_2$, 2 and Me_2CO, 2.

2301. Coles, G. and Graham, J. I. **The influence of preheating on oxidized and partially oxidized coal upon its rate of adsorption of oxygen.** *Fuels in Science and Practice* **3**, 384-90 (1924).—*C.A.* **19**, 5699.
Preheating influenced the reactions of the later stages of oxidation more than those of the initial rapid adsorption, and decreased the rate of O_2 adsorption. Repeated oxidation increased the rate of O_2 adsorption; the effect of H_2O on the adsorption of O_2 was not so marked as with oxidation of fresh coal.

2302. Costa, Domenico. **The absorbing power of starch for gases and its action on magnesyl derivatives.** *Gazz. chim. ital.* **54**, 207-11 (1924).—*C.A.* **18**, 3175.
Under the same conditions starch absorbed nearly 2 times as much HCl gas as cellulose. With cellulose, absorption ceased when the product corresponded to $C_6H_9O_5 + HCl$. Starch continued to absorb HCl slowly beyond this point and gave a black substance easily sol. in H_2O. SO_2 and NH_3 were absorbed in proportions that corresponded closely to 1 mol. for a simple mol. of starch.

2303. Shorter, S. A. and Hall, W. J. **Hygroscopic capacity of wool in different forms and its dependence on atmospheric humidity and other factors.** *J. Textile Inst.* **15**, 305-27T (1924).—*C.A.* **18**, 2813.
Different forms of the same material showed small but unmistakable differences. Yarns and tops gave the same results. Noils were found to be less hygroscopic because of the presence of foreign matter. Oil was found to diminish the regain of wool.

2304. Shorter, S. A. **Thermodynamics of water absorption by textile materials.** *J. Textile Inst.* **15**, 328-36T (1924).—*C.A.* **18**, 2813.
An equation connecting the heat of diln. with vapor pres. data was adapted to a textile material, and the heat of absorption under different conditions of temp. and humidity was calcd. It was detd. for cotton that for the same humidity the first powers of the regain at different temps. were to each other inversely as the first powers of the corresponding temps.

2305. Trotman, S. R. and Wyche, C. R. **The amino-nitrogen content of wool in relation to chlorination.** *J. Soc. Chem. Ind.* **43**, 193T-195T (1924).—*C.A.* **19**, 402.
Ordinary and deaminated wool had the same shrinkage, elasticity and tensile strength and absorbed practically the same amt. of Cl_2. Cl_2 was both adsorbed and entered into chem. combination. The prolonged action of Cl_2 gave rise to H_2SO_4 and sol. N compds.

2306. Urquhart, A. R. and Williams, A. M. **Moisture relations of cotton. The taking up of water by raw and soda-boiled cotton at 20°.** *J. Textile Inst.* **15**, 138-48T (1924).—*C.A.* **18**, 1754.
There were at least 2 possible values for the moisture regain for a sample of cotton exposed to an atm. of given temp. and humidity, a higher value if the cotton had been initially wetter than the atm., and a lower value if it had been drier.

If cotton was heated to 110°C it was less able to absorb water vapor.

2307. Urquhart, A. R. and Williams, A. M. **Moisture relations of cotton. II. Absorption and desorption of water by soda-boiled cotton at 25°C.** *J. Text. Inst.* **15**, 433-42T (1924).—*C.A.* **19**, 1631.

Curves plotted showed that the absorption curve was higher than the desorption curve, but, contrary to previous statements, these curves did not meet at zero humidity, but at a point corresponding with 1.18% relative humidity. The curves did not meet at 100% relative humidity. At 100% relative humidity the moisture content of soda-boiled cotton was 22.6%.

2308. Urquhart, A. R. and Williams, A. M. **Moisture relations of cotton. Effect of temperature on the absorption of water by soda-boiled cotton.** *J. Textile Inst.* **15**, 550-72T (1924).—*C.A.* **19**, 898.

The absorption of water by cotton at all humidities and up to 110°C was studied. The increase of moisture content which began at about 60°C was due to swelling of the material and the consequent exposure of new surface. Any process which depended for its success on the swollen state of the cotton would consequently become easier above 60°C at high humidities.

2309. Costa, Domenico. **The absorbing power of nitrocellulose for gases.** *Gazz. chim. ital.* **55**, 540-8 (1925).—*C.A.* **20**, 583.

The nitric esters of cellulose, $C_{24}H_{18}O_8(ONO_2)_{10}(OH)_2$, fixed NH_3 at first in proportions corresponding to 1 mol. of NH_3 or each ONO_2 group present. The NH_3 absorbed combined with the ONO_2 groups, forming the true salt of NH_4 with consequent denitration and dehydrogenation and decompn. of the cellulose complex. Dry HCl displaced the ONO_2 groups in nitrocellulose completely.

2310. Leblanc, M.; Kroger, M., and Kloz, D. **The adsorption properties and particle size of several lamp-blacks in organic liquids and in crude rubber mixtures as well as the effect of these lamp-blacks on the properties of vulcanized products.** *Kolloidchem. Beihefte* **20**, 356-411 (1925).—*C.A.* **19**, 3398.

The sorptive capacity for water vapor showed irregularities which may be traced back to the ash content and the content of extractives. A high degree of dispersion was necessary, but not sufficient, for the development of great adsorptive power.

2311. Urquhart, A. R. and Williams, A. M. **Moisture relations of cotton. The absorption of water by cotton mercerized without tension.** *J. Textile Inst.* **16**, 155-66T (1925).—*C.A.* **19**, 2749.

The variations in water-fixing power of mercerized cotton with the concn. of the mercerizing soln. employed were strikingly similar to the variations in dimensions of the unit hairs. Mercerization increased the accessible surface of the cotton in proportion to the mercerization ratio, which, therefore, might have been used as a measure of the absorptive capacity of the material for dyes as well as water.

2312. Swan, Enoch. **Absorption of water by dried films of boiled starch—absorption and desorption between 20° and 90°C.** *J. Textile Inst.* **17**, 527-36T (1926).—*C.A.* **21**, 500.

The retentive power of a starch film was greater the higher the temp., or the more prolonged the period of heating of its original prepn.

2313. Trotman, S. R. and Trotman, E. R. **Further experiments on the chlorination of wool.** *J. Soc. Chem. Ind.* **45**, 111-5T (1926).—*C.A.* **20**, 2586.

Only a small portion of the Cl_2 taken up by the wool entered into chem. combination with the wool under those conditions by which unshrinkable finish was generally produced. A more thorough understanding of the action was necessary to reach a satisfactory control of the "unshrinkable" process.

2314. Hock, L. and Bostroem, S. **Thermochemical comparison of various kinds of lamp and gas blacks.** *Kautschuk* 21-2 (1927).—*C.A.* **21**, 1335.

The particle size of the carbon blacks varied inversely with the heat of wetting by C_6H_6. By comparing the heat of wetting of various blacks, their relative mean particle size was detd. Based on a surface index of 11 for "Micronex" gas black, another American air-floated gas black had a relative surface of 137, several lamp blacks 18.5 to 44.6 and "Thermatomic" black 2.

2315. Lowry, H. H. and Kohman, G. T. **The mechanism of the absorption of water by rubber.** *J. Phys. Chem.* **31**, 23-57 (1927).—*C.A.* **21**, 1372.

A systematic study was made of the influence on the rate of absorption and on the final equil. of (1) the vapor pres. of the surrounding H_2O medium, (2) the H_2O-sol. components of the rubber, (3) the state (liquid or vapor) of the surrounding medium, (4) the combined S (an index of rigidity), (5) the temp., (6) the hydrostatic pres. of the surrounding medium, and (7) the aging of the rubber before and during absorption.

2316. Schumacher, E. E. and Ferguson, L. **A convenient apparatus for measuring the diffusion of gases and vapors through membranes.** *J. Am. Chem. Soc.* **49**, 427-8 (1927).—*C.A.* **21**, 837.

An efficient diffusion-measuring app., embodying a mech. clamp and Hg seal, was described in detail. This app. was useful for measuring the rate of diffusion of gases and vapors through wax, leather, rubber and similar membranes.

2317. Urquhart, A. R. **Moisture relations of cotton. Absorption of water by cotton mercerized with and without tension.** *J. Textile Inst.* **18**, 55-72T (1927).—*C.A.* **21**, 2069.

Changes in the absorptive capacity of cotton brought about by mercerization were very similar for all varieties of cotton examd. The application of tension acted in opposition to the swelling forces, so that the absorptive capacity of cotton mercerized with tension was less than that of cotton mercerized loose.

2318. Alekseevskii, E. V. **Adsorption of vapors by animal and vegetable fibers.** *Zhur. Prikladnoi Khim.* **1**, 184-9 (1928).—*C.A.* **23**, 4346.

CCl_3NO_2 was best adsorbed by dyed new wool and dyed used silk while linen was the poorest adsorbent. $AsCl_3$ was best adsorbed by wool, hairs and rubber. Paper was the poorest adsorbent, but disintegrated quickly, while the strength of wool fibers was not affected. Most of the adsorbents darkened on exposures because of deposition of As.

2319. Barker, S. G. **The hygroscopic nature of textile fabrics.** *Trans. Inst. Chem. Eng.* **6**, 162-7 (1928).—*C.A.* **24**, 1221.

Tables show the regain for various fibers under different conditions of temp. and relative humidity.

2320. Dubosc, A. **Adsorption and diffusion of gases through rubber and balloon fabrics.** *Rev. gen. caoutchouc Feb.*, **1928**, No. 39, 7-8.—*C.A.* **22**, 2078.

A review and discussion of the general phenomena.

2321. Fleming, Horace. **Conditioning small samples of fiber.** *Textile Colorist* **50**, 253 (1928).--*C.A.* **22**, 4824.

A simple method, ascribed to Rawson, for detg. the dry wt of small samples was described.

2322. Hill, S. E. **Method for demonstrating the diffusion of oxygen through rubber and various other substances.** *Science* **67**, 374-6 (1928).—*C.A.* **22**, 2091.

A simple visual demonstration of the diffusion of O_2 may be made by using luminous bacteria as an indicator.

2323. Kanata, Kazuo. **Permeabilities of colloidal substances to gases.** *Bull. Chem. Soc. Japan* **3**, 183-8 (1928).—*C.A.* **23**, 18.

The relative permeabilities were detd. for rubber, gelatin and celluloid for O_2, H_2, CO_2, SO_2 and NH_3. The permeability and hence the absorption was caused by the solution of gas in the colloidal substance.

2324. Newsome, P. T. **Note on the McBain-Bakr balance for the sorption of vapors by fibrous and film materials.** *Ind. Eng. Chem.* **20**, 827 (1928); *Chemistry & Industry* **47**, 594 (1928).—*C.A.* **22**, 3070.

The sorption of vapors by fibrous and film materials may be measured by suspending the sample from the spring, evacuating and introducing by stopcock controls a small quant. of liquid. The pressure and elongation of the spring are measured with a cathetometer.

2325. Schaposchnikoff, W. G. **Moisture content of textile fibers.** *Melliand Textiber.* **9**, 844-50 (1928).—*C.A.* **23**, 1273.

While 8.5% had been considered as the normal regain for cotton, the tests showed a min. of 6.87%, a max. of 15.28% and an av. of 11.66%. The av. regain of silk was 13.75%, of H_2O-retted flax 14.15%, of hemp 14.72%, of jute 16.35%, of rayon 18.79%, of woolen 19.56% and of worsted 19.54%. The av. relative humidity was 76.8%.

2326. Tammann, G. and Bochow, K. **The absorption of hydrogen by rubber at elevated pressures and the behavior of the rubber after the pressure is lowered.** *Z. anorg. allgem. Chem.* **168**, 322-4 (1928).--*C.A.* **22**, 2491.

When rubber, Zn and dil. H_2SO_4 were subjected to high pressures, e.g., 550 or 1150 kg per cm², the rubber became satd. with H_2. When the pressure was released the rubber was porous, and some time afterwards was still several times its original vol.

2327. Yamamoto, T. **The solubility of carbon dioxide in vulcanized rubber.** *Bull. Inst. Phys. Chem. Res. Tokyo* 7, 999-1001.—*C.A.* **23**, 2632.

Specimens of tubing, cut into bits, dried, and tested for increase of wt in 1 atm. of CO_2 at 25°C, showed that black tubing, d_4^{25} 0.9300, dissolved 0.146 g CO_2 per 100 g and bright brown tubing, d_4^{25} 0.9380, 0.166 g CO_2 per 100 g.

2328. Davey, W. Cecil and Ohya, T. **The permeability of rubber mixings.** *Trans. Inst. Rubber Industry* **5**, 27-30 (1929).—*C.A.* **23**, 5350.

The permeability of H_2 was lower in accelerated than in unaccelerated mixts.; it was lowered still further by softeners and by antioxidants and increased by mineral fillers. With the finest pigments, however, the increases were relatively small.

2329. King, A. T. **The regain of stretched fibers and the porous structure of wool.** *Trans. Faraday Soc.* **25**, 451-58 (1929).

Initial H_2O absorption by wool consisted of an adsorption layer on the internal surfaces of the pores; the second stage consisted of a filling up of the pores, and the third of an osmotic absorption.

2330. Kohman, G. T. **The absorption of oxygen by rubber.** *J. Phys. Chem.* **33**, 226-43 (1929).—*C.A.* **23**, 2600.

The influence of surface area on the rate of O_2 absorption by raw and vulcanized rubber and the changes in tensile strength which result from the O_2 absorption were studied.

2331. Morris, V. N. and Street, J. N. **Permeability of rubber to air. I. Effect of temperature, pressure and humidity.** *Ind. Eng. Chem.* **21**, 1215-1219 (1929).—*C.A.* **24**, 988.

The permeability was almost linearly proportional to the total pressure. The temp. coeff. of the permeability was very high, e.g. a drop of 20°F cutting the permeability to about 0.5 its value, and the permeability being extremely low at 0°C.

2332. Peirce, F. T. **A two-phase theory of the absorption of water vapor by cotton cellulose.** *J. Textile Inst.* **20**, 133-50T (1929).—*C.A.* **23**, 5381.

There are 2 distinct phases in which H_2O mol. were held in cotton cellulose: (1) H_2O mol. were definitely assocd. with 1 hexose unit as in a chem. compd. and (2) the H_2O mol. filled the spaces available under attractive forces like those in a liquid.

2333. Rosenzweig, Adolf. **The moisture content of textiles and its relation to the relative humidity of the air.** *The Melliand* **1**, 870-3 (1929).

Textiles strove to absorb humidity corresponding to the relative humidity of the air. Under com. condition they were able to absorb the relative moisture of the air slowly, and obtain equilibrium values in those rare cases, when the constant changes of humidity exceeded the daily variations continuing in this direction for months.

2334. Sheppard, S. E. and Newsome, P. T. **The sorption of water vapor by cellulose and its derivatives.** *J. Phys. Chem.* **33**, 1817-35 (1929).—*C.A.* **24**, 956.

All samples exhibited hysteresis. The increased sorption by the hydrated cellulose was accounted for on the basis of differences of "fine structure" between the native and mercerized cellulose. Sorption decreased as the amt. of esterification increased.

2335. Speakman, J. B. **The rigidity of wool and its change with adsorption of water vapor.** *Trans. Faraday Soc.* **25**, 92-103 (1929).—*C.A.* **23**, 5323.

The rigidity of dry wool fibers was slightly greater for fibers of intermediate diam. From the shape of the rigidity-water adsorbed curve, the reduction in rigidity was caused by adsorption of water by certain groups in the wool.

2336. Speakman, J. B. **Adsorption of water by wool.** *Nature* **124**, 411 (1929).—*C.A.* **24**, 1222.

The adsorption of H_2O by wool fibers (stretched 30% of their length under H_2O) was compared with the adsorption of H_2O by untreated wool fibers. Each sample was taken from dryness up to satn. in stages, and then in the reverse order to dryness. The stretched samples adsorbed more H_2O in every case than the untreated ones.

2337. Urquhart, A. R. **The mechanism of the adsorption of water by cotton.** *J. Textile Inst.* **20**, 125-32T (1929).—*C.A.* **23**, 5381.

Adsorption of H_2O took place at the OH groups of the long, spiral, somewhat flexible mols. of cellulose and on drying there was a tendency for twisting and rearrangement of the mols. or micelles so that the residual valences of the OH groups mutually satified each other, thereby reducing the hygroscopicity. During reabsorption there was a tendency to return to the original orientation, the reproducibility of the hyteresis loop being thereby explained.

2338. Wineland, Albert J. and Waters, Ralph M. **The diffusibility of anesthetic gases through rubber.** *Anesthesia and Analgesia* **8**, 322-3 (1929).—*C.A.* **24**, 468.

Ten-liter bags lost the following amts. of wt in 48 hrs: O_2, 0.32 g; C_2H_4, 1.00 g; CO_2, 4.68 g; and N_2O, 7.00 g.

2339. Abrams, Allen and Chilson, Warren A. **Vapor transmission through papers.** *Paper Mill* **53**, No. 38, 24-8 (1930).—*C.A.* **24**, 6010.

The resistance of paper to the penetration of water vapor was detd. It consisted essentially in exposing the paper to water vapor for a definite time, having satd. air on one side of the sheet and a definite lower humidity on the other side.

2340. Bancroft, W. D. and Barnett, C. E. **Phase-rule studies on the proteins. I. Determination of solid compounds with hydrogen chloride or ammonia.** *J. Phys. Chem.* **34**, 449-98 (1930).—*C.A.* **24**, 2151.

By means of pres.-concn. curves the type of combination which occurred between proteins and NH_3 or HCl was established. Casein, zein, arachin, fibrin and gliadin absorbed NH_3, without the formation of a chem. compd.. On the other hand, casein, arachin, fibrin, gliadin and edestin formed definite compds. with HCl, while zein did not.

2341. Collins, Geo. E. **The swelling of cotton hairs in water and in air at various relative humidities.** *J. Textile Inst.* **21**, 311-5T (1930).—*C.A.* **25**, 418.

The desorption and absorption of cotton hairs showed a close parallelism between the extent of the dimensional changes and the amt. of the absorption, at least over the temp. range of 20°-100°C studied.

2342. Davidson, G. F. and Shorter, S. A. **The dry weight of cotton.** *J. Textile Inst.* **21**, 165-78T (1930).—*C.A.* **24**, 6026.

The "true dry weight" was defined as the const. wt obtained by prolonged exposure at room temp. to an atm. dried by P_2O_5. The time required to reach apparent constancy of wt depended upon the accuracy required; under conditions of commercial testing the rate of loss was slow after a few hrs.

2343. Herzog, R. O. **Trends of research. The behavior of regenerated cellulose to water.** *Rayon Record* **4**, No. 6, 313-7 (1930).—*C.A.* **24**, 2878.

A review on the state of knowledge of behavior of regenerated cellulose to water, and investigations which threw light on the mechanism of water absorption.

2344. Jenkins, W. J. and Bennett, H. B. **Sorption experiments with cellulose nitrate. I. Sorption of vapors by cellulose nitrate.** *J. Phys. Chem.* **34**, 2318-29 (1930).—*C.A.* **24**, 5567.

The amt. of acetone sorbed by cellulose nitrate depended only slightly on the side from which equil. was approached. Sorption of acetone by stable cellulose nitrate increased up to a max. and then decreased.

2345. Larian, Maurice; Lavine, Irvin; Mann, C. A., and Gauger, A. W. **Studies on the development of Dakota lignite. II. Sorption of water vapor by lignite, peat and wood.** *Ind. Eng. Chem.* **22**, 1231-34 (1930).—*C.A.* **25**, 397.

The shapes of the vapor pres. vs. moisture curves were similar. Peat and wood dried to a lower moisture content than lignite at any given vapor pres. Hysteresis was greatest for lignite and least for birch.

2346. Lavine, Irvin and Gauger, A. W. **Studies on the development of Dakota lignite. I. Aqueous tension of the moisture in lignite.** *Ind. Eng. Chem.* **22**, 1226-1231 (1930).—*C.A.* **25**, 397.

A study of the desorption and adsorption of H_2O vapor by 3 lignites showed: (1) loss of moisture was accompanied by decrease in vapor pres.; (2) vapor-pres. lowering varied but little and was similar to that for wood; (3) in drying for storage there was little need to reduce H_2O below 16%; (4) marked hysteresis occurred; (5) increase of temp. shifted the dehydration curve toward the region of lower H_2O content.

2347. Mauersberger, Herbert R. **Relative moisture absorption of woven textile materials.** *The Melliand* **2**, 223-9 (1930).
The regain of any woven textile fabric in hygroscopic equil. with the surrounding atm. depended on the percent of the relative humidity and the temp. At a given relative humidity the higher the temp. the less the percent regain. The rate of absorption increased with each material fairly uniformly, but there was a point where the rate increased rapidly. The regain of a fabric was considerably below, at ordinary temps. and humidities, that of the raw materials from which it was made.

2348. Oguri, Sutezo and Nara, Masaaki. **Hygroscopic moisture of cellulose.** *J. Soc. Chem. Ind., Japan* **33**, Supp. binding 267-70 (1930).—*C.A.* **24**, 5479.
Standard cotton cellulose, bamboo cellulose, wood cellulose, and nitrocellulose were placed in a closed vessel satd. with H_2O vapor at const. temp., and the equil. moisture detd. The OH group in cellulose had a special attraction for H_2O as was shown by the fact that the equil. H_2O of the original cotton cellulose was higher than that of nitrocellulose. Cellulose required long exposure to satd. vapor to attain equil. The curves of velocity of satn. of moisture closely resembled those of adsorption.

2349. Pidgeon, L. M. and Maass, O. **Adsorption of water by wood.** *J. Am. Chem. Soc.* **52**, 1053-68 (1930).—*C.A.* **24**, 1974.
The adsorption of H_2O by certain coniferous woods and by cotton cellulose was measured by a new method. The complete range of vapor pressures was covered and adsorption isothermals produced between 12° and 42°C. In wood which had been dried for a long period of time the adsorption isothermals were the same at low vapor pressures, but differed at the higher vapor pressures. Adsorption isosteres were represented by log $a/c = B + AT$ for adsorption representing more than 2%.

2350. Pidgeon, L. M. and Maass, O. **The penetration of water vapor into wood.** *Can. J. Research* **2**, 318-26 (1930).—*C.A.* **24**, 4155.
The rate of diffusion of water vapor through wood was studied through a comparison of the time taken for samples of various thicknesses to become satd. Continuous measurements of the amt. of adsorption were carried out by the use of a quartz spring balance completely enclosed in the app. at a const. vapor pressure. The movement of water through wood, at concns. below the satn. point took place as vapor diffusion through the spaces of the wood structure.

2351. Rubenstein, L. **Sorption experiments with cellulose nitrate. II. Sorption of vapors by cellulose nitrate.** *J. Phys. Chem.* **34**, 2330-42 (1930).—*C.A.* **24**, 5567.
The sorption was measured for MeOAc, EtOAc, Me_2CO, and MeEtCO at 20°C and the absorbent at 30°C; the sorption increased to a max. and then decreased. With MeOH at 20°C and cellulose nitrate at 30°C, the sorption decreased with N content. The reversibility of sorption phenomena was also considered.

2352. Sheppard, S. E. and Newsome, P. T. **Sorption of water vapors by cellulose and derivatives. II. Kinetics of sorption.** *J. Phys. Chem.* **34**, 1158-65 (1930).—*C.A.* **24**, 3641.
The rate of sorption depended primarily on diffusion, but a structure factor of porosity intervened. One state of the sorption process was the attachment of water mols. to free hydroxyls of the cellulose mol. Some of the cellulose hydroxyls were free, since cellulose took up only 23% as "hydrate cellulose" and 16 to 18% as "native" cellulose.

2353. Speakman, J. B. **Adsorption of water by wool.** *J. Soc. Chem. Ind.* **49**, 209-13T (1930).—*C.A.* **24**, 3376.
The adsorptive and desorptive properties of purified wool fibers were studied over a wide range of atm. humidities. Marked hysteresis existed between the 2 processes. Water adsorption was dependent upon the polypeptide groups in these mols.

2354. Speakman, J. B. **Micelle structure of the wool fiber.** *Nature* **126**, 565 (1930).—*C.A.* **25**, 1387.
Existence of micelles within the wool fiber was proved by swelling and adsorption studied and by the action of Na_2S on wool. It was deduced that the micelles were lamellar in shape.

2355. Strachan, James. **Adsorption on the crystal lattice cellulose.** *Nature* **125**, 671 (1930).—*C.A.* **24**, 3149.
Light passing through natural cellulose fibers deeply stained with I_2 was completely polarized by absorption. Microscopic analysis of this phenomenon proved that the polarization was due to ultramicroscopic cryst. particles of I_2 oriented on the lattice. Oriented crystal overgrowths of $CaCO_3$ and $BaSO_4$ were also produced on cellulose.

2356. Urquhart, A. R. and Eckersall, Norman. **The moisture relations of cotton. VII. A study of hysteresis.** *J. Textile Inst.* **21**, 499-510T (1930).—*C.A.* **25**, 1089.
The absorption and desorption curves for cotton formed the boundaries of an equil. area, any point on which was capable of representing the amt. of H_2O present in cotton under appropriate conditions of humidity and pre-history. Data were given for Sakel cotton, raw and soda-boiled at 25°C, and for raw Webber and Acala cottons, soda-boiled and mercerized Sakel cotton at 20°C.

2357. Williams, Ira and Neal, Arthur M. **Solubility of oxygen in rubber and its effect on rate of oxidation.** *Ind. Eng. Chem.* **22**, 874-8 (1930).—*C.A.* **24**, 4660.
The soly. of O_2 in rubber followed Henry's law. Oxidation of rubber proceeded at a uniform rate as long as the concn. of O_2 remained above a certain min. In air at 70°C the concn. of O_2 in rubber was below that necessary for maintaining uniform

oxidation at a max. rate. Elevated temps. produced a type of oxidation, the course of which was sensitive to high concns. of O_2 and about which little was known.

2358. Filby, E. and Maass, Otto. **Volume relations of the system cellulose and water.** *Can. J. Research* 7, 163-77 (1932).—*C.A.* **26**, 5414^9.
The vol. of the system water vapor and cellulose was found to be much smaller than that given by the components as long as the amt. of adsorbed H_2O was below 4%. With more than 8% of adsorbed H_2O the d. of subsequently sorbed H_2O was found to be the same as that of the normal liquid.

2359. Bancroft, W. D. and Calkin, J. B. **The taking up of water by cellulose.** *Textile Research* **4**, 371-98 (1934).—*C.A.* **28**, 7025^3.
H_2O adsorbed by cotton could be removed partially by centrifuging. The amt. of moisture adsorbed by cotton from satd. H_2O vapor (at 25°C) was detd. by approaching the equil. from both sides. The amt. taken up from satd. H_2O vapor by a sample of cotton was 27%. Various forms and derivs. of cellulose took up different amts. of H_2O. The adsorption of moisture by cellulose being an exothermic reaction, increasing the temp. decreased the amt. taken up. Under present exptl. conditions there was a hysteresis effect.

2360. Steinberger, R. L. **The thermodynamics of swelling.** *Textile Research* 4, 451-62, 513-24 (1934).—*C.A.* **28**, 7111^8.
Entropy changes with swelling were related to the distribution of the H_2O mols. within the gel. Vol. contraction was ascribed to the dissocn. of ordinary H_2O which had a complex mol., to the simple unimol. form in the gel. Since swelling and capillarity were intimately related phenomena the important points of contact of the two were discussed.

2361. Argue, G. H. and Maass, Otto. **Measurement of the heats of wetting of cellulose and wood pulp.** *Can. J. Research* **12**, 564-74 (1935).—*C.A.* **29**, 5652^8.
When the H_2O was left as a result of partial desorption a higher value was obtained. The heats of wetting of wood meal and different wood pulps were detd. The heats of adsorption were calcd., and all the data were discussed from the point of view of the phys. structure of cellulose. A few preliminary measurements of the heat of adsorption of NaOH were made.

2362. Astbury, W. T. and Lomax, R. **An x-ray study of the hydration and denaturation of proteins.** *J. Chem. Soc.* **1935**, 846-51.—*C.A.* **29**, 6487^7.
The hypothesis was advanced that a fully extended polypeptide chain was characterized by 2 principal side-spacings, one (about 4.5 A.) arising from the effective thickness of the backbone of the chain, and the other (about 10 A.) from the lateral extension of the side chains standing out from the amino acid residues.

2363. Filby, E. and Maass, Otto. **Sorption of water on cellulosic materials.** *Can. J. Research* **13B**, 1-10 (1935).—*C.A.* **30**, 609^2.
Care was taken that no vapors other than water were present no matter how long a time was required for the establishment of equil. The adsorption and desorption isotherms of standard cellulose, spruce wood, surgical cotton, Kodak rag cellulose and bleached sulfite were detd.

2364. Lykov, A. V. **The kinetics of the sorption of vapors by cellulose.** *J. Phys. Chem. (U.S.S.R.)* **6**, 731-46 (1935).—*C.A.* **30**, 6620^1.
The kinetics of the adsorption and absorption of water vapor from moist air by a sphere of 6.6 cm diam. of pure dry celluloses at 20°-75°C and 62-100% relative humidity was studied. The internal temps. of the sphere were followed by 3 thermocouples. By use of the Fick surface layer and internal-diffusion laws, the sorption law and its coeffs. were detd.

2365. Stamm, Alfred J. and Loughborough, W. Karl. **Thermodynamics of the swelling of wood.** *J. Phys. Chem.* **39**, 121-32 (1935).—*C.A.* **29**, 2686^1.
Detns. were made (for the system Sitka spruce wood-water) of the relative vapor pres.-moisture content desorption isotherms. Temps. varied from room temp. to 100°C, and conditions were carefully controlled to minimize the hysteresis effect. Fiber-satn. points decreased linearly with increased temp., and were reduced by 0.1% per 1°C rise.

2366. Speakman, J. B. and Cooper, C. A. **The adsorption of water by wool. I. Adsorption hysteresis.** *J. Textile Inst.* **27**, 183-5T (1936).—*C.A.* **30**, 7857^6.
Adsorption and desorption data on wool at 25°C from relative humidities of 10.6% to 89.6% were given. The range of humidity over which wool must be dried to pass from adsorption to limiting desorption conditions appeared to be independent of regain and was about 18%.

2367. Speakman, J. B. and Stott, E. **The adsorption of water by wool. II. The influence of drying conditions on the affinity of wool for water.** *J. Textile Inst.* **27**, 186-90T (1936).—*C.A.* **30**, 7857^7.
The adsorption power of wool, dried from regains below satn., decreased with increasing temp. of drying. The decrease in H_2O absorption was produced by partial as well as complete drying but not by drying from satn. nor by heating wool which was dried at low temp. The normal affinity for H_2O of wool which had been dried at a high temp. was restored by allowing it to reach satn. with H_2O vapor. The reduced adsorptive power of wool heated over H_2O at a high temp. was irreversible.

2368. Speakman, J. B. and Cooper, C. A. **The adsorption of water by wool. III. The influence of temperature on the affinity of wool for water.** *J. Textile Inst.* **27**, 191-6T (1936).—*C.A.* **30**, 7857^8.
Adsorption isotherms of wool at intervals of 5°C from 25° to 55°C were given. Complete isotherms above 55°C could not be obtained owing to the susceptibility of the disulfide bond of wool to H_2O at high temp., as evidenced by formation of HgS on the fibers. At low partial pressures of H_2O vapor, the amt. of H_2O adsorbed decreased as a linear function of temp. At partial pressure 0.975 the isobar showed a min. at about 43°C, indicating that swelling of wool in H_2O was a min. near that temp.

2369. Boer, J. H. de and Fast, J. D. **Diffusion of hydrogen through regenerated cellulose and some cellulose derivatives.** *Rec. trav. chim.* **57**, 317-32 (1938).—*C.A.* **32**, 4778^{7}.

H_2 diffused through metals in the at. form, and through cellulose acetate in the mol. form. Diffusion through cellulose derivs. (celluloid, cellulose triacetate, cellophane) was greater than through cellulose. While H_2 diffused readily through nitrocellulose and cellulose acetate, these derivs. were practically impermeable to air; regenerated cellulose (cellophane) was practically impermeable to both of these gases. The temp. relationship of the diffusion of H_2 was detd.

2370. Galzova, E. S. **The drying of raw cotton with flue gases.** *Khlopchatobumazhnaya Prom.* **8**, No. 9, 24-6 (1938).—*C.A.* **34**, 8291^{5}.

The SO_2 adsorbed by the cotton during drying with flue gases was greater at the higher concn. of SO_2 in the gases, the higher moisture content of the cotton, and the longer time the cotton was in contact with the gases. Almost all the SO_2 adsorbed by the cotton was given off again when the material was allowed to lie in the open air.

2371. Daynes, H. A. **Note on the theory of water absorption by rubber.** *Rubber Chem. Tech.* **12**, 532-4 (1939); *Trans. Inst. Rubber Ind.* **14**, 191-3 (1938).—*C.A.* **33**, 3204^{6}.

The changes in water content of rubber with time of exposure to various conditions of humidity could not be calcd., either for practical use or for verifying theories of the mechanism of absorption.

2372. Houtz, C. C. and McLean, D. A. **Adsorption of water by papers at elevated temperatures.** *J. Phys. Chem.* **43**, 309-21 (1939).—*C.A.* **33**, 3654^{7}.

Adsorption isotherms for water on tissue papers at 100°-150°C and equil. water-vapor pressures from 0 to 25 mm Hg showed considerably higher adsorption on paper from kraft wood pulp than from linen rag. Values of the consts. in the Freundlich adsorption equation, which applied to the data, were given. Hysteresis was found.

2373. Neiman, R. S. and Kargin, V. A. **Sorption of water vapor by cellulosic fibers.** *Org. Chem. Ind. (U.S.S.R.)* **6**, 628-33 (1939).—*C.A.* **34**, 5278^{7}.

Sorption and desorption of water vapors by various cellulosic and casein fibers showed that equil. was attained in 1 to 15 hrs by the vacuum method of McBain. Different specimens of viscose fiber with closely resembling serimetric properties gave identical sorption isotherms.

2374. Wiegerink, James G. **The moisture relations of textile fibres at elevated temperatures.** *Textile Research* **10**, 357-371 (1939-40).

Data were obtained for both "desorption" and "adsorption," the yarns being brought to equilibrium from a wet condition and a dry condition, resp. The fibres studied were raw cotton, "purified" cotton, mercerized cotton, clothing wool, carpet wool, viscose rayon, cuprammonium rayon, raw silk, degummed silk and cellulose acetate. The temperatures ranged from 96°F to 302°F and the relative humidities ranged from 5% to 90% for temperatures below 212°F and up to the maximum obtainable at atmospheric pressure above 212°F.

2375. Goodings, A. C. and Turl, L. H. **The density and swelling of silk filaments in relation to moisture content.** *J. Textile Inst.* **31**, T69-80 (1940).—*C.A.* **35**, 3822^{2}.

The regain of degummed white Japanese silk was measd. at 25°C under both adsorption and desorption conditions for relative humidities ranging from dryness to satn. Measurements were made on small bundles of yarn hung on a quartz spiral in a closed chamber having controlled relative humidity. The density measurements were made on the same silk (benzene was used) at moisture contents ranging from dryness to satn. The longitudinal swelling of the filaments accompanying moisture absorption was also measd.

2376. King, G. and Cassie, A. B. D. **Propagation of temperature changes through textiles in humid atmospheres. I. Rate of absorption of water vapor by wool fibers.** *Trans. Faraday Soc.* **36**, 445-53 (1940).—*C.A.* **34**, 4276^{7}.

The time necessary to equilibrate with water vapor was entirely dependent on the rate of loss of the heat of adsorption. A temp. of 65°C was observed in the wool 30 sec after the introduction of the water vapor; a rise of 80°C was not inconsistent with the cooling curve observed. By correcting for the effect of the heat of adsorption it was found that the wool attained equil. in a time less than 15 sec.

2377. Sakai, Wataru. **Urea. III. The hygroscopicity of urea and inorganic salts.** *J. Soc. Chem. Ind., Japan* **43**, Suppl. binding 190 (1940).—*C.A.* 34, 7684^{6}.

The hygroscopicity of urea was compared with inorg. salts such as K and NH_4 salts by means of the stationary air method at 15°C under various degrees of humidity. Under suitable conditions, especially of surface and of soly. of the solid, urea could be nonhygroscopic.

2378. Sheppard, S. E., Houck, R. C., and Dittmar, C. **Structure of gelatin sols and gels. VI. Adsorption of water vapor and the electrical conductivity.** *J. Phys. Chem.* **44**, 185-207 (1940).—*C.A.* **34**, 2680^{4}.

Two types of gelatin were used: ash-free "lime-processed" calfskin gelatin (isoelec. point at pH 4.8) and ash-free "acid-processed" pigskin gelatin (isoelec. point at pH 8.2). The samples were used in the form of skins or films obtained by coating cellulose-nitrate surfaces with the gelatin soln. and then stripping off the gelatin skins. The sorption isotherms were curves of double flexure, resembling those obtained with cotton, cellulose wool, silk and other fibrous materials.

2379. Spoelstra, H. J. and Berenschot, G. H. **Moisture absorption and moisture loss in roselle and jute bags.** *Arch. Suikerind. Nederland en Ned.-Indie* **1**, 423-7 (1940).—*C.A.* **35**, 1232^{5}.

There was no difference in lab. expts. between the 2 kinds of material, either in the form of fiber or finished textile.

2380. TIBILOV, S. P. **Adsorption of organic vapors on organic adsorbents and the quenching of fluorescence.** *J. Phys. Chem. (U.S.S.R.)* **14**, 942-63 (1940).—*C.A.* **35**, 3873^4.

Vapors of quinone, nitrobenezene, $(CH_3)_2$-aniline, aniline and biacetyl were studied in the quenching of palmitic acid fluorescence. The intensity of fluorescence of all these adsorbents was greatest around 400 mμ and decreased to nearly zero around 600 mμ.

2381. STAMM, ALFRED J. AND MILLETT, MERRILL A. **Internal surface of cellulosic materials.** *J. Phys. Chem.* **45**, 43-54 (1941).—*C.A.* **35**, 1985^8.

Microscopical measurements, sorption of gases (CO_2, SO_2, NH_3, HCl), heats of swelling, adhesion tension of H_2O, and the selective adsorption of a solute (stearic acid, phenol) from soln. were detd. Wood (pine and spruce), various types of paper, cellulose acetate yarn and sulfite pulp were studied. Systems in which the cell walls were not swollen gave surfaces of about 2×10^3cm²/g and those in which the cell walls were swollen gave surfaces of about 3×10^6cm²/g.

2382. BABBITT, J. D. **Adsorption of water vapor by cellulose.** *Can. J. Research* **20A**, 143-72 (1942).—*C.A.* **37**, 16^9.

Adsorption on cotton was similar to that on wood, except that internal surface area available was less by a factor of 1.86. When the available heats of adsorption were plotted against the relative humidity there was no appreciable difference between cotton and wood. There was an excess of internal energy in the adsorbed state over that of the liquid state.

2383. BARKAS, W. W. **Wood-water relationships. VII. Swelling pressure and sorption hysteresis in gels.** *Trans. Faraday Soc.* **38**, 194-209 (1942).—*C.A.* **36**, 6872^7.

The hysteresis found in the isotherms of vapor pres. against moisture content of gels was based on the plasticity resulting from residual hydrostatic stresses. If during natural swelling a gel was subjected to restraints of such a type that shear stresses were called into play, then the plasticity induced hysteresis. If the applied restraints were purely compressive, no sorption hysteresis resulted, but the equil. values of H_2O content at any vapor pres. were lower than those of the free gel.

2384. CALVET, EDOUARD. **The constitution of gels of nitrocellulose and acetone.** *Ann. faculté sci. Marselle* **16**, 17-35 (1942).—*C.A.* **41**, 2303^b.

Acetone absorbed by nitrocellulose was not fixed on the NO_2 groups. Ordinary cellulose in the form of absorbent cotton (or cotton for nitration) would absorb acetone. The heat evolved per g of acetone was about 80 cal/g as with nitrocellulose.

2385. FREY-WYSSLING, A. AND SPEICH, H. **The permeability of cellulose fibers.** *Helv. Chim. Acta* **25**, 1474-84 (1942).—*C.A.* **37**, 6451^2.

Bleached, dried-ramie fibers were immersed in pure liquids for 24 hrs at 20°C and the birefringence of the fibers was detd. For lipophilic liquids (such as C_6H_6 or toluene), it was concluded that these liquids did not permeate the fibers. CO_2H groups in cellulose favored the adsorption of N-bases; such groups were absent in starch and the N-bases did not permeate starch grains.

2386. HINTZE, O. E. **Water absorption by paint surfaces in relation to pigment content.** *Fett u. Seifen* **49**, 332-9 (1942).—*C.A.* **37**, 6910^9.

The amt. of pigment had little effect on the H_2O absorption of films which contained (1) urea resins or glycerides of fatty acids having conjugated double bonds and which were very flexible, (2) compds. of a decided hydrocarbon character such as polyisobutylene, polystyrene, chlorinated rubber, asphaltic materials, (3) esters of mineral acids such as nitrocellulose or polyvinyl chloride, (4) polymers with carbonyl groups in which the latter were adjacent to a tertiary C atom, such as polymethacrylic acid ester.

2387. IGUCHI, MASAAKIRA. **Catalytic oxido-reduction by some metallic complex salts. XIX. The oxygen absorption of the cobalt cyanide-amine complexes.** *J. Chem. Soc. Japan* **63**, 1743-51 (1942).—*C.A.* **41**, 3353*b*.

The absorption of O_2 by the Co complex of CN, ethylenediamine, and triethanolamine was studied at 25°C with the Warburg manometer. The rate of absorption was expressed by a curve in each case.

2388. IGUCHI, MASAAKIRA. **Catalytic oxido-reduction by some metallic complex salts. XX. Catalytic reduction of sodium cinnamate and isatin by cobalt cynamide complex salt.** *J. Chem. Soc. Japan* **63**, 1752-4 (1942).—*C.A.* **41**, 3353*c*.

The absorption of H_2 by the system $CoCl_2KCN$ increased when the system contained Na cinnamate or isatin.

2389. KRISCHER, OTTO. **Heat and mass transfer in drying. The analytical and graphical treatment of the drying of porous hygroscopic materials.** *Forsch. Gebiete Ingenieurw.* **13**, *Ausgabe B, Forschungsheft* No. **415**, No. 4, 22 pp. (1942).—*C.A.* **37**, 6164^2.

The general case of drying was discussed where moisture could diffuse as liquid as well as a vapor while heat transfer could take place by conduction as well as direct internal heating. Numerical examples were presented for rayon and wool.

2390. LOWRY, H. H. **Relation of the physical constitution of coal to its chemical characteristics.** *J. Geol.* **50**, 357-84 (1942).—*C.A.* **37**, 743^5.

Extensive studies, employing solvent analysis, thermal decompn., oxidation, reduction and other methods, have failed to establish fundamental chem. differences corresponding to the recognized petrographic entities in coal.

2391. NICKERSON, R. F. **Structure, properties and utilization of cotton.** *Ind. Eng. Chem.* **34**, 1149-54 (1942).—*C.A.* **36**, 7326^2.

The concept of H-bonding between cellulose chains and between internal-fiber surfaces was used as a working hypothesis to interpret the properties and phenomena exhibited by cotton and its derivs. The effects of moisture, heat, stresses and time were emphasized.

2392. ONUSAǏTIS, B. A. **Sorption ability and the colloidal structure of coal.** *Bull. acad. sci. U.R.S.S., Classe sci. tech.* **1942**, No. 5-6, 17-28.—*C.A.* **38**, 4404².

Typical Donbass coals were studied in respect to sorption of water vapor, with the investigation of changes of porosity and sorption capacity after heating to 280°C at atm. pressure and in vacuo. The results confirmed the colloidal nature of the coal and the caking process.

2393. SIMRIL, V. L. AND SMITH, SHERMAN. **Sorption of water by cellophane.** *Ind. Eng. Chem.* **34**, 226-30 (1942).—*C.A.* **36**, 1830⁴.

Four sorption isotherms at temps. from 16.5° to 49.5°C were given for generated cellulose in the form of cellophane. ΔH, ΔF and ΔS values calcd. for the intermediate temp. range showed a low entropy (high ΔS) for the H_2O at low moisture contents. The entropy of the sorbed water on desorption was lower than that on adsorption at all moisture contents. The hysteresis loop was interpreted on the basis of the entropy of the sorbed water.

2394. WELTZIEN, W.; WINDECK-SCHULZE, K., AND PIEPER, J. **The measurement of the absorption of moisture by textiles.** *Zellwolle, Kunstseide, Seide* **47**, 57-67 (1942).—*C.A.* **37**, 4254⁹.

The samples (1 g) were first degreased with CH_3OH, dried at 85°C and washed twice with water. The flask contg. the sample was placed in a vessel used as a thermostat and the basket was suspended on a torsion balance by means of a long wire. After the weighing the sample was dried *in vacuo* over P_2O_5 and the moisture was calcd. to 100 g of absolutely dry fibers. A no. of rayons, loose staple rayons and staple-rayon fabrics thus tested yielded values of 13-15% for the absorption of moisture and approx. 1.5% higher values for the emission of moisture at 65% relative atm. humidity and 25°C.

2395. FLORY, PAUL J. AND REHNER, JOHN JR. **Statistical mechanics of cross-linked polymer networks. I. Rubberlike elasticity. II. Swelling.** *J. Chem. Phys.* **11**, 512-20; 521-6 (1943).—*C.A.* **38**, 291⁹.

A model was proposed for the structure of a cross-linked network which was amenable to statistical treatment. Expressions were derived for the structural entropy of the network, and for the entropy change on deformation. The max. degree of swelling of the network in contact with the pure solvent was related to the degree of cross-linking. The swelling capacity should have been diminished by the application of an external stress.

2396. KRISCHER, OTTO. **Thermodynamics of the drying of solid bodies.** *Chem. Tech.* **16**, 117-21, 129-32 (1943).—*C.A.* **38**, 5705³.

In drying wood which was to be free from cracks and strains the lowest possible moisture gradient was desirable. This could be attained by high-frequency drying, in which the interior of the piece was heated while the outside was cooled. It could also be attained by intermittent vacuum drying, in which the heat stored in the material was used for the evapn.

2397. MÜLLER, F. HORST. **A simple, rapid method for the determination of the maximum water absorption by substances, with special application to small absorption values and small test samples.** *Kolloid-Z.* **105**, 16-20 (1943).—*C.A.* **38**, 4491².

The sample, evacuated to low pressures, was first connected to a flask contg. pure H_2O. After equil., the moist sample was connected to a vessel immersed in a liquid-air bath. Afterward the H_2O from the sample condensed in the cold bath was removed and the vessel allowed to warm to room temp. The pressure was read on a Hg manometer, and from the known vol. of the vessel the wt of H_2O was detd. by the gas law. Typical results for the H_2O uptake were polystyrene 0.15-0.20%, Vinifol 0.3-0.4%, cellulose triacetate 6-10%.

2398. MURPHY, E. J. **Gases evolved by the thermal decomposition of paper.** *Trans. Electrochem. Soc.* **83**, 12 pp. (1943).—*C.A.* **37**, 4570³.

Curves were given to show the rate of evolution of gas by the thermal decompn. of paper as a function of time and also the dependence of rate on temp. The temp. dependence was in approx. agreement with the Arrhenius formula for reaction velocities. The gases evolved consisted of H_2O, CO_2 and CO; H_2O vapor was the most prominent constituent.

2399. TANIGUCHI, MASAKATSU AND HOSONO, MASAO. **Moisture adsorption by cellulose acetate.** *J. Soc. Chem. Ind. Japan* **46**, 1103-5 (1943).—*C.A.* **42**, 6531*a*.

Air-dry pulverized cellulose acetate did not reach equil. in 24 hrs at 25°C in an atm. of 95% relative humidity; a film prepd. from Me_2CO soln. reached equil. in 3 hrs. The degree of solvation of the film affected its adsorption of moisture; e.g., a film contg. 8.1, 3.2, and 0.1% Me_2CO adsorbed 2, 8.2, and 12.2%, resp., of moisture when equil. was reached.

2400. THIES, F. H. **Improvements in defining tension measurements. VI. Employment of surface-area refinements.** *Allgem. Textil-Z.* **1**, 11-13 (1943).—*C.A.* **39**, 420².

Textile techniques were discussed. The changes in fiber lengths and thickness during refining and the mode of action, which was demonstrated in the refining process, were explained.

2401. AMERONGEN, G. J. VAN. **A modified method for the direct estimation of the sorption of oxygen by rubber.** *Mededeel. Kunststoffeninst. Rubber-Stichting, Delft* No. **39**, 8 pp. (1944) *Rubber Chem. Tech.* **19**, 170-5 (1946) (in English).—*C.A.* **40**, 2674⁹.

The adsorption of O_2 by rubber could be read directly and made roughly 4 times as quickly as by a manometric method. Measurements of raw rubber, Buna-S, and gutta-percha (with and without antioxidants) at 80°C and of vulcanized rubber and Perbunan at 80°C, 90°C, and 100°C were tabulated. The rate was 2-3.5 times as great in O_2 as in air, i.e. roughly proportional to the sq root of the O_2 pressure.

2402. AMERONGEN, G. J. VAN . **The permeability of rubberlike substances to gases.** *Communication* No. **46**, *Rubber Stichting: Rev. gén. caoutchouc* **21**, 50-6 (1944).—*C.A.* **40**, 3924⁴.

The permeability of various elastomers were detd: H_2 to natural rubber, Buna-S, methylrubber, Perbunan, Neoprene G, Neoprene E, Koroseal, Oppanol B-200, Mipolam-MP, Thickol-B, Pliofilm, Triacel, cellophane, and gutta-percha; CO_2 to natural rubber, Buna-S, methylrubber, Perbunan, Neoprene G, Koroseal, Oppanol B-200, Mipolam-MP and Thiokol-B. With increase in the percentage of combined S in natural rubber, the permeability decreased progressively.

2403. Bull, Henry B. **Adsorption of water vapor by proteins.** *J. Am. Chem. Soc.* 66, 1499-1507 (1944).—*C.A.* 38, 6156^1.

Data were given for the rate of loss and gain of wt of gelatin, albumin and wool over H_2SO_4 and the effect of temp. on the moisture content of gelatin, albumin and wool in a vacuum oven. The H_2O adsorbed as a function of the relative pressure at 25° and 40°C was detd. for nylon, unstretched and stretched; silk; wool; *b*-zein; *c*-zein; salmin; elastin; collagen; gelatin; egg albumin lyophilized; unlyophilized and heat-coagulated; β-lactoglobulin lyophilized and wet crystals; serum albumin; α- and β-pseudoglobulin and γ-pseudoglobulin. The B.E.T. theory described water adsorption by proteins in a very satisfactory manner.

2404. Carson, Frederick T. **Effect of humidity on physical properties of paper.** *Natl. Bur. Standards (U.S.)*, Circ. No. C445, 12 pp. (1944).—*C.A.* 38, 3125^9.

A review was given of the changes in the phys. properties of paper with change in the hygrometric environment.

2405. Cleland, J. E. and Fetzer, W. R. **Moisture-absorptive power of starch hydrolyzates.** *Ind. Eng. Chem.* 36, 552-5 (1944).—*C.A.* 38, 4147^2.

The hydrolyzates dispersed on diatomaceous silica with 83.4 and 90.7% reducing sugars (as dextrose) had approx. the same equil. values after 150 hrs as invert sirup (42% H_2O at 78% relative humidity); glycerol absorbed approx. 70% more H_2O (70% H_2O at 78% relative humidity). The max. H_2O absorption of diatomaceous silica was 0.13% H_2O at 78% relative humidity, 0.63% H_2O at 100%.

2406. Doty, Paul M.; Aiken, W. H., and Mark, H. **Water-vapor permeability of organic films.** *Ind. Eng. Chem., Anal. Ed.* 16, 686-90 (1944).—*C.A.* 39, 854^8.

An app. for detn. of water-vapor permeability was described. It was also possible to measure the value of 2 consts., soly. coeff. and diffusion velocity, which together det. the vapor permeability of film. The dependence of permeability on film thickness, vapor pressure and temp. was discussed.

2407. Glückauf, E. **Permeability of adsorbing substances.** *Nature* 154, 831-2 (1944).—*C.A.* 39, 1097^4.

The adsorption of water vapor by keratin and by cellulose was explained by assuming 2 or more states of adsorption, in which the adsorbed mols. had markedly different mobilities. Fick's law applied only to the concn. of the mobile part, which attained appreciable values only at higher concns. of total water.

2408. Hermans, P. H. and Vermaas, D. **Velocity of penetration of water and glycerol in cellulose threads.** *Kolloid-Z.* 109, 5-9 (1944).—*C.A.* 41, 3291g.

The absorption of H_2O by dry cellulose fibers was observed by optical means. After a time a sharply defined line was detected along the periphery of the fiber which indicated the distance penetrated by the H_2O. In absolutely dry cellulose, H_2O penetrated very slowly. In cellulose which contained some moisture, the diffusion velocity increased with the 4th or 5th power of the equil. moisture in the fiber. Glycerol penetrated the cellulose fiber only when the latter was in equil. with a relative humidity of at least 40%.

2409. Hermans, P. H.; Hermans, J. J., and Vermaas, D. **Density and refractivity of cellulose fibers.** *Kolloid-Z.* 109, 9-16 (1944).—*C.A.* 41, 3291*b*.

The best interpretable d. values were obtained with liquids which did not penetrate the fiber substance. It was doubted if the d. values obtained in the He voluminometer were the true values. The d. measurements of natural (bleached cotton, standard cotton, α-pulp, Bemberg rayon) and synthetic (viscose) fibers in CCl_4 were correlated with the refractive properties of these fibers. There was close relationship between the d. percentage cryst. material, and sorption capacity of the fiber for H_2O.

2410. Hermans, P. H.; Vermaas, D., and Hermans, J. J. **Cellulose-water system. I. Space arrangement in the cellulose-water system and the degree of packing of cellulose fibers.** *J. makromol. Chem.* 1, 247-90 (1944).—*C.A.* 40, 201^7.

The distribution of H_2O within the hollow spaces of the fiber was used to interpret the d. data derived from x-ray analysis. The modified concept was used also for the evaluation of water-vapor sorption and desorption data of the model filaments.

2411. Hermans, P. H.; Hermans, J. J., and Vermaas, D. **System cellulose-water. III. Dependence of the optical properties of cellulose fibers on their water content.** *Kolloid-Z.* 109, 86-90 (1944).—*C.A.* 41, 3291*e*.

The influence of the moisture content on the double refraction of cellulose fibers could be evaluated quantitatively by the same simple equation developed for the effect of moisture on the refractive capacity of isotropic cellulose fibers. Good agreement was obtained between the phys. behavior of the cellulose-water systems and those of much simpler binary systems, such as H_2SO_4-H_2O.

2412. Lauer, K. **Cellulose fibers. V. Sorption of organic vapors by cellulose fibers.** *Kolloid-Z.* 107, 86-8 (1944).—*C.A.* 39, 183^4.

The adsorption isotherms of purified cotton for the org. liquids deviated from the S-shaped isotherm for H_2O. Nevertheless, the adsorption isotherms for MeOH and EtOH reflected the overlapping of adsorption and swelling phenomena, though in a different order. In contrast, propanol, isopropanol and butanol, as well as benzene, toluene, paraffin hydrocarbons, CCl_4 and $CHCl_3$, produced pure adsorption isotherms without involving swelling phenomena. Similar results were obtained with viscose rayons.

2413. MATTHES, A. **Theory of the swelling process in gels. Gel structure of artificial fibers from regenerated cellulose. II.** *Kolloid-Z.* **108**, 79-94 (1944).—*C.A.* **40**, 7609⁹.

The swelling of cellulose hydrate was considered a special case of adsorption, and was discussed at length, following a consideration of the sorption isotherms of active charcoal and cellulose hydrate. Sorption in the case of cellulose hydrate was ascribed to H_2O (a) held in solid soln., (b) held by adsorption, and (c) condensed in the capillaries of cellulose hydrate. The difference in adsorption and desorption isotherms was a measure of the no. of free points at which H_2O can be held.

2414. RIEHL, N. **The diffusion of gases through rubber membranes.** *Kolloid-Z.* **106**, 201-6 (1944).—*C.A.* **38**, 5710⁶.

Thin rubber membranes with a thickness of several hundredths mm when dried over P_2O_5 were highly permeable to all gases. This permeability was immediately reduced by several powers of 10 if the rubber was allowed to absorb even traces of moisture. On cooling to −57°C the permeability became many times greater than at ordinary temp.

2415. SHEPPARD, S. E. AND NEWSOME, P. T. **Electrical anisotropy of xerogels of hydrophile colloids. I.** *J. Chem. Phys.* **12**, 244-8 (1944).—*C.A.* **38**, 3894³.

Polyvinyl alc., gelatin, cellulose acetate (24.5% acetyl), polyvinyl acetal, hydrolyzed polyvinyl acetate, vinylite X, cellulose acetate (40% acetyl), cellulose nitrate, polyvinyl acetate, and polystyrene were coated in sheet form and "fibered" internally by stretching to 100% or more elongation. Circular disks were cut from the fibered sheets, and their degree of orientation was measured in an alternating elec. field.

2416. SPEAKMAN, J. B. **Analysis of the water adsorption isotherm of wool.** *Trans. Faraday Soc.* **40**, 6-10 (1944).—*C.A.* **38**, 3529¹.

The water adsorbed by wool appeared to be of 3 types: (1) that which combined with hydrophilic side chains with great evolution of heat (5.8 kg-cal per mol. of α-water adsorbed); (2) loosely bound β-water, which was responsible for the fall in rigidity of wool during water adsorption; (3) water condensed at relative humidities greater than 80%. Apart from capillary-condensed water, the total amt. of H_2O adsorbed by wool at different humidities was given by the equation $A = 0.1012\ H^{0.395} + 0.0002754\ H^{1.78}$.

2417. YEE, J. Y. AND DAVIS, R. O. E. **Accelerated method for determining moisture absorption.** *Ind. Eng. Chem. Anal. Ed.* **16**, 487-90 (1944).—*C.A.* **38**, 5351².

In a special humidity chamber with forced air circulation, the sample dishes were suspended from the top of the chamber. There was good agreement and reproducibility of results on duplicate samples in different chambers. Under identical conditions as much moisture was found to be absorbed during 4 hrs in the accelerated method as was absorbed in 24 hrs with a static method.

2418. AIKEN, W. H.; DOTY, PAUL M., AND MARK, H. **Water-vapor permeability—what it is and how it works.** *Modern Packaging* **45**, No. 12, 137-40, 166, 168 (1945).—*C.A.* **39**, 5125³.

The structure of film-forming materials, the measurement of permeability to water vapor, the permeability const., and the effect of plasticizers on the permeability consts. were discussed. Data were given for cellophane, Pliofilm, polyethylene, Saran, polyvinyl chloride-acetate copolymer VYNW, 3-ply glassine, ethylcellulose, polyvinyl chloride, rubber, and polystyrene.

2419. CALVET, J.; DALBERT, R., AND CHÉDIN, J. **Gelatinization phenomena: calorimetric study of the absorption of acetone by the Bakelites.** *Mém. services chim. état (Paris)* **32**, 220-39 (1945).—*C.A.* **42**, 4390*e*.

In unpolymerized phenolics the phenolic function alone explains the heat liberated by the absorption of Me_2CO. In polymerized phenolics the heat liberated at the start of absorption of Me_2CO (100 cal per g) is more than that accounted for by the –OH groups (71 cal). It is equal, however, to that accounted for by the two groups –OH (71 cal) and $-CH_2-$ (26.2 cal). The two groups have an independent and additive attraction for Me_2CO.

2420. KING, G. **Sorption of vapors by keratin and wool.** *Trans. Faraday Soc.* **41**, 325-32 (1945).—*C.A.* **39**, 5150⁵.

The rates of absorption and desorption of H_2O, MeOH, and EtOH were detd. on wool and horn keratin. The diffusion in these cases was the rate-controlling process. The rate was approx. linear. The diffusion coeff. (cm^2/sec) was estd.: water on horn, from 7.5×10^{-9} to 9.0×10^{-9}; MeOH on wool, 1.7×10^{-10}; MeOH on horn, 2.2×10^{-10}; EtOH on wool, from 3.6×10^{-12} to 11.6×10^{-12}. It was impossible to remove the last 6% of MeOH or EtOH from wool fibers.

2421. KING, G. **Permeability of keratin membranes to water vapor.** *Trans. Faraday Soc.* **41**, 479-87 (1945).—*C.A.* **40**, 786⁷.

The rate of diffusion of H_2O vapor through a horn keratin membrane was detd. at 20°, 25°, and 30°C and vapor pressure gradients from 10 to 95% relative humidity. The diffusion coeff. was a function of H_2O concn. and temp., and was to a large extent, independent of the elasticity of the keratin lattice.

2422. PAL'VELEV, V. T. **Sorption of methane by Don Basin coals under high pressures.** *Bull. acad. sci. U.R.S.S., Classe sci. tech.* **1945**, 578-91 (in Russian).—*C.A.* **41**, 2553*d*.

The equil. amt., reached after over 100 hrs of sorption, was roughly 2 cc. CH_4/g coal, at 25°C. From 100 to 150 kg/cm² upwards, sorption of CH_4 remained at a const. max. level independent of further rise of pressure; e.g., at 25, 75, 150, 500, 900 kg/cm² the amts. of sorbed CH_4 were 9, 12, 15, 15, 16 cc./g. That CH_4 was adsorbed, not absorbed, followed from the rapidity of establishment of equil., which was reached in a few min. Below 100 kg/cm², most of the CH_4 in coal was adsorbed; above 100-200 kg/cm², the amt. of compressed free gas exceeded adsorbed gas.

2423. REES, W. H. **Some experiments on the evaporation of water from a plane surface.** *J. Textile Inst.* 36, T165-8 (1945).—*C.A.* 39, 5494^2.

A method was described for measuring the effect of fabrics on the rate of evapn. of water from a moist surface with which they were in contact. In general, single layers of scoured and bleached samples had little effect of rate of evapn. from the bare porous plate. Waterproofed fabrics, however, greatly decreased the rate of evapn. With 2 layers of a scoured fabric, the rate was greater than for one layer.

2424. SOLOMON, M. E. **Use of cobalt salts as indicators of humidity and moisture.** *Ann. Applied Biol.* 32, 75-85 (1945).—*C.A.* 39, 5140^8.

Paper impregnated with cabaltous salts offered a simple procedure for measuring humidity in small spaces. $CoCl_2$ was blue at low humidities, pale red at high humidities, with a graded series of lilac colors between. Correspondence between color and relative humidity was close, though the color was influenced slightly by temp.

2425. THOMAS, A. MORRIS AND GENT, W. L. **Permeation and sorption of water vapor in varnish films.** *Proc. Phys. Soc. (London)* 57, 324-49 (1945).—*C.A.* 40, 1678^3.

Both the permeability and sorption of the films were detd. at const. moisture concns., that is, by using streams of moist air, the amts. permeating and the amts. sorbed being directly weighed. In addn. to moisture permeability, some measurements of that of H_2 and CO_2 were reported. The exptl. results could be interpreted by assuming that the diffusion process was analogous to that of substances in soln. The results for CO_2 and H_2 indicated that the diffusion process was dependent on the microphys. properties of the film.

2426. ZHURKOV, S. N. AND LERMAN, R. I. **Effect of the volume sorption of vapors on the solidification temperature of polymers.** *Compt. rend. acad. sci. U.R.S.S.* 47, 106-9; *Doklady Akad. Nauk. S.S.S.R.* 47, 109-12 (1945).—*C.A.* 40, 4277^8.

Characteristic S-shaped curves were obtained by plotting the log of the high elastic modulus E vs. temp. When the polymers were swollen in the vapors of org. solvents they gave identically shaped log E vs. temp. curves, but at a lower temp. It was found for 4 polymers, butadiene-acrylonitrile, polymethylacrylate, butadiene rubber, and polyisobutylene, that the lowering in temp. of solidification ΔT after swelling with any of 30 different solvents was a linear function of the no. of sorbed mols.

2427. ZHURKOV, S. N. **The effect of volume sorption of the mechanical properties of polymers.** *Compt. rend. acad. sci. U.R.S.S.* 49, 198-201 (1945) (English summary).—*C.A.* 40, 4278^2.

The effect of absorption of MeOH, EtOH, BuOH, acetone, and water on the elastic properties of cellulose acetate (28% free hydroxyl in fibers 20 μ in diam. and 1 m long) was detd. The quantity of vapor absorbed was measured by means of a spring balance having a quartz spiral. The observations obeyed the following equation: $E = E_0 - K(C/M)$, where E and E_0 were the elasticity moduli of the fiber in the dry and swollen states, resp., K was a const. equal to 1.37 to 1.4 for the above solvents, taking $M = 2 \times 18$ for H_2O, and (C/M) was the molar concn. of absorbate in the fiber.

2428. AMERONGEN, G. J. VAN. **Permeability of different rubbers to gases and its relation to diffusivity and solubility.** *J. Applied Phys.* 17, 972-85 (1946).—*C.A.* 41, 878^h.

The soly. of the gas was calcd. from the permeability and the diffusivity, and was also detd. by direct measurement. H_2, O_2, N_2, CO_2, CH_4, NH_3, SO_2 and He were tested at 5 temps. between 17° and 50°C with natural rubber, Buna-S, Perbunan, Neoprene-G, Oppanol B-200, Butadiene rubber, Methyl rubber, Mipolam-Mp, and Thiokol-B. Differences in permeability were caused by differences in soly. and rates of diffusion.

2429. CARSON, F. T. AND WORTHINGTON, VERNON. **Water-vapor-permeability tester.** *Paper Ind. Paper World* 27, 1799-1805, 1816 (1946).—*C.A.* 40, 3942^7.

The hygrometric conditions were maintained by equil. with a satd. soln, of an appropriate salt. The temp. of this soln. and of the testing chamber was held const. by means of an envelope of moving air that completely surrounded the testing chamber, an open-coil heater, and a thermoregulator used to control the temp. of this air bath. Devices for supporting and weighing the permeability cells in the cabinet, without disturbing the hygrometric conditions, were explained in detail.

2430. CASSIE, A.B.D. **Water absorption of keratin.** *Soc. Dyers Colourists, Symposium on Fibrous Proteins* **1946**, 86-95.—*C.A.* 41, 1529*c*.

The sorption isotherm and measured heat effects required the absorption at high regains to be due to an increase of entropy. This eliminated capillary condensation and potential theories which ascribed absorption to a decrease in the heat content of the system without increase of entropy. The isotherm was analyzed by means of an appropriate multimol. absorption theory, and the water-attracting groups in keratin (—CO—) gave the energy of bonding of the water to the groups of 6.6 kg-cal per mol. The increase in entropy due to absorption of water required the sorbed water to be present as discrete clusters, which seemed inconsistent with the water-repellency of cut horn keratin surfaces.

2431. CREUTZ, E. C. AND WILSON, ROBERT R. **Absorption of water by films of cellophane and polyvinyl alcohol.** *J. Chem. Phys.* 14, 725-8 (1946).—*C.A.* 41, 2302^h.

The absorption of water and dehydration of the these films was found to obey a diffusion equation by means of which a diffusivity may be defined. A rapid change in water content immediately after changing the ambient conditions suggested the presence of adsorbed surface layers. The total absorption was found to increase faster than the relative humidity.

2432. DOTY, PAUL M. **The diffusion of vapors through polymers.** *J. Chem. Phys.* 14, 244-51 (1946).—*C.A.* 40, 3961^3.

Available data on the permeability of gases through polymers showed that for a given gas there was a linear relation between log *Po* and *E* (the energy of activation for permeation). The effect of plasticization on permeation of water vapor was studied exptly. Lowering of the heat of soln. was the predominant effect. From the data, the entropy of soln. can be calcd. and interpreted as showing that water mols. dissolved in the unplasticized polymer exhibited much less freedom than when they were dissolved in plasticized polymer.

2433. DOTY, PAUL M.; AIKEN, W. H., AND MARK, H. **Temperature dependence of water-vapor permeability.** *Ind. Eng. Chem.* **38**, 788-91 (1946).—*C.A.* **40**, 5618^{3}.

The temp. was varied from -10° to 80°C, and measurements with 10 polymer films were made of the rate of moisture transfer, vapor-pressure driving force, film area, and film thickness. In all cases, an exponential dependence of permeability on temp. was shown to exist. Vapor transfer involved the processes of soln. of water mols. at the wet side of the film, movement by diffusion and possibly capillarity through the film, and evapn, at the dry side of the film.

2434. HAILWOOD, A. J. AND HORROBIN, S. **Absorption of water by polymers. Analysis in terms of a simple model.** *Trans. Faraday Soc.* **42B**, 84-92, discussion 94-102 (1946).—*C.A.* **42**, 7134*e*.

The model chosen was that of a two-phase system consisting of H_2O vapor and a solid soln. of H_2O in the polymer. The solid soln. contained hydrates formed between the H_2O and definite units of polymer, which hydrates were prevented by their immobility from forming any new phase. An equation giving sigmoid isotherms was derived from this model. Good agreement was obtained between this equation and published data for wool, hair, silk, nylon, and cotton.

2435. HERMANS, P. H. AND WEIDINGER, A. **The hydrates of cellulose.** *J. Colloid Sci.* **1**, 185-93 (1946).—*C.A.* **40**, 6810^{6}.

Cellulose hydrate was formed from "mercerized" cellulose by a process of intramicellar swelling. Native cellulose did not show intramicellar swelling. In the sorption of H_2O by cellulose, "mercerized" cellulose formed cellulose hydrate and "water cellulose," whereas native cellulose did not take part in the sorption process.

2436. KING, G. **Molecular rotation in keratin.** *Nature* **158**, 134 (1946).—*C.A.* **40**, 6319^{5}.

The effects of the sorption of H_2O, MeOH, and HCHO on the dielec. const. and on the reduction of relative rigidity of keratin were shown graphically. Equimolar amts. of H_2O and MeOH had about the same effect (up to 0.7 moles per 100 g keratin); HCHO was much more effective in the same concn. range.

2437. KOCH, H. **Relationships between the moisture content of textiles and the relative atmospheric humidity during absorption and desorption. Hysterises of swelling.** *Schweiz. Arch. angew. Wiss. Tech.* **12**, 176-84 (1946).—*C.A.* **40**, 6822^{7}.

Data were given for the absorption and desorption of hydrate cellulose.

2438. MACMILLAN, W. G.; MUKHERJEE, R. R., AND SEN, M. K. **The moisture relationships of jute. I. Adsorption isotherm and heat of wetting.** *J. Textile Inst.* **37**, T13-24 (1946).—*C.A.* **40**, 6281^{4}.

Adsorption and desorption isotherms for tossa (Corchorus olitorius) and white (C. capsularis) jute, detd. at 70°F (21°C), showed that the tossa was more hygroscopic than the white. Heating for 4 hrs at 110°C diminished the hygroscopicity. The heats of wetting of jute, wool, and cotton were measured and the data discussed. The regain values of jute for different humidities at 21°, 30°, 40°, and 50°C were tabulated. Between 40 and 85% relative humidity, a decrease of 0.5% regain for each 10° rise was noted.

2439. MCBAIN, JAMES W.; MYSELS, KAROL J., AND SMITH, GEROULD H. **Studies of aluminum soaps. VII. Aluminum soaps in hydrocarbons. The gels and jellies and transformations between them.** *Trans. Faraday Soc.* **42B**, 173-80 (1946).—*C.A.* **42**, 9208*e*.

The soaps were the dilaurate, distearate, dioleate, dinaphthenate (av. mol. wt of acid, 210), and monolaurate of Al, and the solvents were isooctane, heptane, cyclohexane, and benzene. Visual observation of the phases in evacuated glass tubes was supplemented by data obtained by x-ray diffraction, osmometry, viscosimetry, measurements on the McBain-Bakr sorption balance, and detns. of the mech. properties. Gels (i.e. discontinuous systems of cryst. soap, more or less swollen, and frequently intermeshed with sol or jelly) and Jellies (i.e. one-phase, homogeneous, transparent, isotropic, elastic systems) bridge the gap between dry cryst. Al soaps and their sols in hydrocarbons.

2440. MITTON, R. G. **Absorption of water vapor by chrome-tanned leather.** *J. Intern. Soc. Leather Trades Chem.* **30**, 330-4 (1946).—*C.A.* **41**, 876^{h}.

Samples of calf leather, Cr-tanned and mold-proofed with phenylmercuric nitrate but not fat liquored, colored or finished, were exposed to relative humidities from 0 to 98.8% at 21°C for 3 months. For the absorption curve the samples were preconditioned at 0% relative humidity for 3 months. These samples contained about 2.5% H_2O, as calcd. by math. extrapolation to infinite time of an exptl. drying curve continued to 16 months. For the desorption curve, the samples were preconditioned 3 months at 98.8% relative humidity.

2441. MUSSO, POMPILIO. **Water absorption by foils of plasticized Vipla.** *Materie plastiche* **12**, 26-31 (1946).—*C.A.* **40**, 6877^{5}.

Foils (polyvinyl chloride 60% and plasticizer 40%) were prepd. 10 × 2 × 0.05 cm (surface 41.2 cm^2) and were weighed after 3 days storage. Each was immersed in 100 cc. of H_2O of 20°, 50°, and 70°C and the wt increase observed after 1, 3, 5, 7, 10, and 30 days. The rate of absorption was influenced by the temp., the type of polyvinyl chloride and by the plasticizer; at 70°C, 7 to 10 days sufficed to show the trend. Washing (to remove emulsifiers or dispersing agents) reduced H_2O absorption markedly, and the foils retained full transparency even after immersion. H_2O absorption of plasticized polyvinylchloride was reversible and was typical of the particular combination used.

2442. SAKURADA, ICHIRO AND TANIGUCHI, MASAKATSU. **Wettability of high-molecular substances by water.** *J. Soc. Chem. Ind. Japan* 49, 35 (1946).—*C.A.* 42, 6206*c*.

The degree of adsorption of moisture and wettability were not the same thing, e.g. polyvinyl alc. had a very large value of the former in comparison with its wettability by water, whereas polyvinyl acetate had the opposite properties. Neither polystyrene nor pariffin absorbed moisture, but their wettabilities by water were different.

2443. SKAU, EVALD L. **The possible contribution of shape to the swelling and moisture-sorption behavior of cotton fiber at the saturation point.** *Textile Research J.* 16, 556-63 (1946).—*C.A.* 41, 869*h*.

Conclusions were drawn as to the effect contributed by the shape of a cotton fiber to its moisture-sorption behavior.

2444. SPEAKMAN, J. B. AND SAVILLE, A. K. **Some physical properties of nylon.** *J. Textile Inst.* 37, P271-93 (1946).—*C.A.* 40, 7640[9].

Water adsorption isotherms at 20°C to 35°C were detd. and the heats of reaction were calcd. Longitudinal and lateral swelling with adsorption of water was studied, preliminary to detns. of the rigidity of nylon at different relative humidities, temps., and pH values on the behavior of nylon under longitudinal stress were examined.

2445. ZETTLEMOYER, A. C.; SCHWEITZER, E. D., AND WALKER, W. C. **The internal surface area of hide.** *J. Am. Leather Chem. Assoc.* 41, 253-64 (1946).—*C.A.* 40, 5941[4].

The B.E.T. surface was detd. for limed hide, washed free of sol. salts, degreased in acetone, and dried *in vacuo* over P_2O_5. Hide samples were heated 1 hr in a high vacuum at 110°C, and N_2 was repeatedly adsorbed and desorbed before the final measurements. The results gave a surface area for untanned hide of 4.8 m^2/g. Pressing the untanned hide at 10,000 lb/ft^2 decreased the area to 1.0 m^2/g. Formaldehyde tanning decreased it to 0.8 m^2/g.

2446. CHERNYSHEV, A. B.; POMERANTSEV, A. A., AND FARBEROV, I. L. **The filtration of a gas through a reactive, porous medium.** *Doklady Akad, Nauk S.S.S.R.* 56, 727-9 (1947).—*C.A.* 44, 8197*i*.

When a gas penetrated a porous medium with which it reacted chemically, a reaction front was formed behind which the gas retained its total (inital) concn. and in front of which no gas existed. The velocity of displacement of this front was a linear function of the amt. of gas consumed. This was verified by measurements on the rate of filtration of air or N_2 satd. with I_2 vapor through dried starch paste.

2147. DEAN, R. B. AND MCBAIN, JAMES W. **The sorption of organic vapors by monolayers of soap.** *J. Colloid Sci.* 2, 383-5 (1947).—*C.A.* 42, 435*c*.

Na stearate monolayers spread on surfaces of 0.002 *M* Na_2HPO_4 and held at a const. pressure of 9.5 dynes/cm were found to expand in area to a detectable extent (about 1%) when exposed to the vapors of some volatile liquids, but other vapors had no measurable effect. Expansion indicated that the vapors were adsorbed by the Na stearate. In general, expansion was produced by those compds. whose spreading pressure on water was greater than 9.5 dynes/cm.

2448. DOLE, MALCOLM AND MCLAREN, A. D. **The free energy, heat, and entropy of sorption of water vapor by proteins and high polymers.** *J. Am. Chem. Soc.* 69, 651-7 (1947) *C.A.* 41, 3677*b*.

Published data were used to calculate differential free energies and differential and integral heats. The fraction of the polar groups assocd. with one H_2O mol. at satn. was shown to be equal to the fraction of amorphous polymer in stretched and unstretched nylon. Differential and integral free energies and heats of hydration were given for cellophane, cellulose acetate, polyvinyl alc., polyvinyl butyral, and vinylidene chloride-acrylonitrile copolymer.

2449. GLOCKLER, GEORGE AND HOLLINGSWORTH, C. A. **The rate of oxygen absorption by α-ray cuprene.** *Trans. Electrochem. Soc.* 92, 9 pp. (1947).—*C.A.* 41, 5771*e*.

An expression for the rate of O_2 absorption by α-ray cuprene was detd. At const. pressure it was the same law that expressed the rate of O_2 absorption after the initial stages, by the C_2H_2 polymer obtained in the silent elec. discharge. The equation had to be modified for variation of the O_2 pressure.

2450. HOOVER, SAM R. AND MELLON, EDWARD F. **Effect of acetylation on sorption of water by cellulose.** *Textile Research J.* 17, 714-16 (1947).—*C.A.* 44, 7057*i*.

Recalcn. of data for the adsorption of H_2O by cellulose esters on the basis of the cellulose content of the samples revealed that the apparent decrease of the H_2O adsorption of cellulose acetate was due to a diln. effect; the H_2O uptake of cellulose was not diminished by acetylation. Esters of cellulose with higher fatty acids (C_3, C_4, etc.) had reduced affinities for H_2O, the max. reduction (85%) being observed with esters of hexoic and heptoic acids.

2451. JACQUÉ, L. AND CARON, MLLE. **Hydration and dehydration of various phenolic plastics as a function of the surrounding media (water, humid and dry air) and of time. Influence of the immersion in water on the density as a function of time.** *Inds. plastiques* 3, 41-6 (1947).—*C.A.* 41, 4329*i*.

The change of wt and dimensions of phenolics which were molded to rods and slabs, and immersed in distd. H_2O or exposed to humid or dry aid, was studied during a period of 400 days. The change was greatest were phenolic was loaded with cotton flock; it was smaller with wood flour,and smallest with mica fillers.

2452. KUNO, HISASHI; YAMAGUCHI, GORO, AND NAGAI, SCHOICHIRO. **Moisture adsorption by urea nitrate.** *J. Electrochem. Soc. Japan* 15, 69-72 (1947).—*C.A.* 44, 9770*g*.

Urea nitrate from pure urea and HNO_3 and dried 5 hrs at 50°C adsorbed H_2O vapor much more slowly than $(NH_4)_2SO_4$ or urea. Addn. of $CaCO_3$ and variation in the amt. of urea in the salt increased the moisture adsorption.

2453. Magne, Frank C.; Portas, H. J., and Wakeham, Helmut. **A calorimetric investigation of moisture in textile fibers.** *J. Am. Chem. Soc.* 69, 1896-902 (1947).—*C.A.* 42, 371*e*.

The quantities of bound and free water in textile fibers were detd. calorimetrically by a mixt. method. The fibers used were a cord of Acala-1517 cotton, a yarn of Rowden cotton, a commercially mercerized cord of Wilds-13 cotton, a "Cordura" rayon yarn, a nylon cord, and glass fibers. Interpretation of the results for cellulose fibers permitted differentiation between water of primary adsorption and water adsorbed in multilayer formation or by capillary condensation.

2454. Noll, August. **Determination of tensile strength and water sorption of moistened paper.** *Wochbl. Papierfabrik.* 75, 50-2 (1947).—*C.A.* 42, 5222*a*.

The paper sample (after air conditioning) was dipped into distd. H_2O for 5 sec. After withdrawing, the excess H_2O was removed from either side by passing the strip rapidly over the prow of the base, placing it between the filters on an inlaid bronze plate, and weighting it with the overlay a carefully ground bronze plate for exactly 0.5 min. The tensile strength was immediately detd. and compared with that of a similar (conditioned) air-dried strip. In water sorption, the app. was similar to that used in wet strength.

2455. Pierce, S. W. and Holms, J. F. **Method for the determination of water-vapor permeability at low temperatures.** *Paper Trade J.* 124, No. 16, 64-6 (1947).—*C.A.* 41, 3623*h*.

The testing procedure was outlined which gave the following results: (g/100 in^2/24 hrs) for water-vapor transmission at 0°C, 0.017 in.-board 0.907, 0.0018 waved paper 0.042, creased 0.317, rubber HCl film 0.016, 0.0035 Al foil 0.012, 0.017 board (wax-coated) 0.004, 0.0009 moisture-proof regenerated cellulose 0.003, 0.0007 Al foil 0.00.

2456. Rouse, Prince E., Jr. **Diffusion of vapors in films.** *J. Am. Chem. Soc.* 69, 1068-73 (1947),—*C.A.* 41, 5363*i*.

The sorption isotherm coupled with permeation rates under several vapor-pressure differences could be used to calc. the diffusion coeff. of a vapor within a film as a function of concn. The rate of diffusion of water in a polythene film indicated that the gradient of vapor pressure within the film was approx. equal at a pressure about 1.0 cm. The transmission of water vapor through a nylon film increased very rapidly with increasing vapor pressure on the wet surface.

2457. Rowen, John W. and Blaine, R. L. **Sorption of nitrogen and water vapor on textile fibers.** *Ind. Eng. Chem.* 39, 1659-63 (1947).—*C.A.* 42, 1058*i*.

Water and N_2 sorption isotherms for cotton, wool, silk, nylon, and viscose and acetate rayons were detd., and fiber surface areas available to the nitrogen were found to vary from 0.31 m^2/g for nylon to 0.98 m^2/g for viscose rayon. Wool and viscose rayon had slightly greater adsorption capacities for both N_2 and water than did silk and cotton; adsorption capacities of acetate and nylon were lowest.

2458. Shreve, George W.; Pomeroy, Harold H., and Mysels, Karol J. **Studies of aluminum soaps. VIII. Water sorption and moisture content.** *J. Phys. & Colloid Chem.* 51, 963-6 (1947).—*C.A.* 41, 6739*f*.

The sorption isotherm of water vapor on $Al(OH)(OOCC_{11}H_{23})_2$ at 50°C showed less than 3% water sorbed at satn. The moisture content may be accurately detd. from the loss in wt on drying.

2459. Smith, Sherman E. **The sorption of water vapor by high polymers.** *J. Am. Chem. Soc.* 69, 646-51 (1947).—*C.A.* 41, 4358*d*.

The sigmoid type of sorption curve was characterized by two classes of sorbed water. The regain (wt ratio of sorbate to dry sorbent) was thus divided into two portions corresponding to bound water and condensed water. Plot of the data for the sorption of water on Cellophane, soda-boiled cotton, wool, and nylon confirmed the linear relation with hysteresis shown by parallel lines with the desorption curve having the higher intercept for bound water. The nylon isotherm showed no appreciable hysteresis.

2460. Tatsuno, Tsuneo. **Bagasse as water-absorbing material.** *Rept. Taiwan Sugar Expt. Sta. (Formosa)* No. 1, 111-16 (1947).—*C.A.* 42, 1031*i*.

Dried and powd. bagasse can absorb 20% of its weight of moisture from an atm. satd. at 25-30°C and can retain 3-5 times its wt of liquid water. A mixt. of 50 g of the air-dry powder and 200 ml of a 20% brine of $MgCl_2$, when dried, absorbed 155% of its wt of water from air of 100 relative humidity in 18 days. Pure $CaCl_2$ or $MgCl_2$ will not absorb as much under the same conditions.

2461. Vandoni, Robert and Marcel, Boivin. **Diffusion of water vapor across membranes of plastic materials.** *Mém. services chim. état. (Paris)* 33, 239-46 (1947).—*C.A.* 44, 3333*g*.

H_2O vapor from liquid H_2O (maintained at const. temp. slightly below room temp.) diffused through a membrane to an evacuated system where it was frozen by solid CO_2. Data were given for various types of wire-cable insulation contg. Thiokol, Gobanyl, and Oppanol.

2462. White, Howard J. Jr. and Eyring, Henry. **The adsorption of water by swelling high polymeric materials.** *Textile Research J.* 17, 523-53 (1947).—*C.A.* 42, 373*i*.

The process is not strictly a surface phenomenon; the adsorbent swells as water is adsorbed. The water uptake is a continuous function of relative humidity. It differs from adsorption by liquids by the fact that the adsorbent possesses and retains during the adsorption a certain amt. of dimensional stability. Data are outlined on the various phenomena assocd. with the adsorption process to give information on the fundamental adsorption process. The adsorption is expressed in terms of the relative humidity, regain, and mol. parameters in the simplest case.

2463. Barkas, W. W. **Hysteresis in the swelling of gels.** *Nature* 162, 32-3 (1948).—*C.A.* 42, 7523*c*.

Hygroscopic natural fibers generally show sorption hysteresis. If different hydrostatis stresses were present depending upon whether the gel was undergoing adsorption or desorption, the difference in hydrostatic pressure must produce a change in vol. of the gel. This was detd. experimentally for spruce and beech.

2464. Barkas, W. W. **Sorption, swelling and elastic constants of the cell-wall material in wood.** *Trans. Faraday Soc.* 42B, 137-50 (1948).—*C.A.* 43, 4009*a*.

Quant. information on the elastic properties of hygroscopic materials may be derived from data on their sorption and swelling. The elastic consts. of the natural wood and of the material composing the cell walls were calculated. Certain consequences of the theory of swelling stresses were discussed, e.g., sorption hysteresis, the instability of capillary spaces on drying, and the limiting value of the adsorption moisture content at the satd. vapor pressure.

2465. Barkas, W. W. **Sorption and swelling of cellulose under natural and imposed restraints.** *Proc. Tech. Sect. Paper Makers' Assoc. Gt. Brit. & Ireland* 28, 189-210 (Discussion, 211-16) (1948).—*C.A.* 43, 4009*b*.

The sorption and swelling of the natural material in cotton, wood, and paper were described. Both the sorption and swelling resulted from a given vapor-pressure rise and must be sensitive to applied stresses. The sensitivity of sorption to stress in a plastic material provided a plausible explanation of the sorption hysteresis found in cellulose and other fibers.

2466. Baughan, E. C. **Absorption of organic vapors by thin films of polystyrene.** *Trans. Faraday Soc.* 44, 495-506 (1948).—*C.A.* 43, 437*c*.

Absorption was detd. by weighing thin films of the polymer, on suitable supports, at 20°C at measured vapor pressures of the low-mol. component; these were obtained by soln. in the nonvolatile Bu sebacate. The solvents were benzene, toluene, m-xylene, CCl_4, Bu acetate, dioxane, and di-Et ketone (in which polystyrene dissolved at 20°C), cyclohexane, propyl ether, and nitromethane (in which it only swelled).

2467. Bond, R. L.; Griffith, M., and Maggs, F.A.P. **Some properties of water adsorbed in the capillary structure of coal.** *Discussions Faraday Soc.* **1948**, No. 3, 29-40.—*C.A.* 43, 1167*i*.

At satd. H_2O vapor five coals adsorbed more than required to fill the pores, but swelling measurements on meta-lignitous indicated quantitatively that the vol. adsorbed equaled the sum of the vol. swelling and the porosity or that the pore vol. of the swollen coal was filled. Dilatometer results, using dry coal and coal satd. with water vapor plus dibutyl phthalate satd. with water vapor, indicated no discontinuity in the adsorbed phase over the range -70° to +20°C. The effect of adsorbed water on the apparent dielec. const. was very marked.

2468. Brecht, W. **Estimation of the water content and the absorption of water by paper.** *Das Papier* 2, 18-22 (1948); *Melliant Textilber.* **29**, 1-3 (1948).—*C.A.* 45, 8246*c*.

Formulas, tables, and curves were given for converting moisture content as ordinarily detd. to moisture content referred to the dry wt.

2469. Cutler, Janice A. and McLaren, A. D. **Sorption of water vapor by proteins and polymers. III.** *J. Polymer Sci.* 3, 7292-4 (1948).—*C.A.* 43, 7294*b*.

Published data for the sol. and insol. proteins as well as for sol. polyvinyl alc. (PVA) and insol. nylon were analyzed on the basis of the equation: $\ln p/po = \ln v_1 + v_2\ (1-1/n) + \mu\ (v_2)^2$, where p/po was relative vapor pressure, v_1 and v_2 were vol. fractions of water and polymer, resp., n was no. of segments in polymer chain, and μ was energy interaction factor. The const. values for μ were given and the pressure range over which each was const., for nylon, PVA, salmine, egg albumin (unlyophilized and coagulated, resp.), gelatin, and collagen, resp., at 25°C.

2470. Davis, S. and McLaren, A. D. **Free energy, heat, and entropy changes accompanying the sorption of water vapor by proteins.** *J. Polymer Sci.* 3, 16-21 (1948).—*C.A.* 42, 3239*f*.

Integral and differential free energies and integral and differential heats and entropies of sorption were calcd. as functions of the amts. of water sorbed on silk, wool, egg albumin (unlyophilized and heat-coagulated), salmine, collagen, gelatin, and lactoglobulin (cryst. and lyophilized). All calcns were referred to satd. water vapor at the standard state. Some of the proteins showed pos. net differential entropies of sorption at low vapor pressures.

2471. Dole, Malcolm. **Statistical analysis of the sorption of vapors by high polymers.** *J. Colloid Sci.* 3, 411-12 (1948).—*C.A.* 43, 16*i*.

Sorption equations previously derived were applied to published data for the sorption of C_6H_6 and PhMe by rubber. The agreement between theory and expt. was excellent up to relative pressures of 0.8-0.95.

2472. D'yachenko, P. F. **Adsorption and bonding of water by casein.** *Kolloid. Zhur.* **10**, 199-202 (1948).—*C.A.* 43, 7787*c*.

Adsorption of H_2O from satd. vapor by casein (0.299 g/g) and the integral heat Q of adsorption (17.1 cal/g) were not affected by treating casein with HCOH vapor, during which 25 mg HCHO per g were taken up. HCOH little affected Q of wetting by 0.1 *N* NaOH (22.1-22.8 cal/g) but lowered Q of wetting by 0.1 *N* HCl (12.8 instead of 17.0 cal/g).

2473. Frey, Harold, J. and Moore, Walter J. **Adsorption of vapors on organic crystals. I. adsorption of water vapor on glycine, leucine, diketopiperazine, and diglycylclycine.** *J. Am. Chem. Soc.* 70, 3644-9 (1948).—*C.A.* 43, 2066*h*.

The water adsorption at 15°, 25°, and 40°C appeared to occur primarily on the ionic COO and NH_3^+ groups of the amino acids and on the peptide linkages in diketopiperazine. Thermodynamic treatment of the adsorption isotherms indicated that the free energy of adsorption at the mono layer point was about 1000 cals less than the free energy of condensation of water vapor to liquid water.

2474. GREEN, R. W. **Adsorption of water vapor on collagen and elastin.** *Trans. Proc. Roy. Soc. New Zealand* 77, 24-46 (1948).—*C.A.* 42, 8046*f*.

The isotherms for water-vapor adsorption on collagen, elastin, and CH_2O-, quinone-, and Cr-tanned collagen were measured by the isopiestic method. Equil. was attained much more rapidly by adsorption than by desorption. The isotherm exhibited hysteresis, especially in the tanned samples. Thus it was important to specify whether a given H_2O content was approached by adsorption or desorption.

2475. HAUSER, PAUL M. AND MCLAREN, A. DOUGLAS. **Permeation through and sorption of water vapor by high polymers.** *Ind. Eng. Chem.* 40, 112-17 (1948).—*C.A.* 42, 3640*a*.

Studies by Doty, et al. of H_2O vapor transmission by high polymers indicated that the permeability const. P could be broken down into two factors. These factors were D, the diffusion const and S, the soly. coeff.; that is P equaled DS. The values of S were obtained from H_2O-vapor sorption isotherms in air at 25° and 40°C. The P detns. were made by the cup method at several temps. These findings made the expression $P=DS$ useful only for describing the behavior of the vinyl polymers and only at low relative humidity.

2476. HEERING, H.; PUELL, H., AND DREWITZ, I. **Determination of the water-vapor permeability of cable sheath materials.** *Kunststoffe* 38, 49-51 (1948).—*C.A.* 43, 8738*a*.

The water vapor permeability D of several synthetic materials in 10^{-8} g hr^{-1} cm^{-1} tor^{-1}, measured in this manner, was found at 25°C: Oppanol-soot mixts. 0.006-0.08, paraffin 0.02, polyisobutylene 0.14, Thiokol mixts. 0.08-0.5, polyethylene 0.22, polybutylene-polystyrene mixts. 0.25, colophony 0.34, bitumen mass 0.80, rubber mixts. 2-10, polystyrene 3.3, benzylcellulose 16, polyacrylate 31, cellulose hydrate foil 77-200, cellulose triacetate foil 100.

2477. INGERSOLL, H. G. AND JOHNSON, A. A. **Ion exchange and fiber contraction.** *Nature* 162, 225 (1948).—*C.A.* 43, 468*g*.

Contraction in cellulose fibers was caused by H_2O migrating out of the filament to establish osmotic equil. Eventually, as the solute diffused into the filament, the osmotic forces were reversed and H_2O flowed into the filament, causing an increase in length.

2478. JOGARAO, A. **Water absorption and anistropic swelling of horn-keratin.** *J. Sci. Ind. Research* 7B, No. 8, 124-8 (1948).—*C.A.* 43, 2073*c*.

H_2O absorption was higher in buffalo-horn than in cow-horn keratin. Definite increase in H_2O absorbed from root to tip was shown by buffalo horn, but only random distribution was shown by cow-horn keratin.

2479. KETTERING, JAMES H. **Determination of the rate of water absorption of light-weight cotton fabrics.** *Am. Dye-stuff Reptr.* 37, 73-5 (1948).—*C.A.* 42, 3182*i*.

The rate of evapn. of H_2O from a plane surface was detd. The method distinguished between high and low-absorbency fabrics selected by 2 comparable methods.

2480. KOVACS, A. **Diffusion and absorption of water in plastic materials.** *J. chim. phys.* 45, 258-69 (1948).—*C.A.* 44, 10457*d*.

The rate of absorption of water from the vapor and liquid states by parallelopiped prisms of cellulose acetate, celluloid, and plexiglass followed Fick's diffusion law. Generally, 1-3% more water was absorbed from the liquid state than from vapor by the thermoplasts, and 5-10% more by the phenoplasts.

2481. LEROY, R. **Water of constitution and moisture.** *Inds. agr. et aliment* 65, 213-28 (1948).-*C.A.* 43, 1625*e*.

There was sufficient complexity in the interaction between water mols. to account for the variety of observed phenomena. The calcn. of the rate of water loss was an important practical application of this information. The water loss in cereals was more important at low temp. than at high temps., and the methods of moisture detn. led to conflicting results.

2482. MELLON, EDWARD F.; KORN, ALFRED H., AND HOOVER, SAM R. **Water absorption of proteins. II. Lack of dependence of hysteresis in casein on free amino groups.** *J. Am. Chem. Soc.* 70, 1144-6 (1948).—*C.A.* 42, 4818*g*.

The amino groups were responsible for the absorption of about 0.25 of the total amt. of water absorbed by casein, throughout the entire range of relative humidities (R.H.). The desorption expts. were all made at 30° ± 0.1°C and 51, 75, 84, and 93% R.H. by lowering the R.H. from the highest to the next lower level. Equil. was reached in 18 days, 3 times as long as required for absorption. The lowest R.H. reached was 6%.

2483. MELLON, EDWARD F.; KORN, ALFRED H., AND HOOVER, SAM R. **Water absorption of proteins. III. Contribution of peptide group.** *J. Am. Chem. Soc.* 70, 3040-4 (1948).—*C.A.* 43, 467*c*.

The vapor-phase H_2O absorption of glycine peptides from 2 to 6 units in length was detd.; the values showed clearly that nonhygroscopic amino acids may give hygroscopic peptides. Polyglycine peptides of longer chain length showed that the peptide linkage must be responsible for most of the H_2O absorption by these materials. The absorption of the peptide chain backbone was probably of the same magnitude, if not identical, for all long-chain poly-peptides and proteins.

2484. OOIWA, MASAYOSHI. **The capillary absorption of wood. I. The absorption of alcohols.** *J. Chem. Soc. Japan, Ind. Chem. Sect.*, 51, 35-6 (1948).—*C.A.* 44, 9214*h*.

After pieces of beech wood (2 × 3 × 0.16 cm) were dipped into H_2O, MeOH, EtOH, PrOH, or BuOH, their increase in wt Q was measured against time, t, at 5-25°C. The relation, $Q=Ad\ (\gamma t/2\eta)^{1/2}$, in which d

was d., γ surface tension, and η viscosity of the solvent, held well after about 10 min.

2485. OOIWA, MASAYOSHI. **The capillary absorption of wood. II. The absorption of water.** *J. Chem. Soc. Japan, Ind. Chem. Sect.* 51, 36-7 (1948).—*C.A.* 44, 9214*i*.

Water absorption by pieces of beech wood (initial H_2O content, Q_o, of 6, 14, and 25%) differed markedly in velocity after about 10 min. and was well expressed by $\ln (Q_S - Q_o)/(Q_S - Q) = -DAt/L$, where D = diffusion coeff., Q_S and Q were the amts. of H_2O at t and at equil., resp., and A and L were the cross section and length of the pieces, resp.

2486. SCHULMAN, J. H. **Water-protecting properties of cuticles.** *Discussions Faraday Soc.* 1948, No. 3, 169-72.—*C.A.* 43, 6043*b*.

The wax layer theory of water retention and the theory of lipoprotein lamellar organization of the epicuticle in the form of a porous valve system were examd. The latter better explained the asymmetrical behavior of the cuticle.

2487. SHREVE, GEO. W. **Sorption of cyclohexane vapor by aluminum dilaurate.** *J. Colloid Sci.* 3, 259-61 (1948).—*C.A.* 42, 6199*e*.

A silica-spring sorption balance was used to det. the sorption of cyclohexane by $Al(OH)(OOCC_{11}H_{23})_2$ at 50°C. Two runs were made the first on gel soap and the second on gel that transformed into elastic jelly during the run. The jelly sorbed much more than the gel and showed marked hysteresis on desorption.

2488. SIMHA, ROBERT AND ROWEN, JOHN W. **Distribution of water in cellulose and other materials.** *J. Am. Chem. Soc.* 70, 1663-5 (1948).—*C.A.* 42, 4743*i*.

The combination of H_2O with cellulose, silk, and wool in the limit of low vapor pressures can be described in terms of adsorption theory. However, as one approaches the limit of high vapor pressures, the system can be analyzed in terms of a theory of polymer-liquid mixts.

2489. STAMM, ALFRED J. **The passage of water through the capillary structure of wood.** *Discussions Faraday Soc.* 1948, 264-73.—*C.A.* 43, 3607*d*.

H_2O moved through wood by vapor diffusion, bound H_2O diffusion through the cell walls below the fiber-satn. point, and free-H_2O movement above the fiber-satn. point through the capillaries, under external pressure or capillary forces. The diffusion of solute through satd. wood, calcd. by analogy with elec. conduction, was in good agreement with expt.

2490. THOMA, PAUL J. **Moisture content of paper and its effect on printing.** *Am. Ink Maker* 26, No. 10, 28-9, 59 (1948).—*C.A.* 43, 1186*h*.

Moisture content below 4% resulted in poor mech. performance and a 4.5 to 5.5% moisture content gives best paper strength. The moisture content of paper had some effect on the finish of the ink; this may have been due in part to the fact that a higher moisture gives the supercalendar a better chance of working on the coating and sealing the surface.

2491. WEAVER, E. R. AND RILEY, RALPH. **Measurement of water in gases by electrical conduction in a film of hygroscopic material.** *Anal. Chem.* 20, 216-29 (1948).—*C.A.* 42, 4096*b*.

A film of H_3PO_4 was exposed to a known concn. of water vapor and its elec. resistance measured. The film was then exposed to the gas being tested, and the pressure of the latter varied until the elec. resistance of the film reached the above-mentioned value. If the total pressure of the sample was known, its H_2O content could be calcd.

2492. WEAVER, E. R. AND RILEY, RALPH. **Moisture determination by electrolytic film.** *Refrig. Eng.* 55, 266-7 (1948).—*C.A.* 44, 3843*a*.

This method had been applied to detg. the moisture content of a gas. A thin film of liquid such as H_3PO_4 in a gelatin or plastic material was spread over the surface of a solid insulator between metallic electrodes. The electrolyte tended to reach equil. with the water vapor in the gas; the cond. of the resultant equil. mixt. was a measure of the water content.

2493. WESTWATER, J. W. **Oxygen absorption by cast plastic films.** *Ind. Eng. Chem.* 42, 1494-500 (1948).—*C.A.* 42, 7567*f*.

Films (0.065 to 1.9 mils) of com. plastics on glass were exposed to dry O_2. Wt detns. were made at intervals up to about 1000 hrs max. Cast films had both oriented and unoriented mols., the ratio depending on the polymer, solvent, and film thickness. Absorbed O_2 was held by both chem. bonds and secondary forces.

2494. WITT, R. K.; WOLFE, P. D., AND RUST, D. M. **Cotton fabric laminates.** *Modern Plastics* 25, No. 9, 123-5, 184-91 (1948).—*C.A.* 42, 6578*a*.

Comprehensive data on the engineering properties of grade L and C cotton fabric specimens were presented.

2495. ZHURAVELVA, E. I. **Uptake of the moisture of air by corn starch.** *Kolloid. Zhur.* 10, 203-8 (1948).—*C.A.* 43, 9504*h*.

At relative humidity (x) of 0.5%, the amt. (w) of H_2O taken up by starch was $w_o[1 - \exp(-kt)]$, where t was time. At higher x, $w = w_o \exp(-n/t)$; the const. n depended on x and was, e.g., 1.4 day^{-1} in satd. vapor. Addn. of 0.5% sunflower oil did not affect the adsorption isotherm, and addn. of 5% crude sugar increased w_o only above x of 75%.

2496. ABBOTT, N. J. AND GOODINGS, A. C. **Moisture absorption, density, and swelling properties of nylon filaments.** *J. Textile Inst.* 40, T232-46 (1949).—*C.A.* 43, 5191*d*.

Absorption by both drawn and undrawn nylon was increased by immersion in alc., but decreased again by treatment in satd. benzoic acid soln. The regains of drawn and undrawn filaments were detd. for R.H. 0-100%, and when pretreated with alc., up to 90%. Appreciable differences in regain occurred only in the upper half of the R.H. range. Longitudinal swelling measurements were carried out over 0-100% R.H. The longitudinal and lateral swellings were equal in drawn nylon, but in undrawn, the former was 3 times the latter.

2497. Burleigh, Edward G. Jr.; Wakeham, Helmut; Honold, Edith, and Skau, Evald L. **Pore-size distribution in textiles.** *Textile Research J.* **19**, 547-55 (1949).—*C.A.* **43**, 8685*i*.

The pore-size distribution curves obtained for 10 selected fabrics indicated that the Hg-intrusion method could be used to show significant differences in fabric porosity in the range from 0.2 to 20μ. The curve peaks for all the fabrics fell between 2 and 4.5μ. These peaks were due predominantly to the interfiber pore-size distribution.

2498. Campbell, H. and Johnson, P. **Investigations on cellulose nitrate. II. Liquid- and vapor-phase adsorption of acetone.** *J. Polymer Sci.* 4, 247-63 (1949).—*C.A.* **43**, 8244*d*.

Vapor-phase adsorption isotherms were independent of the cryst.-amorphous ratio, but depended on its N-content. There was no limiting adsorption, because of complete soln. in acetone. In terms of the liquid-mixt. concns., there appeared to be limited adsorption, but this was due to the nonideal nature of the solns. When allowance was made for this, the liquid and vapor isotherms were the same within exptl. error.

2499. Crank, J. and Park, G. S. **Evaluation of diffusion coefficient for chloroform in polystyrene from simple adsorption experiments.** *Trans. Faraday Soc.* 45, 240-9 (1949).—*C.A.* **43**, 5654*g*.

Diffusion was considered to be the rate-controlling process in the rates of sorption and desorption of $CHCl_3$ by polystyrene sheet. Rectangular pieces of polystyrene sheet were suspended in vessels each contg. a fixed partial pressure of $CHCl_3$ by means of di-Bu phthalate-$CHCl_3$ mixtures at 25°C. When the rate of sorption was highest, the gradient of $CHCl_3$ concn. in the air was negligibly small.

2500. D'Agostino, Oscar. **Properties of some aerosols.** *Rend. ist. super. sanita* **12**, 398-416 (1949).—*C.A.* **44**, 6702*c*.

The elec. charge of some org. aerosols and also of NH_4Cl smoke, after filtration through media such as fine Fe and Al wire, glass wool, charcoal of various meshes, pumice, wool, and rayon, was studied. An attempt was made to correlate the nature and magnitude of the charge with the structure of the aerosol.

2501. Elod, Egon and Frohlich, Hans Gunther. **The effect of the fine structure of cellulose hydrate fibers on their properties.** *Textil-Rundschau* **4**, 117-26 (1949).—*C.A.* **43**, 5587*h*.

The swelling of cellulose hydrate fibers in H_2O increased with decreasing fiber d. Surface acetylation of the fiber did not change appreciably the d. or extent of swelling. If the acetylated portion of the fiber was dissolved away, the "stripped" fiber would show one of two distinct types of behavior.

2502. Gilby, A. R. and Heymann, E. **The rate of evaporation of water through duplex films.** *Australian J. Sci. Research, Ser. A,* **1**, 197-212 (1949).—*C.A.* **43**, 6884*f*.

The efficiency of duplex films in reducing evapn. was greater in wind than in still air and increased with the wind velocity. When duplex films thicker than 10 μ were placed on water surfaces, even a wind of 8 m.p.h. did not increase the evapn. rate. With all duplex films thicker than 10 μ the total evapn. resistance was proportional to the film thickness and depended on the nature of the spreader.

2503. Green, R. W. **Adsorption of water vapor on casein.** *Proc. Roy. Soc. New Zealand* 77, 313-17 (1949).—*C.A.* **43**, 4537*c*.

Adsorption isotherms were detd. for samples of casein dried at room temp. over 70% H_2SO_4 and over concd. H_2SO_4, at 100°C in vacuum and at 103°C in air oven. At water activities (*aw*) below 0.4 course of the isotherm was strongly influenced by the method of drying, but from 0.4 to 0.96 the isotherms coincided. The no. of layers of water was 6 to 7, which agreed with the no. for collagen and elastin. *Vm*, the wt of adsorbate required to fill the first mol. layer of 100 g of adsorbent, was calcd. on various assumptions of amino acid compn.

2504. Hall, A. J. **Properties of rayon and synthetic fibers in relation to their moisture-absorption qualities.** *Brit. Rayon Silk J.* **26**, No. 303, 55-6 (1949).—*C.A.* **43**, 9457*i*.

The water retained after hydroextraction and its counterpart, swelling, was given for ten fibers. These factors affected ease of dyeing.

2505. Howsmon, John A. **Water sorption and the polyphase structure of cellulose fibers.** *Textile Research J.* **19**, 152-62 (1949).—*C.A.* **43**, 4849*d*.

A large-scale equil. moisture-regain method was illustrated by a variety of cellulose materials covering a wide range of moisture sorption capacity. An attempt to evaluate both accessibility and crystallinity of cellulose from moisture-regain data was made, and a proposed revision of the scale of reported crystallinities of various types of cellulose was the result.

2506. Hutton, E. A. and Gartside, J. **Moisture regain of silk. I. Adsorption and desorption of water by silk at 25°C.** *J. Textile Inst.* 40, T161-9 (1949).—*C.A.* **43**, 4018*a*.

The isotherms were detd. by a vacuum adsorption app. for Japanese, Chinese, and Italian silks both before and after degumming. The degummed silks had lower regain at all humidities than the corresponding silks in the gum, and showed less hysteresis. All the degummed silks adsorbed H_2O to approx. the same extent.

2507. Hutton, E. A. and Gartside, J. **Adsorption and desorption of water by nylon at 25°C.** *J. Textile Inst.* **40**, T170-4 (1949).—*C.A.* **43**, 4018*c*.

The isotherms were detd. by vacuum adsorption and desiccator methods for parachute nylon fabric of delustered yarn. A small, but definite, hysteresis was found. Regain at satn. was approx. 8.70%. The adsorptive capacity decreased with increasing temp. of drying, but subsequent satn. with H_2O vapor restored the normal affinity for H_2O.

2508. Jackson, E. C. and Roper, E. R. **Water-absorbency apparatus.** *Am. Dyestuff Reptr.* **38**, 397-401 (1949).—*C.A.* **43**, 6423*h*.

The absorption rate of toweling was measured in an app. in which the specimen was in contact under definite pressure with a porous plate fed with H_2O from a calibrated horizontal tube at a neg. head. It was const. for any specimen in the range from 20 to 50%. Decreasing the flow resistance caused the influence of the head to be greatly increased and limited the range of samples that could be tested under a specific head.

2509. Karle, J. **Evaporation of polar hydrocarbon monolayers.** *J. Chem. Phys.* 17, 500 (1949).—*C.A.* 43, 7767*d*.

Monolayers of cerotic acid and n-octadecylamine were produced on soda glass from the melt. The rate of evapn. of these films in vacuo was studied from the rate of decrease of scattered electron intensity relative to that of the substrate. Throughout the course of the evapn. the structure of the films remained changed. If evapn. occurred from within the patches an increase in the angle of tilt should be expected as the evapn. proceeds.

2510. Launer, Herbert F. and Wilson, William K. **Photochemistry of cellulose. Effect of water vapor and oxygen in the far and near ultraviolet regions.** *J. Am. Chem. Soc.* 71, 958-62 (1949).—*C.A.* 43, 5941*b*.

Irradiation at 30-40°C of sheets of paper of varying cellulose content and cuprammonium degree of polymerization (D.P.) showed that at 254 mμ H_2O vapor retarded the decrease in α-cellulose and D.P., whereas O_2 had no effect. In the near ultraviolet (388 and 359 mμ), the reverse was found.

2511. Negishi, Michiharu; Shoji, Fumiko; Mori, Hideko, and Ito, Heihachiro. **Elasticity, tensile properties, and the mechanism of deformation of fibers. I. Influence of humidity of air on the elastic recovery of cellulose fibers.** *J. Soc. Textile Cellulose Ind.* (Japan) 5, 178-80 (1949).—*C.A.* 46, 3756*f*.

Natural and hydrated cotton fibers showed a slighter tendency of elastic recovery with higher relative humidity. Regenerated cellulose fibers showed more elastic recovery in humid air.

2512. Negishi, Michiharu; Shoji, Fumiko; Mori, Hideko, and Ito, Heihachiro. **Elasticity, tensile properties, and the mechanism of deformation of fibers. II. Influence of humidity of air on the strain-stress curve of cotton fibers.** *J. Soc. Textile Cellulose Ind.* (Japan) 5, 219-21 (1949).—*C.A.* 46, 3756*g*.

The S-shaped strain-stress curve and the tensile strength of natural and hydrated cotton fibers in the wet state were similar to those shown by rubber in a low-temp. range. The const. elastic elongation under a range of stresses seemed to result from the crystn. effect during the deformation.

2513. Oguri, Sutzeô; Tomabechi, Kazuo, and Ono, Takashi. **Nonpermeability of packing materials to water vapor. III. An experiment on permeability to water in carbon dioxide gas.** *J. Soc. Textile Cellulose Ind.* (Japan) 5, 343-5 (1949) (English summary).—*C.A.* 46, 4146*g*.

Com. wrappers (Cellophane, paraffin, asphalt, and other coated papers) were found less permeable to H_2O in CO_2 than in air.

2514. Pollack, Louis R.; McElwain, Robert E., and Wagner, Paul T. **Oxygen absorption of vulcanizates. A means of evaluating aging resistance.** *Ind. Eng. Chem.* 41, 2280-86 (1949).—*C.A.* 44, 868*h*.

The rates of absorption of Θ_2 by natural rubber, Neoprene (GR-M), GR-S, butadiene-acrylonitrile copolymer, Butyl, and Thiokol-FA vulcanizated at 120°C were measured. Comparative aging tests were carried out in O_2 under 300 p.s.i. at 70° and in air at 70°C. There was good correlation between absorption of O_2 and decrease in tensile strength, particularly during aging in O_2 under pressure.

2515. Preston, J. M. and Nimkar, M. V. **Measuring the swelling of fibers in water.** *J. Textile Inst.* 40, P674-86 (1949).—*C.A.* 43, 7690*e*.

Published data for transverse, axial, and vol. swelling H_2O of cotton, linen, jute, mercerized cotton, linen, rayons, wool, silk, and nylon was tabulated, showing many inconsistencies. An investigation was made of the centrifugal method for direct measurement of vol. swelling. A series of runs on viscose fibers for different lengths of time at 1000 G showed a rapid initial fall of retained H_2O for the first 4 min. followed by slower fall.

2516. Rowen, John W. and Simha, Robert. **Interaction of polymers and vapors.** *J. Phys. & Colloid Che.* 53, 921-30 (1949).—*C.A.* 43, 6491*d*.

The system adsorbent-adsorbate at high vapor pressures was a soln. in which equil. was detd. by the free energy of diln. and an elastic term. In regard to the former, use was made of current theories of polymer solns. An apparent elastic modulus of the order of 10^8-10^9 dyne cm^{-2} was derived from the high-vapor pressure portion of the adsorption isotherm of cellulose. The elastic term represented only a few % of the total effect.

2517. Schultz, T. H.; Miers, J. C.; Owens, H. S., and Maclay, W. D. **Permeability of pectinate films to water vapor.** *J. Phys. & Colloid Chem.* 53, 1320-30 (1949).—*C.A.* 44, 3333*f*.

Films were prepd. from alkali-deesterified pectin having a methoxyl content of 3.8% and an intrinsic viscosity of 3.2 in the form of Ca, Ca Na, NaH, and H pectinates. Transmission rates for permeation of water vapor through films 40 microns thick varied from 1400 to 4300 g per m^2 per day at 25°C with a relative humidity differential of 81-31% .

2518. Scott, Walter M. **Some recent developments in cotton research at the Southern Regional Research Laboratory.** *Textile Research J.* 19, 436-43 (1949).—*C.A.* 43, 6829*g*.

Rotproofing and weatherproofing methods for cotton were discussed, also the production of water-resistant cotton by self-sealing through swelling.

2519. Skark, Leopold. **Moistening and elongation of flat fibrous structures, especially fiber boards.** *Das Papier* 3, 82-5 (1949).—*C.A.* 43, 5591*e*.

When the H_2O was increased from an initial 0.6% to a final 4.0%, the stretched board was stronger than the unstretched sample. The increased H_2O had actually contributed to an increase in tensile strength and resistance to fracture of the stretched material. When the H_2O was raised from 0.7% to 9%, the stretched sample at the higher H_2O still showed somewhat better strength than did the unstretched sample, but the over-all strength was inferior.

2520. TONER, RICHARD K.; BOWEN, CAROL F., AND WHITWELL, JOHN C. **Moisture determination in textiles by electric meters. II.** *Textile Research J.* **19**, 1-8 (1949).—*C.A.* **43**, 2779*h*.

While the moisture meters tested, when properly calibrated and used, can give results comparable to those of oven analyses, expts. demonstrated clearly the necessity for calibrating for the material and condition of use. Isothermal calibration lines diverged as the moisture increased; for equal increments of temp. the difference increased as the temp. rose. For accuracy the meters should be used at the temps. of calibration or the readings corrected by an amt. experimentally detd.

2521. WAKEHAM, HELMUT AND SPICER, NANCY. **Pore-size distribution in textiles. A study of windproof and water-resistant cotton fabrics.** *Textile Research J.* **19**, 703-10 (1949).—*C.A.* **44**, 845*b*.

An improved method was described for studying the nature of interfiber and interyarn pore spaces in textile fabrics by means of a Hg-pressure porosimeter. The fibers in water-resistant fabrics swell when exposed to moisture, closing the pores of the fabrics and reducing the passage of water and other wetting liquids. A definite relationship apparently existed between pore size and vol. on the one hand and water permeability on the other.

2522. WINK, W. A. AND DEARTH, LEONARD R. **Measurement of water-vapor permeability at low temperature—the hygrometric sweep gas method.** *Tappi* **32**, 232-8 (1949).—*C.A.* **43**, 5948*c*.

The sensitivity of the new method resulted from a combination of the inherent sensitivity of the hygrometric principle and the ability of the small elec. hygrometer accurately to measure small changes in the relative humidity of the air passing over a specimen. Data were given for Cellophane, a Cellophane-kraft laminate, a glassine laminate, Pliofilm, and a sulfite laminate.

2523. YAICHNIKOV, I. S. **Absorption and elimination of water by casein.** *Zhur. Obshcheĭ Khim. (J. Gen. Chem.)* **19**, 527-30 (1949); *J. Gen. Chem. U.S.S.R.* **19**, 477-80 (1949).—*C.A.* **43**, 6882*b*; **44**, 5679*d*.

The rate of loss of H_2O by casein was detd. over H_2SO_4 at room temp. In 85 days, 10 g lost 1.2755 g, on subsequent drying *in vacuo* the loss rose to 1.2941 g after a total of 147 days, and, on drying at higher temps. (up to 100° to 110°C), the final loss, after 181 days, was 1.4617 g. The final amts. of H_2O given up or absorbed correspond to 350-475 moles, which gave the amt. of polar groups in casein.

2524. YOUNG, FRANK E. AND JONES, FRANCIS T. **Sucrose hydrates. The sucrose-water phase diagram.** *J. Phys. & colloid chem.* **53**, 1334-50 (1949).—*C.A.* **44**, 5200*h*.

The sucrose-H_2O system was studied over the range -30° to +40°C by warming curves, soly. detns., and microscopy. The warming curves gave evidence of the existence of 8 new solid phases, in addn. to ice and anhyd. sucrose. Transformations from one solid phase to another were extremely sluggish, so the solid-liquid equil. curves could be followed far into the region of metastability.

2525. BARTHOLOMEW, W. V. AND NORMAN, A. G. **Moisture sorption by some common plant materials.** *Agron. J.* **42**, 427-31 (1950).—*C.A.* **45**, 294*h*.

Moisture sorption by cotton, hemp, jute, oat straw, corn stalks, straw, oak leaves, alfalfa, pine needles, Sudan grass and grass roots, and clover was studied at relative humidities up to 100%. The moisture sorption increased geometrically with increase in relative humidity up to about 95% and above this the moisture sorption was small. Between 20 and 90%, $y = ax/(1-x)+c$, where y = percentage moisture, x = relative vapor pressure, and a and c were +consts.

2526. BELL, E. R., SEIDL, M. G., AND KRUEGER, N. T. **Water-vapor permeability of building papers and other sheet materials.** *Heating, Piping, Air conditioning* 22, No. 12, 109-15 (1950).—*C.A.* **45**, 3141*f*.

Dry and wet method of ASTM Tentative Standard Procedure C214-47T were used to test 100 products. Mean vapor-permeability values ranged from approx. 0 to 100 grains/(ft^2)/(hr)/(in. Hg). Wet-method values were nearly always greater than dry-method, but the ratio of the 2 values was not const.

2527. BENSON, SIDNEY W. AND ELLIS, DAVID A. **Surface areas of proteins. II. Adsorption of nonpolar gases.** *J. Am. Chem. Soc.* 72, 2095-2102 (1950).—*C.A.* **44**, 7119*b*.

The adsorption isotherms of N_2, O_2, CH_4, A, butane, SF_6, and neopentane were detd. on several samples of dry, lyophilized proteins. The isotherms were treated by the simple B.E.T. theory, and reasonable and fairly consistent values obtained for the surface area. The total lack of hysteresis and speed of attainment of equil. over a range of mol. symmetries and sizes, together with the small net heats of adsorption past the monolayer region, indicated that the proteins had no fine pore structure.

2528. BENSON, SIDNEY W.; ELLIS, DAVID A., AND ZWANZIG, ROBERT W. **Surface areas of proteins. III. Adsorption of water.** *J. Am. Chem. Soc.* 72, 2102-5 (1950).—*C.A.* 44, 7119*d*.

Measurements were made of the effect of surface area of 2 different dry, lyophilized proteins on their adsorption of H_2O. Within narrow limits, the H_2O adsorption was independent of surface area in the range below ¼ satn. pressure. It was inferred from this that H_2O adsorption was qualitatively different from N_2 adsorption and probably took place at specific sites on the protein mol.

2529. BONE, W. A. AND TURNER, H. A. **Some effects of the evaporation of water from cotton cellulose.** *J. Soc. Dyers Colourists* **66**, 315-27 (1950).—*C.A.* **44**, 8116*g*.

Cotton cellulose was modified when a strip of bleached cotton fabric was dipped in water to give two distinct types of products: (a) one, sol. and transportable in water, brown in color, markedly fluorescent in ultraviolet radiation, with enhanced reducing properties; (b) the other, solid, non-transportable in water, restricted to the boundary region, with higher cuprammonium fluidity and methylene-blue absorption than the original cellulose. Wide variations in the partial pressure of O_2 caused little change in the apparent intensity of the brown line.

2530. Brown, Hugh M. and Graham, John S. **Measurement of fineness of cotton by air-flow methods.** *Textile Research J.* **20**, 418-25 (1950).—*C.A.* **44**, 8117*b*.

When porosity meters were calibrated in units of wt per unit length of fiber (fineness), the curves for different varieties of cotton were quite different. Resistance to air-flow through a fiber plug correlated more closely with the surface area of the fibers composing the plug than with their fineness. This surface area varies with variety and maturity, independently of the fineness of the cotton.

2531. Childs, E. C. and Collis-George N. **The permeability of porous materials.** *Proc. Roy. Soc. (London)* **A201**, 392-405 (1950).—*C.A.* **44**, 8198*b*.

The pore-size distribution was obtained by an interpretation of the moisture characteristic of the material, i.e. of the curve of moisture content plotted against pressure deficiency. A simple statistical theory, based on the calcn. of the probability of occurrence of sequences of pairs of pores of all the possible sizes led to an expression of the permeability as the sum of a series of terms. A combined use of the moisture characteristic and the permeability detd. the coeff. of diffusion of H_2O in the material as a function of moisture content.

2532. Dean, Robert B. and Li, Fa-Si. **The sorption of vapors by monolayers. II. Organic vapors on stearic acid monolayers.** *J. Am. Chem. Soc.* **72**, 3979-82 (1950).—*C.A.* **45**, 1405*c*.

The increase in surface pressure of stearic acid monolayers upon exposure to satd. org. vapors, viz. n-C_6H_{14}, 2,3-dimethylbutane, CCl_4, MeC_6H_5, n-C_8H_{18}, n-$C_{10}H_{22}$, and C_6H_6, was measured. There is a small increase in pressure even at the highest available surface pressure; this indicates adsorption on the monolayer. The adsorption of C_6H_{14} on stearic acid was calcd. from measurements at various relative pressures using the simplified Gibbs adsorption equation. Adsorption appears to be nearly const. at about one mol. of n-C_6H_{14} per 28 A.^{2}, over a wide range in mol. area of stearic acid.

2533. Dole, Malcolm and Faller, I. Lucille. **Water sorption by synthetic high polymers.** *J. Am. Chem. Soc.* **72**, 414-19 (1950).—*C.A.* **44**, 4753*g*.

H_2O sorption data at 25°C were detd. for eleven synthetic linear polymers and interpreted in the light of the B.E.T. and other sorption theories. Sorption by the polyesters was so small that it probably occurred only on end-groups. Sorption by polyvinylpyrrolidone was so great that probably every peptide bond served as a sorption site. Sorption by the polyamides was small and greatly affected by the extent of disorder in the solid.

2534. Dwyer, Orrington E. and Baumann, J. A. **Desorption of unreacted isoprene from synthetic rubber latex. Effect of pressure, agitation, and latex depth.** *Ind. Eng. Chem.* **42**, 1230-9 (1950).—*C.A.* **44**, 7081*d*.

In its escape from the tiny polymer particles, isoprene must diffuse through the aq. film which seps. the particles from the vapor in the vapor bubbles and above the latex. The operating variables of temp., pressure, latex depth, and degree of satn. were studied for different operating conditions. Venting at 40° and 60°C showed that the rate of desorption depended greatly on the temp. The venting rate varied in an approx. way, inversely with the (abs. pressure)^2. An increase in the depth of the latex decreased the rate of venting; however, this effect was less pronounced at relatively great depths and with relatively great driving forces.

2535. Dwyer, Orrington E. and Burke, Lowell T. **Desorption of unreacted isoprene from synthetic rubber latex. Effect of temperature and agitation.** *Ind. Eng. Chem.* **42**, 1240-5 (1950).—*C.A.* **44**, 7081*h*.

The rate of monomer released from the latex was detd. by direct measurement of the accumulated vapor. Temp., pressure, and agitation were practicularly important, and moderate changes in any of these may change the rate of venting several fold. Temp. and agitation had beneficial effects, whereas an increase in pressure reduced the venting rate. An increase in depth decreased the venting rate per unit vol. of latex, e.g., a 4-fold increase in depth reduced the rate 40%.

2536. Evans, A. and Keiller, C. Q. **Apparatus for measuring the permeability to water vapor of bituminous emulsion films.** *J. Soc. Chem. Ind.* (London) **69**, Suppl. No. 1, S1-3 (1950).—*C.A.* **45**, 5462*i*.

Water vapor from a const.-humidity chamber diffuses through the test film and is collected in a dehydrating agent suspended from a calibrated spring. Films of bituminous emulsions of the clay-stabilized type gave permeabilities of approx. 120×10^{-8}g cm/cm^2/hr/mm Hg.

2537. Finkelshteĭn, T.; Kargin, V., and Rogovin, Z. **Changes in physical-mechanical properties of cellulose fibers under the action of elevated temperatures.** *Tekstil. Prom.* **10**, No. 8, 9-11 (1950).—*C.A.* **45**, 858*i*.

Heating hydrated cellulose fibers in a high vacuum for 2 hrs at 200°C did not affect the degree of polymerization and strength of fiber. At higher temps., dehydration and breakdown of the macromol. occurred as indicated by lowered mol. wt and poorer mech. properties.

2538. Freytag, Hans. **The loading (adsorption) of surfaces with hydrogen peroxide.** *Z. Naturforsch.* **5b**, 123 (1950).—*C.A.* **44**, 6701*i*.

Paper, printed with a picture or writing, was exposed to the vapors of 30-40% H_2O_2 for 5 min. and then pressed against a reagent paper (PbS pptd. on filter paper) for several min. The impression on the paper transferred to the reagent paper was a measure of the capacity of the surface of the paper to absorb H_2O_2 and thus was a property of the kind and nature of the surface. The part of the paper without an impression adsorbed H_2O_2 depending upon the nature of its surface; on coming into contact with the reagent paper, the adsorbed H_2O_2 oxidized the PbS to $PbSO_4$ and the imprinted part was transferred white, and the printed part black, to the reagent paper.

2539. GREEN, R. W. **The reaction of hydrogen chloride with dry proteins. I. Collagen.** *Trans. Proc. Roy. Soc. New Zealand* **78**, 291-300 (1950).—*C.A.* **45**, 1799*i*.

Standard hide powder, deaminized collagen, hypochlorite-treated collagen and that subsequently deaminized, and degummed silk (0.08% ash), were dried to const. wt in vacuum over P_2O_5, and treated with dry HCl gas in desiccators over concd. H_2SO_4 for periods up to 70 days. Max. wt gains were about 30 g/100 g protein for standard hide powder and deaminized collagen and about 17 g/100 g protein for degummed silk. Wt loss by desorption, when the HCl-treated proteins were placed in evacuated desiccators over CaO, was slow at room temp., and equil. was not established in 75 days. At 100°C the materials reached const. wt in 6 days.

2540. HELLMAN, N. N. AND MELVIN, E. H. **Surface area of starch and its role in water sorption.** *J. Am. Chem. Soc.* **72**, 5186-8 (1950).—*C.A.* **45**, 2746*c*.

The surface areas of dasheen, corn, tapioca, and potato starches available to N_2 at -195°C are 2.62, 0.70, 0.28, and 0.11 m^2/g, resp. Interpretation of the H_2O sorption isotherms of these 4 starches by the B.E.T. equation requires surface areas of 330, 334, 348, and 422 m^2/g, resp. The N_2-available surface area of starch does not give a quant. explanation of the water-sorptive capacity of starches.

2541. HOOVER, SAM R. AND MELLON, EDWARD F. **Application of polarization theory to sorption of water vapor by high polymers.** *J. Am. Chem. Soc.* **72**, 2562-6 (1950).—*C.A.* **44**, 8734*f*.

The equation $ln\ Po/P = K_2K_1^a$ (in which k_1 and k_2 were both dependent on temp.), fitted the exptl. data for the sorption of H_2O on a variety of high polymers. Results on casein, benzoylcasein, silk, polyglycine, wool, ovalbumin, cotton, mercerized cotton, nylon, and viscose rayon were presented as straightline functions (log log Po/P vs. a log K_1).

2542. HUNT, CHARLES M.; BLAINE, RAYMOND L., AND ROWEN, JOHN W. **Submicroscopical structure of cellulose from nitrogen sorption measurements.** *Textile Research J.* **20**, 43-50 (1950).—*C.A.* **46**, 9313*h*.

Cotton linters were soaked in cold 10% NaOH solution, washed, neutralized, treated with MeOH, then with C_6H_6, and dried under reduced pressure. N_2 adsorption-desorption measurements were then made at 78°K. Swollen cotton had a B.E.T. area (up to 71.3 m^2 per g). Conditioning in H_2O vapor to a moisture content of 11% almost destroyed all the available internal surface area.

2543. KAMIYOSHI, KAN-ICHI AND HASHIMOTO, HISAO. **Permeation through and sorption of water vapor by the thin film of Japanese lacquer.** *Science Repts. Research Insts. Tôhoku Univ.* **2**, 193-204 (1950).—*C.A.* **45**, 10610*g*

The Japanese decorative waterproof lacquer "Urushi" was used. The sorption of water vapor at 0°C followed the Freundlich isotherm, $x = kp^{1/n}$, and Hüttig's isotherm, $p/V(1+p/p_o) = p_o/cV_m + p/V_m$, but at higher temps. the Langmuir isotherm, $x = ap/(1+bp)$, fits the data more closely. Heat treatment of the lacquer in vacuum at 135-150°C caused a great decrease in the amt. of water adsorbed. The permeability of the Japanese lacquer was of the order of $2\text{-}3 \times 10^{-7}$ cc./sec for a film 1 mm in thickness and 1 cm^2 in area, when the pressure difference on opposite sides of the lacquer was 1 cm.

2544. KATCHMAN, BERNARD; CUTLER, JANICE, AND MCLAREN, A. D. **Sorption of water vapor by tobacco mosaic virus.** *Nature* **166**, 266-7 (1950).—*C.A.* **44**, 10444*e*.

The uptake of H_2O vapor by tobacco mosaic virus was detd. at 25°C and the adsorption isotherm was represented by a sigmoid curve, found typically for proteins and other polypeptides. The first sorbed H_2O mols. were not primarily adsorbed into the interior as in the case with other proteins.

2545. KNIGHT, GEO. D. **Wettability of paper surfaces by water and the surface adsorption of water by paper.** *Tappi* 33, 59-66 (1950).—*C.A.* **44**, 4250*i*.

The wettability was very sensitive to almost any type of treatment. The penetration of the ink into paper could be markedly increased by vacuum on the same side and adjacent to the ink, if the paper was backed by a nonporous solid. Modifications of the Kubelka-Munk equations made possible the calcn. of the quantity of dye adsorbed and the depth of penetration. The reflectance of the colored side of the tested sheet, backed by a pad of the original paper, was a measure of the amt. of dye absorbed.

2546. KOIZUMI, NAOKAZU AND ONO, SOZABURO. **Dielectric properties of starch. I. The behavior of water absorbed by starch in the field of ultrahigh frequency.** *Bull. Inst. Chem. Research, Kyoto Univ.* **20**, 47-8 (1950) (in English).—*C.A.* **47**, 2569*e*.

The measurements were made at 214 Mc., and the dielec. const. and loss were observed at various temps. 10°-55°C. The ϵ' (real part of the dielec. const.) of the system rose as temp. was raised, and the greater the water content, the higher was ϵ' at a given time. At low water content, ϵ'' (the imaginary part of the dielec. const.) rose with increasing temp., but at higher water content, ϵ'' had a max. and decreased at still higher temp. This loss may be due to rotation of dipoles of water mols. in starch.

2547. KUROSAKI, SHIGEHIKO. **Dielectric properties of sorbed water. I. Polarization of sorbed water in vinyl polymers.** *J. Chem. Soc. Japan*, Pure Chem. Sect., 71, 522-4 (1950).—*C.A.* **45**, 6444*i*.

The change of dielec. const. of powd. vinyl polymers due to the adsorption of moisture was detd. by the beat method. On the assumption that water was dissolved in vinyl polymers, the sp polarizations of sorbed water in polyvinyl chloride was about 30, in polyvinyl alc. 6.6-7.8, in polyvinylformal 4.7-6.4. The sorbed water was in the state of ionization sorption.

2548. Mason, S. G. **The specific surface of fibers-its measurement and application.** *Tappi* 33, 403-9 (1950); Pulp Paper Mag. Can. 51, No. 9, 109-15 (1950).—*C.A.* 44, 10458*e*.

2549. McLaren, A. D. and Ottesen, M. **Sorption of water vapor by plakalbumin.** *Compt. rend. trav. lab. Carlsberg, Sér. chim.* 27, 325-32 (1950) (in English).—*C.A.* 45, 4996*f*.

The sorption of H_2O vapor by plakalbumin at 20 °C agreed with that by ovalbumin. The B.E.T. equation applied up to a relative vapor pressure of 0.5.

2550. Mitchell, Thomas J. **The rate of evaporation in the determination of water.** *Chemistry & Industry* **1950**, 751-3.—*C.A.* 45, 3761*c*.

The rate of evapn. (W) of H_2O in the 1st stage of drying appeared to vary as the 0.8 power of the mass velocity of the air. In an oven with natural convection at 100 °C and ambient air at 20 °C calcd. $W = 255$ g/100 cm^2/hr. Actual rate of H_2O evapn., $W = 70$ g/100 cm^2/hr in an Al dish 69 mm in diam. and 20 mm deep in a steam oven. The rate through sand or celite in the dish was not appreciably lower than for water alone. Vacuum-oven rate was higher.

2551. Mitchell, Thomas J. **Determination of water in sugar solutions by desiccation at room temperature.** *Chemistry & Industry* **1950**, 815-17.—*C.A.* 45, 3761*e*.

The best method for detg. water is by drying in a vacuum oven. If desiccation at room temp. is desired, the use of vacuum, stirring, and an absorbent are necessary.

2552. Park, G. S. **Diffusion of some halomethanes in polystyrene.** *Trans. Faraday Soc.* **46**, 684-97 (1950).—*C.A.* 45, 929*g*.

The over-all rate of absorption of CH_2Cl_2, $CHCl_3$, CCl_4, CH_2Br_2, $CHBr_3$, and MeI by polystyrene sheet was detd. at several surface concns. The diffusion coeffs. penetrant D_0 were given for each penetrant at 25°C and for CH_2Cl_2, $CHCl_3$, and MeI at 15° or 35°C.

2553. Rånby, Bengt G. and Grinberg, Boris. **Sorption of water vapor by hydrolyzed cellulose and by micelles isolated from cellulose.** *Compt. rend.* **230**, 1402-4 (1950).—*C.A.* 44, 7532*d*.

The sorption isotherms of water vapor on hydrocellulose and cellulose micelles of different origins were detd. at 20°C by means of a McBain quartz spiral balance at relative humidities of 0-90%. The isotherms of hydrocellulose had the classical S form of normal celluloses; the isotherms of 5, 15, 40, 60, and 90-min. hydrolyzed products were close together and slightly below that of the original cellulose; the av. relative sorption between 5 and 60% relative humidity was 87% for hydrolyzed (5 min.) Egyptian cotton and 78% for hydrolyzed (5 min.) viscose rayon; other hydrocelluloses had intermediate values. The isotherms of the cellulose micelles were normal sigmoidal curves and the av. relative sorption varied from 73 to 85%.

2554. Rao, K. Subba; Rao, M. Bhimasena; Vasudevamurthy, A. R., and Rao, B. Sanjiva. **Hysteresis in sorption XVII. Hardening of sericin and its influence on sorption-desorption hysteresis.** *Proc. Natl. Inst. Sci. India* 16, 1-4 (1950).—*C.A.* 44, 8195*e*.

Sericin was hardened by HCHO and basic chromium sulfate. Sorption and desorption curves of H_2O vapor were conducted at 30 °C on the hardened and unhardened samples. The former exhibited a hysteresis effect which persisted in subsequent cycles. The latter showed a hysteresis loop which decreased in size with subsequent cycles of sorption and desorption and finally disappeared.

2555. Seidel, M. P. **The preparation and properties of resin saturating papers. The moisture sorption and dimensional stability of paper-base laminates.** *Tappi* **33**, 551-3 (1950).—*C.A.* **45**, 2667*g*.

All of the papers were impregnated with a phenol-HCHO varnish. The impregnated sheets were stacked with the machine directions all parallel and hot pressed at 1000 lb/in², and 170-175°C. Before removing from the press, the laminates were cooled to 50 °C. Test pieces for H_2O sorption and swelling were cut 1 × 3 × 0.065 in. and submerged edgewise in distd. H_2O at room temp. and measurements made at 1, 2, 7, 30, 60, and 90 days. Av. H_2O sorption, edge swelling, and cross-grain elongation were detd. after 30 days' submergence: The 2 kraft sheets showed definite superiority in these properties.

2556. Simril, V. L. and Hershberger, A. **Permeability of polymeric films to organic vapors.** *Modern Plastics* 27, No. 10, 97, 98, 100, 102, 150-2, 154, 156, 158 (1950).—*C.A.* 44, 6232*f*.

Permeability results for 16 polymeric films to 15 org. vapors were expressed in terms of a permeability const. P (no. of moles of vapor per sec per cm Hg across the film passing through 1 cm^2 of film having a thickness of 1 cm). The mechanism of transport was: (1) passage of small mols. through preformed holes or capillaries, (2) diffusion of small mols. through the mass by holes formed as a result of thermal motion in the polymer chains, and (3) diffusion resulting from the interaction of diffusing mols. with active spots in the film.

2557. Simril, V. L. and Hershberger, A. **Permeability of polymeric films to gases.** *Modern Plastics* 27, No. 11, 95, 96, 98, 100, 102 (1950).—*C.A.* 44, 7620*d*.

The gas permeability of 21 polymeric films with H_2, NH_3, N_2, O_2, H_2S, CO_2, and SO_2 was a function of existing holes or easily opened holes in the film structure. The introduction of side chains in the main polymeric chains and presence of plasticizers and water all tended to increase permeability.

2558. TAKEDA, BUNSHICHI. **Absorption, passage, and evaporation of moisture. I. Moisture-permeability and air-permeability of papers.** *Rept. Inst. Sci. Technol. (Univ. Tokyo)* 4, 120-5 (1950); *J. Chem. Soc. Japan, Pure Chem. Sect.* **72**, 598-603 (1951).—*C.A.* 45, 7790*c*.

Papers having large air-permeability generally showed large moisture-permeability, but small air-permeability did not always correspond to small moisture-permeability. Paraffin paper, asphalt paper, ryphan (hydrochlorinated rubber), metal foil, film of polystyrene resin, etc., belonged to good moisture-proof film. Cellophane, parchment paper, etc., had large permeability for moisture in spite of their small permeability for air.

2559. TAKEDA, BUNSHICHI. **Absorption, passage, and evaporation of moisture. II. Moisture permeability of cellulose derivatives and synthetic resins (1).** *Rept. Inst. Sci. Technol.* 4, 171-6 (1950).—*C.A.* 45, 7790*d*.

Moisture-permeability of cellulose acetate, cellulose nitrate, benzylcellulose, polyvinyl alc., polyvinyl acetate, polyvinylbutyral, polyvinyl chloride, copolymer of polyvinyl chloride and polyvinyl acetate, polystyrene, etc., was measured. The moisture-permeability of these substances had no relation to their permeability for H_2, but was greatly influenced by the existence of hydrophile groups.

2560. WELLER, SOL AND STEINER, WALDO A. **Separation of gases by fractional permeation through membranes.** *J. Applied Phys.* **21**, 279-83 (1950).—*C.A.* 44, 6216*c*.

The permeabilities of thin org. films of rubber, ethylcellulose, polyethylene, and polystyrene toward O_2 and N_2 were measured. For an ethycellulose film the studies were extended to include CO_2, A, He, and H_2. The enrichment of a binary gas mixt. in a single stage of permeation was calcd. for the extreme cases of perfect mixing and no mixing.

2561. WELLER, SOL AND STEINER, WALDO A. **Engineering aspects of separation of gases. Fractional permeation through membranes.** *Chem. Eng. Progress* 46, 585-90 (1950).—*C.A.* 45, 394*f*.

Permeability coeffs. toward a no. of gases were detd. for a variety of com. packaging films. Ethylcellulose seemed to be most suitable for the fractionation of air, and polystyrene most suitable for the sepn. of He and H_2 from gas mixts. Since the films were not perfectly selective, in general it is necessary to employ a multistage, recycle system to obtain gases of high purity, but the no. of stages can be small in favorable cases.

2562. YOSHIOKA, KOSHIRO. **Hydration of starch grains.** *J. Chem. Soc. Japan*, Pure Chem. Sect., **71**, 456-8 (1950).—*C.A.* 45, 6013*i*.

Various methods for the detn. of bound water of starch grains were compared. Almost the same results were obtained by means of $CuSO_4$, EtOH, and sucrose. The quantities of bound water of various starch grains detd. by $CuSO_4$ as an indicator were given.

2563. ZAIDES, A. L. **Effect of heating on the structure and properties of proteins. I. Collagen.** *Kolloid. Zhur.* **12**, 347-51 (1950).—*C.A.* 45, 889*a*.

Untreated collagen took up 10 and 40% H_2O at relative humidities of 10 and 90%, resp., while collagen treated at 170°C absorbed about 5 and 30%. Absorption of H_2O vapor by chrome-tanned leather was little affected by heating. The wt increase of untreated collagen in H_2O, 0.1 *N* HCl, and 0.1 *N* NaOH was 64, 231, and 188%, and of heated collagen 37, 54, and 90%, resp.

2564. ZETTLEMOYER, A. C.; CHAND, AMIR, AND GAMBLE, ERNEST. **Sorption by organic substances. I. Krypton and nitrogen on polyethylene, nylon, and collagen.** *J. Am. Chem. Soc.* 72, 2752-7 (1950).—*C.A.* 44, 8735*a*.

The adsorption of N_2 and Kr on polyethylene was measured at both liquid N_2 and liquid O_2 temps. For nylon and collagen, Kr adsorption was measured at two temps. The adsorption isotherms were typical Type II except for a rather gradual break where the monolayer was completed. The B.E.T. surface areas were of reasonable magnitude and agreed very well for the two gases at different temps. on the same sample. The heat of adsorption of Kr increased as more gas was added to the surface, and then decreased again after one monolayer was completed. The entropy curves for Kr on polyethylene and nylon fell toward limiting values as one layer was completed.

2565. ZHURAVELEVA, E. I. **Loss of moisture by corn starch to air.** *Kolloid Zhur.* 12, 32-5 (1950).—*C.A.* 44, 4273*e*.

Starch, which had been kept for some days in satd. H_2O vapor and acquired w_0 g H_2O per g, was transferred at 16°C into a desiccator in which the relative humidity was ϕ%. The amt. of H_2O decreased according to equation $w = w_0 - a \exp(-k/t)$, t was time (days). At $\phi = 0.5$, the const. $k = 0.31$, but at higher humidity k during the first 10 days was about 3 times as great as later. The final w was used to det. the desorption isotherm. This touched the adsorption isotherm at $\phi = 0.5$, but showed hysteresis of about 0.02 g H_2O/g at higher relative humidities.

2566. ZÍMA, RUDOLF. **Determination of moisture in commercial starches by drying.** *Chem. Listy* 44, 55-9 (1950).—*C.A.* 45, 5958*c*.

Predrying of starch at low temps. could be omitted. Drying 3 hrs at 120°C of 10-g starch samples gave const. values. The same results were obtained with 5-g samples in 1.5 hrs. The max. error was 0.1%.

2567. ARLOV, A. P. **Effect of surface roughness on rate of water absorption in paper.** *Norks Skogindustri* 5, 403-8 (1951)(in English).—*C.A.* 46, 6384*b*.

Sized papers (with contact angle over 90°C) absorbed H_2O slower the rougher the surface and the bulkier the sheet. With unsized sheets the opposite effect was found. Seven beater-sized samples from a paper sized with pronounced 2-sidedness, as regards water absorption and surface roughness, were tested and showed greater water absorption on the smoother surface in agreement with the lab. expts.

2568. Benson, Sidney W. and Seehof, Jerrold M. **The surface areas of proteins. IV. Sorption of polar gases.** *J. Am. Chem. Soc.* **73**, 5053-8 (1951).—*C.A.* **46**, 1845*g*.

The sorptions of NH_3, HCl, BF_3, and CH_3NH_2 gases by egg albumin were detd. at several temps. The sorption was independent of the state of dispersion of the solid protein but related to the specific nature of the protein. NH_3 and HCl sorption data and CH_3NH_2 desorption data, followed Freundlich-type isotherms. The partial molal differential heats of sorption were 7.5 ± 0.5 and 12 kcal./mole for NH_3 and HCl, resp. The attainment of equil. was very slow, and hysteresis was evident.

2569. Bergstrom Lourenco, Oscar. **Determination of the permeability of films used in packaging.** *Anais assoc. quim. Braxil* **10**, 313-18 (1951).—*C.A.* **47**, 5579*h*.

The moisture pickup of small (3 × 3 cm) cylindrical vials, contg. suitable chemicals and sealed with the foils to be tested was followed. The permeability of the films was calcd. from $Q = k\,\Delta P\,(a/e)t$, in which k was the permeability coeff., ΔP was the vapor pres. differential, a the film area, e the film thickness, t the elapsed time, and Q the moisture pickup. Brazilian impermeable Cellophane had a permeability ($k = 0.0012$-0.0072) comparable to that of Pliofilm (0.0010-0.0026) and about 1/50 that of ordinary Brazilian Cellophane (0.080-0.33).

2570. Cabrera, N. **Evaporation and mobility of naphthalene molecules.** *Nature* **167**, 766-7 (1951).—*C.A.* **45**, 7845*c*.

The values of the mean displacement of adsorbed mols. were of the order of 10^{-4}-10^{-6} cm.

2571. Cutler, Janice A.; Kaplan, E.; McLaren, A. D., and Mark, H. **The permeation of vapors through polyethylene.** *Tappi* **34**, 404-7 (1951).—*C.A.* **46**, 290*e*.

Data for a 0.0024-cm film in g/m^2-hr were given. The vapor pres. (mm Hg) and the permeability were, resp.: H_2O, 4.7, 0.021; 22.4, 0.108; propanol, 7.0, 0.07; 19.0, 0.26; acetone, 6.2, 0.25; 25.3, 0.18; propionitrile, 4.5, 0.03; 23.5, 0.35; benzene, 4.8, 0.09: 21.0, 1.16; hexane, 6.0, 0.025; cyclohexane, 6.1, 0.019; 24.0, 0.57; 1,2-dichloroethane, 7.7, 0.32; 21.2, 1.72; *trans*-dichloroethylene, 5.6, 0.23; 25.8, 2.10; *cis*-dichloroethylene, 6.4, 0.26; 22.8, 1.51; nitroethane, 4.5, 0.11; 19.5, 0.70.

2572. Dean, Robert B. and Hayes, Kenneth E. **The sorption of vapors by monolayers. III. A surface balance for the measurement of the effect of vapors on monolayers.** *J. Am. Chem. Soc.* **73**, 5583-4 (1951).—*C.A.* **46**, 2373*f*.

The monolayer chamber had a vapor vol. of 1.5 liter and was regulated to 0.1°C. Surface-pressure measurements were reproducible to ±0.05 dyne/cm and surface concns. to 0.1×10^{-10} moles/cm^2. Equil. was reached usually in one-half hr at 30°C using stearic acid and hexane vapor.

2573. Garin, A. **Determination of water in textiles.** *Bull. inst. textile France* **No. 23**, 9-24 (1951).—*C.A.* **46**, 1260*i*.

A survey of methods was given.

2574. Grinberg, B. **The sorption of water vapor by cellulose.** *Ann. chim.* **6**, 489-535 (1951).—*C.A.* **46**, 1251*h*.

The sorption isotherm of H_2O vapor on cellulose was S-shaped and showed hysteresis. The app. consisted of 5 McBain balances (quartz fiber). At the beginning of each expt., the cellulose samples were dehydrated at 50°C, and then put in contact with H_2O vapor at known temp. and pres. The samples used included Egyptian cotton, native and mercerized firwood cellulose, and rayon viscose. Hydrolysis, which decreased the degree of polymerization most during the first 5 min., caused a decrease in sorption. Sorption was measured for regenerated cellulose by using different times of aging of the alkali cellulose and of the viscose, and fibers made with no extension and with 100% extension. Aging had little effect on sorption, but decreased greatly the rate of penetration.

2575. Hayes, Kenneth E. and Dean, Robert B. **The sorption of vapors by monolayers. IV. Calculation of the amount of hexane adsorbed on a stearic acid monolayer.** *J. Am. Chem. Soc.* **73**, 5583-4 (1951).—*C.A.* **46**, 2373*g*.

The amt. of org. vapor adsorbed on a long-chain monolayer was detd. and applied to the system of stearic acid-hexane. The thermodynamic standard state used in the calcn. was chosen as the surface concn. of stearic acid given by the spreading pressure of stearic acid under hexane vapor. The adsorption of hexane followed a type-III isotherm at low stearic acid concns. and a type-V isotherm at high acid concns. with a limiting ratio of one mol. of hexane to one of stearic acid.

2576. Hellman, N. N. **Determination of moisture in starch by drying.** *Cereal Chem.* **28**, 79 (1951).—*C.A.* **45**, 3628*g*.

It was found that corn, potato, and tapioca starches dried at 25°C and 10^{-6} mm Hg pressure lost no more wt upon heating to 110°C at this same pressure.

2577. Hirota, Kozo and Kawamura, Fumio. **Determination of bound water in proteins.** *Monograph Ser. Research Inst. Applied Elec.* (Japan), *Research Biophys.* No. 2, 11-19 (1951)(in English).—*C.A.* **46**, 8702*c*.

Detns. were made on gelatin and its x-ray-radiated product. When g (g H_2O per g dry gelatin) was plotted as a function of a (activity of H_2O from vapor-pressure detn.), the 2 curves cross at $a = 0.8$ and below this the radiated gelatin held less H_2O. The constants v_m and c of the B.E.T. equation were detd. and the excess energy, per mol. of H_2O adsorbed on the first layer over that of pure H_2O, calcd. Since radiation reduced v_m by one half with little change in the excess energy adsorbed it was postulated that only those gelatin mols. which had absorbed an x-ray quantum were changed in structure and hence in adsorption properties.

2578. Katchman, Bernard and McLaren, A. D. **Sorption of water vapor by proteins and polymers. IV.** *J. Am. Chem. Soc.* 73, 2124-7 (1951).—*C.A.* 45, 7407*c*.

The H_2O vapor sorption isotherms of polymethacrylic acid, polyvinyl benzoate, polyisobutyl methacrylate, polyethylene, polyvinyl isobutyl ether, methoxypolyglycol, polyacrylonitrile, polyvinyl acetate, ethylene-vinyl alc., polyglycine-DL-alanine and polymethyl vinyl ketone, were detd. Cryst. insulin and soybean trypsin inhibitor sorb more H_2O than do the corresponding amorphous samples. A 1 to 1 correlation of polar groups and sorbed H_2O mols. in proteins and polymers was generally not observed because structural relations tend to limit sorption.

2579. Kawamura, Fumio and Hirota, Ginzo. **Change of bound-water content of gelatin by x-rays.** *Kagaku (Science)* 21, 469-70 (1951).—*C.A.* 46, 3369*e*.

Isotherms of bound water in gelatin were detd. for both x-ray-irradiated and -unirradiated samples at 10°C. The amt. of NH_3 vapor produced by x-rays was as small as 0.1 mg per 1 g of the sample. The B.E.T. consts. V_m and c (energy const.) were calcd., which showed that energy of adsorption decreased only slightly, but monolayer capacity V_m decreased appreciably, when the sample was irradiated by x-rays.

2580. Kovacs, A. **Study of water absorption of plastic materials.** *Ind. plastiques modernes* (Paris) 2, No. 6, 31-4 (1950); 3, No. 1, 30-2 (1951).—*C.A.* 45, 4479*g*.

The absorption in air followed Henry's law for relative humidities up to 0.75 after which there is marked deviation. In liquid the absorption was proportional to the vapor pressure, altered by any liquid-solid interaction. The absorption rose rapidly with temp. to a max. and then decreased slowly. The rate of satn. was characteristic of the plastic and increased with the temp. The permeability was the product of the amt. absorbed and the diffusion const. (D). D increased with the amt. of absorption and decreased with the amt. of desorption owing to swelling and deswelling of the plastic.

2581. Kroll, Karl. **Movement of moisture through softwoods during drying at 100°C. I. General considerations.** *Holz Roh-u. Werkstoff* 9, 176-81 (1951).—*C.A.* 45, 7847*d*.

In tubes closed at one end, the vapor movement was both a diffusion and streaming process. In large-diam. tubes, this outward streaming was a Poiseuille flow. When pore diam. was less than mean free path of vapor mols., the derived flow equation lost its significance, since the streaming was now a Knudsen mol. flow. A wide transition region existed between these two types of flow. The movement of bound water was not a diffusion phenomenon, but resulted from differences in capillary tensil forces.

2582. Kurosaki, Shigehiko. **Dielectric properties of sorbed water. II. Capillary condensation theory on the sorbed water in several high-polymer films.** *J. Chem. Soc. Japan*, Pure Chem. Sect., 72, 688-91 (1951).—*C.A.* 46, 1316*c*.

The dielec. consts. of paper, cellulose acetate, polyvinylformal, and polymethyl methacrylate films were detd. by resonance method for various amts. of sorbed water. The power factors of dried and wet films were also measured over the frequency range $10^3 \sim 10^7$ cycles/sec. No evidence was found of the existence of capillary-condensed water in these adsorbates for relative humidty less than 80%.

2583. Kurosaki, Shigehiko. **Dielectric properties of sorbed water. III. Sorbed water on polyvinyl chloride film.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 72, 990-2 (1951).—*C.A.* 46, 7836*h*.

The moisture sorption isotherms of polyvinyl chloride were detd. at 12°, 20°, and 30°C. The increase of dielec. const. with moisture content was detd. at the frequency 500 kc. The heat of sorption at the initial stage was calcd. to be 7 kcal./mole.

2584. Mandelkern, Leo and Long, F. A. **Rate of sorption of organic vapors by films of cellulose acetate.** *J. Polymer Sci.* 6, 457-69 (1951).—*C.A.* 45, 4523*f*.

Cellulose acetate films, were suspended from a sensitive spring balance within an evacuated chamber, and Me_2CO or CH_2Cl_2 vapors admitted under known vapor pressure to det. the rate of their sorption by the films. Films that had been cast on glass took up vapors more easily when incompletely dried than when fully dried (50 days in a vacuum oven at 120°C) or when water-leached and dried 5 days. Films cast on Hg had an even lower rate of sorption. The rate of sorption of CH_2Cl_2 was found to be fundamentally like that of Me_2CO in spite of their different solvency as liquids.

2585. Mellon, Edward F. and Hoover, Sam R. **Hygroscopicity of amino acids and its relationship to the vapor phase water absorption of proteins.** *J. Am. Chem. Soc.* 73, 3879-82 (1951).—*C.A.* 45, 9333*g*.

Under conditions where the polar groups can be expected to be very highly coordinated into the crystal structure, amino acids absorbed little if any H_2O even at high humidities. However, all types of H_2O adsorption including hysteresis, were possible within these relatively simple substances. The polar groups of the proteins must be comparatively uncoordinated and completely available to H_2O mols. This situation was similar to that required by the polarization theory of adsorption and, therefore, this isotherm described the water adsorption curve of proteins from 6 to 93% relative humidity.

2586. Milligan, W. O.; Bushey, Gordon L., and Draper, Arthur L. **Isobaric and isothermal studies in the system soap-water.** *J. Phys. & Colloid Chem.* 55, 44-53 (1951).—*C.A.* 46, 3831*h*.

From dehydration isobars the definite existence of Ca palmitate monohydrate was shown. (Heat of hydration estd. to be -33 ± 5 kcal. per mole.) α-Na palmitate and stearate existed as hemihydrates, but the β, δ, and ω crystn. forms of these soaps were not definite hydrates.

2587. Nevell, T. P. **Oxidation of cotton cellulose by nitrogen dioxide.** J. *Textile Inst.* 42, T91-129 (1951).—*C.A.* 45, 5413*f*.

The oxidation of cotton cellulose with NO_2 was studied. The main reaction was shown to be the formation of uronic acid groups but in some cases nearly 3 atoms of O per C_6 unit, instead of 2, were consumed giving up to 700 millimoles of carboxy per 100 g. These oxycelluloses were found to be partially sol. in H_2O, and much more hygroscopic than unmodified cotton.

2588. Nice, G. R. **Apparatus for the measurement of the water vapor permeability of leather.** *J. Soc. Leather Trades' Chemists* 35, 17-20 (1951).—*C.A.* 45, 5958*i*.

Leather specimens clamped across the necks of wide-mouth bottles contg. a solid desiccant are exposed to an atm. of known high relative humidity. From the increased wt of the desiccant for a given time, the amt. of water vapor which has passed through the leather is detd. and the permeability calcd.

2589. Nissan, A. H.; Causer, L. W., and Underwood, N. C. **Rapid testing of large packages for water-vapor permeability. I. Apparatus.** *Brit. Paper and Board Makers' Assoc., Proc. Tech. Sect.* 32, 415-24 (1951).—*C.A.* 46, 2296*h*.

A conditioning cabinet was described designed for use in the detn. of water-vapor permeability of large packages in a tropical atm. of 38 ± 0.5° and 90 ± 2% relative humidity.

2590. Park, G. S. **Diffusion of some organic substances in polystyrene.** *Trans. Faraday Soc.* 47, 1007-13 (1951).—*C.A.* 46, 2873*e*.

Sorption rates were detd. at several pressures for CH_2ClCH_2Cl, $MeCHCl_2$, PrCl, BuCl, CH_2I_2, C_6H_6, and $CCl_2{:}CHCl$ by polystyrene sheet. Diffusion coeffs. (D_p) calcd. from the sorption half-times satisfy approx. the relation $D_p = D_0 \exp(\alpha v_p)$, where D_0 and α were parameters and v_p was the vol. fraction of the penetrant.

2591. Pomeroy, C. D. and Mitton, R. G. **The real densities of chrome- and vegetable-tanned leathers.** *J. Soc. Leather Trades' Chemists* 35, 360-82 (1951).—*C.A.* 46, 3784*f*.

The density of both leathers, detd. by displacement of N_2, ranged from 1.51 to 1.39 depending on the H_2O content as well as on the nature and extent of tannage. The density of both leathers increased to a max. (H_2O about 12%) and then diminished. The density varied with the nature of the gas used in measuring the vol., increasing in the order He, N_2, H_2, and O_2, probably as the result of a slight adsorption of the gases on the fibers. The d. by displacement with liquids having mols. of various sizes were the same for all, but slightly lower than that for He.

2592. Prager, Stephen and Long, F. A. **Diffusion of hydrocarbons in polyisobutylene.** *J. Am. Chem. Soc.* 73, 4072-5 (1951).—*C.A.* 45, 9333*f*.

The diffusion coeffs. of C_3H_8, C_4H_{10}, iso-C_4H_{10}, C_5H_{12}, and neopentane in polyisobutylene were calcd. from sorption data at 35°C. All increased exponentially with increasing concn. of the hydrocarbon in the polymer. An increase in both the degree of branching and the size of the diffusing mols. lowered the diffusion coeff., although the former effect was much more pronounced than the latter.

2593. Preston, J. M. and Chen, J. C. **Some aspects of the drying and heating of textiles. IV. The effect of drying conditions on the latent strain in the yarn of viscose cakes.** *J. Soc. Dyers Colourists* 67, 97-100 (1951).—*C.A.* 45, 4934*e*.

The effects of drying viscose in cake form by convection, infrared, and high-frequency methods were compared. The data for the cakes dried by the high-frequency method showed that it was possible to dry cakes substantially free from strain. As judged by the standard of freedom from latent strain, the next best method of drying appeared to be drying from the inside and very slow drying.

2594. Preston, J. M. and Bennett, A. **Some aspects of the drying and heating of textiles. V. Migration in relation to moisture content.** *J. Soc. Dyers Colourists* 67, 101-3 (1951).—*C.A.* 45, 4934*f*.

The higher the moisture content the more marked was the migration, and there was a characteristic lower limit at which it ceased. The cessation of migration and the second temp. step during drying corresponded to approx. the same stage in the dehydration of fibers. After this stage the residual moisture was all or nearly all in the fibers.

2595. Quackenbos, H. M. Jr. **Effect of adsorbed water on physical properties of molded phenolics.** *Modern Plastics* 28, No. 11, 107-8, 110, 170-1, 173 (1951).—*C.A.* 45, 7373*i*.

H_2O adsorption by molded phenolics under varying conditions of exposure was discussed. Information was presented to permit estimates of dimensional stability, warping, and stresses.

2596. Sato, Hideshi. **Water sorption by potato starch and its components.** *J. Chem. Soc, Japan*, Pure Chem. Sect., 72, 790-3 (1951).—*C.A.* 46, 5933*c*.

The sorption isotherms of water vapor were detd. for potato starch, fractionated amylose, and amylopectin at 10°, 20°, and 40°C. From the results, the isosteric differential sorption heat and entropy were calcd.

2597. Shelton, J. Reid and Cox, William J. **Volumetric oxygen absorption test for rubber aging.** *Ind. Eng. Chem.* 43, 456-63 (1951).—*C.A.* 45, 4081*i*.

Uncured Hevea rubber mixts. were much more resistant to oxidation than corresponding cured mixts., but after normal vulcanization, the degree of vulcanization had relatively little effect. The data on O_2 absorption indicated that the addnl. protection imparted by Hevea rubber was 2-fold; (1) a normal antioxidant activity, which reduced the O_2 absorbed, and (2) an effect on the nature of vulcanization, whereby absorption of a given percentage of O_2 in the early period of oxidation involved smaller changes in phys. properties.

2598. Thomas, A. Morris. **Moisture permeability, diffusion and sorption in organic film-forming materials.** *J. Applied Chem. (London)* **1**, 141-58 (1951).--*C.A.* 45, 7847*a*.

Sorption of H_2O vapor at 25-40°C by films of unplasticized polyvinylchloride (PVC), polymethyl methacrylate (Perspex), cellulose acetate, baked linseed oil, and electrical-insulating varnishes was a function of relative humidity and was independent of temp., facts which lead toward an equality of the heats of sorption and liquefaction. The results were expressed by the B.E.T. adsorption equations. The no. of polymer units per adsorption site were 160 for PVC, 29 for Perspex, and 12 for cellulose acetate. Diffusion consts. were calcd. from sorption and desorption rate measurements.

2599. Ashpole, D. K. **The moisture relations of textile fibers at high humidities.** *Proc. Roy. Soc.* (London) **A212**, 112-22 (1952).--*C.A.* 46, 11692*d*.

There is no true equil. at satn. The immediate satn. regain is identical with the moisture held by the fibers after centrifuging wet samples under standard conditions. The hysteresis loop closes at satn. Detns. of desorption regains can be expected to yield a unique curve for any one fiber only when desorbing from the satn. regain or above it. Desorption from lower initial regains will yield points within the hysteresis loop.

2600. Bogaty, Herman; Campbell, Kenneth S., and Appel, Wm. D. **The evaporation of water from cellulose.** *Textile Research J.* **22**, 75-81 (1952).—*C.A.* 46, 3755*h*.

The influence of H_2O on cellulose deterioration was discussed. A brown, fluorescent, water-sol. material resulted from evapn. of H_2O at the cellulose-water-air interface. Oxycellulose, of mildly reducing acid type, was formed, oxidation occurring in part at the primary OH group with the formation of polyglucuronic acid; this was followed by chain scission and formation of sol. fractions of low mol. wt.

2601. Bogaty, Herman; Campbell, Kenneth S., and Appel, Wm. D. **The oxidation of cellulose by ozone in small concentrations.** *Textile Research J.* **22**, 81-3 (1952).—*C.A.* 46, 3755*g*.

O_3 in amts. likely to occur in air at the earth's surface (up to 0.06 p.p.m.) deteriorated cotton textiles when wet. The deterioration was slight when compared with "weathering" elements such as light, heat, wetting, and drying, and microörganisms. Increased O_3 content causes increased cellulose deterioration.

2602. Bowler, Wm. W. **Water-vapor permeability and sorption of Hevea latex films.** *Ind. Eng. Chem.* **44**, 787-91 (1952).—*C.A.* 46, 10663*d*.

There was considerable difference between the structures of *Hevea* films vulcanized after drying and vulcanized as latex. This was evidenced by the different water-vapor permeability and sorption. The wt of water passing through an uncompounded film was inversely proportional to x in a wide range and directly proportional to Δp except when Δp is very high. This was not true of films vulcanized as latex. Films cast from vulcanized latex were found to be much more permeable, to sorb less, and to have a greater neg. temp. dependence of permeability than uncompounded films or films vulcanized dry.

2603. Broughton, G. and Hobbs, A. K. **Moisture determination in paper by oven drying.** *Tappi* **35**, 217-19 (1952).—*C.A.* 46, 7327*b*.

In analyzing the factors involved only in the actual drying operation, it was concluded that the temp. of drying was the most crit. variable in moisture detn. on paper. Supplying the oven with dry air increased the measured moisture content slightly; however, it did not increase the precision of the results.

2604. Brubaker, David W. and Kammermeyer, Karl. **Separation of gases by means of permeable membranes; permeability of plastic membranes to gases.** *Ind. Eng. Chem.* 44, 1465-74 (1952).—*C.A.* 46, 9932*h*.

A series of 22 com. and exptl. plastic films were subjected to permeation by CO_2, H_2, O_2, and N_2 at 20°, 30°, and 40°C to det. resp. permeability consts., *P*. Films examd. were vinyl chloride, ethylcellulose, and polyethylene types. No over-all predictable regularity in the temp. effect on *P* was noted.

2605. Dean, Robert B. and Hayes, Kenneth E. **The sorption of vapors by monolayers. V. The differential heats of adsorption of hexane on stearic acid monolayers.** *J. Am. Chem. Soc.* 74, 5982-4 (1952).—*C.A.* 47, 3652*d*.

Adsorption of hexane on stearic acid monolayers at 20°C was calcd. from surface-pressure measurements. Differential heats of sorption at 25°C were calcd. from these and data for 30°C reported previously. On close-packed monolayers the heat of sorption rose with increasing amts. of hexane sorbed, reaching the heat of vaporization of hexane when the mole ratio of hexane to stearic acid was 0.5. On a clean water surface the heat of sorption was not significantly different from the heat of vaporization of hexane.

2606. Denbigh, K. G. and Raumann, Gertrud. **The thermoösmosis of gases through a membrane. I. Theoretical. II. Experimental.** *Proc. Roy. Soc. (London)* **A210**, 377-87, 518-33 (1952).—*C.A.* 46, 10835*i*.

A theory was developed on the basis of Onsager's treatment of irreversible processes. The effect depended on the heat of soln. and the heat of transport within the membrane. Exptl. details were given for measurement of the thermoosmotic effect of CO_2, N_2, H_2 and water vapor through a natural rubber membrane. Observations agreed with the theory.

2607. Fujita, Hiroshi. **A numerical solution of the differential equation for adsorption-controlled diffusion in a solid.** *Textile Research J.* **22**, 281-6 (1952).—*C.A.* 46, 4877*g*.

An attempt is made to evaluate a numerical solution of a set of equations.

2608. Garin, A. **Factors influencing the determination of water in textiles.** *Bull. inst. textile France* No. **30**, 13-35 (1952).—*C.A.* 47, 2494*e*.

A general discussion of the importance of moisture detn. in textiles was followed by a survey of general principles of the various methods of detn.

2609. Grabe, Franz. **The full synthetic fibers and their chemical-technical utilization.** *Chem.-Ztg.* 76, 436-8 (1952).—*C.A.* 46, 11691*i*.

The water absorption and retention, the mech. strength, and the resistance to alkali, acid, and oxydans of Perlon (ϵ-amino caprolactam fiber), Pan (polyacrylic fiber similar to Orlon), and Rhovyl (polyvinyl chloride fiber) were studied and compared to natural fibers and rayon. The synthetic fibers showed higher resistance to rotting, low water absorption, and no penetration of dirt.

2610. Grahen, N. and Werner, G. **Passage of water vapor through textiles.** *Bull. inst. textile France* No. 30, 379-86 (1952).—*C.A.* 47, 2494*g*.

H_2O vapor was principally transferred through the pores of fabrics, but may also take place through extremely dense fabrics of low porosity. With hydrophobic fibers, H_2O vapor could also be transferred through the thin adhering water layer.

2611. Green, R. W. **Reaction of hydrogen chloride with dry proteins. II. Collagen, silk fibroin, elastin.** *Trans. Proc. Roy. Soc. New Zealand* 79, 485-93 (1952).—*C.A.* 46, 8683*e*.

Silk fibroin in gaseous HCl adsorbed from 1.24 g of HCl/100 g (0.24 hr) to 17.30 g HCl (2164 hrs). These samples retained from 0.47 to 2.90 g of HCl at 100°C *in vacuo* over CaO. In 0.2 *M* HCl in Et_2O silk fibroin adsorbed from 0.19 g of HCl (1 hr) to 2.47 g HCl (610 hrs). Elastin in gaseous HCl adsorbed from 17.8 g of HCl (2 hrs) to 30.3 g of HCl (1726 hrs) and retained from 1.32 to 2.80 g of HCl at 100°C *in vacuo* over CaO.

2612. Green, R. W. **Reaction of hydrogen chloride with dry proteins. III. Adsorption of water vapor on hydrochlorides of collagen and of silk fibroin.** *Trans. Proc. Roy. Soc. New Zealand* 79, 494-504 (1952).—*C.A.* 46, 8683*h*.

Water-vapor adsorption isotherms at 25°C were detd. for several modifications of silk fibroin and for hydrochlorides of silk fibroin and collagen at relative humidities from 6 to 95%. Analysis of the data supported the hypothesis of adsorption on polar groups. The power of basic groups and of aliphatic OH to coordinate H_2O was unaffected by reaction with HCl.

2613. Gregor, Harry P.; Sundheim, Benson R.; Held, Kalman M., and Waxman, Monroe H. **Ion-exchange resins. V. Water-vapor sorption.** *J. Colloid Sci.* 7, 511-34 (1952).—*C.A.* 47, 941*d*.

Sorption of H_2O vapor by com. ion-exchange resins was measured in a humidistat and a McBain sorption balance. The heat of sorption was measured in an isothermal calorimeter. At higher humidities, cross-linking decreased the sorption by the resins. Factors that increased sorption were: (1) decreasing divinylbenzene content and (2) existence of the resin in the hydrogen form. For a given resin, the sorption was least for the alkali or alk. earth metals with the largest hydrated ionic vols. Quaternary ammonium resins sorbed more H_2O when in the iodate state than in the chloride state.

2614. Grotjahn, H. and Hess, K. **Influence of the internal surface of cellulose samples.** *Kolloid-Z.* 129, 128-32 (1952).—*C.A.* 47, 5113*d*.

The internal surfaces of various cellulose samples were detd. by A adsorption at 90°K. The surface of various com. samples with a normal H_2O content was in the range 1.3-1.7 m^2/g, and did not change very much in vacuum drying at 100°C. Dried rayon fibers had internal surfaces of only 0.3 m^2/g. Cellulose samples dried by azeotropic distn. or extn. with C_5H_5N, EtOH, EtOH-Et_2O mixts., had 3.6-9.5 m^2/g, those with BuOH 22-38 m^2/g. If the samples were worked in a Strecker mill prior to drying with org. solvents, the final area was 40-200 m^2/g. The values for cellulose powder pptd. from viscose and dried with BuOH were of the order of 280 m^2/g.

2615. Haas, Howard C.; Farney, Leonard, and Valle, Claude Jr. **Properties of ethylcellulose films.** *J. Colloid Sci.* 7, 584-99 (1952).—*C.A.* 47, 4601*f*.

Films of ethylcellulose were cast on glass and Hg from solns. in C_6H_6, PhCl, Me_2CHNO_2, and a C_6H_6-CCl_4 mixt. The poorer solvents (C_6H_6 and PhCl) gave films of higher birefringence, higher d., lower brittle-point temp., and greater toughness. The higher cross-section birefringence observed with poorer solvents was attributed to the greater formation of a gel structure during drying of the film.

2616. Haller, R. **The effect of the vapor of various substances on textiles.** *Textil-Rundschau* 7, 359-65 (1952).—*C.A.* 47, 326*e*.

Fibers or fabrics were exposed to steam contg. various additives. AcOH had no effect on native or bleached cotton. ClO_2 had little effect on bleached cotton but gave pos. evidence of oxycellulose formation in native cotton. ClO_2 caused serious degradation of wool (special precautions were taken to avoid explosive concns. of ClO_2). NH_2Cl formed some oxycellulose in native cotton, but produced a much greater conversion to oxycellulose in bleached cotton. NH_2Cl degraded wool, especially affecting phys. properties and fiber structure, and had a similar, but less severe, effect on silk.

2617. Hammond, A. **The sorption of water by high-polymeric materials.** *Selected Govt. Research Repts.* (Gt. Brit.) Vol. 1, *Plastics, Rept.*, No. 4, 169-98 (1952).—*C.A.* 47, 2568*i*.

The theories of water sorption are reviewed: the mechanism of the sorption process, the mechanism of swelling, equil. water sorption and swelling of cellulosic materials and noncellulosic materials, water sorption and swelling under mech. pressure, hysteresis in sorption, effect of temp. on the equil. water sorption, rate of water sorption, sorption and swelling in liquids other than water.

2618. Harris, B. L. and Bialecki, A. **Permeability to water of thin unsupported films of pure drying oils.** *Am. Paint J.* 37, No. 12, 68-76; *Offic. Dig. Federation Paint & Varnish Production Clubs* No. 335, 884-7 (1952).—*C.A.* 47, 4628*g*.

Studies on the H_2O permeability of linseed-oil films revealed that probably no discreet pores existed, that soly. effects were not controlling factors, that surface effects were paramount, and that permeability followed Fick's Law for a const. humidity. H_2O permeability of the oils decreased in the order oleate < linoleate < linolenate < α-eleostearate. The glycerol esters are more permeable than the pentaerythritol esters.

2619. Hellman, N. N.; Boesch, T. F., and Melvin, E. H. **Starch-granule swelling in water-vapor sorption.** *J. Am. Chem. Soc.* 74, 348-50 (1952).—*C.A.* 47, 2522*g*.

Microscopic measurements of the swelling of individual starch granules occurring with the sorption of water vapor at various relative pressures showed that the linear granule swelling in a water-satd. atm. over the vacuum-dry dimension was corn, 9.1; potato, 12.7; tapioca, 28.4; waxy corn 22.7%.

2620. Higgins, James J. **The air drying of paper.** *Tappi* 35, 93-9 (1952).—*C.A.* 46, 6830*f*.

Air drying of paper was studied on handsheets, by using an exptl. tunnel drier in which temp., humidity, and air velocity were closely controlled. The paper showed an initial const. drying rate, followed by a period of falling rate. The rate of drying was shown to vary considerably from the leading to the trailing edge of the sheet. The curves obtained in this manner showed that the moisture did not vary with depth in the interior of the sheet during drying.

2621. Humphreys, F. E. **The drying of collagen and its reabsorption of water from humid atmospheres.** *J. Soc. Leather Trades' Chemists* 36, 90-6 (1952).—*C.A.* 46, 10657*a*.

Heating to const. wt in an oven at 110°C gave the same H_2O content for hide powder as prolonged desiccation at 20°C over P_2O_5 or drying at 60°C at 60 mm pressure. Drying in a steam oven (97°C) gave low results unless used under reduced pressure. Soaking in water or conditioning at 75% relative humidity previous to drying did not affect the results.

2622. Kast, W. and Schwarz, B. **Water absorption in the lattice region of cellulose II (cellulose hydrate).** *Z. Elektrochem.* 56, 228-33 (1952).—*C.A.* 47, 939*e*.

The 101 spacings in crystals of cellulose II (regenerated cellulose fibers) were measured. The results were: for bone-dry fibers (1) 7.020, fibers dried in a hot N_2 stream 7.227, dried fibers that were then moistened completely 7.365, hydrated fibers that had not been dried 7.560 A.

2623. Koshiyama, Kiichi and Takei, Kunio. **Diffusion of hydrogen sulfide through a built-up film of stearic acid on a copper plate.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 73, 29-30 (1952).—*C.A.* 46, 9932*g*.

Built-up films of stearic acid and its salts were prepd. on a clear Cu plate, and the diffusion velocity of H_2S through the films was detd. The area of one mol. in a unimol. film on water was for Al stearate 29.0 A.^{2}, for stearic acid 18.8, and for Ba stearate 17.6.

2624. Landrock; A. H. and Proctor, B. E. **The simultaneous measurement of oxygen and carbon dioxide permeabilities of packaging materials.** *Tappi* 35, 241-6 (1952).—*C.A.* 47, 314*e*.

The test sheet, having an area of about 0.03 m^2, is clamped between 2 chambers and supported on both sides by a coarse screen. The lower chamber contains N_2; a mixt. of 80% O_2 and 20% CO_2 is swept through the upper chamber. The test is continued until the concn. of either test gas in the lower chamber is increased about 1% or until the pressure in the lower chamber is increased by no more than ½ in. Hg. At the conclusion of the test, some gas is drawn off from the lower chamber and analyzed in a conventional Orsat app. When the relative humidity is above 0%, it is necessary to correct for the vol. occupied by the water vapor.

2625. Magne, Frank C. and Skau, Evald L. **Nonfreezing water and nonfreezing benzene capacities of cottons and modified cottons.** *Textile Research J.* 22, 748-56 (1952).—*C.A.* 47, 871*d*.

The calorimetric, heat-of-fusion method was used to det. the amt. of nonfreezing water present in cotton and modified cotton fibers at various moisture contents. Results indicate that the nonfreezing water capacity was related to the total available surface, the proportion of amorphous cellulose, and the degree of distention of the wetted fibers.

2626. Marshall, Patricia A. and Moore, Walter J. **Sorption of ammonia by silk fibroin.** *J. Am. Chem. Soc.* 74, 4779-83 (1952).—*C.A.* 47, 1459*a*.

The sorption of NH_3 by silk fibroin was measured at -77° and -63°C with an app. of the volumetric type. There was a marked hysteresis in the sorption isotherms; the loop closes at zero pressure. The B.E.T. monolayer point for adsorption occurred when 1 NH_3 mol. was held for each 2 peptide links in the adsorbent, whereas the monolayer point on desorption occurred at 1 NH_3 for each peptide link.

2627. Meissner, H. P. and Byrne, J. **Bonding of thin films.** *J. Applied Phys.* 23, 1170-3 (1952).—*C.A.* 47, 378*i*.

Unsupported films of nitrocellulose of 0.25 micron and less in thickness bonded immediately and spontaneously in air to solid surfaces that they were made to touch. Bond strength increased with diminishing film thickness. Similar behavior was shown by films of Au, regenerated cellulose, polymethyl methacrylate, and gelatin.

2628. Milligan, W. O. and Draper, Arthur L. **Isobaric and isothermal studies in the system soap-water. II.** *J. Phys. Chem.* 56, 123-8 (1952).—*C.A.* 46, 9379*a*.

Sorption-desorption isotherms at 12 and 2°C were obtained for certain cryst. forms of Na stearate and Na palmitate, using water vapor as the adsorbate. The adsorption isotherms for the β-form (small crystals) produced by the dehydration of the α-form and for the δ-form had two inflection points below 0.3 p/p_o, whereas those for the β- (large crystals) and ω-forms were regular in this region. The B.E.T. function gives a linear plot. Heats of adsorption calcd. using the Clausius-Clapeyron equation declined rapidly from extremely high values at low pressures, rose slightly at intermediate pressures, and declined to approach the heat of liquefaction of water at the satn. pressure. The desorption isotherms exhibited low-pressure hysteresis.

2629. Miyake, Akira. **Dielectric constant and sorption property of high polymers.** *Busseiron Kenkyû* (Researches on Chem. Phys.) No. 48, 1-10 (1952).—*C.A.* 46, 5384*e*.

Statistical mech. theory is given of the relation between the change of dielec. const. and amt.

of gas sorbed on high polymers for cases in which the sorbed mols. are bound weakly and tightly.

2630. NAGHSKI, J.; MELLON, E. F.; KORN, A. H., AND OGG, C. L. **Water sorption studies on rutin and the determination of moisture.** *J. Am. Pharm. Assoc.* 41, 599-602 (1952).—*C.A.* 47, 1338*b*.

Absorption and desorption curves for H_2O at various relative humidities demonstrate the extremely hygroscopic nature of rutin High temp., vacuum, and an extremely dry atm. in the oven are essential to insure complete drying.

2631. OKAMURA, ISAO. **Drying of regenerated cellulose fibers.** *Teijin Times* 22, No. 4, 4-5 (1952).—*C.A.* 46, 6826*g*.

The swelling degree of regenerated cellulose fibers decreased upon reimmersion in H_2O after drying. The conditions of drying affected also the phys. properties of rayon fibers.

2632. QUACKENBOS, H. M. JR. AND HILL, J. M. **Effect of absorbed water on physical properties of phenolic plastics.** *Trans. Am. Soc. Mech. Engrs.* 74, 41-50 (1952).—*C.A.* 46, 3793*g*.

The absorption of water by phenolic plastics obeys Fick's law and can be described completely by a satn. const., a diffusion const., and a simple relation between diffusion const. and temp. Two important consequences of water absorption are that mech. properties change and all dimensions expand, the magnitude of each seeming to remain roughly const. for each percentage of water absorbed.

2633. RICHTER, G. A.; HERDLES, L. E., AND WAHTERA, W. E. **Vapor sorption of cellulose at high relative humidities.** *Ind. Eng. Chem.* 44, 2883-93 (1952).—*C.A.* 47, 2978*a*.

Sorption of H_2O was affected more by changes in fiber at 95-100% relative humidity than at lower relative humidities. Sorption of org. vapors at high relative humidities depended on the vapor in question and on the extent to which the fiber had been swollen at the time of exposure to the vapor.

2634. RICK, ANTON W. **Water vapor permeability and its measurement.** *Deut. Farben Z.* 6, 351-3 (1952).—*C.A.* 46, 10710*h*.

The *static method* consists in placing water, salt soln., or a hygroscopic agent inside a dish closed by a film of the material to be tested, and detg. the wt changes of the dish in a desiccator or a humidity chamber. In the *dynamic method*, a window covered by the test film is passed by a stream of moist air on one side, and by a stream of dry air on the other, and the moisture carried off by the dry air is held by drying tubes and weighed. In the *manometric method*, the film is placed between 2 evacuated systems, one contg. water to produce vapor of the partial pressure prevailing at the given temp., the other held dry by a freezing trap, measuring the vapor pressure of the water thus held by vaporizing it periodically against a manometer.

2635. SPIERS, C. H. **The hydration of collagen and leather.** *J. Soc. Leather Trades' Chemists* 36, 20-5 (1952).—*C.A.* 46, 8402*i*.

The real d. of dry and hydrated samples of collagen, vegetable leather, and Cr leather were detd. by means of an air-displacement method. The d. increased to a const. value with increasing hydration. The values for the dry and hydrated states were: collagen, 1.22 and 1.40; Cr leather, 1.33 and 1.48; vegetable leather 1.38 and 1.43. When H_2O is absorbed by collagen or leather the increase in real vol. is much less than the vol. of H_2O absorbed. For Cr and vegetable leathers the initial compressions are 6- and 4-fold, resp., and diminish to the same value as that for collagen.

2636. TAKEDA, BUNSHICHI. **Absorption, passage, and evaporation of moisture. III. Relation between the permeability and absorption of moisture. IV. A relation between the moisture permeability and the thickness of the film.** *Rept. Inst. Sci. and Technol., Univ. Tokyo* 6, 235-42; 243-6 (1952).—*C.A.* 47, 1468*a*.

Both the moisture permeability and absorption of org. films (bladder membrane, cellophane, cellulose acetate, polyvinyl alc., and polyvinyl acetate) were measured. Moisture permeability increased with increasing pressure of water vapor, especially in polyvinyl alc. At the same time the moisture absorption increased with vapor pressure. A relation between the moisture permeability and the thickness of the film was derived.

2637. TAYLOR, J. B. **Sorption of water by viscose rayon at low humidities.** *J. Textile Inst.* 43, T489-515 (1952).—*C.A.* 46, 11693*d*.

Sorption data were given for moisture regains below 2 ½% at 25-65°C for a com. viscose rayon. The isotherm was reproducible so long as H_2O was not removed at too high a temp.

2638. TRELOAR, L. R. G. **Absorption of water by hair, and its dependence on applied stress.** *Trans. Faraday Soc.* 48, 567-76 (1952).—*C.A.* 46, 10739*d*.

Expts. with horsehair, in which the water content in the stressed and unstressed states at 75.5% relative humidity was detd. by weighing, showed a small increase of 0.28% on the dry wt for a stress of 482 $kg/cm.^2$ Data were presented for the length changes which accompanied water absorption, and for the water absorption as a function of relative humidity. In yarn or cord, the effect of tension together with twist was to produce a lateral compression on the fibers.

2639. TSUBOI, MASAMICHI. **The molecular state of water bound to the peptide linkage.** *Bull. Chem. Soc. Japan* 25, 160-4 (1952).—*C.A.* 47, 5218*h*.

Infrared study in the 3-μ region of a film of "Amilan" (Toyo Rayon Co.), polycaprolactam, in both wet and dry state revealed a band at 2.86 μ, attributable to H_2O bound to the peptide linkages. No absorption was observed at 2.90-3.03 μ. Considerations of the effect on absorption caused by H-bonds led to the conclusion that the bound H_2O of the polymer was held to two O atoms and no free OH was present.

2640. VILLABONA, JOSÉ. **Permeability of polyethylene to gases, vapors, and liquids.** *Rev. plásticos* (Madrid) 3, 304-6 (1952).—*C.A.* 47, 4646*f*.

The loss in wt in g/24 hrs from 200-ml polyethylene bottles of 188 cm^2 surface area at 35°C was

15 for 42 g C_2HCl_3, 19 for 120 g C_2HCl_3, 36 for 240 g C_2HCl_3, 13 for 142 g CCl_4, 6 for 77 g C_6H_6, 5 for 72 g C_6H_6, 7 for 106 g C_6H_6, 16 for 115 g 50/50 mixt. C_6H_6-C_2HCl_3 mixt., 3 for 70 g ligroine, 1 for 64 g petroleum or 93 g 50/50 petroleum-acetone mixt., and 0 for AcOH, AcOH-water mixt., acetone, acetone-water, acetone-paraffin oil, paraffin oil, H_2O, EtOH, or EtOH-paraffin oil-amyl alc. mixt.

2641. WINGARD, R. E. AND ROZIER, W. H. **Comparative drying rates—infrared versus heated air.** *Alabama Polytech. Inst. Bull.* 47, No. 4, *Eng. Expt. Sta., Eng. Bull.* No. 15, 3-14 (1952).--*C.A.* 46, 6870*h*.

For seven different materials (sand, sawdust, sugar, Celotex, Filter-cel, cotton cloth, and $CaCO_3$), a combination of steam and infrared heating gave the highest rates of drying and the lowest drying times. Steam heating alone gave the lowest rates and the longest times. Infrared heating alone gave more rapid drying than steam but the rates were not quite as high as for combined steam and infrared heating.

2642. YAVOROVSKAYA, S. F. **Evaluation of some construction materials and technical substances in respect to their permeability and adsorbability of mercury vapor.** *Gigiena i Sanit.* **1952**, No. 12, 35-9.—*C.A.* 47, 4058*i*.

Plywood, asbestos cardboard, microporous rubber, tiles, and other materials of construction showed a considerable (1.8 to 7-fold) decrease of permeability to Hg vapor after they had been satd. with H_2O vapor. Generally, an increase in temp. increased permeability of these substances to Hg, which was especially well shown in microporous substances. Introduction of S into the formulations of wall construction materials (plaster) can serve as an addnl. method for removal of Hg from the air-spaces of buildings.

2643. BRUBAKER, DAVID WILLIAM AND KAMMERMEYER, KARL. **Flow of gases through plastic membranes.** *Ind. Eng. Chem.* 45, 1148-52 (1953);—*C.A.* 47, 6708*h*.

The effects of ambient conditions, mol. wt, thickness, and type of membrane on the permeability const. *P* (cc.-cm/sec-cm²-cm Hg) were detd. in the transmission of He, H_2, CO_2, O_2, and N_2. Of 56 samples tested, in nearly all cases, log *P* vs. $1/T$ from -75° to 50 °C was a straight line. Membrane thickness (0.0003-0.037) and pressure (up to 6 atm.) did not affect *P*.

2644. DAY, A. G. **Vacuum microbalance for measuring sorption in dielectrics.** *J. Sci. Instr.* 30, 260-3 (1953).—*C.A.* 48, 405*d*.

A balance for measuring the rate of sorption of water vapor by nonpolar dielectrics consisted of a glass-beam assembly contained in a vacuum-tight brass case and equipped with a fused-quartz torsion fiber to measure wt changes. The period of swing was 10 sec., capacity 300 γ, sensitivity of fiber $8°/\gamma$, and sensitivity of the balance 2×10^3 radians/g. With a load of 0.1 g, a change of 0.02 γ was indicated.

2645. DRECHSEL, PAUL; HOARD, J. L., AND LONG, F. A. **Diffusion of acetone into cellulose nitrate films and study of the accompanying orientation.** *J. Polymer Sci.* **10**, 241-52 (1953).—*C.A.* 47, 5114*c*.

Sorption and desorption of acetone by films of cellulose nitrate (11 and 12% N) were studied at 30 °C by following the wt of vapor takeup or loss as a function of time. The takeup-time, *t*, curves showed marked inflections. The rate of vapor takeup was much more rapid for films cast on glass than for films cast on Hg. Studies of the optical anisotropy of the films showed that the orientation of the polymer mols. normal to the plane of the film was increased by the diffusion process.

2646. JERGER, EDWARD W. **Mechanism of moisture movement in the drying of organic granular solids.** *Iowa State Coll. J. Sci.* 27, 198-9 (1953).—*C.A.* 47, 5729*i*.

Equations for the drying of soybeams and of corn were derived on the assumption that diffusion is the method of movement of moisture. Expts. showed that velocities of 23-52ft/min. had no effect on the rate of drying.

2647. MAGGS, F. A. P. **Reversal of temperature dependence for physical adsorption of nitrogen.** *Research Correspondence* 6, 13-14S (1953).—*C.A.* 47, 7285*g*.

The adsorption of N_2 on coal shows the normal temp. effect over the range 77°-273°K and also a reversed effect over a limited temp. range. Argon and H_2 show similar reversed effects; only the adsorption-temp. curves peak at a different temp.

2648. SAXENA, A. P. **The theory and testing of fabric wettability.** *Indian Textile J.* 63, 234-7 (1953).—*C.A.* 47, 6662*f*.

The kinetic effect is more important in wetting fabrics than the static contact angle. A simple method is described for measuring the speed of wetting. The wt increase of a 2-in.square fabric just touching a water surface is measured by an analytical balance after every 30 sec. Three distinct parts appear on the curves representing the water uptake of woolen gabardine, cotton duck, and cotton gabardine: (1) in the induction period no water is absorbed; (2) in the S-shaped part wetting occurs at a rapid and variable rate; and (3) in the end part water uptake is steadily rising.

Chapter II. ADSORPTION FROM SOLUTIONS ON SOLID ADSORBENTS

This chapter on the solid-solution interface is concerned with publications of a fundamental nature; those concerned with direct applications have been entered in Chapter V. As indicated in the Table of Contents, the publications given in Chapter II have been arranged to some extent according to the chemical composition of the adsorbent. Both the carbon adsorbents in Sections 1 and 2 and the noncarbon adsorbents in Sections 3 and 4 (clays, silica and alumina gels, soils, etc.) are materials with adsorbing surfaces which are rather poorly defined from a chemical and structural point of view. The overall chemical composition of these materials may not in general be a good indication of the actual composition at or near the surface. The boundary surfaces of inorganic solids (Sections 5 and 6) and metals (Section 7) may be defined with a little more certainty.

Studies on carbon adsorbents in various solutions constituted about 40 percent of this part of the literature for the period 1900–42. Between 1943–53 the number of publications on the same subject decreased to 5 percent. The main factor contributing to this change was not so much the decrease of interest in carbon adsorbents as the increase in the number of publications concerned with natural materials, such as the clays, bleaching earths, soils, etc., and with synthetic inorganic materials such as the porous oxides, catalyst supports, single crystals, etc. Some of these new materials became successful commercial adsorbents in the period after the outbreak of World War II.

The abstracts concerned with the literature on ion exchange (Section 8) and chromatography (Sections 9 and 10) show the extensive development of these techniques. The ion exchangers can now be applied to the removal of many inorganic constituents and a high degree of selectivity can often be realized. This has had immediate and important applications. Investigations in ion exchange have been principally in columns, although considerable work has also been reported in what is generally termed batch testing. The adsorption column has many inherent advantages and a high degree of separation is potentially possible.

The investigations concerned with chromatography have been quite numerous. Approximately half of the publications on this subject in Chapter II are concerned with the column technique and an equal number employed paper chromatography in many ingenious procedures. The ramifications of chromatography have furnished the chemist with a large number of varied techniques which provide a potential selectivity not previously possible. The literature reveals that this tool is very productive in many fields of investigation and it is being actively used by both the analyst and the chemical engineer.

The techniques of ion exchange and chromatography are having a major influence on the newer developments in analytical chemistry. A lack of exact reproducibility in various batches of the same adsorbent appears to be the principal handicap to the general adoption of a proposed scheme of analysis. There are now available a large selection of adsorbents, many of which are tabulated with their sources of supply in a concluding section of this volume (page 1365). The ability to specify the detailed requirements of the adsorbent for certain analytical separations might be a material aid to the manufacturer in production control.

Partition chromatography has been entered under the general classification of Chromatography in Columns. It is considered as a case where the solid adsorbents and some one of many varieties of adsorbates act together as a special adsorbent system.

Lattice imperfections at the boundary planes of solids has long been considered as a contributory source to the adsorption potential. Current activities in the growth of special crystals and in solid state physics in general have stimulated a great deal of new interest, and the results of these researches should be closely followed for pertinent facts relevant to the adsorption problem. Conversely, in the formation of any solid from the gas, liquid, or solution phase, there are attendant adsorption phenomena, the recognition of which will contribute to the understanding of reactions in solid state physics.

II-1. Carbon Adsorbents With Organic Solutions

2649. GINZBURG, D. Z. **The relation of the structure of organic acids to their adsorption from mixed solvents.** *Trudy Akad. Nauk Belorusskoi S.S.R.* **1939**, No. 5, 27-43; *Khim. Referat. Zhur.* 4, No. 2, 20 (1941).—*C.A.* **37**, 2243^{6}.

Adsorption of homologous series of fatty acids and of m- and p-$NO_2C_6H_4$-COOH on activated charcoal from the following mixts. of solvents was investigated: H_2O-EtOH; CCl_4-C_6H_6; CCl_4 (or C_6H_6)-EtOH. Adsorption of fatty acids from pure polar solvents (H_2O and EtOH) and from their mixts. obeyed Traube rule. During the adsorption from the system CCl_4-C_6H_6 the Traube rule was obeyed by the first members of the homologous series (up to valeric acid); then the adsorption increased somewhat with the increase in the no. of C atoms. The curves adsorption-compn. of the solvent mixts. had a min., corresponding to the max. of the curve of mol. polarization of the mixt.

2650. RĂDULESCU, DAN; RĂDULESCU, FLUOR, AND OPREANU, ROMULUS. **Capillary properties of pure liquids. Desorption isotherm of carbon tetrachloride.** *Bul. Chim. Soc. Chim. România* [2], 1, 56-64 (1939) (in French).—*C.A.* **37**, 3315^{8}.

The desorption of CCl_4 from charcoal at 0°C was studied. From breaks in the desorption curve it was deduced that the thickness of the capillary layer of adsorbed CCl_4 was not greater than 10 times the radius of the molecule. Possible sources of error were discussed.

2651. DYBINA, P. V. **Obtaining sodium thiosulfate from the waste products of sulfur dyes.** *J. Chem. Ind. (U.S.S.R.)* **17**, No. 1, 58-9 (1940).—*C.A.* **34**, 4577^{4}.

The filtrate from the sulfur dyes was purified with activated charcoal and evapd. to crystn. The final product contained 95.8% $Na_2S_2O_3$.

2652. DOBINE, MATHIEU. **Adsorption of concentrated solutions of acetic acid by blood charcoal.** *Compt. rend.* **212**, 155-7 (1941).—*C.A.* **39**, 4276^{7}.

Three curves were presented for the adsorption isotherms of moist charcoal, charcoal dried at 130°C, and a charcoal with a very small proportion of water (0.35 g water for 2 g charcoal). The curve for the last case climbed rapidly to a concn. 4 N to 5 N after which the curve was nearly sym. with charcoal dried at 130°C, then followed a further rapid climb to concn. 13 N to 14 N after which the curve fell off again. If the necessary correction was made by detg. the titer of the acid, the isotherms became identical.

2653. DOBINE, MATHIEU. **Adsorption of concentrated aqueous solutions of acetic acid by blood charcoal—true adsorption of the solvent and of the solute—reciprocal action of each of these substances on the adsorption of the other.** *Compt. rend.* **212**, 339-42 (1941).—*C.A.* **39**, 4276^{9}.

The adsorption of HAc initially increased slowly with concn., then increased rapidly, and in the range between 13 N and water-free rose almost vertically. The adsorption of HAc became very large at very high concns., where the amt. of water was small. The two isotherms crossed at a point corresponding to a concn. of 11 N. Between 0 and 11 N the curve obtained by dehydration lay over that by diln. min., above 11 N the positions were reversed. Dil. HAc activated the adsorption of water because the wetting of the charcoal was facilitated. At higher concns. HAc displaced water mols. from the surface of the charcoal by reason of its larger mol. size. Solvation, which diminished with concn., brought about a weaker displacement of water and resulted in a weaker adsorption of water.

2654. JAIN, KESHO DASS AND JHA, J. B. **Adsorption of mono- and polybasic acids by sugar charcoal.** *J. Indian Chem. Soc.* **17**, 685-90 (1941).—*C.A.* **35**, 5764^{4}.

Aliphatic and aromatic monobasic acids were adsorbed from aq. soln. by sugar charcoal (sugar was carbonized with H_2SO_4, washed, dried, ground, passed through a 120-mesh sieve and finally heated at 800-850°C for almost 1 hr) in a regular manner, but adsorption curves obtained from adsorption values for org. and inorg. di- and tribasic acids were periodic in nature. Amts. of acids adsorbed from 100 cc. of soln. by 1 g sugar charcoal during 18 hrs were given for oxalic, malonic, succinic, phthalic and citric acids, and hydrogen phthalate, Na-hydrogen succinate and Na-hydrogen oxalate.

2655. KRATZ, A. **Removal of oil from engine and heating condensates with the activated carbon Hydraffin.** *Papier-Fabr.* **39**, 85-6 (1941).—*C.A.* **37**, 6781^{5}.

The effectiveness in removing oil and the percentage load which the carbon was capable of adsorbing increased with increase in the condensate temp. A condensate temp. almost as high as the b. p. under the operating pressure should be used. Pure mineral oils were better adsorbed by the Hydraffin than fatty oils, since fats or sapond. fractions may close the pores of the charcoal.

2656. STEENBERG, BÖRJE. **The adsorption of strong electrolytes on active charcoal.** *Svensk. Kem. Tid.* **53**, 447-50 (1941).—*C.A.* **38**, 5446^{9}.

H ions were primarily adsorbed on activated ash-free charcoal from dil. solns. of strong inorg. electrolytes. From strong org. electrolytes the cations were preponderantly adsorbed. In the presence of large nos. of anions in the soln. the elec. work decreased and at equil. more H ions were adsorbed. This action of the ions was influenced by their valence, concn. and individual properties. The latter may be connected with the hydrophobic character of charcoal.

2657. TISELIUS, ARNE. **Adsorption analysis: experimental arrangement and some results with mixtures of glucose and lactose.** *Arkiv Kemi, Mineral. Geol.* **14B**, No. 32, 8 pp. (1941).—*C.A.* **35**, 5407^{1}.

The necessary app. was described and the results of tests made on glucose and lactose solns. tabulated. The method will be found applicable to solns. of other saccharides. The adsorption of saccharides from aq. solns. by charcoal were governed chiefly by the size of the mol.

2658. Bhatia, S. L. and Lal, Manohar. **Adsorptive power and activation of vegetable charcoal. II.** *J. Indian Chem. Soc., Ind. & News Ed.* **5**, 111-13 (1942).—*C.A.* **37**, 1637^1.

Wood charcoal adsorbed 20.32 g I_2 per 100 g; when heated for 2 hrs at approx. 350-360°C, it adsorbed 44.196 g I_2. In a series of tests, 5-g samples of sieved wood charcoal were soaked for 24 hrs in 10 cc. of the particular org. liquids, filtered, dried at 100°C and then heated 2 hrs at 350-360°C; one g of each treated charcoal was allowed to stand overnight with 50 cc. of 0.1 *N* I_2 soln. and then the mixture was shaken for 2 hrs, after which the amt. of I_2 adsorbed was detd. The highest increase in adsorptive power (188.18%) of vegetable charcoal for I_2 was obtained by treatment of the charcoal with PrOH.

2659. Cheldelin, Vernon H. and Williams, Roger J. **Adsorption of organic compounds. I. Adsorption of ampholytes on an activated charcoal.** *J. Am. Chem. Soc.* **64**, 1513-16 (1942).—*C.A.* **36**, 5403^7.

Adsorption data were given for the following compds. on charcoal: acetic acid, propionic acid, glycine, *dl*-alanine, *β*-alanine, *l*-tyrosine, *dl*-*a*-aminobutyric acid, *dl*-norleucine, *dl*-valine, *dl*-leucine, *dl*-isoleucine, *dl*-serine, *dl*-threonine, *dl*-methionine, *l*-lysine, *l*-aspartic acid, *l*-asparagine, benzoic acid, aniline, *o*-, *m*- and *dl*-tryptophan, urea, *d*-glucose, *i*-inositol, *l*-hydroxyproline, caffeine, creatine, creatinine, Ca pantothenate (dextro), Ca pantothenate (from liver ext.), biotin, pyriodoxine-HCl, thiamine-HCl. The exptl. data fit the Freundlich adsorption isotherm.

2660. Eyster, H. C. **Enzyme action.** *Science* **96**, 140-1 (1942).—*C.A.* **37**, 897^2.

Threshold values were determined for some narcotics that affected the adsorptivity of activated charcoal for methylene blue. Threshold value was the maximum amount of drug which would not produce any decrease in adsorption. Values in % were: EtOH 8, Et_2O 1, $CHCl_3$ 0.5, Na barbital 0.1, sulfanilamide 0.025, saponin 0.06.

2661. Rao, Nagamani Shama and Jatkar, S. K. K. **Binary systems. Introduction.** *Quart. J. Indian Inst. Sci.* **5**, 65-72 (1942).—*C.A.* **40**, 1078^3.

Complex formation in liquid binary mixts. influenced the selective adsorption of either component by charcoal or silica gel. Mixts. of C_6H_6 and CCl_4 with EtOH, iso-AmOH, and AcOH were used. The dielec. polarization was found to indicate complex formation where other phys. properties were not sensibly affected. The curves usually obtained on plotting adsorption isotherms for binary liquid mixts., equil. concn. C vs. the change due to adsorption $(C_o - C)$, were discussed covering U-, inverted U-, S-, and M-shaped curves.

2662. Rao, Nagamani Shama and Jatkar, S. K. K. **Binary systems. V. System benzene-ethyl alcohol.** *Quart. J. Indian Inst. Sci.* **5**, 73-9 (1942).—*C.A.* **40**, 1078^7.

Adsorption studies gave S-curves for sugar charcoal, blood charcoal and carbon or silica gel, and inverted U-curves for Norit and sugar charcoal activated by steam and CO_2. The shapes of the curves were explained on the basis of complex formation and the assocn. of polar mols. to form nonpolar ones. The S-curves had max. at 20 mole % EtOH, and zero adsorption at 90% for carbon or silica gel and 25% for sugar charcoal.

2663. Rao, Nagamani Shama and Jatkar, S. K. K. **Binary systems. VI. Systems isoamyl alcohol-benzene.** *Quart. J. Indian Inst. Sci.* **5**, 80-6 (1942).—*C.A.* **40**, 1078^8.

Adsorption on carbon or silica gel gave an S-curve (max. at 10 mole % iso-AmOH and zero selectivity at 35 mole % 10 mole %; iso-AmOH) and on Norit an inverted U-curve with min. in both cases at 65-75 mole % 10 mole %; iso-AmOH.

2664. Rao, Nagamani Shama and Jatkar, S. K. K. **Binary systems. VII. System isoamyl alcohol-carbon tetrachloride.** *Quart. J. Indian Inst. Sci.* **5**, 87-90 (1942).—*C.A.* **40**, 1078^9.

Adsorption on both carbon or silica gel and Norit gave S-curves with max. at 10 mole % iso-AmOH, zero selectivity at 25 mole % and min. at 50 mole %. The *n*-compn. curve showed an abrupt fall at 97 mole % 10 mole % iso-AmOH where the dielectric const. showed a max.

2665. Rao, Nagamani Shama and Jatkar, S. K. K. **Binary systems. VIII. System benzene-carbon tetrachloride.** *Quart. J. Indian Inst. Sci.* **5**, 91-7 (1942).—*C.A.* **40**, 1079^1.

The selective adsorption curve for carbon or silica gel, which showed C_6H_6 to be adsorbed in moderate concns. and CCl_4 in concd. solns., was S-shaped with max. at 45 mole % C_6H_6, zero selectivity at 50 and a min. at 20-25 mole %. Norit gave an inverted U-curve with min. at 75-80 mole % C_6H_6. The evidence, aided by cryoscopic study, indicated the probable complex formation of $CCl_4.4C_6H_6$.

2666. Rao, Nagamani Shama and Jatkar, S. K. K. **Binary systems. IX. System benzene-acetic acid.** *Quart. J. Indian Inst. Sci.* **5**, 98-102 (1942).—*C.A.* **40**, 1079^2.

Adsorption studies in C_6H_6-AcOH solns. showed S-curves for blood charcoal and sugar charcoal (max. at about 20 mole % HOAc, zero selectivity at 40 for blood charcoal and 25 for sugar charcoal, min. at about 80 mole %) and an inverted U-curve for carbon or silica gel (max. at 20 mole % AcOH). This behavior was attributed to the existence of polar single mols. of AcOH in dil. soln. and of the relatively nonpolar dimeric form in which AcOH mostly existed in more concd. soln.; the dimer was more polar than C_6H_6. On the surface of the adsorbents the complex $C_6H_6.2(AcOH)_2$ may be formed.

2667. Rao, Nagamani Shama and Jatkar, S. K. K. **Binary systems. X. System ethyl alcohol-water.** *Quart. J. Indian Inst. Sci.* **5**, 103-6 (1942).—*C.A.* **40**, 1079^4.

The dielectric const. for the H_2O-EtOH system were measured at 96 kc; the calcd. P_2 curve had an abrupt min. at 50 mole % EtOH and a max. at 25, corresponding to $EtOH.H_2O$ and $EtOH.3H_2O$. Various phys. properties of the system and selective adsorption by carbon confirmed these results.

2668. SASTRI, M. V. C. **Active carbon. IV. Adsorption of methylene blue by activated charcoal: effect of anions and cations.** *Quart. J. Indian Inst. Sci.* **5**, No. 3, 145-61 (1942).—*C.A.* **40**, 3959^4.

The pH values of solns. contg. 0.15% methylene blue and varying amts. of HCl, H_2SO_4, NaOH, and NaCl were detd. before and after adsorption with active charcoal. The adsorption changed abruptly in a crit. range of pH characteristic for each specimen because of its buffer action. The adsorption of methylene blue was enhanced by conditions that favor the adsorption of anions.

2669. SASTRI, M. V. C. **Active carbon. V. Adsorption of methylene blue by activated charcoal: examination of the theory of hydrolytic adsorption.** *Quart. J. Indian Inst. Sci.* **5**, No. 3, (1942) 162-76.—*C.A.* **40**, 3959^5.

Adsorption of methylene blue by active charcoal produced a decrease in pH with a liberation of acid. The theory of hydrolytic adsorption was not supported by the exptl. results.

2670. KUHN, A. AND GERHARD, H. **The adsorption of vitamin C.** *Kolloid-Z.* **103**, 130-5 (1943).—*C.A.* **38**, 289^4.

The effect of various treatments on the adsorption of ascorbic acid by active charcoals was investigated. Without special treatment the charcoals adsorbed the acid and partly oxidized it. This oxidation could be greatly diminished by treating the charcoals with reducing agents, especially Na_2S and $Na_2S_2O_4$. The Fe content of the charcoals did not affect the oxidation. Other adsorption agents were tried; of these floridin, frankonite and bentonite did not adsorb ascorbic acid in practical quantities.

2671. LOCKHART, CARLOS E. H. **Activated charcoal. Methods of determining the adsorbing power.** *Rev. facultad cienc. quím.* **18**, 23-34 (1943) (Pub. 1945).—*C.A.* **41**, 1070^c.

The methylene blue test gave consistent results. Variation of the time of contact from 5 to 30 min. did not cause a noticeable difference. The adsorbing power for methylene blue and for H_2O in an atm. satd. with H_2O vapor at 24° to 28°C were parallel. Charcoal of high adsorbing power must be used in quantities smaller than those prescribed in the method of the Argentine Pharmacopeia.

2672. RAO, NAGAMANI SHAMA AND JATKAR, S. K. K. **Binary systems. XI. Hydrogen bond in benzene.** *Quart. J. Indian Inst. Sci.* **6**, 1-42 (1943).—*C.A.* **40**, 1079^5.

The mol. polarization P_2 and the electronic polarization P_{E2} of the polar component, and selective adsorption by carbon or silica gel and activated coconut-shell charcoal were studied in the entire concn. range for the binary systems formed with C_6H_6 by CCl_4, $CHCl_3$, CH_2Cl_2, ethylene dichloride, ethylene dibromide, C_6H_5Cl, tert-BuCl, iso-AmBr, and iso-BuCl. Anomalous apparent polarization P_2 in concd. solns. was accompanied by still more marked anomalous selective adsorption at compns. corresponding to the possible mol. complexes. The apparent selective adsorption curves indicated all the possible compds. that can be formed by H-bonding of C_6H_6 to the halogenated compds.

2673. ROZEN, A. M. **Adsorption from solutions at high pressure.** *Compt. rend. acad. sci. U.R.S.S.* **41**, 296-7 (1943) (in English).—*C.A.* **38**, 6155^8.

Adsorption isotherms of AcOH by activated carbon were detd. at 25°C under pressures of 1, 1000 and 2000 kg/cm². The isotherms at all 3 pressures were of the same type; none of them conformed to Freundlich's equation. On plotting increment of adsorption against pressure, straight lines were obtained for representative concns., viz., 0.1, 0.15, 0.05, 0.02 and 0.01 *M*.

2674. SEILER, K. AND BOLLIER, P. **Moisture content and decolorization power of granulated adsorbent carbon, Swiss Pharmacopeia. V.** *Hundert Jahre Schweiz. Apoth.-Ver (Centenaire soc. suisse pharm.)* **1843—1943**, 526—30 (1943).—*C.A.* **38**, 1843^6.

The abnormally high moisture content of treated carbon could not be ascribed to subsequent adsorption of H_2O from the air, but rather to insufficient length of drying. The moisture content did not exert an unfavorable influence on the decolorization power. The max. adsorption by the carbon was detd. in a humid atm. and under normal conditions. The efficacy of adsorption of methylene blue was tested by the saponin foam method.

2675. TISELIUS, A. AND HAHN, L. **Adsorption analysis. II. Analytical separation of the products formed in the breaking down of starches.** *Kolloid-Z.* **105**, 177-82 (1943).—*C.A.* **38**, 3921^4.

Mono- to tetra-saccharides could be adsorbed on charcoal and removed selectively with the aid of ephedrine. Losses during the process were prevented by treating the charcoal 2-10 times with the dil. displacement soln. of ephedrine before attempting to adsorb the desired compds. In this way, the differences in adsorption tendencies of the various products became more pronounced and their sepn. from mixts. was facilitated.

2676. TOLMACHEV, YU. M. **The adsorption of uranyl salts on solid adsorbents.** *Bull. acad. sci. U.R.S.S., Classe sci. chim.* **1943**, 28-34 (English summary).—*C.A.* **38**, 1158^9.

UO_2 ion was reversibly adsorbed by activated charcoal at room temp. from UO_2-$(NO_3)_2$ solns. in accordance with the Freundlich equation. Its adsorption on schists from Central Asia and the Leningrad region was irreversible and was probably accompanied by chem. reaction. The schists with greater adsorptive power had a higher initial U content.

2677. ZAREZHINSKIĬ, YA. L. **Kinetics of sorption on granular substances.** *J. Phys. Chem. (U.S.S.R.)* **17**, 32-44 (1943).—*C.A.* **37**, 6515^6.

Exptl. data on the isotherms and the rates of adsorption and desorption of H_2O and Me, Et, iso-Pr and Pr alcs. as a function of concn. were detd. Measurements were made on single grains of activated charcoals prepd. from anthracite, birch wood and from bones. While the adsorptive capacities of the 3 charcoals differed by a factor of 8, the initial rates of adsorption differed by only 30-40%.

2678. Burgers, W. G. **Dependence of the adsorption isotherm on the amount of adsorbent.** *Rec. trav. chim.* **63**, 46-52 (1944) (in French).—*C.A.* **39**, 1584¹.

The adsorption of AcOH in dil. aq. soln. (0.01 to 0.4 *N*) was measured for 1, 2 and 3 g of carbon (Norit). The adsorption proceeded to equil. and in the range observed the diminution of the specific amt. adsorbed with increasing amt. of adsorbent was probably solely attributable to the exhaustion of the soln.

2679. Claesson, Ingrid and Claesson, Stig. **The adsorption of some high-molecular substances on active carbon.** *Arkiv. Kemi, Mineral. Geol.* **A19**, No. 5, 12 pp. (1944) (in English).—*C.A.* **41**, 1524*b*.

When a soln. of high-molecular substances such as nitrocellulose, synthetic rubber, or polyvinyl acetate was adsorbed on carbon, it was found that adsorption increased with decreasing mol. wt for the same class of substances. The adsorption equil. was not obtained immediately and the time was longer for lower mol. wts. With decreasing mol. wt the affinity factor *f* increased more than the space factor.

2680. Damerell, V. R. and Urbanic, A. **A study of the colloidal system carbon dispersed in xylene.** *J. Phys. Chem.* **48**, 125-33 (1944).—*C.A.* **38**, 3532⁵,

Certain surface-active chemicals greatly increased the degree of dispersion of carbon in xylene, as judged by sedimentation and ultramicroscopic analysis. Lecithin, Cu oleate, Co naphthenate and Aerosol OT (Na dioctyl sulfosuccinate) were most effective, in the order named. Results varied somewhat for the 3 different types of carbons investigated. The best dispersions were obtained with the type which had the least adsorbed O_2 and the smallest surface area. Oleic acid, which was one of the several surface-active agents which did not increase the degree of dispersion, was not adsorbed by the carbon particles, but Cu oleate and Co napthenate were adsorbed.

2681. Gyani, B. P. **Studies of adsorption in relation to constitution. III. Adsorption of carbohydrates from aqueous solutions by charcoal.** *J. Indian Chem. Soc.* **21**, 79-82 (1944).—*C.A.* **39**, 2240⁷.

Ten of the simpler saccharides, arabinose, dextrose, galactose, levulose, maltose, mannose, raffinose, rhamnose, sucrose, and xylose, were studied; animal charcoal was used as adsorbent. The adsorption increased with increasing mol. wt, and sugars of the same family form distinct groups of adsorption isotherms. The adsorption coeffs. of the various sugars of the same family were close together and increased in regular steps in passing from the pentoses to the bioses. The adsorption equation $x/m = ac^{1/n}$ was generally obeyed. Silica gel adsorbed the sugars poorly.

2682. Kiselev, A. V. and Shcherbakova, K. D. **Adsorption from solutions and the microporosity of activated charcoals.** *Doklady Akad. Nauk S.S.S.R.* **45**, 257-9 (1944); *Compt. rend. acad. sci. U.R.S.S.* **45**, 241-3 (1944).—*C.A.* **39**, 5150⁹.

The adsorption of aliphatic alcs. (butyl through heptyl), fatty acids (acetic through heptylic), and Na salts of oleic and erucic acids from aq. solns. by a specially purified activated charcoal was studied. At low concns. the adsorption, which increased with an increase in mol. wt, was apparently controlled by contending forces acting on the adsorbate. At higher concns., corresponding to max. adsorption, the vol. of the micropores of the adsorbent was the factor controlling the extent of adsorption.

2683. Papps, George and Othmer, Donald F. **Tall oil-separation of stearic and abietic acids by selective adsorption after hydrogenation.** *Ind. Eng. Chem.* **36**, No. 5, 430-4 (1944).—*C.A.* **38**, 3181¹.

Equil. studies were made to det. the adsorption isotherms of stearic acid by activated charcoal at 35.5°C, with the following solvents: hexane, heptane, petroleum ether, isoöctane, Solvesso 1, Solvesso 2, iso-PrOH, PrOH, MeOH, EtOH, nitromethane, nitroethane and 1- and 2-nitropropanes. Similar data were reported for pure abietic acid with Solvesso 1, Solvesso 2, MeOH, EtOH, iso-PrOH, PrOH, nitromethane, nitroethane and 1- and 2-nitropropanes. Selective-column studies for mixts. contg. 50% of each acid and for hydrogenated tall oil were reported. Stearic acid was preferentially adsorbed and the sharpness of sepn. depended mainly on the solvent, the best of which was 1-nitropropane.

2684. Régnier, Jean; Bazin, Suzanne and Féré Jacqueline. **Adsorption on charcoal, without agitation, of different salts of procaine base. Determination of cation and anions.** *Compt. rend. soc. biol.* **138**, 159-61 (1944).—*C.A.* **39**, 4539⁴.

The solns. were filtered through purified vegetable charcoal under identical conditions, and the adsorption of cation and anion was detd. Fixation increased in the order: isobutyrate, hydrochloride, phenylpropionate, monobasic citrate, dibasic citrate. In every case fixation of cation and anion was nearly equal, as though mols. of salt were adsorbed, although the compds. were known to be highly ionized.

2685. Régnier, Jean and Bazin, Suzanne. **Fixation on charcoal, without agitation, of different sodium salts. Determination of base and acids.** *Compt. rend. soc. biol.* **138**, 337-8 (1944).—*C.A.* **39**, 4539⁵.

Na salts in solns. of NaCl, Na isobutyrate, and Na citrate, 0.1-0.001 *M*, were adsorbed to a lesser degree than the corresponding procaine salts. fixation of Na was about the same for chloride and citrate and considerably less for isobutyrate. Approx. equal amts. of cation and anion were adsorbed.

2686. Régnier, Jean and Bazin, Suzanne. **Fixation on charcoal, without agitation, of salts of procaine base mixed with sodium salts. Determination of bases and acids.** *Compt. rend. soc. biol.* **138**, 375-6 (1944).—*C.A.* **39**, 4539^{6}.

Mixts. of procaine isobutyrate and NaCl, and procaine-HCl and Na isobutyrate, 0.1-0.002 *M*, were used. In either case approx. as much cation as anion was fixed, but a larger proportion of the procaine than of the Na, and a larger proportion of the HCl than of the isobutyric acid.

2687. Rozen, A. M. **Adsorption from solutions at high pressures.** *J. Phys. Chem. (U.S.S.R.)* **18**, 383-5 (1944).—*C.A.* **39**, 3190^{9}.

Exptl. data on the adsorption of HOAc on active charcoal at 25°C and at pressures of 1, 1000, and 2000 atm. were shown in 4 sets of graphs. The form of the adsorption curves was the same at all three pressures, and the relations of pressure to percentage increase in adsorption were strictly linear.

2688. Bodforss, Sven and Ehrlen, Inge. **Adsorption of amine bases on activated carbon.** *Kgl. Fysiograf. Sällskap. Lund, Förh.* **15**, 3-12 (1945) (in German).—*C.A.* **43**, 6037*d*.

The adsorption of amine bases on activated carbon (Kahlbaum, dried at 110° to const. wt) was detd. at 19°C ± 1°. Bases that were sufficiently strong, such as mono-, di-, and trimethylamine, mono-, di-, and triethylamine, nicotine, and piperidine were detd. by tritration with HCl. Special methods for weaker bases were described. Tables of the adsorption data were given. In water, adsorption of the aliphatic bases increased with mol. wt. Aliphatic bases were adsorbed much less than aromatic bases. However, piperidine was adsorbed less than diethylamine. Nicotine demonstrated the constitutional factor in adsorbability. In EtOH, increased mol. wt usually increased adsorption.

2689. Ferrandis, Vincente Aleixandre. **Adsorption from nonaqueous solutions.** *Anales fis. y quim (Madrid)* **41**, 709-45 (1945).—*C.A.* **41**, 4350*e*.

Adsorption by activated charcoal or activated Al_2O_3 was studied from non-aq. solns. of oxalic, malonic, succinic, glutaric, latic, malic, tartaric, citric, mono-, di-, and trichloroacetic, bromoacetic, cyanoacetic, phenylacetic, fumaric, maleic, mesaconic, and cetraconic acids. The solvents were MeOH, EtOH, iso-PrOH, isoBuOH, Et_2O, nitrobenzene, $CHCl_3$, CCl_4, and CS_2. In general, there was competition between soly. and adsorbability. The greater the adsorption of a substance, the less was the degree of ideality of its soln. The presence of OH or COOH groups and double bonds raised the adsorbability of the acids. Cis isomers were adsorbed better than trans in all solvents tested.

2690. Hassler, John W. and McMinn, W. E. **The nature of active carbon.** *Ind. Eng. Chem.* **37**, 645-9 (1945).—*C.A.* **39**, 3989^{4}.

Adsorption isotherms were detd. at 25°C of methylene blue, malachite green, alizarin red, ponceau red, blackstrap molasses, caramel, phenol, and I_2 in aq. solns., (the first 3 in EtOH soln.) on 9 com. carbons. The sp. adsorptive power changed with grinding of the various carbons. Variation of sp adsorptive power was brought about by changes in the carbons by oxidation. With carbons prepd. by activating cellulose waste in CO_2 for various lengths of time, the adsorption of I_2 increased with activation time of 15, 20, and 30 mins. The Freundlich isotherms were parallel. Impregnation with $ZnCl_2$ and with $CaCl_2$ changed the slope of the isotherm. Adsorption of CCl_4 vapor decreased the adsorption of methylene blue from aq. soln.

2691. Velasco, J. R. and Ruiz, J. Oliver. **Adsorption of dyes.** *Anales fís. y quím. (Madrid)* **41**. 1409-28 (1945).—*C.A.* **42**, 7129*d*.

The adsorptions of aq. solns. of Alizarin Red, Alizarin Brilliant Orange, Acid Navy Blue, Brilliant Scarlet, and Brilliant Green by activated carbon (Merck) were detd. The results could be interpreted rigorously up to the point of inflection by $a = (abc + abfc^2)/(1 + ac + abc^2)$. After the point of inflection there was a different phenomenon, since, when it appeared that the surface reached satn., the quantity adsorbed began to increase on increasing the concn. equil. The theoretical assumption of Langmuir for gases was generalized to apply to the present aq. solns.

2692. Agroskin, A. A. and Pentrenko, I. G. **Selective wetting of coal.** *J. Applied Chem (U.S.S.R.)* **19**, 737-46 (1946) (in Russian).—*C.A.* **41**, 4290*d*.

Contact angles θ were detd. at the boundaries coal-water-air and coal-water-org. liquid by projecting the contours of the drop with a 10,000-fold magnification. Drops of $C_6H_4(CH_3)_2$, $C_6H_5CH_3$, C_6H_6, gasoline, kerosene, deposited on polished coal immersed in water, showed a neg. wettability $B = \cos\theta$, the org. liquid failing to displace the water; the energy necessary to overcome the hysteresis was higher than the energy liberated in wetting. Owing to hysteresis, a water drop hanging vertically from a polished coal surface was not torn off by a spreading kerosene film, despite the equil. gain in surface energy (26.7-12.4 = 14.3 ergs/cm^2).

2693. Dzhigit, O. M.; Dubinin, M. M.; Kiselev, A. V., and Shcherbakova, K. D. **Active charcoals and adsorption from solutions.** *Compt. rend. acad. sci. U.R.S.S.* **54**, 141-4 (1946) (in English).—*C.A.* **41**, 2625*f*.

The adsorption of mainly butyl and heptyl alcs. from water solns. by means of 6 different charcoals ranging widely in pore size was investigated. The charcoal structure was shown to have a strong effect on the shape of the adsorption isotherms and on the values of limit adsorption. The rule of const. adsorbed limit vols. was approx. true for each of the carbons studied for the 4 alcs. butyl to heptyl. The micropores of the charcoals were equally accessible to the different alcs.

2694. Ghosh, B. and Khan, Ava. **Studies on the absorption of quinine by different adsorbents with a view to its extraction from very dilute solutions.** *J. Indian Chem. Soc.* **23**, 344-8 (1946).—*C.A.* **41**, 4894b.

As much as 96% of the quinine was adsorbed from a 0.15% soln. by the amt. of charcoal which was only twice the wt of the quinine sulfate.

Fuller's earth and kieselguhr adsorbed 86% and 62%, resp. Kaolin, MnO_2, tin oxide, silicic acid, and $Al(OH)_3$ adsorbed less in that order. Elution of the charcoal with Na_2CO_3 soln. recovered 84% of the quinine. Totaquine behaved similarly to quinine.

2695. GUPTA, PROMODERANJAN AND DE, PADMALOCHAN. **Polarity of molecules in relation to their adsorption by charcoal.** *J. Indian Chem. Soc.* **23**, 353-60 (1946).—*C.A.* **41**, 6106*b*.

Tests with a sugar charcoal in a medium showed that the trans form was better adsorbed in the case of fumaric and maleic acids. Introduction of a chloro group increased the adsorption, whereas a hydroxyl group, and particularly an amino group, decreased the adsorption. The hydroxyl group also decreased the adsorption in the case of BzOH and salicylic acid. Aniline was adsorbed better than phenol and BzOH adsorbed better than salicylic acid in aq. medium but the reverse held in C_6H_6 and $CHCl_3$ mediums.

2696. HARTMAN, ROBERT J.; KERN, RAYMOND A., AND BOBALEK, EDWARD G. **Adsorption isotherms of some substituted benzoic acids.** *J. Colloid Sci* **1**, 271-6 (1946).—*C.A.* **40**, 5317^2.

Adsorption isotherms for 7 acids on charcoal from C_6H_6 showed the following descending order: *o*-aminobenzoic, salicylic, *o*-chlorobenzoic, *p*-toluic, benzoic, *m*-toluic, and *o*-toluic. The adsorptions followed the Freundlich equation and the consts. of the equation were evaluated.

2697. KISELEV, A. V. AND SHCHERBAKOVA, K. D. **Adsorptive properties and structure of adsorbents. I. Limiting adsorption from solutions on activated charcoal.** *Acta Physicochim. U.R.S.S.* **21**, 539-54 (1946) (in English).—*C.A.* **41**, 19^h.

Investigation of the adsorption from aq. soln. by ash-free charcoal of the homologous series of acids from acetic to caprylic and alcs. from butyl to heptyl showed that the limiting adsorbed vols. were const. at about 0.28 cc. per g. Adsorption (the difference between the amt. of adsorbate in the adsorption space and in the same vol. of the surrounding soln.) passed through a max. for adsorbates of high soly. Dimethylethylcarbinol, cyclohexanol, phenol, benzoic acid, salicylic acid, methylene blue, and Congo red yielded adsorption vols. of 0.2, 0.24, 0.27, 0.22, 0.19, 0.20, and 0.04 cc. per g, resp.

2698. VOLMAN, D. H. AND KLOTZ, I. M. **Adsorption isotherms for hydrogen-bonded liquids on charcoal.** *J. Chem. Phys.* **14**, 642 (1946).—*C.A.* **41**, 1906d.

In van der Waals adsorption on charcoal, a plot of the wt adsorbed as a function of the relative pressure of the vapor gave curves roughly the same for most compds. The exceptions were characterized by strong H-bonds in the liquid state. When the b.p. was plotted against the van der Waals a, "normal" liquids lay in a narrow range between 2 curves. The compds. H_2O, EtOH, MeOH, NH_3, H_2S, and HCl, which lay outside the "normal" region, were characterized by strong H bonds in the liquid state. Evidently there was a strong parallelism between the adsorbability and condensation properties of a gas.

2699. WETTERHOLM, ALLAN. **Frontal adsorption analysis as a quantitative method.** *Harald Nordenson Anniv. Vol.* **1946**, 460-7.—*C.A.* **43**, 5325*e*.

The analysis was first carried out with known solns. of each of the pure components of the mixt. to det. the change in the concn. which would cause unit change in the n, $\Delta\mu$. The percentage content of each component became $fX\Delta\mu/g$, were $g=$ grams of sample/100 ml of soln. The method was employed in the analysis of mixts. of glycerol and ethylene glycol, with water as solvent and highly activated Höganäs MK carbon as adsorbent. Under these conditions no adsorption displacement took place, even when aniline was added to the mixt. as a further test. The analysis could be carried out with as little as 25 ml of the 0.5% soln. of the unknown used.

2700. AKAMATU, HIDEO AND NAGAMATSU, KAZUO. **A new suggestion for a model representing the structure of carbon black.** *J. Colloid Sci.* **2**, 593-8 (1947).—*C.A.* **42**, 2488*c*.

X-ray diffraction patterns were obtained for violanthrone, $C_{34}H_{16}O_2$; isoviolanthrone, $C_{34}H_{16}O_2$; and pyranthrone, $C_{30}H_{14}O_2$, which, because of their high content of 6-membered C rings, were considered to be models for elementary carbon. Patterns for 3 dyes representing violanthrone (Indanthrene Dark Blue B.O., Color Index No. 1099), Isoviolanthrone (Indanthrene Violet R extra, Color Index No. 1103), and pyranthrone (Indanthrene Gold Orange G, Color Index No. 1096), closely resembled those of carbon black. The pure compds. gave patterns quite different from either carbon black or graphite. When the three compds. were all mixed and repptd., the product gave a diffraction pattern almost indistinguishable from carbon black.

2701. DAVIDSON, G. F. **Determination of methylene blue.** *Shirley Inst. Mem.* **21**, 29-39 (1947).—*C.A.* **42**, 841*c*.

Wts of H_2O obtained by drying methylene blue at 105°C for 4-22 hrs agreed with those obtained by drying over P_2O_5 at room temp. for 13-27 days. A soln. contg. approx. 0.08 millimoles of I_2 and 0.2 moles of H_2SO_4 in 100 ml was reduced at 50°C with a slight excess of $CrSO_4$ soln. after removal of air with CO_2. The soln. was stirred for 0.5 hr with CO_2 and titrated potentiometrically with 0.01 *N* $K_2Cr_2O_7$. The vol. $K_2Cr_2O_7$ required to oxidize the reduced I_2 was detd. from the 2 breaks in the titration curve. The error was ±0.5%.

2702. GROVES, T. E.; BOWDEN, S. T., AND JONES, W. J. **Quantity of adsorbent and temperature as factors in adsorption from solution.** *Rec. trav. chim.* **66**, 645-54 (1947) (in English).—*C.A.* **42**, 2490*a*.

Adsorption of AcOH from aq. soln., up to 0.4 N, was detd. using 1, 2, and 3 g of activated charcoal powder per 50 cc. of soln. The isotherms were independent of the amt. of adsorbent. The isotherms obeyed the equation, $x/m = k\ c^n$, with the following values for the consts. k and n, resp.; at 0°C, 3.16, 0.58; 18°C, 3.08, 0.63; 50°C, 2.42, 0.77; 80°C, 2.17, 0.80.

2703. Hesse, Gerhard and Sauter, Oskar. **The pH dependence of adsorption of acids and bases.** *Naturwissenschaften* **34**, 251 (1947).—*C.A.* **43**, 6035*c*.

Acids were best adsorbed on amphoteric adsorbents in acid medium and vice versa. True adsorption was assumed with charcoal and the fact that acids adsorb best in acid medium was explained by preference of the charcoal for unionized acid.

2704. Innes, W. B. and Rowley, H. H. **Adsorption equilibriums of liquid mixtures of carbon tetrachloride and methanol with charcoal.** *J. Phys. & Colloid Chem.* **51**, 1172-81 (1947).—*C.A.* **42**, 1101*f*.

The selective adsorption of CH_3OH and CCl_4 on charcoal from a liquid mixt. of the two was measured directly and found to agree reasonably well with values calcd. from adsorption measurements of the mixed vapors. At 25°C, CCl_4 was preferentially adsorbed on charcoal below 0.6 mole fraction of CCl_4 in the liquid phase. At higher mole fractions of CCl_4, CH_3OH was selectively adsorbed.

2705. Kuznetsov, M. I. and Dybskiĭ, V. V. **Kinetics of the swelling of coal in pyridine.** *J. Applied Chem. (U.S.S.R.)* **20**, 976-96 (1947) (in Russian).—*C.A.* **42**, 5205*f*.

The rates of swelling were detd. by the vol. of C_5H_5N adsorbed by 7 types of coal ground to 900 mesh/cm^2 and pressed, under 30 atm., into 1-g cylindrical briquets of 2 cm diam. The briquets were supported by a glass filter, giving access to the liquid from the bottom. A pyridine reservoir, connected with the measuring pipet, permitted uninterrupted observation during 96 hrs. The "physical" capacity of the sample, as distinct from the absorption due to swelling, was detd. in each case with alc.; the corresponding amt. was subtracted from the vol. of C_5H_5N absorbed, giving the pure colloidal swelling effect. The figures were further corrected for moisture and ash content and reduced to 1 g dry and ash-free substance. Three coals swelled very rapidly in the initial stages and reached satn. in a few hrs; the remaining coals progressed gradually and there was no indication of satn. after 96 hrs.

2706. Lemieux, R. U. and Morrison, J. L. **Adsorption of aliphatic acids on activated charcoals.** *Can. J. Research* **25B**, 440-8 (1947).—*C.A.* **42**, 434*i*.

Max. adsorption on charcoals of different degrees of activation was detd. for acetic acid about 2.0 *N*, propionic acid about 0.5 *N*, butyric acid about 0.35 *N*, valeric acid about 0.25 *N*, and caproic acid about 0.04 *N*. The amt. adsorbed per g plotted against the concn. in the substrate exhibited a typical Langmuir curve. The activation process was discussed.

2707. Ruderman, L. Ya. **Physicochemical properties of the mixtures obtained in the recovery of organic solvents with activated carbon.** *J. Applied Chem. (U.S.S.R.)* **20**, 908-11 (1947) (in Russian).—*C.A.* **42**, 4829*b*.

Numerical calcn. of the amts. of upper and of lower liquid layer.(obtained with a ternary liquid mixt. of given compn. with the aid of the miscibility triangle) was illustrated by the example of the H_2O -EtOH-Et_2O.

2708. Swann, Sherlock, Jr. and Kerfman, H. D. **The electrolytic reduction of carbonyl compounds at carbon cathodes.** *Trans. Electrochem. Soc.* **92**, 11 pp. (1947).—*C.A.* **42**, 41*g*.

Several types of carbon were used as cathodes in the electrolytic reduction of EtMeketone, benzophenone, acetophenone, benzoic acid, *N, N-dimethylvaleramide*, and *p*-aminobenzanilide in acid soln. and of dipropyl ketone, benzophenone, and acetophenone in alk. soln. The cathodes were active only in the reductions of EtMeketone in acid soln., benzophenone in alk. solns., and acetophenone in both acid and alk. solns. Marked differences in the activities of the different forms of carbon were noted.

2709. Dzhigit, O. M.; Kiselev, A. V.; Terekhova, M. G., and Shcherbakova, K. D. **Adsorptive properties and the structure of adsorbents. II. Adsorption by active carbon from solutions in a wide range of concentrations.** *J. Phys. Chem. (U.S.S.R.)* **22**, 107-20 (1948) (in Russian).—*C.A.* **42**, 5298*c*.

Charcoal from a fruit stone, contg. 0.66% ash, was used. The adsorbed amt. of partially miscible fatty acids and alcs. increased with concn. to a limit which, when expressed as vol. adsorbed, was almost identical for valeric, hexanoic, heptanoic, and octanoic acids, and butyl, amyl, hexyl, and heptyl alcs. The max. varied from 0.50 to 0.57 cc./g and the liquid vol. of MeOH adsorbed from the vapor at the start of the hysteresis curve was 0.53 cc./g. The amt. adsorbed of highly sol. substances first increased with concn., reached a max., and decreased again. The concn. of the max. adsorption was 2.5, 2, and 13. mol. for AcOH, propionic, and butyric acids, and 3.3 and 1.8 M for EtOH and propanol, resp. The max. values of isobutylcarbinol, dimethylethyl-carbinol, phenol, and cyclohexanol were 0.46, 0.39, 0.47, and 0.38 cc./g, resp.

2710. Hansen, Robert S. **Multimolecular adsorption from binary liquid solutions.** *Univ. Microfilms Publ.* No. **1052**, 141 pp. (microfilm $1.76, paper enlargements $14.10); Microfilm Abstracts 8, No. 2, 33-4 (1948).—*C.A.* **43**, 4536*h*.

2711. Holman, Ralph T. and Hagdahl, Lennart. **Displacement analysis of lipides. Preliminary studies with normal saturated fatty acids.** *Arch. Biochem.* **17**, 301-10 (1948).—*C.A.* **42**, 6392*b*.

Satd. fatty acids can displace their lower homologs from charcoal. Cetyl pyridinium chloride and especially picric acid serve as displacement agents. The displacements are not quant. but may serve in qual. studies.

2712. Iwakami, Yoshimoto. **Adsorption of iodine in various organic solvents.** *J. Chem. Soc. Japan*, Pure Chem. Sect., 69, 9-10 (1948).—*C.A.* **46**, 8460*c*.

I_2 was adsorbed by active charcoal from the solns. (1) in MeOH, ethyl ether, (2) CS_2, toluene. From the results, the brown color in (1) was attributed to the combination of I_2 and solvent through polar force. The violet color in (2) was attributed to the condition in which I_2 existed in the free state.

2713. Kharin, A. N. and Protasov, P. N. **Uptake of substances by granulated carbon from a stream of solution. I. The dynamics of the sorption of acetic acid by carbon with coarse pores.** *Zhur. Fiz. Khim.* 22, 1219-39 (1948).—*C.A.* 43, 1238*e*.

AcOH solns., 0.005-0.05 *N*, were filtered through 20-125 cm long columns of birch charcoal, of which the ash content was 0.20% and the pore vol. 80%, at a speed of 0.5 cm/min. The amt. of AcOH between the adsorbent grains could not be neglected.

2714. Kipling, J. J. **The adsorption of acetic acid and butylamine from aqueous solutions by activated charcoals.** *J. Chem. Soc.* **1948**, 1483-7.—*C.A.* 43, 2485*d*.

Granular charcoal, steam-activated, showed a max. adsorption of AcOH in acid soln., a marked inflection point at pH 5-6, and negligible adsorption in alk. soln. Adsorption of $C_4H_9NH_2$ showed a max. in alk. soln. decreasing to zero at pH 6. Max. adsorption increased with continued activation of the charcoal, characterized by "activation yield" but the inflection point remained unchanged. The no. of mols. of AcOH and $C_4H_9NH_2$ (having approx. the same area per mol.) adsorbed was a function of the activation yield; this indicated adsorption of undissocd. mols.

2715. Kipling, J. J. **The behavior of charcoal columns in the adsorption and desorption of acid in aqueous solution.** *J. Chem. Soc.* **1948**, 1487-96.—*C.A.* 43, 3686*i*.

Breakdown and distribution phenomena in the adsorption of AcOH soln. on graded charcoal were studied as functions of time, length of column, flow rate, initial concn. and granule size. Results were expressed on the basis of the theory of the kinetics of adsorption of gases from air streams.

2716. Lesokhina, G. F.; Gol'bert, K. A., and Zhukhovitskii, A. A. **Adsorption from solutions by porous adsorbents.** *J. Phys. Chem. (U.S.S.R.)* 22, 363-77 (1948) (in Russian).—*C.A.* 42, 5741*f*.

C_6H_6 was positively adsorbed from its mixts. with CCl_4 at all concn. by sugar charcoal, bakelite charcoal, birch charcoal, anthracite charcoal, silica gel, hopcalite, and askanite (activated clay). The max. of the apparent adsorption was near 20 mol. % of C_6H_6. C_6H_6 was positively adsorbed also from cyclohexane by charcoal and silica gel, and the max. was near 25% C_6H_6. From CCl_4-C_6H_{12} mixts., CCl_4 was adsorbed by charcoal and silica gel, and the max. was near 20% CCl_4. In the systems C_6H_6-heptane and CCl_4-heptane, C_6H_6 and CCl_4 were adsorbed by birch charcoal, and the max. was near 50 and 55 mol. %, resp.

2717. Lesokhina, G. F.; Gol'bert, K. A., and Zhukhovitskii, A. A. **Adsorption from solutions of partially miscible liquids.** *Zhur. Fiz. Khim.* 22, 968-74 (1948).—*C.A.* 43, 461*d*.

If two-phase mixts. of cyclohexane + acetonitrile and cyclohexane + nitromethane were shaken with birchwood charcoal, the liquid might become homogeneous since the charcoal adsorbed preferentially that compd. which was present in the smaller amt. The compn. of the adsorbed part could be calcd. if the vol. of the adsorption space was assumed to be const. (0.53 cc./g). This compn. was 33 mol. % cyclohexane + 67 mol. % acetonitrile when the equil. soln. contained 6 mol. % cyclohexane.

2718. Mukherjee, J. N.; Chatterjee, B., and Ray, A. **Liberation of hydrogen, aluminum, and ferric ions from pure clay minerals on repeated salt treatment and desaturation.** *J. Colloid Sci.* 3, 437-45 (1948).—*C.A.* 43, 372*c*.

The treatment was a two-step process involving leaching the mineral with N $BaCl_2$ and then leaching with 0.02 N HCl. The treatment was carried through 4 cycles for montmorillonite, 8 cycles for kaolin and 5 cycles for pyrophyllite. The base-exchange capacity of montmorillonite, and pyrophyllite decreased markedly with repeated cyclic treatments, but the capacity of kaolin was unchanged after 8 cycles. The presence of dissolved SiO_2 in the exts. from the first 2 cycles with montmorillonite and pyrophyllite showed that decompn. of the absorption complex occurred with these minerals.

2719. Sulzbacher, M. and Pariser, R. **II. Isolation of ethylene chlorohydrin by adsorption.** *J. Soc. Chem. Ind.* 67, 205-6 (1948).—*C.A.* 43, 6*a*.

Ethylene chlorohydrin can be removed from dil. aq. soln. by adsorption on granulated active charcoal. However, such charcoal will not remove the chlorohydrin from an EtOH soln.

2720. Tendeloo, H. J. C.; Mans, A. E., and Hoogh G. de. **Titration of adsorbed acids.** *Rec. trav. chim.* 67, 397-403 (1948).—*C.A.* 43, 5343*a*.

Titration curves obtained by the potentiometric titration of picric acid, salicylic acid, maleic acid, and phosphoric acid in the presence of varying amts. of Norit had the form typical of weak acids. Curves showed the large buffering effect.

2721. Tendeloo, H. J. C.; Mans, A. E., and Hoogh, G. de. **The weak-acid behavior of adsorbed strong acids in solutions containing activated carbon.** *VII° Congr. intern. inds. agr., Paris* 2, 182-8 (1948).—*C.A.* 44, 8196*b*.

Activated carbon (Norit) was purified according to Miller. The acids investigated were picric, *o*-nitrobenzoic, maleic, and phosphoric. From titration curves a buffer capacity was found when activated carbon was added.

2722. Velasco, J. R. and Ruiz, J. Oliver. **Adsorption in solutions. V. Theoretical discussion of experimental results.** *Anales real. soc. españ. fís. y. quím., Ser, B,* 44, 69-94 (1948).—*C.A.* 42, 7129*h*.

For distd. water solns. of Brilliant Scarlet R, Direct Violet, ammonium eosinate, Alizarin Red, Alizarin Orange, Formyl Violet, Brilliant Green, Crystal Violet, and Diphenyl Orange, adsorption isotherms at 2 and 25°C with Merck active carbon showed that the quantity adsorbed per g of adsorbent varied regularly and continuously with the concn. in equil. under given conditions. The isotherms showed a regular portion, with a tendency toward a limiting adsorption, in which the adsorbed layer was unimol. The quantity adsorbed per g of adsorbent diminished with rise of temp. The adsorbability changed regularly and continuously, decreasing on increase of initial concn. It was shown that, for various solns., adsorbability at a given concn. was greater the less the soly. of the dissolved substance.

2723. Vogt, H. **Adsorptive power of carbon and other substances for 8-hydroxyquinoline in aqueous solution.** *Pharm. Zentralhalle* **87**, 38-44 (1948).—*C.A.* **44**, 6700*g*.

The adsorption of 8-hydroxyquinoline from aq. soln. was studied by shaking small amts. of adsorbent (0.1-1.0 g) with the soln. and detg. the amt. of the base unadsorbed by titration with 0.1 *N* $KBrO_3$ and 0.1 *N* $Na_2S_2O_3$. Charcoal was much more efficient than silica gel, Al_2O_3, or clay, and different brands of charcoal showed considerable variation. The amt. adsorbed increased with increasing pH over the range pH 1-5.2.

2724. Weizmann, C.; Bergmann, E.; Sulzbacher, M., and Pariser, E. R. **III. Adsorption of acetone, butyl alcohol, and 2.3-butylene glycol from dilute solutions.** *J. Soc. Chem. Ind.* **67**, 225-7 (1948).—*C.A.* **43**, 6*b*.

From dil. (2-4%) aq. solns., butylene glycol synthesized by *Clostridium polymyxa* and acetone, and butyl alc. produced simultaneously by *Cl. acetobutylicum* can be adsorbed on active charcoal. The affinity of the glycol for the adsorbent was so great that desorption was a more difficult operation. Acetone will perform the extn. In the case of acetonebutanol, it was possible not only to adsorb the mixt., but also to isolate the two components separately by selective adsorption.

2725. Akazawa, Yasaburo; Nakazawa, Taichi, and Okada, Mitsuo. **Adsorbability tests on activated charcoal by capillary analysis. II.** *J. Pharm. Soc. Japan* **69**, 328-30 (1949).—*C.A.* **44**, 1671*g*.

The correct value was found by filtering 50 ml soln. of 0.025-0.0025% methylene blue through a 9-cm paper, discarding the first 30 ml of filtrate, and colorimetric examn. of the next filtrate.

2726. Akazawa, Yasaburo; Nakazawa, Taichi; Okada, Mitsuo, and Ihara, Fujio. **Adsorbability tests on activated charcoal by capillary analysis. III.** *J. Pharm. Soc. Japan* **69**, 330-41 (1949).—*C.A.* **44**, 1671*g*.

The max. concn. of methylene blue which gave a stable curve for each estn. was 0.1%; a concn. of 0.05% was the best.

2727. Chmutov, K. V. and Alekseev, N. G. **Effect of irradiation by supersonic waves on the adsorption of fatty acids by finely porous carbon.** *Doklady Akad. Nauk S.S.S.R.* **67**, 321-3 (1949).—*C.A.* **43**, 7774*f*.

The supersonic field was applied to: (a) 0.1-g samples of carbon in contact with pure H_2O, before adsorption, (b) the carbon in contact and in adsorptive equil. with the 0.01 *N* solns. of the fatty acids. Equil. was reached in 1 hr. On coarse-pore carbon, the adsorptions of propionic, valeric, and heptylic acids, amounted to 1.190, 2.210, and 2.720 mmllimoles/g, resp.; preliminary supersonic irradiation had no effect and irradiation of the equil. system resulted only in very slight increases (1.238, 2.224, and 2.816). With a finely porous carbon, the adsorptions, without irradiation, were 0.749, 0.210, and 0.119, on irradiation (a), 0.475, 0.093, and 0.197, on irradiation (b), 0.895, 0.247, and 0.275. With an open-pore lampblack, the adsorption remained unchanged.

2728. Corrin, M. L.; Lind, E. L.; Roginsky, Adelle, and Harkins, W. D. **Adsorption of long-chain electrolytes from aqueous solution on graphite known area and on polystyrene.** *J. Colloid Sci.* **4**, 485-95 (1949).—*C.A.* **44**, 19*f*.

The adsorption of Na dodecyl sulfate and K myristate from aq. solns. on ash-free graphite of area 3.47 m^2/g (detd. by N_2 adsorption) was measured as a function of the concn. of long-chain compds. at 30°C for Na dodecyl sulfate and 35°C for K myristate. The area of the adsorbed soap mols. reached a min. of 51.0 $A.^2$/mol. for Na dodecyl sulfate and 36.6 $A.^2$/mol. for K myristate. A discontinuity was observed in the adsorption isotherms for Na dodecyl sulfate at a low concn. which corresponded to the crit. concn. for micelle formation. Measurements were also made of the adsorption of Na dodecyl from aq. solns. on polystyrene whose area (detd. by N_2 adsorption) was of the order of 100 m^2/g.

2729. Delga, Jean. **Adsorption of sulfonamides by activated charcoals. Properties of some adsorption complexes.** *Compt. rend.* **229**, 121-3 (1949).—*C.A.* **44**, 6578*i*.

Solns. of *p*-aminobenzenesulfonamide, *p*-aminobenzenesulfonamidopyridine, *p*-aminobenzenesulfonamidothiazole, *p*-aminobenzenesulfonylaminomethyldiazine, and *p*-aminobenzenesulfonylguanidine in H_2O, $(CH_3)_2CO$, EtOH, *N* HCl, and *N* NaOH when stirred with activated charcoal reached an equil. adsorption in 30 mins. obeying Freundlich's rule. The adsorbed sulfonamides were strongly held and were not removed by the above solvents, the most stable adsorption complex was formed from HCl soln.

2730. Dubinin, M. M.; Chmutov, K. V., and Alekseev, N. G. **Structure of active carbons and time of attainment of the adsorption equilibrium.** *Doklady Akad. Nauk S.S.S.R.* **66**, 875-8 (1949).—*C.A.* **43**, 7289*d*.

Adsorption of propionic, valeric, and enanthic acid (25 ml of a 0.01 *N* aq. soln.) was studied on 0.1-g samples of sucrose-carbon activated with CO_2 to different losses of wt: (a) 45.2%, (b) 13.8%, (c) 7.5%, and (d) 3%. Equil. was reached on (a) at room temp. within 1 hr, with 1.30, 2.14, and 2.43 millimoles/g adsorbed, resp. In the case of (b), (c), and (d), equil. was not yet reached after 1 month. For the initial stage of the adsorption, the usual series was reversed. After 48 hrs, the series was still reversed on (c) and on (d). After 16 yrs, the figures were, on (b), 1.24, 1.66, and 1.56 (mixed series), on (c) 1.07, 0.80, and 0.81, on (d) 0.85, 0.41, and 0.25 (reversed series). Since there remained some doubt as to whether the figures obtained after 16 yrs at room temp. corresponded to actual equil., accelerated expts. were made in which the samples were additionally kept at 100°C for from 10 to 29 hrs, then 1 more hr at room temp. The data after 16 yrs at room temp., did not quite repeat itself in the accelerated expt.

2731. Dubinin, M. M. and Zaverina, E. D. **Sorption and structure of active carbons. IV. Structure and sorptive properties of active carbons from phenolaldehyde resins.** *Zhur. Fiz. Khim.* **23**, 469-83 (1949).—*C.A.* **43**, 6037*c*.
Bakelite coke and the activated carbon obtained from it with a small wt loss adsorbed more AcOH than higher acids (C_3, C_5, C_7). When the wt loss was 16%, 20%, and 60%, resp. (activation temps. 1000°, 850°, and 750°C), the adsorption started to rise with the mol. wt of the acid. The adsorption of PhOH increased with the wt loss except in case of the highest loss.

2732. Fu, Ying; Hansen, Robert S., and Bartell, F. E. **Thermodynamics of adsorption from solution. II. Free-energy changes and surface-pressure-area relationships of adsorbed layers.** *J. Phys & Colloid Chem.* **53**, 1141-52 (1949).—*C.A.* **44**, 4305*e*.
The surface excesses (calcd. from the aq. soln. adsorption curves of BuOH, phenol, cyclohexanol, and amyl alc. by sugar char, 2 graphites, and a channel black) were used to derive force-area, force-surface excess, and force-area vs. force curves. The forms of the curves provided addnl. evidence for multilayer adsorption from aq. solns. by graphites and carbon blacks.

2733. Hansen, Robert S.; Fu, Ying, and Bartell, F. E. **Multimolecular adsorption from binary liquid solutions.** *J. Phys. and Colloid Chem.* **53**, 769-85 (1949).—*C.A.* 43, 7288*i*.
Caproic acid, valeric acid, amyl alc., butyl alc., aniline, phenol, and cyclohexanol exhibited multilayer adsorption from aq. solns. on 3 different samples of graphite and on 2 non-porous devolatilized carbon blacks. The amt. of adsorption plotted as a function of the reduced concn., c/c_o, obeyed the B.E.T. equation for multilayer physical adsorption of gases on solids. The adsorption on a porous sugar charcoal, on the other hand, obeyed the Langmuir equation and was limited for the most part to monolayer adsorption. The mol. areas deduced from adsorption values at the monolayer and from areas of the adsorbents as measured by N_2 adsorption were 40 to 150% greater than those obtained for the same solutes as close-packed films on liquid surfaces.

2734. Kharin, A. N. and Voitko, L. M. **The dynamics of sorption of coriander essential oil from aqueous solutions by coarse-porous charcoal.** *Zhur. Priklad. Khim.* **22**, 835-45 (1949).—*C.A.* **45**, 3221*g*.
Coriander oil used was to 75% sol. in H_2O (as *d*-linaloöl?). The aq. exts. were filtered through birch charcoal of 0.1-0.3 cm grains and 80% porosity until satn. Between 0.17 and 0.85 g/liter, the amt. (g) adsorbed by 1 g carbon was 0.26 C.(0.13 + C). The time of "break-through" θ was $KL - \tau$, when the length L of the C column varied between 19 and 109 cm. The const. K was 24-100 min./cm and the const. τ was 700-1900 min.; there was no definite effect of either concn. or the rate of flow (1-2 cm/sec).

2735. Reade, Marguerite A.; Weatherburn, A. S., and Bayley, C. H. **The adsorption of sodium myristate by carbon black.** *Can. J. Research* **27F**, 426-8 (1949).—*C.A.* **44**, 2819*d*.
Adsorption of Na myristate from 0.1% aq. soln. by a series of carbon blacks and an activated charcoal was measured at 70°C. In all cases a preferential adsorption of fatty acid was observed. The extent of adsorption of both the fatty acid and alkali components of the soap increased with decreasing particle size, i.e., with increasing surface area, of the carbons. The adsorption by activated charcoal was considerably higher than that obtained with the finest of the carbon blacks.

2736. Smith, Hilton A. and Hurley, R. B. **The adsorption of fatty acids on carbon blacks. Calculation of particle size.** *J. Phys. & Colloid Chem.* **53**, 1409-16 (1949).—*C.A.* 44, 4747*e*.
Acetic, behenic, capric, lauric, palmitic, and stearic acids from various solvents were adsorbed at 25°C on nine common carbon blacks. The blacks were activated with steam prior to the adsorption studies. Surface areas, calcd. on the assumption of 20.5 A.^{2} for the cross section of the acid mols., were in fair agreement with areas calcd. by other methods. When acetic acid was adsorbed using cyclohexane as the solvent, the isotherm indicated that a unimolecular layer was readily formed on the carbon surface.

2737. Tendeloo, H. J. C.; Mans, A. E., and Hoogh, G. de. **Titration of adsorbed acids. III.** *Rec. trav. chim.* **68**, 253-60 (1949) (in English).—*C.A.* **43**, 6883*b*.
Titration curves of HCl plus gelatin against NaOH, and of picric acid with and without activated charcoal (Norit) against NaOH were interpreted. The titration of adsorbed acids were considered as the prototype of the titration of polyacids, the carboxyl groups mutually interacting.

2738. Vold, Robert D. and Konecny, Christine C. **Suspensibility of carbon in detergent solutions.** *J. Phys. & Colloid Chem.* **53**, 1262-79 (1949).—*C.A.* **44**, 2329*d*.
Channel black and furnace black remaining in suspension 4 hrs after 0.5 g had been shaken in 100 ml of solns. of detergents were detd. with a photoelec. colorimeter. Detergents studied over a range of concns. were Oronite ($C_{12}H_{25}C_6H_4SO_3Na$), Aerosol OT (Na dioctylsulfosuccinate), P-$CH_3C_6H_4SO_3Na$, Na oleate, and Triton X-100 (alkaryl polyether alc.). All curves for carbon vs. concn. passed through a max. with differences in shapes of curves and concn. for max. The data and observations with an electron microscope showed deflocculation of coarse aggregates.

2739. Weatherburn, A. S.; Rose, G. R. F., and Bayley, C. H. **Adsorption of soap by carbon black.** *Can. J. Research* **27F**, 179-93 (1949).—*C.A.* **43**, 7289*b*.
The adsorption of Na soaps from aq. solns. by carbon black was studied. Adsorption of fatty acid and alkali components followed the Freundlich adsorption equation; the extent of adsorption increased with chain length. Adsorption of fatty acid exceeded that of alkali, the more so the

greater the chain length. Excess fatty acid resulted in increased adsorption of fatty acid, but did not affect adsorption of soap, whereas excess alkali increased adsorption of alkali but decreased that of fatty acid and of soap. Adsorption from 95% and abs. EtOH was much lower than from aq. soln.

2740. ZÂFIR, MÂLIK. **Considerations concerning the adsorption of colored solutions. Theoretical part.** *Folia Pharm. (Turkey)* 1, No. 3, 29-31 (1949).—*C.A.* **44**, 7119*g*.

Freundlich's empirical formula for colored solns. rearranged in $x = VdKC/n$, wherein for a given adsorption-tube diam. a vol. change can occur only when the layer height was altered. When a colored soln. of vol. V and concn. C passed through the tube, a gradual loss of pigment occurred by adsorption.

2741. HOLMAN, RALPH T. AND HAGDAHL, LENNART. **Displacement analysis of lipides. III. Separation of normal saturated fatty acids from formic to behenic.** *J. Biol. Chem.* **182**, 421-7 (1950).—*C.A.* **44**, 3883*h*.

The Tiselius-Claesson interferometric adsorption analysis app., packed with a mixt. of 1 part Darco G-60 and 2 parts Hyflo Super-Cel, was used. Solvent mixts. in which the displacer fatty acid was near its soly. limit gave the best sepns. The C_1-C_6 acids were displaced by a 0.4% aq. soln. of $C_9H_{19}CO_2H$; The C_6-C_{10} acids by 2% $C_{12}H_{25}CO_2H$ in 50% EtOH; the C_{10}-C_{13}acids by 1% $C_{14}H_{29}CO_2H$ in 65% EtOH; the C_{14}-C_{15} acids by 1% $C_{16}H_{33}CO_2H$ in 80% EtOH; the C_{16}-C_{20} acids by 1% $C_{22}H_{45}CO_2H$ in EtOH-$CHCl_3$ (78:22).

2742. INOUYE, KATSUYA. **The classification of coal by simple adsorption methods.** *J. Fuel Soc. Japan* **29**, 112-16 (1950).—*C.A.* **44**, 10294*h*.

I_2 and methylene blue adsorption from aq. solns. were suggested to classify coals according to their characteristic inner structures. The essential point was the specific surface areas of both series calcd. from the adsorption data with the assumption of monomol. adsorption. Lignites, sub-bituminous, bituminous coals, and anthracites were classified by this method.

2743. IOFA, Z. A. AND FLORIANOVICH, G. M. **Polarographic determination of adsorbability of charcoal with methylene blue.** *Zavodskaya Lab.* **16**, 142-4 (1950).—*C.A.* **44**, 6768*d*.

Agitate 0.2 g of dried sample for 10 min. with 0.5% methylene blue soln. Treat a 10-ml aliquot with 0.2 ml N H_2SO_4 and make a polarogram in an open vessel against a calibration curve. Charcoal high in ash should be washed with 6 N HCl, followed by H_2O.

2744. LINNER, EDWARD R. AND WILLIAMS, ARDIS P. **The effect of previous heat-treatment on some of the adsorption properties of sugar carbon.** *J. Phys. & Colloid Chem.* **54**, 605-18 (1950).—*C.A.* **44**, 7616*g*.

Purified sugar carbon, which had been subjected to heat-treatment within the range 500-110°C, was used as the adsorbent for acetic, propionic, butyric, and valeric acids. Surface areas were detd. by I_2 adsorption and pH values of aq. suspensions of the carbons. The consts. of the Langmuir equations were detd. for each acid with each carbon sample. The max. amt. of acid adsorbed was used to est. the relative surface area available to each of the acids. The max. surface available for adsorption occurred in all cases for the 800°C sample; pH values of the suspensions were unsatisfactory in explaining the possibility of the formation of oxides at the surface of the carbon during the heat-treatment.

2745. MUKHERJEE, SUDHAMOY AND BHATTACHARYA, SUKHAMOY. **Effect of chemical treatments on the properties of activated charcoal. Adsorption isotherms for methylene blue, iodine, and acetic acid.** *J. Indian Chem. Soc. Ind. & News Ed.* **13**, 240-6 (1950).—*C.A.* **46**, 318*a*.

The variations in the adsorptive power of various charcoal samples for methylene blue, I_2, and AcOH, in different concns., were studied. Each expt. was made with 0.05 g charcoal, prepd. from powd. coconut shell, and the vol. of the adsorbate was 50 cc. for methylene blue and 25 cc. for I_2 and AcOH. Isotherms were given for nonactivated and $ZnCl_2$- or $CaCl_2$-activated charcoals, untreated and after treatment with oxidizing agents. In general, the adsorptive power increased by treatment with oxidizing agents.

2746. NESTLER, F. H. MAX AND CASSIDY, HAROLD G. **Adsorption of low-molecular-weight fatty acids by an activated charcoal. Use of chromatography to obtain adsorption isotherms.** *J. Am. Chem. Soc.* **72**, 680-9 (1950).—*C.A.* **44**, 4747*f*.

Adsorption isotherms for acetic, propionic, and butyric acids on charcoal showed the acids to be preferentially adsorbed throughout the 0 to 100% concn. range. The Freundlich equation was obeyed only between 0.005 and 0.5 wt % concn. Frontal-analysis technique was applied to binary mixts. of these acids and yielded adsorption-isotherm data obeying the Freundlich equation between 0.3 and 1.5 wt % concn. Adsorbed water on the charcoal seemed to act merely as a diluent. Changes in adsorption as evidenced by frontal-analysis diagrams were not observed on changing the method of packing the column, doubling the pressure applied to the column, adding a solid diluent to the charcoal, or prewetting the column with solvent.

2747. PROTASOV, P. N.; KHARIN, A. N.; VOITKO, L. M.; BOGOLYUBOVA, T. G., AND SVINTSOVA, L. G. **The uptake of substances by granulated carbon from a stream of solution. Sorption dynamics of butyric acid from aqueous solution.** *Zhur. Fiz. Khim.* **24**, 182-91 (1950).—*C.A.* **44**, 6231*i*.

Butyric acid solns. (0.01-0.03 N) were filtered through columns (L cm long) of birch charcoal (particle diam. d was 0.15-0.325 cm). The time θ of break-through was $[\theta_0 - (kL/\alpha)]$; α(cm/sec) was the rate of filtration. The consts. θ and k were given. The kinetic coeff. $\beta = -0.027\ \alpha^{0.52}/d^{1.06}$; the factor in it (0.037) seemed to be inversely proportional to $M^{1/2}$; M = mol. wt.

2748. ROWLEY, H. H.; OLNEY, R. B., AND INNES, W.B. **Adsorption equilibria of liquid mixtures of benzene and methanol with charcoal.** *J. Am. Chem. Soc.* **72**, 5180-2 (1950).—*C.A.* **45**, 2741*g*.

The selective adsorptions evaluated by 2 independent methods as a function of liquid compn. were compared with directly measured values for the adsorption of C_6H_6 and MeOH on charcoal. Reasonable agreement was obtained. Surface compn. and spreading-pressure data were given.

2749. Spengler, Günter and Krenkler, Karl. **Selective adsorption of hydrocarbons. I.** *Erdol u. Kohle* **3**, 120-4 (1950).—*C.A.* **44**, 5676e.

A purified benzine fraction (b. 40-48°C) was used as solvent. Small-pored silica gel and active charcoal were found superior to Al_2O_3, fuller's earth, kieselguhr, MgO, SnO, $CaCO_3$, and cryolite. Adsorption isotherms showed the following sequence in order of diminishing adsorption: (Silica gel) 1-methylnaphthalene, (1,2,3,4-tetrahydronaphthalene, xylene, benzene, toluene), cyclohexene, and cetene; (active charcoal) 1-methylnaphthalene, 1,2,3,4-tetrahydronaphthalene, xylene, toluene, (cetane, cetene, octadecane) (benzene, dodecane, cyclohexene), and decahydronaphthalene. Silica gel, therefore, was suited for the sepn. of satd. from unsatd. hydrocarbons, whereas active charcoal would enable sepn. on the basis of side chains on other satd. groups and mol. size.

2750. Trillat, J. J. and Millet, J. **Photocolorimetric study of adsorption of carbon black.** *J. recherches centre natl. recherche sci. (Paris)* **(1950)**, No. 10, 32-5; *Rev. inst. franc. petrole* **5**, 9-12 (1950).—*C.A.* **44**, 3766*a*; **45**, 416*g*.

The amt. of tar oil adsorbed by various carbon blacks from benzene solns. was detd. by measuring the amt. of oil left in the benzene colorimetrically after removing the carbon black. The amt. adsorbed was characteristic of the variety of the black, and the heavier components of the oil were adsorbed the least strongly.

2751. Bartell, F. E.; Thomas, Tudor L., and Fu, Ying. **Thermodynamics of adsorption from solution. IV. Temperature dependence of sorption.** *J. Phys. & Colloid Chem.* **55**, 1456-62 (1951).—*C.A.* **46**, 2873*g*.

Adsorption normally decreased with increase in temp., since it was an exothermic process. The effect of soly. was superimposed on the normal temp. effect and was studied only to a limited extent. The adsorption of Bu alc. from aq. soln. was detd. at 0°, 25°, and 45°C on purified cryst. artificial graphite and highly porous blood char. At low concns. adsorption decreased with rising temp., whereas at higher concns. the adsorption increased with rising temp., reflecting the effect of the decrease in soly. of Bu alc. in H_2O with rising temp.

2752. Chatterji, A. C. and Srivastava, R. D. **Adsorption from nonaqueous solvents I.** *J. Indian Chem. Soc.* **28**, 315-18 (1951).—*C.A.* **46**, 5928*g*.

The adsorption of BzOH on phosphate- and chloride-free animal charcoal from solns. in CCl_4, C_6H_6, $C_6H_5CH_3$, *o*-xylene, *m*-xylene, C_6H_5Cl, $C_6H_5NO_2$, MeOH, EtOH, PrOH, BuOH, and acetone, and of *o*-nitrobenzoic acid and phthalic acid in the last 5 solvents was detd. at 30°C. Adsorption increased as the soly. of the solute decreased in the solvent.

2753. Glueckauf, E. **The "exponential" adsorption isotherms of fatty acids on activated charcoal.** *J. Am. Chem. Soc.* **73**, 849-50 (1951).—*C.A.* **45**, 5484*e*.

Since it was known that active charcoal in a mixt. of strong acids acted as an anion exchanger, the primarily adsorbed group being H_2O, it was suggested that: (1) H_2O was adsorbed according to a Langmuir adsorption; as long as only one species of acid was present, this mechanism was indistinguishable from mol. adsorption following an "exponential" isotherm; (2) when 2 or more acids (HAc, propionic, and butyric) were present, the adsorbed H_2O acted as an anion-exchanger with respect to the acids in soln.; (3) in mixts. of 2 acids, the coeff., $k_{1,2}$, of adsorption of H_2O was taken as the appropriate mean of the single solute coeffs., k_1 and k_2.

2754. Harrap, B. S. **Adsorption of mixed films on activated carbon.** *Trans. Faraday Soc.* 47, 645-9 (1951).—*C.A.* **45**, 9993f.

Adsorption data were given for mixts. of $PhNH_2$ and oleyl alc. on activated charcoal. The wt of oleyl alc. which 0.1000 g adsorbent could adsorb was within the limits 0.0535-0.0545 g and was independent of the pH of the system over the pH range 2-12. The capacity for the adsorption of oleyl alc. was detd. using a Langmuir-type surface balance to detect any excess alc. over that adsorbed at the charcoal-water interface. The adsorbent was prepd. by making Nuchar ash-free (could not adsorb NaOH from aq. soln.).

2755. Jenckel, E. and Rumbach, B. **Adsorption of high polymers from solution.** *Z. Elektrochem.* **55**, 612-18 (1951).—*C.A.* **46**, 4882h.

The adsorption of polymethylmethacrylate, polystyrene, and polyvinyl chloride on Al granules, quartz sand, glass wool, and activated charcoal from soln. in 1,2-dichloroethane, toluene, and 1,4-dioxane was measured at 25 and 50°C at several concns. up to 1 g per liter. Mol. wts of the polymers were 1,200,000, 512,000, and 37,000, resp. Surface areas of the 1st 3 adsorbents were detd. microscopically, but that of the charcoal was detd. with methylene blue. The calcd. no. of mol. layers adsorbed ranged from 1 to 80. The data indicated that very little adsorption occurred on the internal surface of the charcoal.

2756. Rose, G. R. F.; Weatherburn, A. S., and Bayley, C. H. **The sorption of synthetic surface-active compounds by carbon black.** *Textile Research J.* **21**, 427-32 (1951).—*C.A.* **45**, 6895*f*.

The sorption on carbon black of a no. of anionic, cationic, and nonionic surface-active compds. from aq. solns. was measured. The sorption did not conform to the Freundlich isotherm over the concn. range of 0.01%-0.2% by wt. In many cases an abrupt change in slope of the curve occurred at concns. that appeared to correspond approx. to the crit. micelle concns. of the various compds. At concns. above this crit. point the plot of log *X* vs. log *C* appeared to be linear. The sorption of Na alkyl sulfates, 12-18 carbon atoms, increased with increasing chain length of the alkyl group at const. temp., and decreased with increasing temp. at const. chain length. The typical nonionic compds. were sorbed more strongly than were any of the other compds. tested.

2757. Steigmann, Albert. **Photographically active impurities in gelatins.** *Science et inds. phot.* **22**, 441-53 (1951).—*C.A.* **46**, 843b.

Powd. acid pigskin gelatin, extd. with hot, satd. Na_2SO_4 soln., yields compds. of the 4-carboxythiazolidine type, whereas lime process gelatins yielded thiosulfates and trithionates. The exts. contain traces of proteins which could be eliminated by filtration over Mg silicate. Compds. of the 4-carbon types were largely retained by Mg silicate, which did not retain trithionates and thiosulfates. At pH 9.0, active carbon adsorbed only the trithionates and permitted isolation of the thiosulfates.

2758. Tendeloo, H. J. C.; Mans, A. E., and Hoogh, G. de. **Titration of adsorbed acids.** *Rec. trav. chim.* **70**, 191-201 (1951) (in English).—*C.A.* **45**, 6006*c*.

The titration curves of the 3 isomeric hydroxybenzoic acids, and the curves for maleic and fumaric acids, were detd. with NaOH and $Ca(OH)_2$ without any adsorbent and with the acids adsorbed on different amts. cf Norit. The 3 hydroxybenzoic acids did not show any difference in the adsorbed state; the adsorption of maleic acid was less than that for fumaric acid, although the great difference in acidity between the 2 isomers was greatly reduced by adsorption. The titration curves of adsorbed salicylic acid obtained with NaOH and $Ca(OH)_2$ did not coincide.

2759. Thomas, G. Garrod. **Adsorption on coal.** *Nature* **168**, 474 (1951).—*C.A.* **46**, 2872*a*.

From studies of the adsorption of org. mols. from aq. and alc. solns. on coal, the area per mol. of solute decreased as the rank of the coal (and C-content) decreased and the O-content increased. The slope of these curves depended on the particular solute. Adsorption presumably took place through the nonpolar portion of the solute mol.

2760. Waarden, M. van der. **Adsorption of aromatic hydrocarbons in nonaromatic media on carbon black.** *J. Colloid Sci.* **6**, 443-9 (1951).—*C.A.* **46**, 803*d*.

The adsorption of benzene, naphthalene, anthracene, phenanthrene, xylene, and alkylated naphthalenes on carbon black of area 325 m^2/g from n-C_7H_{16} or white mineral oil was measured at room temp. The max. adsorption corresponded to a unimol. layer of aromatic mols. in which the nuclear ring was oriented in a flat position on the carbon surface.

2761. Chatterji, A. C. and Srivastava, R. D. **The adsorption from nonaqueous solvents. II.** *J. Indian Chem. Soc.* **29**, 327-30 (1952).—*C.A.* **47**, 5760*h*.

The adsorptions of naphthalene and acenaphthene in MeOH, EtOH, PrOH, BuOH, acetone, AcOH, C_6H_6, toluene, C_6H_5Cl, n-hexane, $CHCl_3$, and CCl_4 solns. on animal charcoal were detd. at 35°C. Adsorption decreased as the ratio of the solvent surface tension at the air-liquid interface to the solubility decreased. A reciprocal relation was found between soly. and adsorption for acenaphthene when soly. was expressed as mols. per 100 mols. of soln.

2762. Edeskuty, F. J. and Amundson, N. R. **Effect of intraparticle diffusion. I. Agitated nonflow adsorption systems.** *Ind. Eng. Chem.* **44**, 1698-1703 (1952).—*C.A.* **46**, 9894*e*.

The theoretical foundation for the diffusion of solute inside the adsorbent particles was developed for the special case where the particles were cylinders with impervious ends. Exptl. confirmation was obtained with activated charcoal as the adsorbent and phenol in water soln. as adsorbate.

2763. Elton, G. A. H. **Adsorption from binary solutions of completely miscible liquids. II. Thermodynamic requirement for complete preferential adsorption.** *J. Chem. Soc.* **1952**, 1955-6.—*C.A.* **46**, 8460*e*.

Complete preferential adsorption is defined as the case when the surface mole-fraction of one component exceeds its bulk mole-fraction over the whole range between zero and unity. The necessary thermodynamic condition is that the adsorption potentials of the two adsorbates differ in sign. This follows from an activity analysis of the system in terms of the adsorption potentials, which refer to arbitrarily defined standard states in the soln. and surface, resp. These are estd. as 1.0 and 1.1 kcal. for MeOH and CCl_4 on charcoal.

2764. Falk, Hans L. and Steiner, Paul E. **The identification of aromatic polycyclic hydrocarbons in carbon blacks.** *Cancer Research* **12**, 30-9 (1952).—*C.A.* **46**, 8831*h*.

Benzene exts. of some carbon blacks contained the strong carcinogen 3,4-benzopyrene, the weak carcinogen 1,2-benzoperylene, and pyrene, fluoranthene, 1,12-benzoperylene, anthanthrene, and coronene. Furnace blacks, with an av. particle diam. of 80 mμ or more, possessed all 7 of these aromatic hydrocarbons. Soot itself appeared to be carcinogenic on skin but possibly not on respiratory tract epithelium, possibly because lipide solvent was present in the skin and absent in the respiratory tract. The differences in extractable aromatic hydrocarbon from carbon blacks might be related to adsorption phenomena.

2765. Falk, Hans L. and Steiner, Paul E. **The adsorption of 3,4-benzopyrene and pyrene by carbon blacks.** *Cancer Research* **12**, 40-3 (1952).—*C.A.* **46**, 8832*a*.

The adsorption of 3,4-benzopyrene and pyrene on 10 different carbon blacks with an av. particle diam. varying from 10-80 mμ was inversely proportional to particle size. The elution of these hydrocarbons depended on the nature of the black, the nature and vol. of the solvent, and the temp. With each extn., only a fraction of the total adsorbate could be eluted.

2766. Hellström, Nils. **Comparative adsorption experiments. I. Some hydrocarbons in ethyl alcohol and in heptane with some different kinds of carbons.** *Svensk Kem. Tid.* **64**, 263-70 (1952) (in English).—*C.A.* **47**, 2011*e*.

The adsorptions of retene, phenanthrene, and naphthalene dissolved in abs. EtOH were studied for 3 different carbons: Carboraffin carbon, FNX

Special, and an exptl. carbon "606". In case of Carboraffin carbon, heptane was also used as the solvent. The method of frontal analysis was used for the adsorption expts., and adsorption isotherms were calcd. according to Langmuir. Retene and phenanthrene were adsorbed almost equally well and better than naphthalene, in all cases. The satn. capacities in case of Carboraffin carbon were practically the same whether abs. EtOH or heptane was the solvent.

2767. Hocking, C. S. **Separation by modified carbons.** *Research (London)* **5**, 288-9 (1952).—*C.A.* **46**, 8458*f*.

The behavior of activated charcoal coated with diphenylamine or oleic acid was studied with respect to the adsorption and desorption, at different pH values, of methylene blue and picric acid. Adsorption was stronger on diphenylamine-coated charcoal than on oleic acid-coated charcoal.

2768. Izmaĭlov, N. A.; Shostenko, Yu. V., and Bezuglyi, V. D. **Adsorptional method for isolation of caffeine.** *Zhur. Priklad. Khim. (J. Applied Chem.)* **25**, 543-52 (1952).--*C.A.* **46**, 9249*i*.

Adsorption of caffeine from aq. solns. was superior to extn. with immiscible solvents. Adsorption of caffeine by activated charcoal (air-dry) was studied from water, $CHCl_3$, EtOH, $ClCH_2CH_2Cl$, and $CHCl_3$-$ClCH_2CH_2Cl$ solns. The most effective adsorption occurred from H_2O, the mixt. of $CHCl_3$ with $ClCH_2CH_2Cl$ (80-20) was next, while $CHCl_3$ was least satisfactory. For aq. solns. the isotherms equation was $a = 35.5°C$, where a was g and C was g/100 ml. The % adsorption remained essentially constant from pH 3.85 to 8.5, and expts. with adsorption from tea exts. indicated that a temp. rise from 20 to 45°C actually increased by 14-15% the amt. of removed caffeine. The use of a 4-stage countercurrent adsorption set-up resulted in 95.5-98.0% extn. of the caffeine present in tea exts. The charcoal with adsorbed caffeine was washed free of mother soln. by pure water with almost zero loss.

2769. Ixmaĭlov, N. A. and Shostenko, Yu. V. **Adsorption method of isolation of substances from dilute solutions. II. Some peculiarities of molecular adsorption from a stream of solution.** *Zhur. Priklad. Khim.* **25**, 602-9 (1952).—*C.A.* **47**, 6706*c*.

For a caffeine soln. there was a limiting rate of flow of the soln. past the adsorbent at which the max. satn. of the adsorbent still corresponded to its static activity; there also existed a critical flow rate above which the max. adsorption no longer depended on flow rate. The processes appeared to be connected with diffusion within the pores of the adsorbents. The independence of max. adsorption of flow rate appeared in the present case to arise above 2400 liters/hr/m². The relation between max. adsorption and flow rate was given satisfactorily by $A = 34.67\ v^{-0.083}$, where A was max. adsorption in percentage, and v was flow rate.

2770. Kipling, J. J. and Tester, D. A. **Adsorption from binary mixtures: determination of individual adsorption isotherms.** *J. Chem. Soc.* **1952**, 4123-33.—*C.A.* **47**, 3079*h*.

Adsorption from binary mixts. by a solid could not be represented by simple Freundlich or Langmuir equations for the adsorption isotherms of the individual components. A derivation based on the assumption that under all conditions of equil. the surface was completely covered with adsorbate gave results in accord with expt. for either liquid or vapor-phase adsorption. The equations derived are: For the vapor phase $\sigma_1 = x^v/[x^v + K(1 - x^v)]$, where $\sigma_1 =$ fraction of surface covered by component 1, $x^v =$ mole fraction of vapor 1 in vapor phase, and $K =$ a const. In the liquid phase 2 cases must be considered: Case I; ideal case where $p_1 = p_1°x_1$, where $x =$ mole fraction of component present. Case 2: when Raoult's law was not obeyed, i.e., $p_1 \neq p_1°x_1$. The equations were used in calcg. the adsorption of $CH_3OH + CCl_4$ and $C_6H_6 + C_2H_5OH$ mixts. on carbon. Exptl. and theoretical curves were in excellent agreement.

2771. Kiselev, A. V. and Kulichenko, V. V. **Adsorption from solutions in the vicinity of the lower critical temperature. Trimethylamine-water on active carbons and on lampblack.** *Doklady Akad. Nauk S.S.S.R.* **82**, 89-92 (1952).—*C.A.* **46**, 4886*h*.

Adsorption isotherms of Me_3N in soln. in H_2O (18°C), at 0, 32.7, and 70°C, were detd. on 3 types of adsorbents: a peat active carbon, a $ZnCl_2$-activated sucrose carbon, and lampblack with spherical particles. At 0°C, the isotherms passed through a max., as expected for a completely miscible system; above t_c, the curves were S-shaped. The adsorption isotherms of Me_3N on sucrose carbon from aq. soln. and from vapor gave the same final amt. adsorbed at c/c_s. The vapor and the soln. isotherms on lampblack coincided up to the point of beginning multi-mol. adsorption, whereafter the vapor isotherm rose rapidly above the soln. isotherm; formation of the unimol. adsorption layer was the same from vapor and from soln.

2772. Doss, K. S. G. and Singh, Ajit. **Adsorption of thymol blue on activated carbon.** *J. Sci. Ind. Research (India)* **12B** 79-83 (1953).—*C.A.* **47**, 7285*h*.

The adsorption of thymol blue on activated carbon was studied with solns. buffered at pH from 1.26 to 10.0. In general, the amt. of adsorption decreased with increasing pH. The satn. of the adsorbent occurred at lower adsorptions in alk. solns. than in solns. of lower pH. The presence of $CaCl_2$ increased the amt. of adsorption as well as the satn. concn.; as expected, the effect of KCl was small.

2773. Hansen, Robert S.; Hansen, Robert D., and Craig, Roy P. **The effect of steam activation on multilayer adsorption from solution by carbon.** *J. Phys. Chem.* **57**, 215-19 (1953).—*C.A.* **47**, 7287*i*.

The adsorption of n-valeric and n-caproic acids from water on Spheron 6 carbon black (activated by steam) showed that the primary effect of the steam activation was to increase the surface area and not the adsorption per unit area. The indicated monolayer adsorption corresponded to mol. areas of 55 to 70A.² for the acid adsorbates. Considerable water was also retained by the surface.

2774. Hobden, Joan F. and Jellinek, H. H. G. **Adsorption of high polymers from solution onto solids. I. Adsorption of polystyrene on charcoal.** *J. Polymer Sci.* **11**, 365-78 (1953).—*C.A.* **48**, 2441*g*.

The amts. and rates of adsorption of polystyrene from solns. on charcoals at 25°C increased when the MeOH solvent was dild. with MeCOEt, or when the polymer mol. wt was decreased. Langmuir's equation fitted the adsorption isotherms. Amts. adsorbed at equil. were far below that needed to give a monolayer. Fractionated polymer showed a stepwise increase in rate after the char was about half way to equil.

2775. Minne, J. L. van der and Hermanie, P. H. J. **Electrophoresis measurements in benzene; correlation with stability. II. Results of electrophoresis, stability, and adsorption.** *J. Colloid Sci.* **8**, 38-52 (1953).—*C.A.* **47**, 5214*h*.

The effect of Ca diisopropylsalicylic acid and tetraisoamylammonium picrate on the flocculation, electrophoretic velocity, and electroendosmotic velocity of the particles of a 0.1% suspension of carbon black in C_6H_6 was detd. Electrophoresis did not occur unless there was a crit. concn. of ions in soln. The ionic concns. of electrolyte necessary to cause flocculation in the C_6H_6 system were smaller by a factor of 10^{-7} than the concns. causing flocculation in aq. solns. The adsorption of diisopropylsalicylic acid by the suspended carbon black reached a max. at the concn. corresponding to the max. ζ-potential on the carbon.

2776. Smith, R. Nelson; Geiger, C. F., and Pierce, Conway. **The equilibrium exchange rates of adsorbed species with unadsorbed species in solution.** *J. Phys. Chem.* **57**, 382-4 (1953).—*C.A.* **47**, 6214*a*.

The rate of exchange, at equil., of adsorbed radioactive benzene with nonradioactive BzOH in soln. was studied with 5 different types of charcoal. Steam-activated charcoal permitted a more ready exchange of BzOH; this indicated that the capillary pores had been enlarged on activation. Exchange was almost immediate with a carbon black or with a very wide-pore decolorizing charcoal.

2777. Treiber, E.; Porod, G.; Gierlinger, W., and Schurz, J. **The adsorption of macromolecules on active surfaces.** *Makromol. Chem.* **9**, 241-3 (1953).—*C.A.* **47**, 7285*f*.

The adsorption of a high-mol. and a low-mol. polystyrene fraction from cyclohexane soln. on active carbon (followed spectrophotometrically) obeyed Freundlich's equation with exponent $n = 1$, but approached a limiting value at concns. above 0.2 millimole of monomer per liter. Similar adsorption of toluene, used as a polystyrene model, obeyed Freundlich's equation with $n = 0.55$.

II-2. Carbon Adsorbents With Inorganic Solutions

2778. Burshtein, R. and Frumkin, A. **Hydrogen peroxide formation in the adsorption of acids by activated charcoal.** *Compt. rend. acad. sci. U.R.S.S.* **32**, 327-9 (1941) (in English).—*C.A.* **37**, 2243^4.

H_2O_2 was formed when H_2SO_4 was adsorbed on charcoal in the presence of freshly adsorbed O_2, the yield increasing with the concentration of H_2SO_4. The quantity of H_2O_2 reached a max. in about 10 min. and then decreased because of the catalytic decomposition on charcoal. The yield was very low when inert gases instead of O_2 were bubbled through the solution. The formation of H_2O_2 stopped when the adsorption of the acid was complete. At a polarized cathode in the presence of freshly adsorbed O_2, the yield of H_2O_2 increased from 6.5×10^{-5} to 130×10^{-5} amperes per 0.1 g of charcoal. With further increase, the yield decreased.

2779. Vournazos, A. C. **Ionization effects in carbon.** *Prakt. Akad. Athenon* **16**, 80-94 (1941).—*C.A.* **47**, 54*c*.

Chem. analysis of complex hydroxy carbons from electrolysis showed a C-rich system, but with O- and still smaller H-contents, the av. compn. was C 97.24, O 2.59, and H 0.17%. From a dil. soln. of this product carbon had been sepd. electrolytically, the resulting ion migrating slowly to the cathode. A small rod of petroleum coke contg. about 25% low Fe ash served as anode and the cathode was Pt foil. The electrolyte was 28% NaOH and a 30 v. current at 2.5-3 amp. was used at 70°C. In about 3 hrs the anode was consumed by nascent O, while the electrolyte became deep brown. The suspended carbon was allowed to stand and then, with 200 cc. of the supernatant fluid, was decanted and electrolyzed. For this purpose glass cells with Pt-foil anodes and 2-3 mm Pt-wire cathodes were used; 5.5 amp. at 94-96 v. was applied. After 3 hrs the cathode was coated with smooth electrolytic carbon.

2780. Baichikov, A. G. and Selimov. **Adsorption of iodine from oil-well waters by means of activated charcoal.** *J. Applied Chem. (U.S.S.R.)* **15**, 228-36 (1942).—*C.A.* **37**, 2548^9.

Extraction of I_2 from oil-well waters in southern U.S.S.R. by means of activated charcoal was feasible even in waters containing naphthenic acids, which were adsorbed also. Under the best technological conditions thus far obtained, it was possible to recover up to 66% of the I_2. The charcoal could be used in acid waters. Treatment of the charcoal with alkali almost completely desorbed I_2.

2781. Kishi, Haruo. **Analysis by means of radioactive indicators. IX. Sorption of minute quantity of lead by active charcoal.** *J. Chem. Soc. Japan* 63,668-76 (1942).—*C.A.* **41**, 2986*a*.

A dil. soln. of Pb (10^{-4} *N* $Pb(NO_3)_2$) contg. Th B was adsorbed by active charcoal. According to the procedure given, the measurement of the radioactivity detd. the amount of Pb.

2782. Kishi, Haruo. **Analysis by means of radioactive indicators. X. Sorption of minute quantity of lead by active charcoal.** *J. Chem. Soc. Japan* 63, 677-87 (1942).—*C.A.* 41, 2986*b*.

When the concn. of HNO_3 contained in the Pb soln. was small, the amount of adsorbed Pb followed the Freundlich relation. The adsorbed amount decreased with rise of temp. and increased gradually with increase of the time of contact.

2783. Sastri, M. V. C. **Active carbon. II. Ionic adsorption by active carbon.** *Quart. J. Indian Inst. Sci.* 5, No. 3, 107-19 (1942).—*C.A.* 40, 3959^3.

The behavior of active charcoal as a polar adsorbent and the "chemisorption" or chem. interaction with O_2 was discussed.

2784. Sastri, M. V. C. **Active carbon. III. The pH values of aqueous suspensions of activated charcoal.** *Quart. J. Indian Inst. Sci.* 5, No. 3, 120-44 (1942).—*C.A.* 40, 3959^3.

Instantaneous (one min.) and final (10 min.) pH for suspensions of four activated charcoals in pure water were detd. with a glass-electrode assembly. The pH of suspensions of partially washed specimens varied with time, concn., and initial pH of the water. Steady values were reached in ten min. Each thoroughly washed active charcoal had a characteristic pH unaffected by concn. of charcoal or initial pH of the water.

2785. Hamdi, H. **The colloidal chemical properties of humus. Dispersoid chemical observations with graphite oxide.** *Kolloid-Beihefte* 54, 554-634 (1943).—*C.A.* 38, 4495^1.

Finely powd. graphite for electroplating was oxidized with H_2SO_4, HNO_3 and $KClO_3$, washed and electrodialyzed. After drying at 50°C and grinding, it consisted of 60.01% C, 2.09% H and 37.9% O and contained 6.6% water removable by drying over P_2O_5 *in vacuo*. Suspensions, exposed for 16 days to aq. solns. of various alkalies at different concns., were back-titrated with HCl to pH 8.2 and 5.2. The amt. of alkali retained in combination increased in the order $LiOH < NaOH < NH_4OH < KOH$; even stronger sorption was observed with alk. earth hydroxides in the series $Sr(OH)_2 < Ca(OH)_2 < Ba(OH)_2$. Extent of sorption of amino acids at pH 3, 6 and 9 increased with their mol. wt. Max. sorption of NH_4OH, glycylglycine and gelatin was observed, resp., at pH 4.0, 8.5 and 4.8.

2786. Stark, Walter. **Gold from sea water.** *Helv. Chim. Acta* 26, 424-41 (1943).—*C.A.* 37, 6505^3.

The Au in sea water from 3 sources was pptd. by adsorption on charcoal, and the residue was dried and ashed in a porcelain tube. After dissolving in HCl, granulated Zn-Pb was added, and the Pb alloy obtained was cupelled. Water from the Adriatic Sea contained 0.02 mg of Au/m^3, from the Mediterranean Sea 0.4 mg/m^3, and from the Iberian coast of the Atlantic Ocean 2 mg/m^3. The Au content of seaweed was relatively high, 0.17 mg/1000 g of dried material.

2787. Cantino, E. C. **Elimination of nitrate impurities from 30% hydrogen peroxide.** *Ind. Eng. Chem., Anal. Ed.* 16, 181-2 (1944).—*C.A.* 38, 2169^9.

Percolation through activated carbon in a H_2O-cooled column was used to produce a product having a nitrate content of less than 10 p. p. m. and a H_2O_2 concn. of approx. 27 to 29%. Details of the column construction and packing were given.

2788. Tiselius, Arne. **Quantitative adsorption analysis of some amino acid and peptide mixtures on active carbon.** *The Svdeberg (Mem. Vol.)* 1944, 370-8.—*C.A.* 39, 1117^7.

Adsorption analysis was applied to the sepn. of monoamino-monocarboxylic acids and some peptides of the same type with an active carbon as adsorbent. Quant. sepns. were possible with the amino acids and with those peptides which showed low adsorption affinity for carbon. Losses occurred with the higher peptides and some methods of eliminating this difficulty were discussed.

2789. Bachelet, M. **The extraction of actinium and its concentration in the rare earths.** *J. chim. phys.* 42, 98-107 (1945).—*C.A.* 40, 4307^7.

The sorption of *actiniferous* La by insol. sulfates or active carbon was detd. Enrichment by fractional pptn. of hydroxides showed that Ac pptd. between La and Mn. Coeffs. of fractional crystn. of double nitrates of rare earths and Mg were detd. Such fractionation eliminated, in the inactive state, most of the La.

2790. Palacios, J. and Vigón, M. T. **Adsorption of cations by active carbon. Experimental confirmation.** *Portugaliae Phys.* 1, 295-320 (1945).—*C.A.* 40, 2055^2.

The voltaic cells were identical as to electrodes (active carbon and Zn) and electrolyte ($ZnSO_4$ soln.); one could be evacuated, and the other exposed to air. To ensure freedom from O_2, the carbon electrode was baked for several hrs in a vacuum furnace. The current yield of the evacuated cell was closely parallel to that of the control cell, whence it is concluded that O_2 was not the fundamental factor in producing the potential difference in the cells. Cells in which the carbon electrode contained O_2 recovered after discharge more quickly than those without O_2.

2791. Harkins, W. D.; Jura, G., and Loeser, E. H. **Surface of solids. XVI. Adsorbed films of water and normal heptane on the surface of graphite.** *J. Am. Chem. Soc.* 68, 554-7 (1946).—*C.A.* 40, 3665^8.

The adsorption isotherms of water and heptane were detd. on 2 samples of graphite contg. 0.46% ash by weight and less than 0.004% ash by weight. The latter samples had also been treated so that the surface should be free of any O-C "complex." The films of water became thicker than a monolayer at relative pressures above 0.9, attaining an av. of thickness of 3 layers at the max. pressures measured, 0.98. A detailed study of the curve for low values of p/p_o showed that the adsorption curves were convex rather than concave to the pressure axis. The spreading coeff., free energy of emersion, and work of adhesion of water were -47, 25, and 97 ergs cm^{-2}, resp., whereas for heptane the corresponding values were 69, 89, and 109 ergs cm^{-2}.

2792. LEPIN, L. AND STRAKHOVA, G. **Surface reactions. III. Reaction between solutions of hydrolyzed salts and ash-free active carbons.** *J. Phys. Chem. (U.S.S.R.)* 20, 743-52 (1946) *Acta Physicochim. U.R.S.S.* 21,1089-1104 (1946) (in English).—*C.A.* 41, 330*a*.

Adsorption of Cl^- from solns. of $AlCl_3$, $CuCl_2$, $FeCl_2$, and $PbCl_2$ by ash-free carbon was greater than from solns. of KCl or $BaCl_2$. Addn. of HCl increased the adsorption of Cl^- from KCl, $BaCl_2$, or $AlCl_3$ solns. because H^+ neutralized the OH^- ions leaving the carbon. Addn. of HCl lowered the adsorption of Cl^- from $CuCl_2$, $FeCl_2$, and $PbCl_2$ solns. because of the formation of $[CuCl_4]^{--}$ and similar ions. The carbon formed ppts. in solns. of $CuCl_2$, $FeCl_2$, and $PbCl_2$.

2793. QUARTAROLI, ALFREDO. **Unusual adsorption phenomenon with various adsorbing agents.** *Ann. chem. applicata* 36, No. 9/10, 260-5 (1946).—*C.A.* 41, 4692*f*.

Salts which form hydrates facilitated adsorption when present in large quantity. With animal carbon as adsorbent, the presence of 20 g NaCl was found to increase the adsorption of org. acids as follows: formic 17.2-22.0%; acetic 18.0-23.4%; propionic 20.4-26.7%. Benzoic acid (55.8% adsorbed by 1 g of animal carbon) was found to be adsorbed 75% in the presence of 20 g of NaCl.

2794. QUARTAROLI, ALFREDO. **Evaporation and adsorption of ammoniacal solutions in the presence of salts and organic compounds.** *Ann. chim. applicata* 36, No. 9/10, 266-72 (1946).—*C.A.* 41, 4692*h*.

Adsorption of NH_4 compds. by animal carbon increased in the presence of salts. In a 0.05 *N* NH_4OH soln., 32.0% was adsorbed when no salt was present; this was increased with 10 g KCl to 42.3%, with 20 g KCl to 49.0%, with 10 g NaCl to 43.2%, with 20 g NaCl to 49.9%, with 5 g LiCl to 42.7%. The above was true at 30°C, but at 18°C the reverse was true owing to formation of complex salts.

2795. RÉGNIER, JEAN AND BAZIN, SUZANNE. **Fixation of different sodium salts by charcoal without agitation. Determination of the base and of the acid radicals.** *Ann. pharm. franc.* 4, 93-4 (1946).—*C.A.* 41, 2957*h*.

The Na salts were much less strongly fixed by charcoal than the corresponding salts of procaine base. The fixation of Na varied for each salt; it was of about the same order for the chloride and citrate, and definitely less for the isobutyrate. The percentage fixation of the base and of the acid were very close to each other. The anion for the procaine salts, accompanied the cation in the same proportions as present in the mol.

2796. VICKERY, R. C. **Adsorption on carbon of rare earth organic complexes.** *Nature* 158, 623-4 (1946).—*C.A.* 41, 1524^a.

The adsorption on decolorizing charcoal of the violet p-phenetidine complex of Ce was studied. Using 100 mg charcoal with 3-12 mg of CeO_2, recoveries were 95-98%, even in the presence of 10 g La_2O_3. There was zero adsorption of Ce^{++++} in the absence of the org. complex. The aq. filtrates were spectroscopically free of Ce.

2797. CALLER, CLORINDA DE SANDAAL. **Reducing action of charcoal on As_2O_3 and Sb_2O_3.** *Bol. soc. quim. Peru* 13, 94-7 (1947).—*C.A.* 42, 7006*e*.

Charcoal of different kinds of native woods had a different reducing effect on As_2O_3, but no, or only a very slight, action on Sb_2O_3.

2798. COURTY, CLEMENT. **Oxidizing properties of active carbon saturated with air.** *Bull. soc. chim. France* 1947, 642-52;—*C.A.* 42, 1102*h*.

Arsenious acid was oxidized by the O_2 adsorbed on active carbon, as well as being adsorbed directly by the carbon itself. The ratio of the two actions was extremely variable. It depended on the carbon, its condition, time, etc. Magnetic measurements over long periods of time (up to a year) indicated that an equil. content of at. O was slowly established. These same measurements, and other speculations, rule out the appreciable influence of CO_2, O_3, or ion formation.

2799. KRIVOLUTSHAYA, N. S.; TEMERIN, S. A., AND LUKOVTSEV, P. D. **Effect of adsorbed oxygen on the potential and the kinetics of discharge of the carbon-manganese oxide electrode.** *J. Phys. Chem. (U.S.S.R.)* 21, 313-23 (1947) (in Russian).—*C.A.* 41, 6159*f*.

The e.m.f. of the cell MnO_2/4 *N* NH_4Cl/satd. KCl/Hg_2Cl_2/Hg was lowered by 0.009-0.07 v., according to the purity of MnO_2, when MnO_2 and the NH_4Cl soln. were freed from adsorbed and absorbed O_2. If a MnO_2-graphite mixt. was used instead of MnO_2, the shift of the e.m.f. could exceed 0.1 v. When the cell was discharged at a const. current (5-10 milliamp.), the e.m.f. of evacuated cells decreased more rapidly than that of ordinary cells.

2800. SASAKI, TSUNETAKA. **Ionic adsorption by coal dusts. I. Conditions of treatment of coal affecting the adsorption.** *Repts. Research Sci. Dept. Kyushu Univ.* 1, 23-31 (1947).—*C.A.* 46, 7732*c*.

Powd. coke, bituminous coal, and lignite, ranked from greater to lesser carbonization, showed ionic adsorption in the reverse of the above order as detd. by Ca ion adsorbed from 0.005 M $CaCl_2$ in 24 hrs. The adsorption of bituminous coal and lignite increased after heating with $Ca(MnO_4)_2$, $K_2Cr_2O_7$, or other oxidizing agents, especially in the presence of a small amt. of $HgSO_4$.

2801. THIELE, HEINRICH. **Directional effect of ions on anisotropic colloids, ionotropy.** *Naturwissenschaften* 34, 123 (1947).—*C.A.* 43, 4539*e*.

Ions caused a directional effect on anisotropic particles of sols or gels (graphitic acid, Hg sulfosalicylate, V_2O_5, etc.). Addn. of a grain of solid salt in a layer of the colloid caused optical anisotropy.

2802. VILLARS, D. S. **Studies of Carbon Black. I. Electrometric titration.** *J. Am. Chem. Soc.* 69, 214-17 (1947).—*C.A.* 41, 2960*g*.

Carbon blacks (MPC, EPC, acetylene black, and ink black) along with some exptl. blacks were titrated electrometrically with 0.5 *N* KOH by using a glass electrode. The curves of pH vs. ml of base showed no inflection point. A linear relation, however, was found between pH and log ml of base. The slopes of these curves were negatively correlated with their intercepts, and, particle size remaining const., were positively correlated with the O-content of the black. The system behaved as if the presence of O_2 combined on the surface increased the free space required by the H^+ ions before they could successfully adhere to the surface.

2803. WINSLOW, N. M. **Electrode potentials of carbon in acid electrolytes.** *Trans. Electrochem. Soc.* **92**, 14 pp. (1947) (Preprint).—*C.A.* **41**, 6159*d*.

When carbon was exposed to O_2 in the presence of acid, oxidizing characteristics were developed measurable as potential or as capacity to oxidize reducing agents (Fe^{++}). Sorption of both acid and oxygen was essential to the development of oxidizing properties. Quant. correlations of active O and potential with acid sorption were given which indicated a possible chem. mechanism for the formation of active surface complexes on carbon. Typical of results were the following potential readings: hardwood charcoal calcined at 1000°C 0.599 v. vs. satd. calomel; acetylene black 0.540; channel black 0.541; calcined petroleum coke 0.440; natural graphite 0.440; artifical graphite 0.471.

2804. IKEDA, TOSHIO. **Adsorption of boric acid by charcoal.** *J. Electrochem. Soc. Japan* **16**, 109-12 (1948).—*C.A.* **44**, 9767*i*.

The amts. of H_3BO_3 adsorbed on bone charcoal were 11.5, 20.5, 24.8, and 30.8 mg/g at 10°C when the initial concns. of H_3BO_3 were 2.91, 5.71, 8.52 and 11.60 g/liter, resp. Soln. of ash during the adsorption or by ion exchange did not occur. From $Na_2B_4O_7$ solns. HBO_2 produced by dissocn. was adsorbed more strongly than $NaBO_2$, also simultaneously produced. The adsorption of H_3BO_3 in aq. soln. was larger than in alc. soln., and there was a min. in their 50% mixt. at 27°C.

2805. KISELEV, A. V. **Effect of volume layering on the shape of the adsorption isotherms of surface-active substances from the gas phase and from liquid solutions.** *Doklady Akad. Nauk S.S.S.R.* **61**, 657-60 (1948).—*C.A.* **43**, 462*c*.

In the absence of a sepn. of the vol. phase into 2 layers or phases, as in the adsorption of gases under high pressures and in adsorption from mixts. of completely miscible liquids, the excess of one substance in the adsorbed layer over its amt. in the vol. phase passed through a max. If the vol. phase sepd. into 2 layers, one of which was a well-wetting liquid, S-shaped adsorption isotherms were observed. (C_6H_6 vapor on fused quartz, MeOH vapor on carbon black, PhOH from aq. soln. on Hg, AmOH from aq. soln. on carbon black, MeOH vapor on coarse-grained silica gel, BuOH from aq. soln. on carbon.) The capillary condensation of vapors had its counterpart in a capillary layering in the case of incomplete miscibility.

2806. KUKHARENKO, T. A. **Study of lignins by the chemisorption method.** *Zhur. Priklad, Khim. (J. Applied Chem.)* **21**, 291-4 (1948).—*C.A.* **44**, 836*i*.

Detns. of equil. adsorption of $Ba(OH)_2$ and of $Ca(OAc)_2$ on lignin, resulting in definite satn. values characteristic of the given lignin, gave a measure of the ($OH + CO_2H$) and CO_2H group contents, resp. The method was tested on 3 lignin prepns., purified by extn. with $EtOH + C_6H_6$, then with boiling H_2O and dild. HCl, finally by hydrolysis with concd. HCl at 0°. Detns. of the total active group content and of the CO_2H group content by the chemisorption method and by methylation with MeOH and Me_2SO_4 coincided exactly.

2807. LESOKHINA, G. F.; PODUROVSKAYA, O. M., AND GOL'BERT, K. A. **Adsorption of vapor mixtures by porous adsorbents.** *Zhur. Fiz. Khim. (J. Phys. Chem.)* **22**, 961-7 (1948).—*C.A.* **43**, 461*a*.

Birchwood charcoal was placed in one-half of an inverted U tube, and the soln. in the other half. The two halves were kept at one temp. or the soln. was 25°C lower than the charcoal. The charcoal was weighed before and after the expt., and the soln. was weighed and its compn. detd. The "effective adsorption" $a = n_1 - (n_1 + n_2)\ N$ was detd., n_1 and n_2 being the amts. in moles of the 2 components adsorbed by 1 g. For adsorption from satd. vapor N was the mole fraction of the first component in the final soln. For adsorption from dil. vapor, N was the mole fraction in the soln. If a was plotted against N, the curves for the vapor mixts. C_6H_6-CCl_4, benzene-cyclohexane, and CCl_4-cyclohexane were almost identical with the adsorption isotherms from the liquid mixts. of these compds. Adsorption from solns. could be used to predict adsorption from vapor.

2808. TENDELOO, H. J. C.; MANS, A. E., AND HOOGH, G. DE. **Titration of adsorbed acids.** *Koninkl. Nederland. Akad. Wetenschap. Proc.* **51**, 37-40 (1948) (in English).—*C.A.* **42**, 4428*c*.

Titration curves of maleic acid and fumaric acid with NaOH in the presence of activated charcoal (Norit) were compared with similar curves obtained in the absence of the charcoal. The effect of the charcoal added was an apparent decrease in the acid strength. The buffer capacity of the charcoal-contg. solns. was also increased over a wide pH range.

2809. THIELE, HEINRICH. **Viscosity and formation of graphitic acid.** *Kolloid-Z.* **111**, 15-19 (1948).—*C.A.* **43**, 4539*g*.

Micellar solns. of graphitic acid in H_2O had high viscosities (η) that increased rapidly and nonlinearly with increasing concn. They were prepd. by oxidizing purified graphite with HNO_3, H_2SO_4, and $KClO_3$, washing the resulting graphitic acid with H_2O at 40°C to remove H_2O-sol impurities, and shaking with water to form a clear, yellowish soln. that was sepd. from the unpeptized material by filtration through raw silk or sintered glass. The addn. of LiOH or NH_4OH initially decreased η, but acids and flocculating agents had the opposite effect. These micellar solns. were optically clear, in contrast to the graphitic acid suspensions that gave active images under the ultramicroscope.

2810. MUKHERJEE, SUDHAMOY AND BHATTACHARYA, SUKHAMOY. **Influence of oxidizing agents on the adsorptive power of charcoal. I. Potassium permanganate.** *J. Indian Chem. Soc. Ind. & News Ed.* **12**, 137-41 (1949).—*C.A.* **44**, 10444*b*.

The variation in adsorptive power of activated and non-activated charcoals on boiling with 0.02

N, 0.1 *N*, 1.0 *N*, and 2.5 *N* solns. of $KMnO_4$ was studied. The adsorptive powers of both types for methylene blue, I_2, and caramel at first increased and then decreased with increasing $KMnO_4$ concn., optimum adsorption occurring at approx. 0.1 *N*. Optimum adsorption of HOAc by non-activated charcoal occurred with 0.02 *N* $KMnO_4$, and with activated charcoal was not reached within the concn. range studied. No further change was observed on increasing the concn. beyond 1.0 *N*. Non-activated charcoals were more susceptible to oxidation than activated ones. The effects of acid and alk. $KMnO_4$ were similar.

2811. PALMER, R. C. **Effects of salts on soluble ionized monolayers.** *Research (London), Suppl. Surface Chemistry* **1949**, 79-85.—*C.A.* **43**, 8796*h*.

In the adsorption of HCl on charcoal or in the adsorption of detergents on oil-water interfaces, the adsorption H^+ or detergent ions was primary adsorption, and the consequent adsorption of oppositely charged ions ("gegenions") was secondary adsorption. Equations are derived that relate the concn. of primary substance and salts of different valency types necessary to give a const. amt. of primary adsorption. The thickness of the adsorbed film could be related to the degree of thermal vibration of the mols. normal to the film.

2812. PETER, S. **The thixotropy of graphite suspensions in relation to particle size and to the suspending medium.** *Kolloid-Z.* **113**, 29-37 (1949).—*C.A.* **44**, 5184*i*.

The yield point of suspensions was measured by detg. the force required to withdraw a microscope cover-glass. Graphite powder was sepd. by elutriation into 3 fractions, having av. particle diams. of 2.8, 1.7, and 0.8 μ. The yield point increased with concn. and with decreasing particle size. Its increase with time after stirring was a first-order process after the first few min. The elec. cond. increased with time, parallel with the yield point and had nearly the same k. Graphite suspensions in $CHCl_3$, CCl_4, PrOH, and MeOH reached a much lower yield point than those in water and the change with time was very different.

2813. TSVETKOV, V. N. AND SOSINSKIĬ, M. **Rotating magnetic field as a method of studying colloidal systems.** *Kolloid. Zhur.* **11**, 197-208 (1949).—*C.A.* **43**, 7291*c*.

Sols prepd. by mixing alc. solns. of *p*-azoxyanisole or anisaldazine with much H_2O showed proportionality between sin 2α and the frequency of rotation ν as long as ν was less than 3 sec^{-1}. At greater ν the whole liquid in the container rotated. Graphite sols showed proportionality between sin α and H^{-1} as if graphite particles had a const. magnetic moment; and sols prepd. by elec. dispersion of Fe in H_2O behaved as a ferromagnetic subst.

2814. WENZEL, ROBERT N. **Surface roughness and contact angle.** *J. Phys. & Colloid Chem.* **53**, 1466-7 (1949).—*C.A.* **44**, 3334*g*.

Roughness that modifies wetting cannot be detd. from surface profiles. The roughness factor is the ratio of actual surface to that of a smooth surface having the same geometric shape and dimensions and might be detd. by measurements for total area (B.E.T.).

2815. YAMADA, MASAMORI AND KATO, HARUO. **The halogen adsorption of polyvinyl acetal. I. Adsorption by polyvinyl formals. II. Relation between kind of acetal and adsorbability.** *Chem. High Polymers* **6**, 356-66 (1949).—*C.A.* **46**, 1294*f*.

Preliminary expts. on the adsorption of I_2 by polyvinyl formal were given. The abilities of polyvinyl formal, acetal, and butyral to adsorb I_2 were compared with that of active charcoal, and the mechanism of adsorption was discussed.

2816. BOND, R. L.; GRIFFITH, M., AND MAGGS, F.A.P. **Water in coal.** *Fuel* **29**, No. 4, 83-93 (1950).—*C.A.* **44**, 5078*a*.

The submicroscopic pores of coal in contact with satd. water vapor became filled with adsorbed moisture, the properties of which differ greatly from normal liquid water. Some coals adsorbed more water than corresponded to their porosity; but the vol. adsorbed at satn. was equal to the sum of the vol. swelling and the porosity. Volume swelling (% by vol.) of a given coal was 15% in MeOH, 9% in C_6H_6, and 2% in H_2O; hence, water was best for detg. porosity in coals. Isotherms were presented for moisture adsorption at various relative humidities. The heats of wetting of the various coals were also detd. and found to fall in the same order with MeOH and H_2O.

2817. HERRMANN, E. AND STIPETIC, J. **The precipitation of aluminum hydroxide according to Bayer as a problem on the formation of a nucleus.** *Z. anorg. Chem.* **262**, 258-87 (1950).—*C.A.* **44**, 8208*f*.

The kinetics were examd. using seeding crystals of various sizes and histories. The reaction was said to be a genuine process of crystn. The results were evaluated in the light of more recent theories and apparently only $Al(OH)_3$ served as seed. The reaction was classified as autocatalytic.

2818. HUBACEK, JOSEF. **The determination of combined acids and their bonds in solid fuels.** *Paliva* **30**, 259-62 (1950).—*C.A.* **45**, 4443*h*.

One g of powd. coal was washed with H_2O and treated with NaOAc to convert free acids and their salts to Na humates. Portions of the filtrate were titrated with KOH to det. free humic acids, and Fe, Ca, and Mg were detd. in acidified portions and calcd. to the corresponding humates. Dissolved $CaSO_4.2H_2O$ in the filtrate may give high results for Ca humates and was corrected by a sulfate detn. Total humic acids were detd. by treating Na humates with $Ba(OAc)_2$ soln. and noting loss of Ba in the filtrate.

2819. KOIDE, TAKEKI; KUBOTA, TAKEO, AND KUROI, TETSUO. **The iodine adsorption of carbon black.** *J. Soc. Rubber Ind. Japan* **23**, 111-21 (1950).—*C.A.* **47**, 3544*c*.

Fundamental expts. were conducted in a study of the I_2 adsorption of carbon black. The amt. of adsorption (per g carbon) increased as the initial concn. of I_2 soln. became high. The amt. of adsorption was effected by the addn. ratio (carbon/total I_2), and for solns. of the same concn. adsorption decreased as the addn. ratio became larger. The amt. of adsorption was influenced by KI in the I_2 soln., and it decreased inversely proportional to KI/I_2. Between 10 and 40°C, the amt. of adsorption became slightly larger with temp. rise.

2820. Akamatsu, Hideo; Takahashi, Hiroshi, and Tamaru, Kenji. **The wet oxidation and the structure of carbon.** *Bull. Chem. Soc. Japan* **24**, 27-32 (1951).—*C.A.* 46, 7411*e*.

The rate of oxidation was followed by detg. the amt. of CO_2 evolved as a function of time from 0.03 to 0.05 g of carbon immersed in 7 cc. of a $K_2Cr_2O_7$ and phosphoric acid soln. The rate of oxidation increased in the order: charcoals, pitch cokes, graphites, carbon blacks. For graphite and carbon blacks, it appeared to be faster for carbons having smaller crystallite dimensions. Activated carbons had a rate of oxidation similar to that of carbon blacks until 20-30% was oxidized, after which the rate slowed down sharply and became similar to that for charcoals.

2821. Erkut, H. **Adsorption in dilute solutions of hydrochloric acid and sodium hydroxide by active carbon.** *Rev. faculté sci. univ. Istanbul* **16A**, 200-20 (1951) (in French).—*C.A.* 46, 4318*e*.

The adsorption on active carbon of HCl and NaOH from very dil. (1-16 millimoles/liter) solns. at temps. of 0 to 45°C was detd. by elec. cond. measurements. Results obtained indicated that about 1% of the surface (574 m^2) was covered. NaOH and HCl mols. are not adsorbed on the same spots on the surface and about twice as much NaOH as HCl was adsorbed. The adsorption results agreed best with Freundlich's equation. Heats of adsorption, calcd. by use of Gibbs' equation and Freundlich's isotherm, were 3400 cal/mol. for HCl and 4700 cal/mol. for NaOH adsorbed.

2822. Herrmann, E.; Stipetić, J., and Ledinski, V. **Formation of crystal nuclei and growth of crystals in the precipitation of aluminum hydroxide in the Bayer process.** *Acad. Sci. et Art. Sloven.* (Ljubljana). Class III, Ser. A, *Dissertationes*, No. 2, 93-120 (in English 120-4) (1951).—*C.A.* 46, 9935*e*.

In the study of the kinetics of pptn. of $Al(OH)_3$ from Na aluminate solns., the neg. effect of org. compds. was eliminated by the addn. of active carbon. The question of the slow rate in contrast to the behavior of undercooled solns. remained unsolved.

2823. Stempel, R. **Separation of iodine from alkali and alkaline-earth halides with active charcoal.** *Z. Anal. Chem.* **133**, 412-14 (1951).—*C.A.* 46, 61*d*.

To 10-20 ml of approx. 0.1 *N* soln. add 0.5-1.0 g of active charcoal, shake well, and filter. Wash 3 times with 10 ml portions of water. Titrate the filtrate with $AgNO_3$ soln.

2824. Suzutani, Toru. **Polarographic studies on adsorption from solutions; discontinuities in adsorption isotherms and the application of this phenomenon to the molecular-weight determination of proteins.** *Japan. J. Physiol.* **1**, 213-32 (1951).—*C.A.* 45, 6895*h*.

$Pb(NO_3)_2$ at several concns. was adsorbed by charcoal (0.35% suspension) and 0.1% suspensions of egg albumin, hemoglobin, and gelatin. Upon completion of adsorption (20 hrs or more), free Pb ions were detd. polarographically (pH 7.0, temp. 20.0 ± 0.1°C). The half-wave potential of Pb ion (-0.44 v. *vs.* normal calomel electrode) was the same in the presence of protein as when detd. from standard soln., and the time (3.5 sec) for a drop to form and fall at the cathode was too short for a significant amt. of desorption. Adsorption isotherms for all proteins studied were steplike.

2825. Adler, I. and Steigman, J. **Adsorption of UX_1 and RaE by an Aquadag-coated dipping Geiger-Müller tube.** *J. Phys. Chem.* **56**, 493-8 (1952).—*C.A.* 46, 8929*a*.

A dipping Geiger-Müller tube coated with an adsorbent such as colloidal graphite was used. The counting rate of the tube then depended on the rate of adsorption of the radiocolloid on the coating. Data were given on the method of coating the G.M. tube with Aquadag, the reproducibility of results, and the behavior of salts of UX_1 (thorium) and RaE (bismuth) in various aq. media.

2826. Hamdi, H. **Coagulation of graphitic oxide sols.** *Kolloid-Z.* **128**, 22-6 (1952).—*C.A.* 47, 25*c*.

Graphitic oxide sol was prepd. by dialyzing the product obtained from the oxidation of graphite by concd. H_2SO_4, concd. HNO_3, and $KClO_3$. A suspension contg. 0.4 g/liter at pH 3.75 was obtained.

2827. Mans, A.E. and Vervelde, G.J. **Titration of adsorbed acids.** *Rec. trav. chim.* **71**, 977-86 (1952) (in English).—*C.A.* 47, 4165*b*.

Titration curves of dil. salicylic acid were detd. with NaOH and $Ca(OH)_2$ with and without the addn. of varied amts. of activated charcoal to the acid soln. The addn. of adsorbent caused a marked change in the dissocn. const. of the acid, and the titration curve shifted from that of a strong acid (without adsorbent) to that of a very weak acid, as amts. of the charcoal were added. The greater the amt. of adsorbent added to the salicylic acid solns., the higher the initial pH of the soln. and the greater the difference between the curves for uni- and bivalent bases; the tritration curve with the NaOH always resembled that of a weaker acid than the curve using $Ca(OH)_2$.

2828. Tovbin, M.V. and Grinberg, A.D. **Dynamics of desorption from solutions.** *Zhur. Fiz. Khim.* **26**, 156-64 (1952).—*C.A.* 47, 4688*a*.

Birch charcoal activated by CO_2 at 1000°C until its porosity was 60.2-67.0%, was satd. with I_2 from a soln. in 0.1 *N* KI. The adsorbed amt. *a* (mg I_2/g) was 230 when the equil. concn. *c* of I_2 in the soln. was < 0.1 mg/liter and 1100 at 7g/liter. Then the charcoal was washed with 0.1 *N* KI soln. No I_2 could be displaced as long as *a* was less than 230. Increase of temp. from 10° to 40°C raised the rate of desorption 2.5-fold. Probably the measured rate of desorption was smaller than the real rate of desorption, because the I_2 desorbed from one patch on the adsorbent was readsorbed by another patch.

2829. JACOBSON, M. G. **Electrochemical method for oxygen determination in gases.** *Anal. Chem.* 25, 586-91 (1953).—*C.A.* 47, 6306*i*.

The depolarization of a carbon cathode in a cell with Zn anode by O_2 was used to det. the O_2 concn. of gas mixts. To obtain the high current d. required, the tubular carbon cathode, through which the gas sample circulated, was covered with insulating varnish except for several "windows," permeable to gas but not to electrolyte. A continuous O_2 indicator was described in which a thermostat controlled the temp. The total change in elec. power, *W*, was proportional to the O_2 concn., *C*. This could be used directly. The electrolyte was oxolite, a soln. of pH 3, which made the instrument insensitive to CO and up to 24% CO_2.

2830. KORDESCH, K. AND MARTINOLA, F. **The galvanic cell: oxygen (on carbon)/potassium hydroxide/zinc.** *Monatsh.* 84, 39-53 (1953).—*C.A.* 47, 6278*g*.

Catalyzed O_2 electrodes in alk. electrolytes were studied in open-circuit and current-supplying states. Potential measurements with varying O_2 partial pressure and pH suggest a reversible O_2/H_2O_2 electrode. Ionic activities in 0.5-10 *M* KOH solns. were detd. The temp. coeff. of the O_2-carbon electrode between 12 and 35°C with a drain of 5 ma./cm^2 was 0.5 mv./degree.

II-3. Non-Carbon Adsorbents With Organic Solutions

2831. EISENACK, ALFRED. **Catalytic action of clays and other silicate minerals and compounds on aromatic amines and phenols.** *Zentr. Mineral., Geol.* 1938A, No. 10, 305-8.—*C.A.* 34, 1976^8.

Clays, mixed with solid amines or suspended in liquid amines, catalyze slow reactions producing dyes and colorless by-products. The reactions, obtained with a large no. of amines and with phenol, were also catalyzed by kaolin, weathered feldspar and basalt, serpentine, pptd. Mg and Al silicates, silica gel, permutite, and $Fe(OH)_3$, but not by active C, pptd. $CaCO_3$ or cellulose. The materials which catalyze the reactions were excellent adsorbents for the dyes produced.

2832. HENDRICKS, S. B. AND ALEXANDER, L. T. **Qualitative color test for montmorillonite (bentonite) type of clay minerals.** *J. Am. Soc. Agron.* 32, 455-8 (1940) Rev. Current Lit. Paint, Colour, Varnish & Allied Ind. 15, 113 (1942).—*C.A.* 36, 6450^2.

Benzidine was slowly oxidized to a blue or greenish blue color in the presence of montmorillonite; Fe^{+++} probably participated in the reaction although $Fe(OH)_3$ and other Fe compds. in the soil did not give the reaction in the absence of montmorillonite. Mn^{++} interfered with the reaction and org. matter had to be removed by treatment with H_2O_2 prior to the test. Kaolin minerals did not give the test.

2833. BIELENBERG, W. AND GOLDHAHN, H. **The adsorption of hydroxybenzenes on bleaching earths.** *Kolloid Z.* 97, 151-3 (1941).—*C.A.* 37, 17^5.

The selective adsorption of various mono-, di-, and trihydroxybenzenes on Floridin XXF and on Tonsil AC was measured. The point was measured at which the color reaction of the solutions of the hydroxybenzenes with a 1% alk. solution of fluorenediazonium chloride disappeared when the solutions were shaken with the adsorbent. Complete adsorption of pyrocatechol took place much faster than that of the univalent phenols (phenol, o-, m-, p-cresol, carvacrol, 1-2-dimethyl-4-hydroxybenzene, 1,4-dimethyl-2-hydroxybenzene, and guaiacol).

2834. BROCKMANN, HANS AND SCHODDER, HELLA. **Aluminum oxide with buffered absorptive properties for purposes of chromatographic adsorption.** *Ber.* 74B, 73-8 (1941).—*C.A.* 35, 2390^8.

Al oxides of various adsorptive activities were prepd. by heating Merck's tech. $Al(OH)_3$ to strong red-heat and then partially deactivating by shaking for shorter or longer periods with moist air. Various dyestuffs showed increasing tendencies toward absorption (methoxyazobenzene, azobenzene, Sudan Yellow, Sudan Red, aminoazobenzene, hydroxyazobenzene).

2835. EICKE, H. **Application of adsorption technique to investigation of tar and bitumen.** *Teer u. Bitumen* 39, 113-15, 122-5, 133-5, 144-9, 154-7, 161-3 (1941).—*C.A.* 37, 1847^5.

The adsorption method, especially when combined with fractional extn., was a valuable aid to the analysis of bitumens. Conditions in the road bed were approached as nearly as possible by a new method of testing based on treatment of solns. of the tar or bitumen with bleaching earth. Fractional extn. was combined with adsorption analysis so that the original substance was sepd. by the adsorption tests into separate groups by means of selective solvents which subsequently serve as sepg. or adsorption media.

2836. ENDELL, JOACHIM; ZORN, RENATE, AND HOFMANN, U. **The benzidine test for montmorillonite.** *Angew. Chem.* 54, 376-7 (1941).--*C.A.* 35, 7878^8.

The widespread use of the blue color given with benzidine as a sp. test for montmorillonite in rocks and soils depended on an oxidizing action leading to formation of semiquinones. Other similar diamines likewise gave a blue color. The blue color cannot, however, be regarded as a test for montmorillonite. Adsorption probably was an important factor.

2837. ERDHEIM, EDUARD. **Dependence of the bleaching power of highly active bleaching earths on their water content and the bleaching temperature used.** *Osterr. Chem.-Ztg.* 44, 217-23 (1941).—*C.A.* 37, 2523^7.

Three mineral oils were bleached with an American active earth and a comparable Rumanian bleaching clay at 110°, 160°, 168°, and 230°C. The best results were obtained at 110°C. Another series was run with a bleaching earth containing 2.7-25.7% water, with 3 mineral oils, soybean, and rapeseed oil at 100°C. Oils having a higher water content bleach better. Earths with high and very low water content could be used to advantage for bleaching at elevated temp. preferably under a CO_2 blanket.

2838. ESME, A. **The use of bentonite as a gel-producing medium and carrier.** *Industrie chimique* **28**, 230-1 (1941).—*C.A.* **37**, 6371^1.

Bentonite swelled in water and could absorb 25-30 times its original vol. It was suitable as a basis for the prepn. of emulsions particularly as a substitute for fatty carriers. The tendency of these gels to dry easily could be greatly reduced by the addn. of glycerol or glycol, sugar soln., and Zn or Mn nitrate or $CaCl_2$.

2839. KRUGER, DEODATA AND OBERLIES, FRIDEL. **Catalytic oxidation of amines at the surface of negative adsorbents. II. Realization of a different course of the reaction in the oxidation of dimethylaniline and some of its homologs on bentonite and on other surfaces.** *Ber.* **74B**, 1711-19 (1941).—*C.A.* **37**, 365^4.

The reaction occurred on various silicates (talc, certain kaolins, asbestos). The prerequisite seemed to be a surface with negatively polar free affinities which made possible the adsorption of the aromatic amine and its further basic oxidation and condensation products, with formation of salt-like complexes. TiO_2 did not become colored in a $PhNMe_2$ atmosphere. Bentonite reacted differently from other silicates.

2840. PACSU, EUGENE AND MULLEN, JAMES W., 2ND. **Separation of starch into its two constituents.** *J. Am. Chem. Soc.* **63**, 1168-9 (1941).—*C.A.* **35**, 3843^7.

Selective adsorption of β-amylose from a mixt. with α-amylose occurred on activated charcoal, fuller's earth and Brockmann Al_2O_3 but best results were obtained with cotton. This adsorbate was formed instantaneously when a cold 1% cornstarch paste was brought into contact with cotton and could be washed free of α-amylose with cold H_2O.

2841. PAGE, J. B. **Unreliability of the benzidine color reaction as a test for montmorillonite.** *Soil Sci.* **51**, 133-40 (1941).—*C.A.* **35**, 6296^5.

The benzidine color test for the presence of montmorillonite in soils and minerals was used on a group of about 35 samples. In one case a strong pos. reaction was given by a colloid whose predominating mineral was of the kaolinitic type. Also, in a few cases bentonites gave weak or no color intensity. The presence of slightly sol. Fe was responsible for some color reaction.

2842. POSPISCHIL, F. **A note on the term "adsorption" in dyeing and dye analysis.** *Wollen- u. Leinen-Ind.* **61**, 67 (1941).—*C.A.* **37**, 6898^7.

"Adsorption" is the ability of a substance to fix other substances without the formation of a chem. compd. This occurred, e.g., in the deposition of inorg. pigments ($BaSO_4$, TiO_2 etc.) on fibers. Filtration of the dissolved dye through $CaSO_4$, silica gel, and kaolin was also discussed.

2843. SUZUKI, SHIN-ICHI. **Titanium compounds. XVIII. Adsorption by titania gel.** *J. Japan Ceram. Assoc.* **49**, 530-41 (1941); *J. Am. Ceram. Soc.* **32**, No. 8, Ceram, Abstracts Sect., 195 (1949).—*C.A.* **44**, 10282*e*.

The adsorption of Benzo Copper Blue 2B by titania gel was studied. Gels were obtained by heating the sol made by the hydrolysis of $TiCl_4$ at 60° and 85°C. The addn. of salt to the sol increased the adsorption of gel in the following decreasing order: $AlCl_3$, $CaCl_2$, $MgCl_2$, $MnCl_2$.

2844. GYANI, B. P. AND GANGULY, P. B. **Adsorption in relation to constitution. I. Adsorption of alkaloids by silica gel.** *J. Indian Chem. Soc.* **19**, 453-60 (1942).—*C.A.* **37**, 3990^4.

Alc. solns. (25 cc.) of the alkaloids were shaken with 2-5 g silica gel, left until equil. was attained and analyzed to find the amt. of adsorption (direct titration with suitable indicators). Silica gel was activated by water washing for several days, drying at 100°C and heating to about 300°C for 3 hrs in a current of CO_2-free air. About 90% of the adsorption took place within 24 hrs, but complete equil. was established only after 20 days (nicotine 3 days and brucine 60 days). The following adsorption values were found: morphine 63.7%, nicotine 78.5%, quinine 49.0%, quinidine 61.8%, cinchonidine 63.2%, brucine 83.1%, strychnine 80.6%, caffeine 20.8%, piperine neg. absorbed. The adsorption isotherms followed Freundlich's equation.

2845. JAMISON, M. M. AND TURNER, E. E. **Separation of diastereoisomerides by selective adsorption on optically inactive material.** *J. Chem. Soc.* **1942**, 611-12.—*C.A.* **37**, 5299^2.

l-Menthyl, d-and *l*-mandelates was adsorbed selectively on Al_2O_3.

2846. KAUTSKY, H. AND MULLER, G. O. **Chemiluminescence of adsorbed dyes.** *Naturwissenschaften* **30**, 315-(1942).—*C.A.* **37**, 4305^1.

Chemiluminescence (produced by O_3) and fluorescence (ultraviolet light) of a series of dye adsorbates on silica gel or alumina gel emitted light of essentially the same color for each dye. Colors ranged from orange red to green. The intensity of chemiluminescence was strongest in the red region.

2847. MEHLICH, ADOLPH. **Adsorption of barium and hydroxyl ions by soils and minerals in relation to pH.** *Soil Sci.* **53**, 115-24 (1942).—*C.A.* **37**, 2861^9.

Natural soils and various H-saturated soil materials were treated with increasing amounts of triethanolamine and NaOH in the presence of a constant amount of $BaCl_2$. After shaking, leaching, and washing, the amounts of Ba and OH ions adsorbed were measured volumetrically. Adsorption of Ba by soils reached a maximum coincident with neutralization of exchangeable H. With humic acid, this occurred at about pH 6.0, peat at 6.8, Eutaw soil at 8.2, and kaolin at 9.6. Equivalent adsorption of Ba and OH ions by these materials occurred above pH 5.2 for lignite, pH 7.6 for halloysite, and pH 8.7 for Permutit.

2848. Meunier, Paul. **The action of montmorillonite clay on vitamin A and the phenomenon of mesomerism in the carotenoid group.** *Compt. rend.* **215**, 470-3 (1942).—*C.A.* **39**, 11³.

Montmorillonite clay in adsorbing vitamin A in nonpolar soln. gave a blue color. Other clays after treatment with HCl or H_2SO_4 behaved in the same way. The color was persistent, but was dispelled by a trace of polar solvent. On repassage through a nonpolar solvent color reappeared. The fact that the blue product could not be isolated from its support showed that the coloration resulted from adsorption.

2849. Munro, L. A. and Monteith, G. E. **The syneresis of silica gels containing addition agents.** *Can. J. Research* **20B**, 212-20 (1942).—*C.A.* **37**, 20⁹.

The method of measurement of syneresis gave duplicate results agreeing within 1.2%. The effect of a series of alcohols—methyl, ethyl, glycol, glycerol, and erythritol—on syneresis was studied. The results indicated that the total volume of syneretic liquid at equilibrium was the same as that of the control (within the experimental error) and that no adsorption had taken place in the gel itself.

2850. Capell, R. G.; Amero, R. C., and Moore, J. W. **New data on activated bauxite desiccants.** *Chem. & Met. Eng.* **50**, No. 7, 107-10 (1943).—*C.A.* **37**, 5802⁵.

Dehydration of org. gases and liquids with an activated bauxite desiccant, Florite, was described. Equil. dryness obtainable, H_2O-adsorption capacity, regeneration and effects of pressure drop and fluid velocity were discussed.

2851. Damle, N. R.; Forster, R. B., and Kudva, K. G. **Green earth of Indian origin as a base-exchanging body.** *J. Indian Chem. Soc., Ind. & News Ed.* **6**, 30-9 (1943).—*C.A.* **38**, 5708⁵.

Green earth adsorbed only basic dyes (methylene blue, malachite green, brilliant green GX) and bases ($PhNH_2$, benzidine). Previous treatment of green earth with aq. solns. of $CaCl_2$, $ZnCl_2$, NaCl or NaOH increased the adsorption; variation of pH had no effect; preheating green earth to 400°C reduced adsorption, preheating to 800°C prevented it. The adsorbed substances could not be replaced by NaCl or removed by water or org. solvents. The "sorption" curves were similar and did not obey Freundlich's law.

2852. Franck, James and Pringsheim, Peter. **Phosphorescence of adsorbed trypaflavine and its quenching by oxygen.** *J. Chem. Phys.* **11**, 21-7 (1943).—*C.A.* **37**, 833⁶.

Dyes adsorbed on, or imbedded in, solids had a greater yield of fluorescence and phosphorescence than they did in liquid solutions. The green phosphorescence of trypaflavine adsorbed on silica gel was half quenched by O_2 at 5×10^{-5} mm pressure; the quenching at higher O_2 pressures was much smaller than would be expected. This indicated that two long-lived excitation states (tautomers of tyrpaflavine) shared in causing the green phosphorescence.

2853. Gyani, B. P. and Ganguly, P. B. **Adsorption in relation to constitution. II. Adsorption of organic acids on activated silica gel.** *J. Indian Chem. Soc.* **20**, No. 10, 331-7,(1943).—*C.A.* **38**, 3180⁷.

The adsorbabilities of a large number of org. acids on active silica gel were investigated. With the exception of HCOOH (adsorbability abnormally large - 92%), the first 13 members of the fatty acid series had adsorbabilities lying between 52.8 and 60%. The adsorbabilities of dibasic acids from alc. solns. showed a regular decrease with an increasing number of C atoms in the chain. With the exception of oxalic acid, the product of adsorption coeff. and the number of C atoms in the mol. was a const. The substitution of OH groups, halogens, and other active groups in the fatty acid mol. increased the adsorbability on silica gel in nearly all cases.

2854. Hartmann, M. and Druey, J. **Adsorption of sulfanilamide, sulfathiazole and *p*-aminobenzoic acid.** *Schweiz. med. Wochschr.* **73**, 558-60 (1943).—*C.A.* **38**, 4098⁸.

Inorg. adsorbents took up more sulfathiazole than *p*-aminobenzoic acid at alk. reaction but less at acid pH. Both sulfanilamide and sulfathiazole were able to replace *p*-aminobenzoic acid in adsorbates.

2855. Meunier, Paul. **Action of acid clays on aromatic amines. Coloration and electromeric effect.** *Compt. rend.* **217**, 449-51 (1943).—*C.A.* **39**, 1794⁸.

Coloration accompanying adsorption of aromatic amines, e.g., aniline, by acid clays (bentonite, montmorillonites) was attributed to dipolar mols. Each dipolar mol. of aniline in contact with clays (whose ions were immobilized since the H^+ ions were retained between layers of silicate anions) could so orient itself that it fixed a proton and formed an ionic bond. Electron-donor solvents (H_2O, EtOH) did not elute the adsorbed aniline, since it had no atom with an incomplete electron shell.

2856. Yadava, B. P. **Charge and stability of colloids. II. Effect of nonelectrolytes.** *J. Indian Chem. Soc.* **20**, 110-14 (1943).—*C.A.* **37**, 6519³.

Addns. of MeOH reduced the adsorption both of Ba^{++} on As_2S_3 and of SO_4^{--} on $Fe(OH)_3$ by about 1/3 or 1/4. For EtOH small increases were noted, for agar-agar changes were slight, and for gelatin small decreases were noted.

2857. Aldrich, D. G.; Hellman, N. N., and Jackson, M. L. **Hydration control of montmorillonite as required for its identification and estimation by x-ray diffraction methods.** *Soil Sci.* **57**, 215-31 (1944).—*C.A.* **38**, 4535¹.

To control the degree of hydration of montmorillonite, clay particles less than 0.2 μ in diam., conditioned and satd. with Ca, were suspended in a ternary soln. of benzene, ethanol and water, the compn. of which was such as to provide true soln. but near-satn. with respect to water.

Benzene was added to the suspension which set free a water-rich 2nd phase in finely divided form throughout the suspension so that it was sorbed uniformly by all of the clay. Most of the supernatant liquid was decanted and the clay dried under controlled conditions.

2858. BATCHELOR, R. W. AND FOSTER, A. G. **Freezing point of adsorbed liquids.** *Trans. Faraday Soc.* 40, 300-5 (1944).—*C.A.* 38, 6156^{4}.
Dioxane adsorbed on Fe_2O_3 gel melted sharply about 6 °C below the normal m. p. (11.7 °C) and had a lower vapor pressure. The gel of coarse capillary structure had an av. capillary radius of the order of 100 A. and the isothermals resembled those of water on Fe_2O_3 gel. Water adsorbed on silica gel of pore radius approx. 11 A. remained liquid even on cooling to -65 °C.

2859. BOSAZZA, V. L. **The adsorption of some organic dyes by clays and clay minerals.** *Am. Mineral,* 29, 235-41 (1944).—*C.A.* 38, 4219^{8}.
Quant. data were detd. for the adsorption of malachite green, Congo red and methyl violet by 3 kaolinites and 2 bentonites. Qual. tests showed that naturally-colored dyes were adsorbed in varying amts. by all the clays tested. Colorless or nearly colorless amines such as benzidine, o-toluidine, diphenylamine reacted to give blue or green colors only with moist illite or montmorillonite clays, not with kaolinite, moist or dry, nor with dry illite or montmorillonite.

2860. ERLENMEYER, H.; BOSSARDT, ALFRED A., AND THEILHEIMER, W. **Comparative flotation experiments with fatty acids as a-hydroxy fatty acids as collectors.** *Helv. Chim. Acta* 27, 1429-32 (1944).—*C.A.* 39, 2471^{4}.
α-Hydroxy acids were particularly suited as collectors. In tests upon the flotation of Fe_2O_3 with valeric, hydroxyvaleric caproic, hydroxycaproic, lauric and hydroxylauric acids, the last two of the acids were outstanding in their action; in the ratio of less than 0.1 mg of the acid to 2 g of Fe_2O_3, they were effective collectors. An artificial mixt. of hydrated Al_2O_3 and quartz was well sepd. with hydroxylauric acid.

2861. GOLDHAHN, H. **Formation of color lakes on fuller's earths.** *Angew. Chem.* 54, 377 (1944); *Chem. Zentr.* **1941, II,** 2871.—*C.A.* 38, 1882^{9}.
The appearance of the adsorption colors of different hydroxyazobenzene dyes on Tonsil (clay), floridin and Al_2O_3 were discussed. The hydroxy benzenes corresponding to hydroxyazobenzene dyes frequently gave, an adsorption on fuller's earths from non-aq. soln., characteristic colors which often corresponded to the colors produced by hydroxyazobenzene dyes.

2862. GRAFF, MORRIS M.; O'CONNOR, ROBERT T., AND SKAU, EVALD L. **Purification of solvents for adsorption spectroscopy. An adsorption method.** *Ind. Eng. Chem., Anal. Ed.* 16, 556-7 (1944).—*C.A.* 38, 6198^{3}.
Hydrocarbon solvents were purified by selective adsorption on silica gel columns. The method was superior to the usual tedious chem. and phys. methods for removing impurities which absorb light in the ultraviolet. Com. samples of cyclohexane, n-heptane, isooctane, Skellysolve-B, and Skellysolve-F, purified in this manner, were found to be transparent in the ultraviolet.

2863. KUL'SKIĬ, L. A. AND KOGANOVSKIĬ, A. M. **Colloid adsorption from water by aluminum and iron hydroxide gels. I. Influence of ferrogel dehydration on Congo red adsorption.** *J. Applied Chem. (U.S.S.R.)* 17, 599-605 (1944) (English summary).—*C.A.* 40, 2054^{9}.
Adsorption of Congo red from colloidal solns. onto active charcoal and Fe hydroxide gels was studied. All isotherms fit the Langmuir equation. Strongly hydrated Fe hydroxide gels had a large sorption capacity which fell sharply with dehydration. Contraction and adsorption loss on dehydration were attributed to decrease in diam. of microcapillaries during dehydration.

2864. LEONT'EVA, A. A. **An attempt to apply thermal analysis to the study of adsorption processes.** *J. Phys. Chem. (U.S.S.R.)* 18, 469-72 (1944).—*C.A.* 39, 2918^{9}.
Brilliant green and, in some expts., methyl violet were adsorbed on kaolin (no Fe), ocher (Fe as hydroxide outside the lattice), glauconite, and nontronite (both have Fe in the lattice). The amts. of dye adsorbed at room temp. were nearly equal for the 4 adsorbents, but boiling EtOH exts. more dye from kaolin and ocher than from glauconite and nontronite. Heating curves of kaolin + dye showed an endothermic effect ascribed to a sublimation of dye above 120 °C.

2865. BRADLEY, W. F. **Molecular associations between montmorillonite and some polyfunctional organic liquids.** *J. Am. Chem. Soc.* 67, 975-81 (1945).—*C.A.* 39, 3190^{9}.
The org. liquids were chiefly: (1) aliphatic di- and polyamines and (2) glycols, polyglycols and polyglycol ethers. Small amts. of clay were simply soaked in the solvent, the solvent was poured off, and the clay washed superficially by decantation, and permitted to air-dry. X-ray diffraction diagrams of the powder were then made with either filtered Fe or Cu radiation. Org. solvents of both the above groups yielded characteristic complexes whether they were used as the pure liquids or as water solns. as weak as molal or one-half molal for the glycols, weaker for the amines.

2866. BROAD, D. N. AND FOSTER, A. G. **The sorption of condensable vapors by porous solids. II. The validity of Gurvitsch's rule.** *J. Chem. Soc.* **1945,** 366-71.—*C.A.* 39, 4785^{9}.
Isothermals of the following liquids were detd. on silica gel at 25 °C: AcOH, acetone, diisopropyl ether, dioxane, n-hexane, morpholine, n-octane, toluene, and tri-ethylamine. The amts. adsorbed at satn. decreased as the diam. of the adsorbed mol. increased. The observed relations could be explained by assuming that the adsorbent contained tapering capillaries. The no. of mols. held in the unimol. layer also decreased as the mol. diam. increased.

2867. DUUREN, A. J. VAN. **Dependence of the adsorption isotherm on the quantity of adsorbent.** *Rec. trav. chim.* 64, 303-4 (1945) (in French).—*C.A.* 40, 3958^{7}.

Aniline and AcOH were adsorbed from C_6H_6 soln. by Terrana, an activated com. decolorizing agent (montmorillonite). The amt. adsorbed at const. concn. per gram of earth was greater for smaller amts. of earth, which ranged from 0.25 to 1.00 g/100 cc. of soln.

2868. GYANI, B. P. AND GANGULY, P. B. **Adsorption in relation to constitution. V. Adsorption of alcohols, esters, and ketones on silica gel.** *J. Phys. Chem.* 49, 226-38 (1945).—*C.A.* 39, 3715^4.

The adsorption of the lower members of the series of alcs., esters, and ketones on active silica gel was measured by a static method. Silica gel was a powerful adsorbent for all the vapors studied. At high relative pressures the amounts of adsorption were always in the inverse order of the mol. wts in the same series of compds. These orders were not maintained at lower relative pressures, and might further change according to the mode of plotting adopted.

2869. KISELEV, A. V.; VORMS, I. A.; KISELEVA, V. V., AND SHTOKVISH, N. A. **Adsorption of fatty acids on silica gel and its ultraporosity.** *J. Phys. Chem. (U.S.S.R.)* **19**, 83-91 (1945).—*C.A.* 39, 3715^6.

The adsorption of AcOH, propionic acid, and stearic acid from CCl_4 at room temp. on silica gel was less the higher the temp. (T) of dehydration of the gel. The vols. of AcOH and stearic acid adsorbed at satn. (extrapolated for AcOH) were nearly identical at 485° and 800°C. For a silica gel of T 200°C (adsorbed a larger vol. of stearic acid than of AcOH) the surface was about 3×10^6 cm^2/g.

2870. SIEGL, W. **Detection of montmorillonite with benzidine.** *Neues Jahrb. Mineral., Geol., Monatsh A*, **1945-48**, 40-3.—*C.A.* **43**, 1287h.

Montmorillonites, which did not react with benzidine alone, gave the blue color if a few drops of dil. FeCl soln. was added. Kaolinites also gave a bluish color after FeCl soln. was added, but gave grayish or violet hues distinguishable from the ultramarine blue given by montmorillonite.

2871. VEDENEEVA, N. E. **Chromatographic adsorption in clay analysis.** *Doklady Akad. Nauk S.S.S.R.* **50**, 429-32 (1945).—*C.A.* **44**, 5274d.

A suspension of the powd. mineral with a dil. soln. of one or two org. dyes were shaken. After sedimentation, characteristic rings appeared, usually rather indistinct, but sometimes in sharp thin zones, or spots on a uniformly colored background. Usually, the chromatograms became increasingly distinct during standing. Expts. with kaolinite, montmorillonite (bentonite), nontronite, and halloysite were described, with methylene blue as a dye. In the special case of halloysite, diiodofluorescein (in acetone soln.) was superior.

2872. BUCHADER, G. AND LEBESGUE, JACQUES. **Evolution during the formation of a silica gel of the fluorescence of a substance dissolved in it.** *Compt. rend.* **223**, 324-6 (1946).—*C.A.* **41**, 29^i.

The intensity and polarization of the fluorescence emitted by rhodamine S when added to a fresh mixt. of Na silicate and H_2SO_4 were measured at different times during formation of the gel. The most rapid increase in intensity was found to occur during the first hrs; after 48 hrs the intensity was 3 times the initial value. During the formation of the gel there was a decrease in the de-cativation of the mols. without emission.

2873. ESME, A. **Chemical control of bentonites by color test for montmorillonite.** *Ann. chim. anal.* **28**, 31 (1946).—*C.A.* **40**, 2762^3.

Montmorillonite gave a blue color in the presence of benzidine: Treat the sample with 3% H_2O_2, evap. to dryness below 100°C and treat 1 g of the residue with a cold, satd. soln. of benzidine. Shake vigorously and allow to stand for a few hrs. The blue superficial color was the result of an oxidizing effect which was really caused by ferric ions present.

2874. FOSTER, A. G. **Validity of Gurwitsch's rule.** *Nature* **157**, 340-1 (1946).—*C.A.* **40**, 3323^1

The sorption isothermals of a no. of org. liquids on silica gels were examined.

2875. GANGULY, P. B. AND GYANI, B. P. **Orientation of molecules in adsorbed layers.** *Bull. Patna Sci. Coll. Phil. Soc.* No. **16**, 92-6 (1946).—*C.A.* **40**, 5316^9.

Adsorption of 14 monobasic acids [not specified] on silica gel from anhyd. alc. indicated the mols. to be adsorbed in a vertical position. Dibasic fatty acids appeared to lie flat except at high concn. Results given for satd. pentane, hexane, heptane, and octane vapors showed the product of adsorption coeff. and mol. area to be const., indicating flat orientation.

2876. MACEWAN, D. M. C. **Halloysite-organic complexes.** *Nature* **157**, 159-60 (1946).—*C.A.* **40**, 2419^9.

Complexes of halloysite with CH_2OHCH_2OH, glycerol, $HO(CH_2)_3OH$, CH_2ClCH_2OH, CH_2BrCH_2OH, and MeOH were described. There was room for one flat layer of alc. mols. between the halloysite sheets; there were two such layers in montmorillonite complexes.

2877. NEDERBRAGT, G. W. AND JONG, J. J. DE. **The separation of long-chain and compact molecules by adsorption.** *Rec. trav. chim.* **65**, 831-4 (1946) (in English).—*C.A.* **41**, 2299^a.

Binary mixts. of satd. hydrocarbons, paraffins, and naphthenes, dissolved in pentane were passed through columns of large quantities of Floridin earth, previously ground and dried at 300°C. Pentane was used as eluant. Extremely good sepns. were accomplished with mixts. of equal amts. of tetracosane ($n_D^{70} = 1.4281$) and di-sec-butyldecahydronaphthalene ($n_D^{70} = 1.4625$), and of octadecyclohexane ($n_D^{70} = 1.4420$) and di-sec-butyldecahydronaphthalene, the paraffins were better adsorbed.

2878. RYKHLIKOV, G. P. AND GAPON, E. N. **Adsorption of organic acids by silica gel. II.** *J. Phys. Chem. (U.S.S.R.)* **20**, 1029-41 (1946) (in Russian).—*C.A.* **41**, 2298^h.

Formic, acetic, propionic, and butyric acid solns. in CCl_4 were shaken with 4 different silica gels. The amt. x (in g-mol.) adsorbed by 1 g of gel, without regard to the adsorption of CCl, satisfied the equation $x = Sc^{1/3}/(c^{1/3} + K)$, S and K being consts. and c the equil. concn. of the acid (g-mol./liter). Distribution of the fatty acids between H_2O and CCl_4 showed that the acids were assocd. in CCl_4 to triple mols. At a given c, x increased from acetic, propionic, and butyric to formic on all gels.

2879. Balma-Perrier, Francoise and Darmois, Eugene. **The measurement of the specific surface of silica powders.** *Compt. rend.* **224,** 1562-4 (1947).—*C.A.* **41,** 6107*e*.

The method was based on the speed of mutarotation of an aq. soln. of tartaric acid and SbF_3 in contact with SiO_2. Powd. silica gave a value of 1000 cm^2/g, compared with 1300 by microscopic examn., and 800 by adsorption of Diamond Magenta dye. The change in surface area of pptd. silica with temp. of calcination was shown, falling from 6.1 to 0.3×10^5 cm^2/g for one prepn. as the temp. was raised from 280° to 1270°C.

2880. Graham, Ronald P. and Crawford, Donald J. **The sorption of oxalate by hydrous alumina.** *J. Colloid Sci.* **2,** 509-19 (1947).—*C.A.* **42,** 1103*e*.

The sorption of $(COOH)_2$ by hydrous Al_2O_3 from 0.05 M solns. at 25°C reached a max. after 1-4 hrs and then decreased steadily. The neutralization of H_3O^+ ion by the alumina during this time increased steadily. The oxalate sorption was ten times that observed for Cl^- under comparable conditions. Expts. with hydrous Al_2O_3 samples prepd. at 30°, 60°, and 95°C demonstrated that the sorption capacity was greatest for the samples prepd. at 60° or 95°C.

2881. Grim, R. E.; Allaway, W. H., and Cuthbert, F. L. **Reaction of different clay minerals with some organic cations.** *J. Am. Ceram. Soc.* **30,** 137-42 (1947).—*C.A.* **41,** 4901*i*.

Kaolinite, illite, and montmorillonite were washed with 0.05 *N* HCl until free from replaceable bases, washed with H_2O or CH_3OH, and then made to react with sufficient KOH to sat. the exchange complex with K^+ at pH 7. These K clays were given variable dosages of n-butylamine acetate, dodecylamine acetate, and ethyldimethyloctadecenylammonium bromide. Addns. of amines or other org. cations in amts. less than equiv. to the base-exchange capacity of the clay were rather completely absorbed in base-exchange reactions. The ability of clays to absorb H_2O was greatly reduced by treating the clays with certain compds. that furnished large org. cation.

2882. Hesse, Gerhard and Sauter, Oskar. **Mutual independence of exchange absorption and van der Waals adsorption on alumina.** *Naturwissenschaften* **34,** 250 (1947).—*C.A.* **43,** 6035*b*.

Al_2O_3 contained enough Na aluminate on the surface to make it an exchange adsorbent. By treatment with HCl it could be changed to an adsorbent of acid character. Adsorption of azobenzene, a neutral substance, was equally strong on acid or on basic adsorbent (pH 5 to 9). Adsorption of a basic dye, p-aminoazobenzene, increased with pH; that of an acid dye, Sudan III, decreased with pH.

2883. Hesse, Gerhard and Sauter, Oskar. **The pH dependence of the adsorption of amphoteric substances.** *Naturwissenschaften* **34,** 277-8 (1947).—*C.A.* **43,** 6035d.

With Al_2O_3 contg. small amts. of alkali, which represented a typical amphoteric absorbent, alanine and asparaginic acid (aq. soln.) were selectively adsorbed with max. at the isoelec. points of these amino acids (6.15 and 2.98, resp.). Curves of adsorption vs. pH were given. The max. were quite sharp.

2884. Hori, Kazuhiko and Kajisaki, Chiyotoshi. **Properties of active earths.** *Bull. Govt. Research Inst. Ceramics* (Kyoto) **1,** No. 1, 9-11 (1947).--*C.A.* **46,** 6346*f*.

Properties were studied of active earths such as acid earths or clay, and activities were measured by adsorption of tar pitch and methylene blue soln. Adsorption activity depended on the H_2O content. Earths consisting of fine particles had higher activities.

2885. Kayser, F. and Bloch, J. M. **The effect of several agents on thixotropic bentonite suspensions.** *Bull. soc. chim. France* **1947,** 741-6.—*C.A.* **42,** 1106*d*.

The thixotropic behavior of 2 com. bentonites from Wyoming and Morocco was observed by the submergence of a metal cylinder under exactly defined conditions. The thixotropic cycle was faster and more pronounced at higher temps. Aging had an effect—usually emphasizing the thixotropic behavior. Prolonged heating destroyed the thixotropic capacity of a gel or promoted syneresis. Freezing did likewise, and if prolonged enough caused flocculation. The addn. of Na citrate, to suppress the thixotropic nature, was recommended for detg. the viscosity of bentonite suspensions.

2886. Low, P. F. and Black, C. A. **Phosphate-induced decomposition of kaolinite.** *Soil Sci. Soc. Am., Proc.* **12,** 180-4 (1947) (Pub. 1948).--*C.A.* **43,** 1511*i*.

The addn. of both phosphate and 8-hydroxyquinoline to kaolinite produced a considerable increase in the concn. of SiO_2 in the soln., whereas NH_4Cl caused only a small decrease in dissolved SiO_2. Data indicated that phosphate in the phosphated kaolinite were present as an Al phosphate.

2887. Mair, Beveridge J.; Gaboriault, Andrew L., and Rossini, Frederick D. **Assembly and testing of 52-foot laboratory adsorption column. Sepn. of hydrocarbons by adsorption.** *Ind. Eng. Chem.* 39, 1072-81 (1947).--*C.A.* **41,** 7167*h*.

Data were given in testing the column of silica gel with 2 different mixts. The fractionation obtained in a smaller adsorption column was given on binary mixts. of hydrocarbons selected to disclose differences in adsorbability arising from differences in mol. size and structure.

2888. Maxted, E. B. **Detoxication of catalyst poisons. V. Thiophene.** *J. Chem. Soc.* **1947,** 624-7.—*C.A.* **41,** 6801*f*.

Thiophene was hydrogenated first to thiophane by virtue of its preferential adsorption on the catalyst. This in turn was oxidized to thiophane sulfone. The hydrogenation stage was effectively limited to the amt. originally adsorbed. Larger quantities led to very slow reactions, owing to the low rate of exchange of C_4H_4S and C_4H_8S between the free and adsorbed phases.

2889. MUKHERJEE, SUDHAMOY; DAS GUPTA, K. K., AND POCHHALI, LOCHHU. **The characterization of Indian bentonites and kaolins.** *J. Proc. Inst. Chemists (India)* **19**, 67-73 (1947).—*C.A.* **42**, 2209 h.

Chem. analysis, quinine and methylene blue adsorption, sedimentation vol., moisture capacity, and the pH and sp cond. in aq. suspension were tabulated for a series of three Indian bentonites (all values less than for Wyoming Na bentonite) and for several natural and activated kaolins.

2890. VEDENEEVA, N. E. **Changes in the spectra of dyes when adsorbed on clay minerals.** *J. Phys. Chem. (U.S.S.R.)* **21**, 881-91 (1947) (in Russian).—*C.A.* **42**, 2517*i*.

Clay suspensions in H_2O were colored with org. dyes, drops of the suspension placed on a white surface, and the amt. of light reflected by the surface through the drop was detd. for 10 regions of the visible spectrum. The expts. were repeated after evapn. of water when a film of clay remained on the support. When the intensity of coloration of kaolinite by methylene blue increased, the max. of adsorption was shifted from 590 to 550 mμ, but drying caused an opposite shift by 40 mμ. When quartz powder dyed with new methylene blue and showing a max. at 560 mμ was placed in contact with silica gel in water, the dye migrated to the gel and then showed a max. at 610 mμ. Brilliant green dyed all bentonite samples in the same color.

2891. BOUTARIC AUGUSTIN AND FABRY, SIMONE. **Phenomenon of adsorption in colloidal solutions.** *Ann. soc. sci. Bruxelles* **62**, Ser. **1**, 47-54 (1948).—*C.A.* 42, 7599*g*.

The degree of adsorption of colored substances such as Fehling soln., eosin, and methylene blue in colloidal soln. was detd. by measuring optical density of the mixed and unmixed solns. It was demonstrated that particles dispersed in a hydrosol have only a feeble adsorbing power for substances that were dissolved and introduced into the hydrosol. They showed a strong adsorbing power only in the flocculated state.

2892. BRADLEY, W. F. AND GRIM, R. E. **Colloid properties of layer silicates.** *J. Phys. & Colloid Chem.* **52**, 1404-13 (1948).—*C.A.* **43**, 2841*c*.

Prepd. montmorillonite-aliphatic amine complexes were subject to dehydrogenation by heat alone at about 300°C, yielding montmorillonite-carbon complexes of interlayered type. The process was considered an extension of the mechanism of catalytic cracking.

2893. KRASIL'NIKOV, K. G. AND KISELEV, A. V. **Adsorption isotherms from solutions on layering or crystallization. Adsorption of phenol on silica gel from solutions in heptane.** *Doklady Akad. Nauk S.S.S.R.* **63**, 693-6 (1948).—*C.A.* **43**, 4536e.

On a fine-pore (15-20A.) and a coarse-pore (50 A.) silica gel, (liquid H_2O adsorption at satn. of 0.53 and 0.92 cc/g, resp.) adsorption curves of PhOH in C_7H_{16} soln. at 20°C were similar and showed no S-shape. The adsorption curve on a coarse-pore became S-shaped at 40°C, whereas the curve on a fine-pore remained normal. At high relative concns., PhOH and C_7H_{16} were adsorbed in a ratio corresponding to the compn. of the PhOH-rich layer. The limiting amts. of PhOH adsorbed at 40°C were on a fine-pore and a coarse-pore, resp., 4.2 and 7.4 millimoles/g corresponding to 0.50 and 0.90 cc./g, resp.

2894. MACEWAN, D. M. C. **Complexes of clays with organic compounds. I. Complex formation between montmorillonite and halloysite and certain organic liquids.** *Trans. Faraday Soc.* **44**, 349-67 (1948).—*C.A.* **43**, 463*e*.

Mols. penetrated between the structural sheets, expanding the whole crystallite structure, and a change could be followed on an x-ray powder diagram. In these complexes the org. mols. entered between the structural sheets of the clay mineral, formed a two-dimensional liquid and lay as flat as possible. Montmorillonite complexes with 1, 2, and 3 such layers were described, but halloysite complexes had not been obtained with more than one. The relation of this type of adsorption phenomena to surface adsorption was briefly discussed.

2895. MACKENZIE, R. C. **II. Investigation of the ethylene glycol-water-montmorillonite system using the Karl Fischer reagent.** *Trans. Faraday Soc.* **44**, 368-75 (1948).—*C.A.* **43**, 463f,

The amts. of water in samples of montmorillonite corresponded to the total water reversibily removable by heating at 195°C. Detn. of the water and glycol in montmorillonite-glycol-water complexes, in conjunction with x-ray examn. led to the conclusions: (a) the (001) spacing of the complex remained const. at 17.1 A.; (b) the min. amts. of glycol and water necessary to give this spacing were interdependent; (c) in the absence of water, 3.3 mols. of glycol per unit cell, in the form of a bimol. layer, was required for production of the 17.1 A. spacing.

2896. MERRILL, R. C.; SPENCER, R. W. AND GETTY, R. **The effect of sodium silicates on the absorption spectra of some dyes.** *J. Am. Chem. Soc.* **70**, 2460-4 (1948).—*C.A.* **42**, 8650*a*.

The addn. of various sodium silicates to a pinacyanol chloride changed the adsorption spectra. The visual color change was from blue to purple. Silicates shifted the band maxima of Rhodamine 6G about 6 mμ toward the violet but did not alter the intensity by more than 2%. This dye was orange and fluorescent in water and red and nonfluorescent in silicate solns. Their effects were attributed to sorption and electrostatic interaction of the dye ion with the silicate ions and micelles.

2897. PRONINA, M. V. **Adsorption analysis applied to the separation of aldehydes and ketones.** *Zavodskaya Lab.* 14, 1493 (1948).—*C.A.* 43, 5341*c*.

The sepn. of aldehydes and ketones from tars was made by the adsorption technique: Dissolve the sample in petr. ether and treat with semicarbazide soln. (1 part semicarbazide, 1 part NaOAc, and 3 parts water) in a separatory funnel with shaking; after standing overnight, remove the aq. layer, wash the petr. ether with water and dry with Na_2SO_4. Pass through silica gel (65-115 mesh) and wash the column with petr. ether until a colorless effluent is obtained; the semicarbazones remain adsorbed and can be readily eluted by Et_2O.

2898. TISELIUS, ARNE. **Adsorption separation by salting out.** *Arkiv. Kemi, Mineral. Geol.* **26B**, No. 1, 5 pp. (1948).—*C.A.* 43, 1624*e*.

Proteins, enzymes, and similar substances of high mol. wt were adsorbed quite strongly in the presence of salt solns. in low concn., especially on some adsorbents (silica gel) that in salt-free solns. showed no or only slight affinity for these substances. Egg albumin was completely adsorbed at the highest salt concn., which was far from the pptn. point of 2.5 *M* $(NH_4)_2SO_4$. Phycoerythrin and hemoglobin (at concn. of 0.3%) were also investigated on filter paper at salt concn. of 0 to 0.73 *M* (the phosphate soln. was 1:1 KH_2PO_4:K_2HPO_4). A no. of dyes were also investigated, and in all cases a marked salting out adsorption was observed.

2899. VENTURELLO, G. AND BURDESE, A. **Discontinuity in adsorption processes with systems of solids and solutions. I.** *Gazz. chim. ital.* **78**, 254-71 (1948).—*C.A.* 42, 8576*c*.

Adsorption was detd. for the systems: calcined Al_2O_3-aq. $CuSO_4$, $Al(OH)_3$-aq. $CuSO_4$, silica gel-aq. $CuSO_4$, calcined Al_2O_3-iodine in C_6H_6, pptd. $CaCO_3$-aq. purpurin, wood charcoal-purpurin, Al_2O_3-aq. eosin, and Al_2O_3-aq. azofuchsin. The isotherms showed discontinuity phenomena in some cases. With I_2 on Al_2O_3, $Al(OH)_3$, silica gel, and calcined Al_2O_3, the action was between ions and dipoles, and an adsorption bond formed between mols. of polarized I_2 and neg. surface ions. In general, discontinuity phenomena did not depend on the type of force between adsorbent and adsorbed substance; hence, they could appear in every adsorption isotherm.

2900. WEIL-MALHERBE, H. AND WEISS, J. **Color reactions and adsorption of some aluminosilicates.** *J. Chem. Soc.* **1948**, 2164-9.—*C.A.* 43, 6035*e*.

Color reactions accompanying adsorption were detd. on clarite, fuller's earth, bentonite, montmorillonite, and kaolin. Color formed on adsorption of dicinnamylideneacetone, dianisylideneacetone, vitamin A, dimethylaminoazobenzene, and other azo dyes was due to an acid-base type of reation. The second type involved an oxidation-reduction mechanizm and was typified by the adsorption on centers of high adsorption energy probably involving chem. interaction.

2901. WHITE, JONATHAN W. JR. **Chromatographic separation of aliphatic 2, 4-dinitrophenylhydrazones.** *Anal. Chem.* 20, 726-8 (1948).—*C.A.* 43, 1289*i*.

Volclay bentonite (325 mesh) was found to adsorb strongly and to give excellent sepn. of many dinitrophenylhydrazones. The adsorbent used consisted of 3 parts by wt of bentonite to 1 part of a diatomaceous filter aid. Results were given for 22 pairs of derivs. involving 12 aldehydes and ketones including Et_2O, Me_2CO in Et_2O, and C_6H_{14} in Et_2O.

2902. ALFREY, TURNER JR. AND RODEWALD, CHARLES W. **Thixotropy in bentonite suspensions.** *J. Colloid Sci.* 4, 283-98 (1949).—*C.A.* 43, 6885*b*.

The app. used was a torsional pendulum thixotrometer consisting of a cylindrical shell suspended, by a torsion wire, within the annular space between 2 concentric cylindrical shells. Thoroughly agitated bentonite suspensions approached linear behavior, but deviated within a few sec after agitation had ceased. The gelation of bentonite suspensions was reversible, but there was also a slower, mechanically irreversible process of consolidation, whose rate was temp.-dependent. Measurements were made with approx. 6% aq. suspensions of com. bentonite at 2-23°C, with or without addn. of 1% EtOH or dioxane. EtOH had very little effect, but dioxane markedly reduced the gelation.

2903. BHATNAGER, S. S.; KAPUR, A. N., AND BHATNAGAR, M. S. **Adsorptive properties of synthetic resins. IV.** *J. Indian Chem. Soc.* 17, 361-9 (1949).—*C.A.* 35, 1288^5.

Protein-CH_2O resin was prepd. from powd. soybean meal. In all adsorption expts. 1 g powd. resin was shaken for 5 min. with 100 cc. of the 0.01 *M* acid soln. and the mixt. set aside for 36 hrs, after which the supernatant soln. was titrated with standard NaOH soln. and the amt. of acid adsorbed was calcd. Adsorption of HCO_2H, AcOH and butyric acid from aq. solns. by acid-condensed phenolic resins followed Traube's rule, whereas with base-condensed phenolic resins, amino resins and protein resins the order was reversed.

2904. BJÖRLING, CARL O. **The adsorption of some phenolic compounds on aluminum oxide.** *Farm. Revy* 48, 588-99 (1949).—*C.A.* 44, 1227*h*.

The o-diphenolic compds. were adsorbed more strongly than were the monophenolic substances. The nonphenolic compds. were adsorbed least. Adrenaline, apomorphine, and catechol were retained by Al_2O_3 both in alc. and aq. soln., and were eluted fully only by acid. Oxedrine, morphine, phenol, and guaiacol were eluted slowly and incompletely by EtOH, fully by H_2O. The o-diphenolic substances were strongly adsorbed compared with the other diphenols. Oxedrine (p-$HOC_6H_4CH(OH)$-CH_2NHMe), ephedrine, apomorphine, morphine, codeine, dionine, pyrocatechol, resorcinol hydroquinone, guaiacol, phenol, veratrole, and anisole were tested.

2905. Blackburn, S. **Separation of 2,4-dinitrophenyl amino acids on buffered silica gel.** *Nature* **163**, 955-6 (1949).—*C.A.* **43**, 7379*a*.

Successful sepns. of 2,4-dinitrophenyl amino acids on silica gel resulted by using concd. phosphate buffers instead of water as the stationary phase. Varying the pH of the buffer, the rate of movement of the band of a particular acid varied within wide limits, the higher the pH the slower the rate. Buffered $CHCl_3$ columns were used for initial sepns. Buffered 5% PrOH-cyclohexane columns were used for sepg. the dinitrophenyl amino acids from each other, e.g., dinitrophenyl leucine from dinitrophenyl valine and I from dinitrophenyl alanine.

2906. Carlén, Sölve. **Surface activity of burnt pholerite preparations.** *Arkiv. Kemi, Mineral. Geol.* **26A**, No. 31, 10 pp. (1949) (in English).—*C.A.* **43**, 6035*h*.

Pholerite consisting essentially of diokite (analyzing the same as pure kaolinite) was treated by heating in H_2O- and CO_2-free air for 2 hrs from 115° to 1200°C and tested at 20°C for adsorption of Fast Red and methylene blue dyes at pH 3-11 in buffered solns. The acid red dye adsorbed more strongly at low pH with a max. between 4 and 6. The alk. methylene blue adsorbed the reverse, with a min. between pH 5 and 7, agreeing with other work that adsorption mainly depends upon adsorbate and pH.

2907. Carroll, Benjamin and Thomas, Arthur W. **Spectral changes of dyes in colloidal solutions of hydrous oxides.** *J. Chem. Phys.* **17**, 1336 (1949).—*C.A.* **44**, 4750*i*.

In the case of Orange I the molor extinction coeff. at 475 mμ showed a decrease of about 40% in the presence of colloidal hydrous Al_2O_3 and the adsorption max. was shifted some 30 mμ toward the violet. In the case of sulfate ion, complete displacement of the dye was observed when the total concn. of sulfate was comparable to that of the dye. When the dye and sol were mixed, the greater part of the spectral change took place within a few min. About 10 to 20 hrs were required to reach the equil.

2908. Dickey, Frank H. **Preparation of specific adsorbents.** *Proc. Natl. Acad. Sci. U. S.* **35**, 227-9 (1949).—*C.A.* **43**, 6489*c*.

Silica gel formed in the presence of methyl, ethyl, propyl, and butyl orange was 4 to 20 times as effective in adsorbing the particular dye as a control gel. Max. adsorption was shown for the dye used in prepn. of the adsorbent, with decreasing effectivity for dyes with decreasing similarity of mol. structure.

2909. Emodi, B. S. **Adsorption of dyestuffs by montmorillonite.** *Clay Minerals Bull.* **3**, 76-9 (1949).—*C.A.* **47**, 6215*c*.

Strong aq. solns. of various basic dyes (in excess) were shaken with small weighed quantities of fairly pure Ca montmorillonite. After shaking, the mixts. were filtered, and the amts. of Ca and dye detd. in the filtrate. The so-called "ionic adsorption" of dyes was not a single base-exchange reaction, but resulted in excess of Ca ions being left in the clay structure.

2910. Jordan, John W. **Alteration of the properties of bentonite by reaction with amines.** *Mineralog. Mag.* **28**, 598-605 (1949).—*C.A.* **43**, 6121f.

Dodecyl- and octadecylammonium bentonite complexes were prepd. and studies were made of alteration of the affinities of bentonite from Clay Spur, Wyoming, with various org. liquids. The mechanism of the adsorption was discussed.

2911. Jordan, John W. **Organophilic bentonites. I. Swelling in organic liquids.** *J. Phys. & Colloid Chem.* **53**, 294-306 (1949).—*C.A.* **44**, 10456*g*.

Hydrophilic bentonite was altered by treating each 100 g of washed and dispersed material with 100 milliequiv. of various aliphatic ammonium salts. Swelling of these complexes in a wide variety of org. liquids generally increased with the dielec. const. of the liquid.

2912. Kamieński, B. **Potentiometric indication of substances in selective adsorption (chromatography). I.** *Bull. intern. acad. polon. sci., Classe sci. math. nat.* **10A**, 127-33 (1949).—*C.A.* **43**, 8911*c*.

Pt-wire electrodes were sealed at intervals through the glass tube of a chromatographic adsorption column so that measurements could be made. A thin conducting film of dialyzed silicic acid was evapd. onto the inside of the glass tube; buffers or quinhydrone may be added to the colloid. Micro calomel electrodes were also connected through the tube wall by sintered-glass filters. Differences of 100 or more mv. may be observed between different electrodes when dil. quinhydrone in C_6H_6 was poured into the glass tube.

2913. Kamieński, B. **Potentiometric chromatography. II. A microelement for the detection of weak acids and bases in gasoline solutions.** *Bull. intern. acad. polon. sci., Classe sci. math. nat.* **1949A**, 75-80.—*C.A.* **44**, 8098*e*.

A micro cell consisted of 2 concentric tubes; the center one contained a Pt wire sealed in a glass tube and tipped with a thin adsorption layer of silica gel contg. quinhydrone, and the outer tube was a micro calomel electrode tipped with a sintered glass filter satd. with KCl soln. When the cell was immersed successively in gasoline-cinchonidine and gasoline-caproic acid (hexanoic acid) solns., a difference of 85 mv. at concn. of about 0.05%, 40 mv. at 0.005%, and 22 mv. at 0.0005% was obtained.

2914. Kamieński, B. **Electrometric analysis of adsorptives. (Potentiometric chromatography).** *Polska Akad. Umiejetności, Rozprawy Wydzialu Mat.-Przyrod.* **74A**, No. 3, 47 pp. (1949) (Pub. 1951).—*C.A.* **46**, 11013*b*.

The chromatographic adsorption of colorless substances was accomplished through the use of specially constructed Pt or Sb electrodes sealed in glass (Pyrex or "Geräteglas") in a system Pt or Sb|absorptive layer of pure silicic acid (10^{-4} or 10^{-5} cm thick)|0.1 *N* KCl|calomel|Hg. As the ions reached the electrode, either sealed or soldered into the absorptive column, or in contact with the chromatogram on paper, etc., a change in potential was observed which was correlated with the concn. of the ion.

2915. KAPLAN, S. AND MELLER, F. **Aluminum oxide as a chromatographic adsorbent and characterization of its activity.** *Zhur. Obshchei Khim.* **19**, 2038-44 (1949); *J. Gen. Chem. U.S.S.R.* **19**, No. 11, a507-12 (1949).—*C.A.* **44**, 4306*e*, 6702*h*.

Al_2O_3 used in the catalytic decompn. of alc. to ethylene was pulverized to yield fractions ranging in size from 0.044 to 0.196 mm. These were heat-activated at 300 °C in a muffle furnace for 3 hrs. Fractions varying in activity were obtained by rotating a sample of the heat-activated powder at 20 °C in a specially constructed humidor. Samples ranging in moisture content from 0 to 11.5% were prepd. The activity was detd. with 5 pairs of dyes in solns. contg. 0.04 g dye per 100 ml soln. (benzene in gasoline in the proportion of 1:4). The activity group to which the various samples of Al_2O_3 belonged was related linearly to its moisture content.

2916. KOGANOVSKII, A. M. **The sorption of colloids. I. Sorption isotherms of substantive dyes and humic acids by the gels of iron hydroxide and aluminum hydroxide.** *Kolloid. Zhur.* **11**, 237-43 (1949).—*C.A.* **44**, 403*a*.

Dry Fe_2O_3 and Al_2O_3 took up little Congo red from solns. in 0.01 *N* NaCl, and the sorption isotherm was of the Langmuir type. The isotherms of sorption of dyes and Na humate by wet Fe_2O_3 and Al_2O_3 from solns. in 0.01 *N* NaCl showed sharp min. and max.; often these were more pronounced and the sorbed amt. x/m was greater the more H_2O was present in the sorbent (up to 95%). The electrophoretic velocity of Fe_2O_3 decreased when x/m increased without any singular point. The max. x/m observed along the first branch of the isotherm (at low concns. of dye) for Fe_2O_3 contg. 87.5% H_2O was 64, 44, 4.9, 0.6, 5.7, and 0.2 mg/g for water blue, Congo red, indigo carmine, methyl orange, neutral red, and methylene blue, resp.

2917. KRASIL'NIKOV, K. G. AND KISELEV, A. V. **Adsorption by porous bodies from solutions in the neighborhood of the critical temperature of mixing. The system silica gel-acetic acid-heptane.** *Doklady Akad. Nauk S.S.S.R.* **69**, 817-19 (1949).—*C.A.* **45**, 6455*g*.

Adsorption isotherms of AcOH in soln. in C_7H_{16}, on a uniformly coarse-pore silica gel, were detd. in sealed tubes, by interferometric analysis, at 45, 30, 20, 8, 4.5, and 0 °C. At 45° and 30°, i.e. in the range of unlimited miscibility, the adsorption isotherm was a curve with a max. At 0 °C, where there were two liquid layers, the isotherm had an upward S-shaped bend.

2918. MACEWAN, D. M. C. **Interlamellar adsorption. I. Natural adsorbents.** *Bull. soc. chim. France* **1949**, D37-40.—*C.A.* **43**, 5254*i*.

Clays (montmorillonite and halloysite) adsorbed various org. substances between the layers in the lattice. These substances must be polar. Adsorption of 1, 2, or 3 layers occurred with montmorillonite, the no. of layers increasing with the ratio of the dipole moment to the parachor. With halloysite, only one layer was formed and the adsorption was less general.

2919. MALQUORI, ALBERTO. **The surface activity of argillaceous materials. IV. Adsorption of alizarin.** *Ann. chim. applicata* **39**, 447-52 (1949).—*C.A.* **45**, 9785*d*.

The adsorption of alizarin (5% alc. soln., with boric acid buffer, pH 3.2) was only significant on clays which were readily dissolved by HCl. No adsorption took place if the clay was preheated to 750 °C.

2920. MORTLAND, M. M. AND GIESEKING, J. E. **Anion sorption and exchange by amine-clay complexes.** *Soil Sci.* **68**, 391-7 (1949).—*C.A.* **44**, 3187*f*.

Radio-P was used to det. the importance of org. matter in anion exchange. The sorption and exchange of anions by free amino groups were not important phenomena in the soil org. matter used.

2921. ORTH, E. **The methylation of bleaching earths.** *Mitt. chem. Forsch.-Inst. Ind. osterr.* **3**, 31-2 (1949).—*C.A.* **43**, 7607*e*.

It was assumed that after reaction of HCl on bentonite, the Al hydroxide was converted from its water-poorer, acid-reacting form into the water-rich basic form. The exchange reactions detg. the (H + Al) value could take place on the acid but not on the basic portions. OH groups in the clay could be etherified by diazomethane.

2922. PHILLIPS, W. M. AND WAKE, W. C. **Micro method for the determination of unsaturation.** *Analyst* **74**, 306-10 (1949).—*C.A.* **43**, 7368*c*.

Cyclohexane was passed through an Al_2O_3 column under pure N_2 to remove peroxide and used as a standard. Capillaries contg. about 6 mg of material were crushed under CCl_4 in a special I_2 flask and treated with a calcd. vol. of ICl soln. from an automatic buret. KI soln. was added and the stoppered vessel placed in a dark place. The excess ICl was finally titrated with Na_2-S_2O_3 soln.

2923. TSUCHIYA, RYOKICHI. **Decolorizing action of various clays.** *J. Chem. Soc. Japan*, Pure Chem. Sect., **70**, 88-90 (1949).—*C.A.* **45**, 4419*b*.

The adsorption of methylene blue by various clays from Niigata Prefecture and by diatomaceous earth from Ishikawa Prefecture was studied with solns. contg. 0.5, 1.0, and 1.5 g/liter. Acid clays generally showed greater adsorbing power than diatomaceous earth.

2924. VAZHENIN, I. G. **Colorimetric determination of adsorbed ammonia by the phenol method.** *Pochvovedenie (Pedology)* **1949**, 359-61.—*C.A.* **44**, 975*g*.

The method was good when equiv. quantities of phenol and hypochlorite were present and the vols. of sample and reagents were kept small and const. The phenol was added first to the soln., mixed thoroughly, and the mixt. treated with hypochlorite; the diln. of the soln. for colorimetric observations was made after heating and cooling about 15 ml of soln.

2925. BERGMAN, W. E. AND FISHER, H. B. **Bentonite suspensions. Effect of sodium chloride, sodium hydroxide, quebracho, and sodium carboxymethylcellulose upon physical properties.** *Ind. Eng. Chem.* **42**, 1895-1900 (1950).—*C.A.* **45**, 849*d*.

In the absence of contamination with NaCl, treatment of aq. bentonite suspensions (oil-field *drilling muds*) with NaOH and quebracho effectively controls the viscosity and gel strength. Use of Na carboxymethylcellulose in addn. permits attainment of low water-loss values. With NaCl present, (above 10,000 p.p.m.) Na carboxymethylcellulose facilitates control.

2926. DEUEL, H.; HUBER, G., AND IBERG, R. **Organic derivatives of clay minerals.** *Helv. Chim. Acta* 33, 1229-32 (1950).—*C.A.* 45, 548*g*.

$S(C_2H_4Cl)_2$ in alc. reacted with the Na salt of bentonite clay to form 88% of the ether, which swelled in EtOH. The acid-form of the clay with propylene oxide formed 89% of the hydroxypropyl ester, which was decompd. by H_2O. The dried acid form with $SOCl_2$ formed the chloride, which reacted with many OH compds. and $(CH_2NH_2)_2$.

2927. GRACIAN Y TOUS, J. AND VIOQUE PIZARRO, A. **Separation of fatty acids by selective adsorption. II. The use of silica as adsorbent.** *Anales real soc. espan. fis. y quim.* **46B**, 375-84 (1950).—*C.A.* 46, 3300*g*.

The following binary acid pairs could be sepd. completely: caprylic-oleic, caprylic-stearic, and oleic-stearic (3.1 ratio); almost completely: caproic-caprylic, palmitic-stearic (in both cases fractions with pure components were obtained), and stearic-oleic (1:4, 1:10, 10:1); and not sepd.: valeric-caproic and palmitic-oleic.

2928. GYANI, B. P. **Adsorption of organic dyes on silica gel. I.** *J. Indian Chem. Soc., Ind. and News Ed.*, **13**, No. 1, 1-7 (1950).—*C.A.* **45**, 1837*i*.

The adsorption by silica gel of night blue, methylene blue, and crystal violet from aq. soln. was studied over a range of dye concns. About 80% of the initial dye concn. was adsorbed on the SiO_2 gel. The adsorption isotherms were similar but failed to follow either Langmuir's or the classical adsorption equation. They were more nearly similar to isotherms for vapor adsorption on solids. The extent of adsorption of dyes on silica gel probably was more closely related to their chem. nature than to their mol. size or mol. wt.

2929. HENDRICKS, S. B. AND DYAL, R. S. **Surface measurement for ethylene glycol retention of clays and its application to potassium fixation.** *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* 2, 71-2; 4, 60-1 (1950).—*C.A.* **46**, 4718*c*.

Ethylene glycol retention, which gave an index of clay surfaces, was measured by weighing the solvate formed from an excess of liquid and a known amt. of clay. This surface minus the external surface as detd. by gas adsorption gave the surface available upon swelling. K clays had 40-70% as great retention of ethylene glycol as the H_2, Ca, or Na clays.

2930. HOYOS, ANGEL DE CASTRO AND LOPEZ-GONZALEZ, JUAN DE DIOS. **Adsorption of Sudan Red by activated bentonites.** *Anales edafol. y fisiol. vegetal* (Madrid) 9, 623-37 (1950).—*C.A.* **45**, 9815*f*.

Samples of a montmorillonite-beidelite and a subbentonite with and without prior activation with acid (preferably 2 *N* HCl) were dried at 110°C, immersed in benzene and slowly titrated with a 5% soln. of the dye. The activated material acquired a blue color.

2931. JORDON, J. W.; HOOK, B. J., AND FINLAYSON, C. M. **Organophilic bentonites. II. Organic liquid gels.** *J. Phys. & Colloid Chem.* 54, 1196-1208 (1950).—*C.A.* 45, 930*c*.

Various aliphatic ammonium bentonite complexes were made by cation-exchange reaction with org. ammonium salts. Gels of these materials were prepd. in several org. liquids, such as benzene, toluene, mineral spirits, alcs., ketones, and their mixts. The org. gels swelled much more than do their untreated counterparts in water. Approx. 50% coverage of the clay flakes by org. matter attached through ion-exchange reaction appeared essential for good gelation. Gels studied were dodecyl-, hexadecyl-, and octadecylammonium bentonites, and dimethyldihexadecyl-, dimethyldodecylhexadecyl-, and dimethyldioctadecylammonium bentonites.

2932. KRAVETS, T. P.; PES'KINA, A. L., AND ZHIDKOVA, Z. V. **New data on light absorption in solutions and in adsorbed layers.** *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* 14, 493-501 (1950).—*C.A.* 45, 4139*d*.

In some dyes of the triphenylmethane series the optical d. of the soln. varied linearly with the thickness, but the straight line started with an ordinate of a magnitude detd. by the wave length. This was attributed to the formation of a film of dye on the walls of the vessel. Spectral adsorption tests were made on chromatographic adsorptions of crystal violet dye on γ-Al_2O_3, α-Al_2O_3, and TiO_2. Results showed that the curves depended (1) on the nature of the adsorbent, (2) on the nature of the remaining solvent, if not completely dried, (3) on the temp. rise, which caused loss of adsorption.

2933. RUSSELL, ALLEN S. AND COCHRAN, C. NORMAN. **Alumina surface area measurement by nitrogen, butane, propane, and stearic acid sorption.** *Ind. Eng. Chem.* 42, 1332-5 (1950).—*C.A.* 44, 8735*g*.

B.E.T. theory applied to n-butane adsorption gave reliable surface areas over the range 2.3-383 m^2/g for Al_2O_3 gels, molybdena-impregnated Al_2O_3 dehydrocyclization catalysts, and fresh and coked SiO_2-Al_2O_3 cracking catalysts. Wide differences in pore size and crystal structure occurred in these samples. Mol. areas for n-butane and propane (calcd. from adsorption) were essentially identical at 39 $A.^2$ (assuming N_2 area of 16.2 $A.^2$). Adsorption of stearic acid on nonporous aluminas yielded areas consistent with N_2 areas if the stearic acid mol. area was 17 $A.^2$.

2934. SIDOROVA, A. I. AND TERENIN, A. N. **Nature of the absorption-spectrum shift in the adsorption of aromatic amines on active clays.** *Izvdst. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* **1950**, 152-61.—*C.A.* 44, 6721*h*.

A blue color was produced on the surface of bentonite powder, fired at 800°C and outgassed, when Ph_2NH vapor was passed over it in vacuo at about 150°C. This color did not disappear on heating, but was destroyed immediately by passing dry NH_3 under 10 mm Hg. Preliminary 2-4 hrs extn. of the clay with 30% H_2SO_4, which resulted in removal of Al, Mg, and Fe cation, without changing the specific surface area (87 m^2/g), followed by washing, drying, and outgassing, prevented the appearance of the coloring with Ph_2NH. The absorption spectrum of the blue-colored powder showed 2 max. at 675 and at 500 mμ, the 1st of which was very close to the 680-mμ absorption max. of the mol. ion (semiquinone) $(Ph_2NH)^+$ formed by the loss of one of the 2 nonbonded electrons of the N atoms in the neutral Ph_2NH.

2935. Talib-Uddeen, O. **Interlamellar adsorption of protein monolayers on pure montmorillonoid clays.** *Nature* **166**, 236-(1950).—*C.A.* **45**, 924*i*.
Flakes of montmorillonite smaller than 0.5 were dipped in a 1% suspension of gelatin (pH 2.5). The x-ray pattern showed 2 monolayers of polypeptide chains in the interlamellar space. Each monolayer was strongly adsorbed to the mineral sheet and exhibited a high degree of order. Under other concns. and pH conditions a single monolayer or four layers were formed.

2936. Vedeneeva, N. E. **The mechanism of the color reaction of benzidine with montmorillonite.** *Kolloid. Zhur.* **12**, 17-24 (1950).—*C.A.* **44**, 3799*e*.
Montmorillonite adsorbed benzidine; the product was blue and had absorption max. at 600 mμ if the clay was moist; on drying, it became pale yellow. Chrysoidine colored the clay whether moist or dry, brick-red. The dyes were attached to the O ions of the mineral surface. The face of this attachment was sufficient for adsorption because the distance between the 2 NH_2 groups was almost equal to that between 2 O ions.

2937. Vedeneeva, N. E. and Rateev, M. A. **Identification of disperse clay minerals by dye.** *Doklady Akad. Nauk S.S.S.R.* **71**, 141-4 (1950).—*C.A.* **44**, 9308c.
Systematic staining expts. with 25 different clays from young sediments were classified in three groups: I. montmorillonite type, with a max. at 605 mμ, and a second max. (for methylene blue, in the presence of KCl) at 625-630 mμ; II. hydromica type, with the max. shifted to 560-575 mμ (benzidine), and 600 mμ (KCl-methylene blue); III. kaolinite type, not stained by benzidine, with methylene blue at 560 mμ (without an effect of added KCl).

2938. Walker, G. F. **Vermiculite-organic complexes.** *Nature* **166**, 695-6 (1950).—*C.A.* **45**, 1839*e*.
Complexes of vermiculite with codeine p-phenylenediamine, benzidine- HCl, and brucine sulfate were found. The existence of van der Waals-type adsorption in vermiculite was discovered by the observation of a stage during the weathering of biotite to vermiculite where a single layer of glycerol mols. penetrated with displacement of the basal reflection from 10 to 14 A. If a small flake of vermiculite was boiled a few min. in glycerol, it acquired a black metallic coating, and the basal spacing moved to 14.06 A.

2939. Walling, Cheves. **The acid strength of surfaces.** *J. Am. Chem. Soc.* **72**, 1164-8 (1950).—*C.A.* **44**, 5181*e*.
By observation of the colors of suitable adsorbed indicators the acid strengths of the surfaces of a no. of materials were semiquantitatively detd. Colors of the adsorbed indicators are, in every case, those of the indicator, or its conjugate acid, as observed in homogeneous soln. Acid strengths appear independent of the indicator used. Although Al_2O_3 and pure SiO_2 appear to have neutral surfaces, SiO_2-Al_2O_3 and SiO_2-MgO are strongly acid.

2940. Bloch, J. M. and Gommery, G. **Relation between the thixotropy of sodium bentonite suspensions under the effect of heat and alcohol, and the molecular adsorption of sodium hydroxide by this clay.** *Bull. soc. chim. France* **1951**, 563-5.—*C.A.* **46**, 2878*e*.
Thixotropic gelation increased with temp., especially above 70°C, but the quantity of NaOH adsorbed remained practically const. When EtOH was added, the gelation passed through a max. at 30% concn., but the amt. of adsorbed NaOH was not affected by the gelation.

2941. Deuel, H. and Huber, G. **Organic derivs. of clay minerals. II. Alkoxy, alkyl, and aryl derivs. of montmorillonite.** *Helv. Chim. Acta* **34**, 1697-1701 (1951).—*C.A.* **46**, 6585*i*.
The chloride of Wyoming bentonite was prepd. by refluxing 20 g of the Na salt with 15 ml $SOCl_2$ in 70 ml $CHCl_3$, washing with $CHCl_3$, and vacuum-drying at 70°C. The chloride yielded alkoxy derivs, of montmorillonite on refluxing in MeOH or EtOH, the Et deriv. on refluxing in Et_2O with EtMgI, and the Ph deriv. on refluxing in C_6H_6 with slow addn. of $AlCl_3$. All the derivs. were vacuum-dried at 70°C. The exchange capacity of the derivs. was 28-57% of the Na salt.

2942. Freĭdlin, L. Kh. and Levit, A. M. **Determination of the relative adsorption coefficients of water and of formic acid on silica gel.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* **1951**, 799-805.—*C.A.* **46**, 3826g.
HCO_2H in aq. soln., at mol. concns. *M* from 10 to 100%, was passed over dry silica gel (4.5 g, 10 ml, length 3 cm), at feed rates varying with *M*. At 285°C, the gas consisted entirely of CO. The ratio of the relative adsorption coeffs. of H_2O and of HCO_2H on the catalyst were calcd. Promotion of the silica gel with K_2O increased the adsorability of the acid. Igniting lowered the adsorbability of HCO_2H even more strongly than of H_2O. The catalyst was more active, the smaller the adsorability of H_2O as compared with HCO_2H.

2943. Funakubo, Eiichi and Matsumoto, Yutaro. **The theory of chromatography and its application. III. The method of determination of adsorption power of alumina and its activation conditions.** *J. Chem. Soc. Japan*, Pure Chem. Sect., 72, 484-7 (1951).—*C.A.* 46, 5407b.
The adsorption of anthracene, anthraquinone, and carbazole by alumina (ignited at various temps.) was studied. For the reactivation of alumina, the ignition method was found to be superior to the washing method. The adsorption power of alumina varied considerably with the time between the process of activation and the actual use.

2944. KARYAKIN, A. V. **Quenching of the fluorescence of acridine compounds in an adsorbed state by oxygen.** *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* **15**, 556-64 (1951).—*C.A.* **46**, 8971*h*.

Quenching of the fluorescence of acridine compds. adsorbed on SiO_2 was not observed on acridines, acridone, 1(and 2)-aminoacridine; 10, 10′-dimethyl 9,9′-biacridan, 10,10′-dimethyl-$\Delta^{9,9'}$-biacridan, and lucigenin bromide (10,10′-dimethyl-9,9′-biacridinium dibromide). The quenching was strong in acridan, 9-iminoacridan, 3,6-diaminoacridine, and 3-aminoacridine. These latter compds. also showed considerable afterglow, and in these mols. the singlet and triplet levels were close together, so that paramagnetic O_2 could transfer the energy from the excited singlet to the metastable triplet state.

2945. KOIZUMI, MASAO AND IMAMURA, MASASHI. **Effect of light on the adsorption equilibrium of dyes.** *J. Chem. Soc. Japan*, Pure Chem. Sect. **72**, 323-6 (1951).—*C.A.* **46**, 739*e*.

Studies were made on silica gel in aq. solns. Rhodamine 6G irradiation caused a slight decrease of adsorption. The excited dye mols. produced by irradiation participated in the adsorption and caused a shift of the equilibrium.

2946. KRASIL'NIKOV, K. G. AND KISELEV, A. V. **Absolute adsorption isotherms from solution.** *Doklady Akad. Nauk S.S.S.R.* **77**, 1047-50 (1951).—*C.A.* **45**, 8847c.

Adsorption isotherms were detd. for solns. of PhOH in C_7H_{16} at 20° and 40°C on the highly coarse silica gel "E", coarse silica gel, a relatively fine-pore silica gel and nonporous $BaSO_4$. Total pore vol. in cc./g, most frequent pore diam. in A., and surface area in m^2/g were, resp.: 1.72, 200, 320; 0.92, 90, 350; 0.53, 30, 600; —, —, 9.7. The porosity of the silica gel showed no effect on the adsorption up to a pore size of 30 A. Adsorption of PhOH from soln. in C_7H_{16} could be used to det. the unknown surface area of a silica gel.

2947. MERRILL, REYNOLD C. AND SPENCER, ROBERT W. **Some quaternary ammonium silicates.** *J. Phys. & Colloid Chem.* **55**, 187-95 (1951).—*C.A.* **45**, 6115a.

The solubilities of micronized silica gel in strong org. bases, particularly quarternary ammonium hydroxides, were reported. The soly. of silica gel in quaternary ammonium hydroxides was about the same as in K or Na hydroxides at equiv. concns.

2948. MILLER, JOHN G.; HEINEMANN, HEINZ, AND MCCARTER, W. S. W. **The effect of solvent on the adsorption of liquids by bauxite and attapulgus clay.** *J. Phys. & Colloid Chem.* **55**, 515-23 (1951).—*C.A.* **45**, 6005*c*.

The adsorption of a large no. of liquids on activated bauxite and attapulgus clay was measured for binary solns. The results were listed in terms of the Freundlich isotherms and were classified into 3 groups: (1) the solvent adsorption was negligible; (2) the solvent adsorption was considerable but unaffected by the adsorption of the solute; (3) the adsorption of the solvent was high and affected the solute adsorption. A large part of the CCl_4 is held by attraction to the adsorbed solute mol.

2949. SCHONBERG, ALEXANDER AND ASKER, WAFIA. **Some adsorption colors and their significance for tautomeric and thermochromic effects.** *Science* **113**, 56-7 (1951).—*C.A.* **45**, 4995i.

When a piece of activated Al_2O_3 was added to a cold colorless soln. of β-dinaphthaspiropyran in xylene, the surface of the Al_2O_3 became bluish-green immediately. The adsorbed compd. could be eluted with MeOH. In C_6H_6, 1,3-diketohydrindene was colorless, but when adsorbed became violet.

2950. SCHROEDER, W. A. **Hydrogen bonding and relative adsorption affinities on silicic acid of certain derivatives of diphenylamine and *N*-ethylaniline.** *J. Am. Chem. Soc.* **73**, 1122-7 (1951).—*C.A.* **45**, 6004*h*.

The unexpected relative adsorption affinities that were shown by nitro and nitroso derivs. of Ph_2NH and PhNHEt on silicic acid columns were correlated with the strength of the H-bonds between the adsorbed compd. and the adsorbent. The order of decreasing adsorption affinity of derivs. of diphenylamine on silicic acid-celite were given.

2951. SLABAUGH, W. H. AND CULBERTSON, J. L. **The effect of certain reagents on the properties of bentonite colloids. II. Organic amines.** *J. Phys. & Colloid Chem.* **55**, 1131-9 (1951).—*C.A.* **46**, 318*e*.

Viscometric and electrophoretic analysis of reaction systems between hydrogen bentonite and org. amines indicated that the reactivity of the bentonite was stoichiometric. Monobasic amines produced dehydration of the clay micelle in proportion to their hydrophobic nature. Dibasic amines produced a type of cross linkage between clay micelles.

2952. TEWARI, SWARUP N. AND GHOSH, SATYESHEWAR. **Adsorption on hydrated chromium oxide and its amphoteric nature.** *Kolloid-Z.* **124**, 31-6 (1951).—*C.A.* **46**, 2873c.

Adsorption of methylene blue, malachite green, and Orange II from solns. of different concns. was detd. on hydrated Cr oxides, pptd. with (a) 10% excess, (b) an equiv., and (c) 10% deficiency of alkali. Adsorption followed the Freundlich equation, and fell off with age, also with increasing temp. With basic dyes adsorption was greatest on a and $a > c > b$, whereas with the acid dye the order was $b > c > a$.

2953. BARSHAD, ISAAC. **Factors affecting the interlayer expansion of vermiculite and montmorillonite with organic substances.** *Soil Sci. Soc. Am., Proc.* **16**, 176-82 (1952).—*C.A.* **46**, 8303*f*.

The extent of interlayer expansion was detd. by the size, charge, and total amt. of the interlayer cations and by the magnitude of the dipole moment and the dielec. const. of the immersion liquid.

2954. Deuel, H.; Huber, G., and Günthard, Hs. H. **Organic derivatives of clay minerals. III. Phenyl-montmorillonite.** *Helv. Chim. Acta* 35, 1799-1802 (1952) (in German).—*C.A.* 47, 452b.
$AlCl_3$ (0.6-3 g) was added to 10 g of the chloride of Wyoming bentonite in 50 ml C_6H_6 at 70°C. The product after washing with H_2O was purified by treatment with a mixt. of Amberlite IR-120 in the H-form and Amberlite IRA-400 in the OH-form. After vacuum drying at 70°C, the product was the phenyl deriv. of the bentonite.

2955. Dyal, R. S. and Hendricks, S. B. **Formation of mixed layer minerals by potassium fixation in montmorillonite.** *Soil Sci. Soc. Am., Proc.* 16, 45-8 (1952).—*C.A.* 46, 5239*i*.
The amt. of ethylene glycol retained by a clay was used as an index of interlayer swelling. K montmorillonites after drying at 100°C showed markedly lower glycol retention than did Ca and H montmorillonites.

2956. Hellström, Nils. **Comparative adsorption experiments. II. Some hydrocarbons in heptane with silica gel.** *Kungl. Lantbrukshögskol. Ann.* 19, 109-12 (1952) (in English).—*C.A.* 47, 7287*d*.
After prepn. and heating 1 hr at 200°C various different steps were taken before the silica gel was immersed in heptane. The adsorption capacity was tested for naphthalene, biphenyl, phenanthrene, and retene. The ratio sequence for naphthalene, phenanthrene, and retene (1/0.30/0.18) was in general agreement with the same ratio as found for activated charcoals. The eventual satn. capacity of the various prepns. was the same in spite of differences in the water content.

2957. Iler, R. K. **Association between polysilicic acid and polar organic compounds.** *J. Phys. Chem.* 56, 673-7 (1952).—*C.A.* 46, 8933*c*.
With $MeO(C_2H_4O)_4Me$ as a standard, detns. were made by titrating a standard silica sol. contg. the org. compd. with a standard gelatin soln. until a definite turbidity was noted. The effect was measured for alcs., glycols, ketones, amides, and amines and was related to H-bonding activity.

2958. Imamura, Masashi; Kato, Shunji, and Koizumi, Masao. **Influence of light on the adsorption equilibrium of dyes. III. Relative measurement.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 73, 770-3 (1952).—*C.A.* 47, 5121h.
The amt. of adsorption slightly decreased by light irradiation in the adsorption of an aq. soln. of Rhodamine 6G by silica gel.

2959. Karyakin, A. V. **Absorption spectra of acridine derivatives in solution and in the adsorbed state.** *Zhur. Fiz. Khim.* 26, 96-102 (1952).—*C.A.* 46, 9983*e*.
Absorption spectra (between 230 and 850 mμ) in EtOH solns. (10^{-4} mole/liter) and reflection spectra of acridine derivs. adsorbed from the vapor on silica gel (between 330 and 1000 mμ) were recorded and tabulated. The compds. studied were acridine, acridone, acridan, 1-, 2-, 3-, and 9-aminoacridine, 3,6-diaminoacridine, dimethylbiacridan, dimethylbiacridene, dimethylbiacridene oxide, and luicigenin bromide. The absorption max. above 330 mμ generally had the same position in the adsorbed state as in soln. The adsorbates however showed new absorption max. in the visible.

2960. Koizumi, Masao; Imamura, Masashi, and Watanabe, Ai. **Effect of light on the adsorption equilibrium of dyes. I. Qualitative experiments on some dyes. II. Adsorption isotherms for Rhodamine 6G.** *J. Chem. Soc. Japan, Pure Chem. Sect.* 73, 802-5; 865-8 (1952).—*C.A.* 47, 6143e.
Adsorption of basic dyes by silica gel and of acidic dyes by alumina was studied. The amt. of Rhodamine 6G adsorbed by silica gel decreased slightly by irradiation. The reaction isotherms of Rhodamine 6G and Rhodamine B by silica gel were studied in darkness and under the irradiation of light. The adsorption decreased with irradiation only in the first case.

2961. Martin, Vivaldi Juan L. and Hendricks, Sterling B. **Reactivity of the hydrogen ions of clays in nonpolar solutions. I. Action of diazomethane.** *Anales edafol. y fisiol. vegetal* (Madrid) 11, 601-29 (1952).—*C.A.* 47, 5211*i*.
Acid clay minerals of the kaolinite, montmorillonite, and illite groups reacted with diazomethane in anhyd. ether to form methoxyl compds. About 50% of the exchangeable H ions in illite and kaolinite esterify rapidly, but the remaining H ions reacted very slowly. In hydrogen montmorillonite, dried at 300°C, only 10% of the exchangeable H ions reacted rapidly without alteration of the basal spacing. The methylation of the Ca and Na salts of montmorillonite indicated that these salts, formed at a pH of 7, contain about 30 meq./100 g H ions capable of reacting and without causing polymer formation.

2962. Slabaugh, W. H. **Stoichiometry of complex silicates.** *Trans. Kansas Acad. Sci.* 55, 484-8 (1952).—*C.A.* 47, 5211*f*.
The ionic exchange of bentonite (montmorillonite) was studied with org. agents; the elementary reactions of Na- and H-bentonite with RNH_3Cl and RNH_2 result in RNH_3-clays. The direct reaction of Na-bentonite with alkyl halides was not successful, but much better was that with acyl halide, to form RCO-clays. The extent of the formation of "mixed anhydrides" with clay was greatly affected by the nature of the cations in the base-exchange position of the clay crystal.

2963. Spencer, W. F. and Gieseking, J. E. **Organic derivatives of montmorillonite.** *J. Phys. Chem.* 56, 751-3 (1952).—*C.A.* 46, 8928h.
Sodium Wyoming bentonite was treated with dil. HCl and product (14 g) treated with 150 ml of thionyl chloride. The resulting chloride was suspended in abs. ether, and PhMgBr added. The phenyl deriv. so obtained had a higher C content and lower cation exchange capacity than did H-montmorillonite. X-ray data indicated that the phenyl groups were in the crystal lattice in a regular manner between the planes.

2964. Stevenson, F. J.; Marks, Joy D.; Varner, J. E., and Martin, W. P. **Electrophoretic and chromatographic investigations of clay-adsorbed organic colloids. I. Preliminary investigation.** *Soil Sci. Soc. Am., Proc.* **16**, 69-73 (1952).—*C.A.* **46**, 5237f.

Aspartic and glutamic acids, glycine, serine, threonine, alanine, valine, leucine, galacturonic acid, and xylose were identified in the hydrolyzate of the colloids by paper chromatography. Traces of ribose and glucurone were detected. An unidentified spot was found which was probably a mixt. of mannose, arabinose, glucose, and galactose.

2965. Tewari, Swarup Narain. **Adsorption of dyes on hydrated aluminum oxide. Investigation of the amphoteric nature.** *Kolloid-Z.* **128**, 19-22 (1952).—*C.A.* **47**, 21*a*.

Several specimens of hydrated Al_2O_3 adsorbed more acid color (Orange II) than basic (methylene blue). The total and relative capacities decreased upon warming and aging and depended upon the method of prepg. the oxide.

II-4. Non-Carbon Adsorbents With Inorganic Solutions

2966. Cernescu, N. **The exchange capacity and the exchangeable cations of soils. Methods.** *Inst. geol. României, Compt. rend., Studii tech. econ., Ser. C,* **1939**, No. 5, 3-61.—*C.A.* **38**, 2151^4.

Satn. of the soil with NH_4 (by washing with NH_4OAc of pH 7) after destruction of the carbonate with acetic acid gave values of the exchange capacity which corresponded to the degree of satn. of soils in equil. with the $CaCO_3$. By percolation with a normal soln. of K acetate of pH 8.3, H in the complex was replaced by K.

2967. Cernescu, N. **The exchange capacity of soils in relation to the clay and humus content.** *Inst. geol. României, Compt. rend., Studii tech. econ., Ser. C,* **1939**, No. 6, 3-46.—*C.A.* **38**, 2151^6.

The extent to which clay and humus took part in the exchange capacity was established by detn. of the exchange capacity before and after destruction of org. matter by H_2O_2. Different soil types were investigated and agreement was found between calcd. and exptl. values. In chernozem over 40% of the exchange capacity was due to the humus, in degraded chernozem 25-30%, in rust-colored forest soils only 18-22%.

2968. Marshall, C. E. **Use of zeolitic membrane electrodes.** *J. Phys. Chem.* **43**, 1155-64 (1939).—*C.A.* **34**, 1539^8.

Exptl. data on the use of zeolitic membrane electrodes to measure cationic activity were detd. Details of the prepn. of electrodes, app., and technique were described. Chabazite and apophyllite crystals were used and measurements made using both uni- and bivalent cations.

2969. Bower, C. A. and Truog, Emil. **Determination of base-exchange capacity of soils and other materials.** *Ind. Eng. Chem., Anal. Ed.* **12**, 411-13 (1940).—*C.A.* **34**, 5984^6.

Base-exchange capacity was detd. in soils and other materials by treating a 1-g of sample with 5 sep. 50-cc. portions of *N* $MnCl_2$ soln. A centrifuge was used to aid the sepn. The excess of $MnCl_2$ was removed by 5 washings with 95% alc. The Mn-satd. soil thus formed was treated with 5 portions of *N* NH_4 acetate to remove the exchangeable Mn. An aliquot of this soln. was used to detn. Mn by oxidation with Na paraperiodate and comparison with standard $KMnO_4$ soln.

2970. Colon, Angel Alberto. **The effect of temperature upon the base-exchange capacity of clays.** *Bol. official asoc. quim. Puerto Rico* **1**, No. 4, 26-30 (1940) (in English).—*C.A.* **37**, 6065^6.

The replaceable K of K-clay decreased in 46 days from 40.8 milliequiv. to 31.93 and 26.9 milliequiv. at 25° and 100°C, resp. The total replaceable bases of the K clay increased from 78.37 to 96.53 and 88.23 milliequiv. at 25° and 100°C, resp. Also in Ca clay the amt. of replaceable Ca decreased with increasing temp. and prolonged heating of the sample; the total exchangeable bases showed a slight decrease upon prolonged heating.

2971. Eitel, W. and Radcqewski, O. E. **Characterization of the mineral clay montmorillonite by ultramicroscope.** *Naturwissenschaften* **28**, 397-9 (1940).—*C.A.* **35**, 3195^7.

Wyoming montmorillonite (natural bentonite) sepd. by sedimentation to give a fraction of smaller than 0.5 μ diameter particle size was studied with 20 to 30,000 magnification. Peculiar ragged skin-like aggregations were found in the microscopic picture after dispersion, with 0.01 *N* NH_4OH soln. These skins were true constituents of a two-dimensional gel.

2972. Filosofov, B. I. **The effect of drying soil on the determination of exchange aluminum.** *Izvestiya Azerbaidzhan. Filial. Akad. Nauk* **1940**, No. 5, 75-7.—*C.A.* **37**, 6390^2.

Air-dry samples could be used for the analysis.

2973. Filosofov, B. I. **Determination of exchange aluminum of the soil in salt extracts.** *Izvestiya Azerbaidzhan. Filial. Akad. Nauk* **1940**, No. 5, 77-8.—*C.A.* **37**, 6390^2.

In detns. of exchange Al in the $BaCl_2$ ext. of the soil, Ba must be removed preliminarily as $BaSO_4$. A part of the Al was co-pptd. with $BaSO_4$. This loss of Al was avoided by extn. of the soil with KCl instead of $BaCl_2$.

2974. Grim, R. E. **The significance of pH in the control of the properties of clay.** *Illinois State Geol. Survey, Bull. No.* **68**, 268-72 (1940) (Pub. 1944).—*C.A.* **39**, 2171^4.

Available data showed that Na^+ and H^+ changed the properties of clay in opposite directions and to a greater degree than other cations such as Mg and Ca. Na^+ or H^+ need not occupy all the exchange positions before they greatly affect phys. properties. The effect was greatest for clays that contained montmorillonite. Ca was the exchangeable ion in the natural clays.

2975. Mitra, R. P.; Mukherjee, S. K., and Bagchi, S. N. **The nature of the reactions responsible for soil acidity. VI. The variability of the total neutralizable acid of colloidal solutions of hydrogen clays.** *Indian J. Agr. Sci.* **10**, 303-16 (1940).—*C.A.* **35**, 555⁴.

The titration curves of colloidal solns. of H-clays showed definite inflection points and minima. The total neutralizable acid of a H-clay sol at these points and also at pH 7.0 was a variable quantity. The total acidities at the inflection point and at pH 7.0 which reacted with different bases were in the order $Ca(OH)_2 > Ba(OH)_2 > NaOH$. $Ca(OH)_2$ reacted with the sol more strongly than baryta.

2976. Mitra, R. P. **The nature of the reactions responsible for soil acidity. VII. The electrochemical properties of colloidal solutions of hydrogen clays.** *Indian J. Agr. Sci.* **10**, 317-43 (1940).—*C.A.* **35**, 555⁶.

The free and total acids of H-clay sols were considerably greater than those of their ultrafiltrates. The actual aq. cond. of the sol was often less than that due to its free H ions whose concn. had been calcd. from the observed pH of the sol. When a neutral salt was added to a H-clay sol, its H-ion activity showed a marked increase.

2977. Mitra, R. P. and Mitra, A. K. **The base-binding capacities of hydrogen clays as determined by different methods.** *Indian J. Agr. Sci.* **10**, 344-51 (1940).—*C.A.* **35**, 554⁵.

The total acidities of colloidal solns. of H-clays calcd. from their electrometric titration curves were compared with their base-binding capacities. There was a marked variability of the total neutralizable acid. Titration with baryta in the presence of N $BaCl_2$ or Ba acetate yielded the highest total acid.

2978. Saidel, Theodor. **New results from investigations on the solution laws as applied to the exchange of soil cations.** *Bodenkunde u. Pflanzenernähr.* **21/22**, 601-21 (1940).—*C.A.* **37**, 6793⁸.

Exchange reactions in soils were discussed theoretically and mathematically. Exchange reactions might be considered as a special case in the realm of heterogeneous reaction systems with incomplete equilibria.

2979. Staĭkov, Ts. **The influence of the degree of acidity on the sorption of calcium and magnesium in soils.** *Bodenkunde u. Pflanzenernähr.* **21/22**, 581-601 (1940).—*C.A.* **37**, 6794⁹.

In the soils studied, the exchangeability of soil Mg increased as the pH increased, relative to that of soil Ca. The exchangeability of Mg differed from that of Ca much more in the peat soils than in the mineral soils. Under the conditions of the tests pure exchange sorption of Mg was observed up to pH 9.3 in peat soils and up to pH 7.4 in mineral soils. In the latter soils pptn. sorption of Mg as the hydroxide was noticeable above pH 7.4 and very apparent above pH 8. The difference between the exchangeability of Mg and Ca increased somewhat in the presence of NaCl. When NH_4Cl was present, it increased strongly.

2980. Stelling, Otto. **The so-called activated bleaching earths.** *Tekn. Samfund. Handl.* **1940**, 109-30.—*C.A.* **38**, 2797².

A bleaching earth was obtained by activating a Swedish clay contg. montmorillonite. The activation process could not be considered to be just an exchange of bases by substitution of metal ions with H ions. The bleaching action attained a max. with the increase of the time for treatment with acid. The higher the concn. of the acid, the more readily was the max. attained. The bleaching action decreased with increased moisture content and grain size.

2981. Yarusov, S. S. **Molecular adsorption of electrolytes on soils.** *Chemisation Socialistic Agr. (U.S.R.R.)* **1940**, No. 6, 49-57.—*C.A.* **37**, 990⁹.

Molecular adsorption of LiCl, NaCl, KCl, NH_4Cl, $CaCl_2$, $SrCl_2$, $BaCl_2$, KBr, and KI from a aq.-alcohol solutions and from their aq. solutions on chernozem soils was studied. Up to 5.7 molecular equivalents of salt per 100 g was adsorbed from aqueous EtOH and up to 3.6 molecular equivalents from aqueous MeOH. A negative adsorption of anions was observed from aqueous solutions of salts in *N* concentration. Equivalent amounts of Ba^{++} and Cl^- were adsorbed from $BaCl_2$ in alcoholic solutions.

2982. Amiot, Raymond. **A study of the adsorption of various cations by a polarographic method.** *Compt. rend.* **212**, 892-3 (1941).—*C.A.* **38**, 5447⁵.

The adsorption of Ba, Cu, Ni and Al ions by a bentonite suspension was studied. The metals were added as the chlorides. The flocculated bentonite was sepd. by centrifugation and the concn. of the metal ion left in soln. was detd. polarographically. A methyl ether of cellulose (tylose) was used to suppress certain disturbing influences. Dissolved O_2 had to be removed only for the measurements of the dil. Cu solns.

2983. Damsgaard-Sorensen, P. **Cation exchange in the soil.** *Kem. Maanedsblad nord. Handelsbl. kem. Ind.* **22**, 65-8 (1941).—*C.A.* **37**, 6389⁹.

At equil. there was a distinct retardation of the ion exchange reaction, which evidently caused a variation of the equil. const. A cation was bound more strongly to the ion exchanger, the lower its ratio to the total amt. of cations. A practical method of calcn. and detn. was described.

2984. Damsgaard-Sorensen, P. **Exchange of cations in soil. III. Contribution to the general theory of cation exchange and its use in the determination of the exchangeable potassium in soil.** *Tids. Planteavl* **46**, 1-150 (1941).—*C.A.* **37**, 5814⁹.

The content of a soil in exchangeable K ions could be considered as a measure of its "available" K_2O content; the water-sol. K_2O was calcd. with the exchangeable K_2O. The simple mass-action equation held for ion exchange only if the atom groups producing the exchange were univalent, identical in structure and orientation with the environment, and did not react one upon the other.

2985. GAPON, E. N. AND VOSHCHINSKAYA, M. A. **The oxyaluminum of podsolized soils as an exchangeable cation.** *Chemisation Socialistic Agr. (U.S.S.R.)* **10**, No. 2, 37-42 (1941).—*C.A.* **37**, 489^{7}.

A 0.1 *N* KCl extract of a podzol (ratio of soil to KCl liquid being 1:2.25) showed that the exchange acidity in terms of milliequivalents (m.e.) per 100 g of soil was equal to the m.e. of Al. When the extract was treated with $(NH_4)_2SO_4$ the oxysulfate of Al, $(Al_2O_3H)_2SO_4$, formed. In another precipitation of $(Al_2O_3H)_2SO_4$ the precipitate was allowed to stand for 2 to 3 days, the salt washed and dried, and then treated with sufficient $BaCl_2$ solution to precipitate the sulfate. Ten percent of the Al existed either as Al^{+++} or as colloidal Al_2O_3. The rest of the Al in podzols was in the form of the oxyaluminum cation, $Al_2O_3H^+$, which may be exchanged for any ion.

2986. GINZBURG, I. I. AND MARGOLINA, N. S. **The sorption of Ni by silicates from dilute solutions in relation to the phenomena of hydrolytic decomposition.** *Bull. acad. sci. U.R.S.S., Sér. geol.* **1941**, No. 3, 159-62.—*C.A.* **38**, 1931^{8}.

The exchange adsorption of Ni by penninite, montmorillonite and nontronite took place differently in dil. than in concd. solns. The silicates were hydrolyzed, and the adsorption paralleled the hydrolysis. More base was displaced than corresponded to the amt. of adsorbed Ni. Mg was more strongly displaced than Ca.

2987. GRAHAME, DAVID C. **Properties of the electrical double layer at a mercury surface. I. Methods of measurement and interpretation of results.** *J. Am. Chem. Soc.* **63**, 1207-15 (1941).—*C.A.* **35**, 4267^{8}.

Accurate values of the differential capacity of the double layer were measured. Equations were given whereby the static capacity and the surface charge could be calcd. from several independent kinds of data. Results of such measurements were given for a no. of solns. It was shown that an incipient pptn. of certain anions gave rise to large values of the capacity of the double layer under appropriate conditions.

2988. HAUSER, E. A. AND LE BEAU, D. S. **Colloidal clays. II.** *J. Phys. Chem.* **45**, 54-65 (1941).—*C.A.* **35**, 1290^{6}.

The cataphoretic velocity of purified, colloidal, monodisperse fractions of bentonite increased with decreasing particle size. With const. particle size it decreased with increasing concn., the drop being most pronounced with the smallest particles. In extreme dilns. (up to 0.5%) the cataphoretic velocity remained const. for a given particle size. The apparent sp. gr. of bentonite at low concns. was smaller than that of dry bentonite; at high concns. it was greater.

2989. HELLER, WILFRIED. **Reversible aggregations of colloidal particles. I. Centrifugal experiments on thixotropic iron oxide sols.** *J. Phys. Chem.* **45**, 1203-37 (1941).—*C.A.* **36**, 311^{8}.

Two dialyzed Fe_2O_3 sols were treated with sufficient NaCl to make them thixotropic. The systems were allowed to age for a week before they were centrifuged. When a thixotropic sol was centrifuged, it sepd. into an upper dil. sol phase and a lower concd. phase which was a thixotropic gel. The kinetics of this sepn. and the effect of aging, electrolyte concn., addn. of various org. substances, and of weak mech. vibrations upon the system were studied.

2990. HURD, CHARLES B. AND THOMPSON, LOUIS W., JR. **Silicic acid gels. XIII. Some examples of re-gelation.** *J. Phys. Chem.* 45,,1263-7 (1941).—*C.A.* **36**, 312^{3}.

Silica gels (contg. 3.5% SiO_2) were broken into lumps and beaten into fine particles in an equal vol. of distd. H_2O. Tabulated data showed the no. of times of re-gelation *vs.* pH of original gel of each mixt. Acidic mixts. (pH = 5.1) reset 8 times whereas basic mixts. did not re-gel at all.

2991. MARSHALL, C. E. AND BERGMAN, W. E. **The electrochemical properties of mineral membranes. I. The estimation of potassium-ion activities.** *J. Am. Chem. Soc.* **63**, 1911-6 (1941).—*C.A.* **35**, 5772^{4}.

Data were given for the charge on the following membranes (expressed as an ionic activity) as related to the temp. of drying: Ca-, H- and K bentonite; for the membrane (bentonite) potentials with the following salt solns.: $CaCl_2$ and $MgSO_4$; and for the effect of pH and large anions (acid phthalate, p-toluenesulfonic acid and p-nitrophenol). The results indicated that K^+ activities could be detd. in the absence of other univalent cations with a precision within 5% at pH values above 4. A high degree of reproducibility was possible with com. Wyoming bentonite from which all particles larger than 200 mμ in equiv. spherical diam. were removed by supercentrifuging.

2992. MEHLICH, ADOLF. **Base unsaturation and pH in relation to soil type.** *Soil Sci. Soc. Am. Proc.* 6, 150-6 (1941).—*C.A.* **37**, 491^{5}.

The base unsatn.pH relationship of base-exchange colloids exhibited a const. and specific characteristic for each mineral, except montmorillonite and hydrous mica, which appeared to be very similar. This relationship of the soils examd. was similar to the principal characteristics of the known base-exchange materials. The base unsatn.-pH relationship was not influenced by base-exchange capacity or buffer activity.

2993. PEECH, MICHAEL. **Determination of exchangeable bases in soils.** *Ind. Eng. Chem., Anal. Ed.* **13**, No. 6, 436-41 (1941).—*C.A.* **35**, 4891^{6}.

The bases were extd. with 1 *N* $AcONH_4$ soln. Magnesium was pptd. with 8-hydroxyquiniline, potassium as cobaltinitrite which was subsequently detd. colorimetrically with a nitroso-R-salt. Sodium was not detd. The data given showed satisfactory recoveries of added quantities of the various bases. Exchangeable hydrogen was computed by subtracting the sum of the exchangeable bases from the base-exchange capacity. Base-exchange capacity was detd. by distn. of NH_3 absorbed by the soil.

2994. VINOKUROV, M. A. **Exchange capacity of the mineral and organic complexes in the soil.** *Pedology (U.S.S.R.)* 1941, No. 5, 33-43.—*C.A.* 37, 4841^7.

Soil satd. with Na was oxidized with boiling H_2O_2 and the exchange capacity of the mineral fraction residue detd. by $BaCl_2$ treatment. Na concn. in the oxidized soln. was a measure of the exchange capacity of the org. fraction. Exchange capacity of a soil varied with the mineral and org. colloid contents at any point in the profile.

2995. BLACK, C. A. **Phosphate fixation by kaolinite and other clays as affected by pH, phosphate concentration and time of contact.** *Soil Sci. Soc. Am., Proc.* 7, 123-33 (1942). (Pub. 1943).—*C.A.* 37, 5538^2.

Finely ground kaolinite retained a max. of phosphate at pH 3.5-4.0. The fixation was apparently mainly an OH-ion replacement. Two other kaolinitic clays showed no max. in fixation at pH 3-4 from a soln. contg. 1 p. p. m. P. In dil. solns. fixation due to Al showed a max. at pH 5-7. This fixation was covered up by the much greater fixation caused by OH replacement in the concd. solns. over the longer period of contact.

2996. BOUTARIC, AUGUSTIN AND BERTHIER, PAULETTE. **The additive law of magnetic properties in the mixtures where the phenomena of adsorption occur.** *Compt. rend.* 215, 62-4 (1942).—*C.A.* 38, 6144^3.

A sol of $Fe(OH)_3$ and a soln . of $FeCl_3$ were mixed in various proportions with a suspension of bentonite which served as an adsorbent. The magnetic susceptibilities of the mixts. were measured. Apparently, adsorption by the bentonite increased the coeff. of magnetization of the fixed substance.

2997. CHATTERJEE, B. AND PAUL, M. **Interaction between hydrogen clays and neutral salts. II. Role of aluminum ions in relation to free and total acids of hydrogen clays.** *Indian J. Agr. Sci.* 12, 113-20 (1942).—*C.A.* 39, 4420^5.

Both Al and H ions were present on the surface of the H-clay particle. Treatment with a neutral salt caused the displacement of some of these ions into the intermicellary liquid, while the remainder continued to be closely assocd. with the clay particle. The proportion of ions remaining assocd. with the clay depended on the displacing power of the cation used.

2998. CHATTERJEE, B. AND SEN, A. **Variation in the electrochemical properties of H-clay sols with temperature.** *J. Indian Chem. Soc.* 19, 189 (1942).—*C.A.* 38, 3182^9.

The H-clay sol was prepd. from the entire clay fractions of a nonlateritic calcareous soil. Free acidity increased from 1.1×10^5 N to 7.9×10^5 N with variations of 1-50 C, resp. Total acidity increased from 200×10^{5}N to 252×10^5N, degree of dissocn. increased from 1 to 50%, and pH at inflection decreased from 9.15 to 7.75 under the same change of temp.

2999. COLEMAN, R. **The adsorption of phosphate by kaolinitic and montmorillonitic clays.** *Soil Sci. Soc. Am., Proc.* 7, 134-8 (1942) (Pub. 1943).—*C.A.* 37, 5538^7.

The H- and NH_4-montmorillonitic clays adsorbed more PO_4 from phosphate solns. at pH 7 and 9.5 than did the corresponding kaolinitic clay. The H- and NH_4-kaolinitic clays adsorbed more PO_4 from the phosphate solns. at pH 3. In the case of montmorillonitic clay PO_4 adsorption was not greatly influenced by changes in reaction, while in the case of kaolinitic clay changes in reaction greatly influenced phosphate adsorption. The fixation by both these clays was due largely to the free Fe and Al oxides in the clays.

3000. DOBROWSKY, ALFRED. **Silica gel as a new adsorbent for the electrolyte in dry cells.** *Z. Elektrochem.* 48, 467-9 (1942).—*C.A.* 37, 5662^9.

Silica gel contg. 10% SiO_2 offered advantages over customary gels (from flour) or bentonite. It showed no syneresis and was not thixotropic; it was sufficiently viscous, indifferent to admixts. and stable in the absence of air. The elec. properties of dry cells prepd. with silica gel meet standard specifications.

3001. GADDIS, SHIRLEY. **New precipitant for Group II ions.** *J. Chem. Education* 19, 327-8 (1942).—*C.A.* 36, 5107^2.

A resin of the amine-formaldehyde condensation type, known commercially as amberlite IR-4, absorbed 12% of its wt of H_2S when left in contact with the gas for several days. The green product was fairly stable and could be used instead of H_2S gas. In elementary classes, 0.4 g of the product was recommended for 2-mg portions of one or more members of the Cu-Sn group. The procedure with respect to Cu imparted a deep-orange color to the ammoniacal soln., so that a supplementary test for Cu was necessary. The resin also absorbed H_3PO_4; this simplified the examn. of Group III.

3002. KELLEY, CARL W. AND THOMAS, R. P. **A method of estimating the organic exchange complex of a soil.** *Soil Sci. Soc. Am. Proc.* 7, 201-6 (1942).—*C.A.* 37, 6074^4.

The org. matter of 10 Maryland soils was detd. by 9 methods and the total exchange capacity was estd. for each soil before and after treatment with H_2O_2. The H_2O_2 treatment did not remove all of the org. matter from a soil. Org. material, fertilizer and CaO treatments influenced the org. matter content and exchange capacity of a soil. Maryland soils had 50-80% of their exchange capacity in org form.

3003. KISHI, HARUO. **Analysis by means of radioactive indicators. X. Sorption of minute quantity of lead by silica gel. 1.** *J. Chem. Soc. Japan* 63, 715-23 (1942).—*C.A.* 41, 2986c.

The dehydration of silica gel was studied from room temp. to 300 °C. The water content decreased suddenly at 25-50 °C and then gradually up to 300 °C. The gel dried at high temp. had a greater tendency to adsorb Th B as well as a dil. soln. of $Pb(NO_3)_2$ containing Th B. The adsorbed Pb increased gradually with increase of the gel, and finally reached a const. value.

3004. KISHI, HARUO. **Analysis by means of radioactive indicators. X. Sorption of minute quantity of lead by silica gel. 2.** *J. Chem. Soc. Japan* 63, 724-33 (1942).—*C.A.* 41, 2986*d*.

The adsorbed quantity of Pb decreased with rise of temp. and increased gradually with the time of contact between the soln. and the gel. In $10^{-4} \times 2.5$ N HCl, HNO_3, or tartaric acid, the adsorbed quantity decreased with increase of acid concn. In NH_4OH or NaOH, the adsorbed quantity was almost independent of concn.

3005. KISHI, HARUO. **Analysis by means of radioactive indicators. XI. Sorption of a minute quantity of lead by silica gel in the course of its formation from silicate solution. 1.** *J. Chem. Soc. Japan* 63, 734-9 (1942).—*C.A.* 41, 2986*e*.

Th B, or 10^{-4} N $Pb(NO_3)_2$ contg. Th B, was added to the aq. soln. of Na silicate. Most of the Th B or Pb was lost during the prepn. of the gel.

3006. KISHI, HARUO. **Analysis by means of radioactive indicators. XI. Sorption of a minute quantity of lead by silica gel in the course of its formation from silicate solution. 2.** *J. Chem. Soc. Japan* 63, 740-5 (1942).—*C.A.* 41, 2986*f*.

The influence of washing upon the amt. of Pb adsorbed by silica gel was studied. A minute quantity of the adsorbed Pb could not be removed by repeated washing.

3007. KISHI, HARUO. **Analysis by means of radioactive indicators. XII. Sorption of a minute quantity of lead by silica gel obtained from acid clay. 1.** *J. Chem. Soc. Japan* 63, 878-82 (1942).—*C.A.* 41, 2986*f*.

The Kambara clay was fused with the mixt. consisting of Na_2CO_3 and K_2CO_3. By adding water to the fusion product and by shaking, a turbid suspension of water glass contg. impurities from the clay was obtained, and was used for the expt. of sorption.

3008. KISHI, HARUO. **Analysis by means of radioactive indicators. XII. Sorption of a minute quantity of lead by silica gel obtained from acid clay. 2.** *J. Chem. Soc. Japan* 63, 883-7 (1942).—*C.A.* 41, 2986*g*.

After adding the $Pb(NO_3)_2$ contg. Th B to the suspension, the suspension was decompd. by the addn. of acid, and the amt. of Pb adsorbed in the resulting gel was detd. by radioactive analysis. Only a very small portion of Pb was adsorbed by the gel.

3009. LUCAS, ROBERT E. **Reliability of lime-requirement calculations based on the rapid Cu method for exchange capacity.** *Soil Sci. Soc. Am., Proc.* 7, 362-7 (1942) (Pub. 1943).—*C.A.* 38, 197^6.

Cu acetate gave higher readings for exchange capacity than NH_4 acetate for soils low in exchange capacity and lower readings than NH_4 acetate for soils of high exchange capacity. When the ammonia procedure was omitted, the colorimetric measurement of Cu as the acetate rather than as the cupra-ammonia form was quite time-saving and sufficiently accurate for the practical detn. of exchange capacity values. There was a pos. correlation ($r = 0.98$) between the exchange capacity by this rapid method and CaO requirement.

3010. MALQUORI, ALBERTO. **Properties of base exchange and swelling in the evaluation of the surface activity of clays.** *Ricera Sci.* 13, 777-82 (1942).—*C.A.* 38, 3893^4.

The property of cation exchange, T, and the swelling (measured for dry cylinders by means of a lever balance) were measured for a no. of different kinds of clay. By comparing the 2 values it appeared that swelling roughly paralleled T for clays of the groups of kaolinite and halloysite, whereas for sericite and montmorillonite there was no such simple relation. The probable reasons for the differences in behavior were discussed and the opinion was expressed that the differences between univalent and bivalent ions probably play a part.

3011. MARSHALL, CHARLES E. **The use of membrane electrodes in the study of soils.** *Soil Sci. Am. Proc.* 7, 182-6 (1942).—*C.A.* 37, 6072^2.

Electrodes sensitive to metallic elements and the direct electrometric detn. of Ca, Mg, K or Na were discussed. It was possible to prep. clay membranes which were, for practical purposes, sensitive only to univalent cations, others sensitive both to univalent and bivalent cations and still others sensitive to uni-, bi-and trivalent cations.

3012. MARSHALL, CHARLES E. AND BERGMAN, W. E. **The electrochemical properties of mineral membranes. II. Measurement of potassium-ion activities in colloidal clays.** *J. Phys. Chem.* 46, 52-61 (1942).—*C.A.* 36, 2462^3.

A membrane electrode composed of a film of electrodialyzed bentonite dried at 490 °C was used to measure K-ion activities from 0.1 N to $10^{-4}N$. Data were given for K-ion activities in 0.5% suspensions of electrodialyzed agar contg. various amts. of K; for pH and K-ion activity for suspensions of Putnam clay, bentonite and illite; and for the effect of salts on K-ion activity in 2.00% bentonite and 4.56% Putnam clay suspensions.

3013. MARSHALL, CHARLES E. AND BERGMAN, W. E. **The electrochemical properties of mineral membranes. IV. The measurement of ammonium-ion activities in colloidal clays.** *J. Phys. Chem.* 46, 327-34 (1942).—*C.A.* 36, 2462^6.

The clay-membrane electrode (hydrogen montmorillonite dried at 490°C) could be used to measure NH_4-ion activities below 0.1 N in solns. in which it was the only univalent cation and in which the concn. of bivalent ions was less than that of the NH_4 ion. Hydrogen ions interfered, but a correction could be applied provided the membrane was not attacked. The pH should be over 4. Titration curves with NH_4OH were given for the following clays: Putnam (beidellite), Wyoming bentonite (montmorillonite), illite and kaolinite.

3014. MARSHALL, CHARLES E. AND KRINBILL, C. A. **The electrochemical properties of mineral membranes. V. Beidellite membranes and the determination of sodium.** *J. Am. Chem. Soc.* 64, 1814-19 (1942).—*C.A.* 36, 6062^8.

Clay membranes were described that were sensitive only to univalent cations (H-montmorillonite 490 °C); to univalent and bivalent cations (H-montmorillonite 350 °C); and to uni-, bi-and trivalent cations (H-beidellite 600 °C). For Na estns., beidellite membranes gave excellent reproducibility. The potentials obtained with solns. less concd. than 0.03 *N* were within 1 millivolt of those calcd. by the Nernst equation.

3015. MARSHALL, CHARLES E. AND KRINBILL, C. A. **The clays as colloidal electrolytes.** *J. Phys. Chem.* **46**, 1077-90 (1942).—*C.A.* 37, 1638^8.

The pH, Na-ion activity and sp. conductance of dialyzed beidellite, montmorillonite, illite and kaolinite samples were detd. for various addns. of NaOH. The fraction of cations active or dissocd. was a function of: (a) the nature of the cations, (b) the nature of the clay, (c) the concn. of the clay, and (d) the degree of neutralization of the clay.

3016. MEHLICH, A. **The significance of percentage base saturation and pH in relation to soil differences.** *Soil Sci. Soc. Am. Proc.* 7, 167-74 (1942).—*C.A.* 37, 6073^7.

Total exchangeable H and the base-exchange capacity were detd. with $BaCl_2$-triethanolamine buffered at pH 8.2. After this 10-g portions of the soil were weighed into containers suitable for shaking in a mech. shaker and increasing amts. of 0.1 *N* $Ba(OH)_2$ added. The soil suspensions were shaken 3 days in the stoppered containers. After the 3rd day the pH was detd. by means of a glass electrode. Percentage base satn.-pH relationship was useful in indicating trends regarding the compn. of the base-exchange colloids present, but it did not permit their pos. identification.

3017. MITRA, R. P. AND RAY, S. P. **Free and titratable acids per particle of subfractions of hydrogen clay.** *J. Indian Chem. Soc.* 19, 401-2 (1942).—*C.A.* 37, 4288^2.

Free and titratable acids for suspensions of H clays of known equiv. diam. were calcd., resp., from the pH and from potentiometric titration with NaOH. Free H^+ was about 1% of the titratable. Free H^+ per particle ranged from the magnitude of 10^6 for 1μ particles to 10 for 0.018-μ particles.

3018. MUKHERJEE, J. N. AND CHATTERJEE, B. **Interaction between hydrogen clays and neutral salts. I. Nature of interaction responsible for liberation of aluminum.** *Indian J. Agr. Sci.* **12**, 105-12 (1942).—*C.A.* **39**, 4419^9.

Acidity developed on treatment of H-clay with a neutral salt was not entirely accounted for by the amt. of Al released. The titratable acid in an aq. $BaCl_2$ ext. of a H clay was approx. equiv. to the amt. of Ba adsorbed. At the same pH, $BaCl_2$ displaced much more Al from the clay than did HCl, the effect of $BaCl_2$ being the same whether the pH was allowed to decrease or kept const. by buffers.

3019. MUKHERJEE, J. N.; CHATTERJEE, B, AND GOSWAMI, P. C. **Limiting exchange of aluminum ions from hydrogen clays on the addition of neutral salts.** *J. Indian Chem. Soc.* 19, 405-7 (1942).—*C.A.* 37, 4288^3.

An estimate of the importance of exchangeable Al^{+++} on H clays was made by alternately leaching a H-clay sol from Latekujan with neutral salt (*N* $BaCl_2$) and with acid through 9 cycles. Al^{+++} recoveries fell off progressively. For the first cycle, of the 31-milliequiv. total capacity of the sol, 25 milliequivs. of Al^{+++} were recovered; for the ninth only 3.4 milliequivs. of Al^{+++}. Total exchange capacity was unaltered.

3020. MUKHERJEE, J. N.; MITRA, R. P., AND BANNERJEE, S. **Alterations in properties of hydrogen clays on removal of free inorganic oxides contained in them. I.** *Indian J. Agr. Sci.* 12, 303-12 (1942).—*C.A.* 39, 4420^6.

Removal of free SiO_2 and sesquioxides from H clays decreased the base-exchange capacity and caused changes in titration curves indicative of modifications in the exchange complex. Another method caused no appreciable change in exchange capacity or titration curves and only a slight modification in chem. compn.

3021. MUKHERJEE, J. N.; MITRA, R. P., AND CHAKRAVORTY, S. K. **Properties of sub-fractions of hydrogen clay prepared from Indian soils. I.** *Indian J. Agr. Sci.* **12**, 291-302 (1942).—*C.A.* **39**, 4419^8.

The sub-fractions of the entire clay of a red lateritic (Bengal) and a black (Central Provinces) soil was studied. With decrease in particle size the Al_2O_3 content increased and both the SiO_2 and and Fe_2O_3 contents diminished. The base-exchange capacity and the free H ions per g of clay showed a rapid increase with decrease in diam. of particles. The exchange capacity per unit external surface varied uniformly with particle size.

3022. MUKHERJEE, J. N.; MITRA, R. P.; CHATTERJEE, B, AND MUKHERJEE, S. K. **Nature of reactions responsible for soil acidity. VIII. Acid character of hydrogen clay in relation to some problems of soil science.** *Indian J. Agr. Sci.* 12, 86-104 (1942).—*C.A.* 39, 4421^8.

The base-exchange capacity of a H-clay varied with the cation of the base used in titration and with the pH. The value observed by titration was increased in presence of neutral salts. In absence of salts the capacity showed by titration with different bases was in the order: $Ca(OH)_2 > Ba(OH)_2 > NaOH$. In presence of fixed proportions of the corresponding chlorides the order was: $Ba(OH)_2 > Ca(OH)_2 > NaOH$. All sub-fractions of a black cotton soil clay showed a similar form of titration curve. Removal of free sesquioxides and SiO_2 from clay materially altered the exchange capacity and the form of the titration curve.

3023. MUKHERJEE, J. N. AND MITRA, R. P. **Nature of reactions responsible for soil acidity. IX. Acid character of H-clays.** *Indian J. Agr. Sci.* 12, 433-73 (1942).—*C.A.* 38, 4734^7.

H-clay was titrated under various conditions and the features of the curves were analyzed. Comparisons were made with the curves of simple polyphase acid systems: satd. solns. of cinnamic acid contg. the solid acid, palmitic and stearic acid hydrosols, and silicic acid hydrosol. The adsorption of the cations was detd. by their valencies, mobilities, and states of hydration if adsorption was due mainly to electrostatic forces, but when it was due to valency forces solubility and other factors were important.

3024. Mukherjee, J. N.; Mitra, R. P., and Ghosh, K. C. **Mixed cation effects in the estimation of base-exchange capacities of hydrogen clays.** *J. Indian Chem. Soc.* 19, 397-8 (1942).—*C.A.* 37, 4512^1.

Total neutralizable acid was detd. at pH 7.0 for the H-clay from a black cotton soil from Padegaon for the permutations of NaOH, $Ba(OH)_2$ and $Ca(OH)_2$ in the presence of 0.002 *N* and 0.1 *N* NaCl, $BaCl_2$ and $CaCl_2$. The neutralizable acid with a given base in the presence of a fixed concn. of salts followed the order: $BaCl_2$, $CaCl_2$, NaCl.

3025. Raychaudhuri, S. P. and Basuraychaudhuri, P. K. **Indian red soils. V. Factors responsible for buffer capacities and base-exchange properties.** *Indian J. Agr. Sci.* 12, 137-52 (1942).—*C.A.* 39, 4419^5.

In red and lateritic soils, the % base satn. tended generally to increase with depth and, in some cases, a max. was reached at an intermediate depth. Buffer curves in general showed a point of inflection at pH 9.8 with a secondary inflection at pH 2.9 or 4.6. Buffer curves of limonite, bauxite, halloysite, kaolin, and montmorillonite show inflections at pH 2.9 and that of humic acid at pH 4.6.

3026. Raychaudhuri, S. P. and Qudrat Ghani, A.K.M. **The physichochemical and electrokinetic properties of gels of silicic acid and aluminum hydroxide.** *J. Indian Chem. Soc.* 19, 311-30 (1942).—*C.A.* 37, 2242^9.

Silicic acid and aluminum hydroxide sols were mixed in varying proportions, and the ppts. purified. Up to a SiO_2-Al_2O_3 ratio of 2, the pptd. gels and mixing ratios were approx. the same, but above this ratio the pptd. gel contained more Al_2O_3. Al_2O_3 could combine with silica even after lump formation. Cation adsorption followed: $Li^+ < Na^+ < K^+ < Mg^{++} < Ca^{++} < Ba^{++} < Al^{+++}$; anion adsorption occurred in the decreasing order: $Fe(CN)_6^{IV}$, HPO_4^{--}, SO_4^{--}, Br^-, Cl^-, NO_3^-. Anion adsorption dropped with SiO_2 content of the ppts. Within moderate limits, the intensity of cation adsorption increased with SiO_2 content of the gel.

3027. Schachtschabel, P. **Investigations of sorption in soils.** *Forschungsdienst, Sonderh.* 16, 87-90 (1942).—*C.A.* 37, 4510^7.

The ions of the soil were not adsorbed in a proportionate manner. K and NH_4 ions were for the most part bound to the mica, Ca ions to the humus, and Mg ions to the montmorillonite. Since the Ca ions were generally in excess, both the montmorillonite and mica held a greater or lesser amt. of Ca ions by selective sorption. This disproportionate distribution also held for H ions as well as for Fe and Al ions.

3028. Thiessen, P. A. **The reciprocal adsorption of colloids.** *Z. Elektrochem.* 48, 675-81 (1942).—*C.A.* 37, 5898^5.

Colloidal Au particles were adsorbed only on the edges of platelike kaolin particles, but were adsorbed on the surface of mica particles and asbestos fibers. When the kaolin was treated with Ba ions, the Au particles are adsorbed on the surface. Anion-active substances (soaps) and nonionic wetting agents did not increase the surface adsorption on kaolin, whereas cation-active substances (invert soaps) did increase the surface adsorption.

3029. Weiser, Harry B.; Milligan, W. O., and Simpson, W. C. **Elimination of sorption-desorption hysteresis in hydrous oxide gels. II. Tantalum pentoxide, stannic oxide and TiO_2.** *J. Phys. Chem.* 46, 1051-9 (1942).—*C.A.* 37, 1911^8.

Sorption-desorption hysteresis with water was greatly modified or eliminated in gels formed by hydrolysis at the b.p. and aging of the resulting sol particles before coagulating the sols to gels. Aged gels of SiO_2 and Ta_2O_5 gave amorphous-type diffraction patterns with both x-ray and electrons, whereas aged gels of SnO_2 and TiO_2 gave weak x-ray patterns corresponding to cassiterite and anatase, resp.

3030. Allison, L. E. **The trend of phosphate adsorption by inorganic colloids from certain Indiana soils.** *Soil Sci.* 55, 333-42 (1943).—*C.A.* 37, 5180^1.

With Na^+ as the exchangeable cation, the curves of P_2O_5 adsorption presented a characteristic max. and min. effect. In general, the first adsorption peak occurred in the pH range of 3.0 to 3.5 and appeared to be due to adsorption by hydrous Fe and Al oxides. At approx. pH 4.5 the curves abruptly changed direction from a strong downward slope to an equally strong upward slope and reached a second high peak at about pH 6.0. This second max. was probably due to adsorption by aluminosilicate clay minerals. With Ca^{++} as the exchangeable cation, the trend of adsorption over much of the reaction range was unlike that in the situation in which Na^+ was the cation.

3031. Antipov-Karataev, I. N. and Zaitseva, N. I. **Methods of determining the absorptive capacity and composition of exchangeable ions in carbonate soils.** *Pedology (U.S.S.R.)* **1943**, No. 9-10, 42-8 (English summary).—*C.A.* 40, 153^9.

Soil (4 g) satd. with Ba (0.5 *N* $BaCl_2$ and 0.01 *N* Ba acetate were used) was treated with 80 cc. 0.05 *N* K_2CO_3, free from $KHCO_3$. The mixt. was allowed to stand for 2 to 4 hrs and shaken occasionally. The suspension was allowed to settle for 40-48 hrs, or a filtrate obtained by passing it through a colloidal filter. To 20 cc. of the filtrate 10 cc. of 0.1 *N* H_2SO_4 was added. The CO_2 formed was driven off by boiling the residual H_2SO_4 titrated with NaOH (0.05 *N*) with a mixt. of bromo cresol purple and bromothymol blue as the indicator.

3032. Brown, Irvin C. **A rapid method of determining exchangeable H and total exchangeable bases of soil.** *Soil Sci.* 56, 353-7 (1943).—*C.A.* 38, 2432^3.

To det. exchangeable H, 2.5 g of soil was placed in a 50-ml Erlenmeyer flask, 25 ml of neutralized *N* NH_4OAc added, the flask stoppered, and the 1 to 10 mixt. allowed to stand for 1 hr with occasional shaking. The pH was detd. on the mixt. From a graph the milliequivs. of exchangeable H per 100 g of soil were read directly. To det. total exchangeable bases, 2.5 g of soil and 25 ml of *N* HOAc were mixed and treated in the same manner as the mixt. prepd. for exchangeable H detn.

The pH of the mixt. was detd. From a graph the milliequivs. of exchangeable bases per 100 g of soil were read directly.

3033. CHARRIN, VICTOR. **Mineral exchange materials.** *Chimie & industrie* 49, 349-50 (1943).—*C.A.* **38**, 6428[3].
Kieselguhr, pumice and $CaCO_3$ were discussed.

3034. CHATTERJEE, B. AND SEN, A. **Properties of synthetic mixtures of colloidal solutions of silicic acid and aluminum hydroxide. I.** *Indian J. Agr. Sci.* **13**, 59-65 (1943) (Pub. 1944).—*C.A.* **42**, 2837*h*.
Synthetic mixts. prepd. from silicic acid and hydrous Al_2O_3 were found to carry a pos. charge. The pH and specific conds. of the mixts. changed with time showing the presence of a slow interaction between colloidal silicic acid and $Al(OH)_3$. The potentiometric titration curves of the mixts. with NaOH did not resemble those of either the silicic acid or $Al(OH)_3$ sols. They showed inflection points between pH 6.5 and 7.5

3035. CLARK, ROBERT E. D. **New effects due to anisotropy of colloidal particles.** *Chemistry & Industry* **1943**, 348-50.—*C.A.* **38**, 10[5].
Studies were made of the orientation of the neg. colloidal bentonite clay particles in aq. suspension. By using a fine W wire with a potential gradiant of several hundred v. per cm for electrodes, it was indicated that the clay particles were arranged perpendicularly to the cathode and parallel to the anode. The expt. showed that the resistance to current flow was decreased by the arrangement around the cathode and increased by that of the anode shortly after potential was applied.

3036. ELGABALY, M. M. AND JENNY, H. **Cation and anion interchange with zinc montmorillonite clays.** *J. Phys. Chem.* 47, 399-408 (1943).—*C.A.* **37**, 5838[7].
Zn-contg. clays possessed marked anion-exchange qualities. Results indicated that the mosaic surface of the clay was capable of independent cation and anion exchange.

3037. FU, YING. **Effect of neutral salts on the adsorption of alkalies by silica.** *J. Chinese Chem. Soc.* **10**, 103-12 (1943).—*C.A.* **38**, 2867[9].
The adsorption from soln. of NaOH and KOH on silica gel was measured in the presence of the neutral salts: NaCl, $NaClO_3$, $NaNO_3$, KCl, LiCl. Freundlich's equation held for all cases. An increased amt. of OH^- ion disappeared from soln. in the presence of neutral salts, the order of effectiveness being: $Li^+ > Na^+ > K^+$. The order was independent of the anion used.

3038. GRAČANIN, M. AND VERLIČ, J. **Investigations of the adsorption complex of Croatian podzolic soils.** *Bodenkundl. Forsch.* **8**, 76-95 (1943).—*C.A.* **39**, 3613[7].
The amt. of exchangeable bases present in the adsorption complex was studied, and also the behavior of the cations in the adsorption complex, and the fixation of bases.

3039. HISSINK, D. J. **The seat of the base-adsorption power in the mineral soil complex.** *Bodenkundl. Forsch.* **8**, 72-6 (1943).—*C.A.* **39**, 3613[8].
Four Netherlands soils were investigated. The principal seat of the base-adsorption power was found to be the "weathering silicate A."

3040. JOHNSON, F. C. **Alumina hydrogel.** *Nature* **152**, 415 (1943).—*C.A.* **38**, 517[9].
Exts. from fusions of alumina with 2 parts $NaKCO_3$ and 1 part borax (as for colorimetric detn. of SiO_2) set on standing to more or less thixotropic gels.

3041. KELLEY, JOSEPH B. AND MIDGLEY, A. R. **Phosphate fixation—an exchange of phosphate and hydroxyl ions.** *Soil Sci.* 55, 167-76 (1943).—*C.A.* 37, 4847[1].
The hydrated Fe oxide, usually distributed as a film over individual soil particles, had marked activity in fixing sol. phosphate that came in contact with it. Phosphate fixation was a physicochem. exchange of phosphate ions for the exposed OH ions of $Fe(OH)_3$. When a suspension of $Fe(OH)_3$ was mixed with a soln. of KH_2PO_4, the pH of the mixt. was higher than that of either of the liquids before mixing. The increase in pH was sometimes greater than a pH unit. Unheated $Fe(OH)_3$ brought about 100% fixation of the phosphate from a soln. contg. 400 p.p.m. of P. After the $Fe(OH)_3$ had been heated at white heat for 3 hrs, it removed no P. When suspensions of $Fe(OH)_3$ were mixed with a soln. of NH_4F or Na_2SiO_3 the pH after fixation was higher than in either of the liquids before mixing.

3042. MUKHERJEE, J. N.; SEN-GUPTA, N. C., AND INDRA, M. K. **Effect of concentration and pH on the viscous and electrochemical properties of H bentonites.** *J. Phys. Chem.* 47, 553-77 (1943).—*C.A.* 38, 672[5].
The sp. cond. of dil. suspensions of H-bentonites first increased linearly with increase of concn., then rose much more rapidly, being convex to the concn. axis, after which the slope again decreased. The pH changed proportionately with -log C. The apparent sp. gr. increased with concn. and reached a const. value which agreed fairly well with the sp. gr. of dry bentonite (dried at 105°C) measured in toluene. The results suggested that as concn. rose aggregates were first formed and that at a still higher concn. these aggregates formed some sort of structure which possessed yield value.

3043. NAYAR, M. R. AND SHUKLA, K. P. **Influence of the size of exchangeable ions on the permeability of soils.** *Current Sci.* **12**, 206-7 (1943).—*C.A.* **38**, 607[9].
The rate of percolation of water through a soil satd. with various univalent alkali cations increased with increasing ionic radii of the satg. ions. A corresponding relation held for soils satd. with bivalent alk. earth cations.

3044. Pavlovschi, Gh.; Mavrodineanu, R., and Ionescu, I. **The methodology of the determination of exchangeable potassium.** *Bodenkunde u. Pflanzenernahr.* **29**, 300-9 (1943).—*C.A.* **38**, 6465^6.

The detn. of exchangeable K was based on the amt. of K going over into the extg. soln. being always proportional to the amt. of K capable of being exchanged. K added to the soil as K salts entered the absorption complex and was considered exchangeable K.

3045. Raychaudhuri, S. P. and Miah, Abul Hussain. **Preliminary study of the aging of alumina and silica gels and of the precipitates obtained from mutual coagulation of alumina and silicic acid sols.** *J. Indian Chem. Soc.* **20**, 195-6 (1943).—*C.A.* **38**, 907^2.

Buffer curves of freshly prepd. (electrodialyzed) gels of SiO_2 and Al_2O_3 and of aluminosilicates of varying SiO_2/Al_2O_3 ratios were made and compared with those aged for 1 yr and with those of naturally occurring clay minerals, such as bauxite, halloysite, kaolin, limonite and montmorillonite. Freshly prepd. substances possessed much less buffer capacity than the aged materials.

3046. Siewert, Gerhard and Jungnickel, Herst. **The alkaline reaction of commercial alumina. Adsorption analysis with alumina.** *Ber.* **76B**, 210-13 (1943).—*C.A.* 37, 5898^3.

The alk. reaction of com. Al_2O_3 (Kahlbaum and Merck) was due to the presence of Na_2CO_3 and $NaHCO_3$, and that Na aluminate could be present in only very subordinate amt. at most. When pure water was passed through a 100-g column of Al_2O_3, the filtrate was at first alk. (pH about 9.5) but ceased being so after about 1 liter had passed through. The Al_2O_3 thus washed alkali-free no longer had any appreciable adsorption effects on cations.

3047. Vendl, M. **The role of hydronium ions in the exchange behavior of siliceous clays.** *Roy. Hung. Palatine-Hoseph Univ. Tech. Econ. Sci., Pubs. Dept. Mining Met.* **15**, 344-54 (1943).—*C.A.* **41**, 6174*b*.

Data on ionic radii and exchangeability indicated that hydronium ions were responsible for previous observations to the effect that the exchange power of H in the case of montmorillonite and kaolin lay between that of Na and K in high concns. and between K and Rb in lower concns.

3048. Venturello, Giovanni. **Ion adsorption by active alumina.** *Atti reale accad. sci. Torino, Classe sci. fis. mat. nat.* **79**, 288-97 (1943-44).—*C.A.* **41**, 4992*f*.

The Brockmann Al_2O_3 (Merck) and a highly pure Al_2O_3 (obtained by the contact, in the air, of a sheet of Al (99.99%) with Hg) were used to examine the ionic adsorption of the anions and cations of the solns. of $CuSO_4$ and $Cu(NO_3)_2$. The adsorption by highly pure Al_2O_3 followed the Freundlich law, whereas Brockmann Al_2O_3 did not, particularly at the highest concns.

3049. Barbier, Georges and Chabannes, Jean. **The retention of the sulfate ion in soils.** *Compt. rend.* **218**, 519-21 (1944).—*C.A.* 39, 2609^4.

SO_4^{--} was adsorbed by the soil more strongly than Cl^- and less strongly than phosphate ions. Ca^{++} favored the retention of sulfate in soils independently of the pptn. of $CaSO_4$. Soils of av. compn. contained 10-20 mg of S per kg in the adsorbed condition.

3050. Cantino, E. C. **Semimicrodetermination of the exchange capacity of soils.** *Soil Sci.* **57**, 399-404 (1944).—*C.A.* **38**, 6457^3.

A sample of air-dry soil equiv. to exactly 1 g of oven dry soil was transferred quant. to a 3 × 16 cm centrifuge tube contg. 25 cc. of NH_4OAc. After agitation, it was digested for 25 min. on a water bath at 60-70 °C and then centrifuged for 5 min. at a force of 10^4 × gravity. After decantation a 20 cc. portion of acetate was added; the mixt. was agitated, digested for 10 min. and centrifuged again. This was continued until Ca ceased to appear in the liquid phase. A final digestion was then run with 10 cc. of reagent and after centrifuging 10 cc. of MeOH were added to the soil residue. This was digested for 5 min. at 45 °C and then centrifuged. This was continued until the color produced when 10 cc. of each of the supernatent liquid and water and 2 cc. of Nessler's reagent were mixed was equiv. to that produced with MeOH and water. The soil was then digested with a final 10 cc. of MeOH centrifuged and alc. removed by decanting. The soil was transferred quant. into a small Kjeldahl flask and the total ammonia was detd.

3051. Ensminger, L. E. **A modified method for determining base-exchange capacity of soils.** *Soil Sci.* **58**, 425-32 (1944).—*C.A.* **39**, 1714^8.

The soil sample was leached with 250 ml of a *N* soln. of the satg. salt and then with 250 ml of a 0.1 *N* soln. of the salt. The quantity of excess 0.1 *N* soln. was detd. by subtracting the dry wt of the funnel, filter paper and sample from the wt of the combination after the sample had been leached with the 0.1 *N* soln. The excess 0.1 *N* soln. and the adsorbed cation were leached out with 0.2 *N* HCl and the total quantity of cation was detd. The total cation minus that present as excess 0.1 *N* soln. was equal to the base-exchange capacity. Base-exchange capacity increased appreciably with time of intermittent leaching when Ba acetate was used. The addn. of 0.5% of BuOH to the Ba acetate soln. lowered the leaching time necessary to obtain equil. between the soil and the satg. soln.

3052. Erbring, H. and Lehmann, H. **Exchange reactions with voluminous organic colloid ions on sodium bentonites.** *Kolloid-Z.* **107**, 201-5 (1944).—*C.A.* 40, 6934^9.

The adsorption of the anion-active materials was negligible. The cation-active materials were bound in relatively large quantities through exchange for the Na ions. 1-Dodecylpyridinium bentonite showed a water absorption of 65%, owing to loading the surfaces of the bentonite platelets with the voluminous 1-dodecylpyridinium ions, whereas the untreated bentonite absorbed 700% water.

3053. Holdridge, D. A. and Francis, Marcus. **Base-exchange phenomena in clays and ceramic materials.** *Trans. Brit. Ceram. Soc.* 43, 131-54 (1944).—*C.A.* 39, 2183^8.

All clays tested were unsatd. with respect to metallic ions and were, therefore, capable of sorbing metallic ions in amts. in excess of the total quantity of metallic ions which they yielded on leaching. The Ca and Mg were immediately replaceable, whereas the Na and K were only progressively so which led to a differentiation of these ions based on their position either within or upon the clay particles.

3054. JOFFE, J. S. AND ZIMMERMAN, MIRYAM. **Sodium, calcium, and magnesium ratios in the exchange complex.** *Soil Sci. Soc. Am., Proc.* 9, 51-5 (1944).(Pub. 1945).—*C.A.* 40, 1258^9.

Solonetz or solonetz-like soils of different Ca:Mg:Na ratios were produced and the effects of these on the soil and plant growth studied. Data were given on the swelling, moisture absorption, and dispersion of the soils contg. various percentages of Na, from 5 to 50, in the exchange complex carrying various Ca:Mg ratios. A high Ca:Mg ratio (11:1) was far more effective in reducing the swelling caused by Na than was the low Ca:Mg ratio (1:1.25).

3055. KRASIL'NIKOV, K. G. AND KISELEV, A. V. **CaO-SiO_2-H_2O system. Sorption of calcium oxide by silica gel.** *J. Phys. Chem. (U.S.S.R.)* 18, 527-36 (1944).—*C.A.* 39, 2689^8.

Silica gel took up CaO from aq. solns. first by adsorption, then by formation of a hydrated Ca silicate. The curve of adsorption showed a region where equil. was established, in which there existed a new solid phase: $CaO.SiO_2.aq$.

3056. KRESTINSKAYA, V. N. AND KHAKIMOV, Z. V. **The mechanism of adsorption of silver sulfate on silica and aluminum hydroxide sols.** *J. Gen. Chem. (U.S.S.R.)* 14, 129-36 (1944) (English summary).—*C.A.* 39, 2240^5.

Silica did not adsorb Ag^+, though the latter may react with Cl^- impurities. SO_4^{--} was not adsorbed, though it may show apparent neg. adsorption due to adsorption of H_2O. There was no mol. adsorption of Ag_2SO_4. Ions reacted at different points on the gel surface and did not enter the crystal lattice of the colloid. This was confirmed by the fact that $ZnSO_4$, which could not form an aluminate, did not show even apparent mol. adsorption.

3057. MALQUORI, ALBERTO. **Behavior of humus in clay-bearing soils. II. Base-exchange capacity of organic substance and of humic acid and its relation to the base-exchange capacity of clay.** *Ann. chim. applicata* 34, 111-26 (1944).—*C.A.* 41, 3240*d*.

The base-exchange capacity of humus in 5 clay-bearing soils was detd. by the oxidation method with H_2O_2.

3058. MARSHALL, CHARLES E. **Uses and limitations of membrane electrodes.** *J. Phys. Chem.* 48, 67-75 (1944).—*C.A.* 38, 2527^3.

By the use of membrane electrodes, cationic activities could be detd. to within 4% at concns. of 0.1 *M* and 2% at 0.01 *M*. Controlled heat-treatment of montmorillonite and beidellite films could produce membranes of varying resistance, charge and sensitivity to cations of different valencies. Mixts. of cations could be analyzed by detg. the mobility ratio of 2 cations within a given membrane.

3059. MATTSON, SANTE AND LARSSON, KARL G. **Laws of ionic exchange. II. The valence effect in relation to the micellar ion concentration and base saturation of Donnan systems.** *Lantbruks-Högskol. Ann.* 12, 222-9 (1944-45).—*C.A.* 39, 4422^9.

The exchange capacity of kaolin and a laterite was very much less than that of bentonite. The bentonite adsorbed relatively more of the univalent ions the more unsatd. it became. These phenomena agreed with the valence effect to be expected from the principles of the Donnan equil.

3060. MUKHERJEE, S. K. AND NANDI, S. K. **Studies on base exchange. I. Comparison of base-exchange capacities and degree of saturation of some Indian soils obtained by different methods.** *Indian J. Agr. Sci.* 14, 74-7 (1944).—*C.A.* 42, 3886*g*.

Ca constituted about 70-90% of the base-exchange capacities of the base-satd. soils and about 20-50% of the acidic soils. Exchangeable K and Na were present in very small amts. and the Mg content was appreciable only in the black cotton types of soil. Exchangeable H constituted about 10-50% of the base-exchange capacity of the acid soils.

3061. MUKHERJEE, S. K. AND GANGULY, A. K. **Studies on base exchange. II. Comparison of different methods of estimating base-exchange capacities and of lime requirement of hydrogen clays, acid soils, and partly and completely desaturated soils.** *Indian J. Agr. Sci.* 14, 203-9 (1944).—*C.A.* 42, 3887*a*.

The amts. of Ba, Ca, and NH_4 adsorbed by the H-clay from a neutral *N* soln. of their chlorides was in the decreasing order NH_4^+, Ba^{++}, Ca^{++}. The pH of successive leachates with $BaCl_2$, $CaCl_2$, and NH_4Cl gradually increased, reaching a const. value which was higher with NH_4Cl. The adsorption of Ba^{++}, Ca^{++}, and NH_4^+ from their chloride solns. increased with the pH of the leaching solns. The adsorption of Ca^{++} and Ba^{++} showed reversal between pH 4 and 6. The base-exchange capacity of a soil remained intact when converted into the H-soil.

3062. NORTON, F. H. AND JOHNSON, A. L. **Fundamental study of clay. V. Nature of water film in plastic clay.** *J. Am. Ceram. Soc.* 27, 77-80 (1944).—*C.A.* 38, 2174^5.

A clean monodisperse fraction of kaolinite had the following characteristics: av. particle size 0.32 μ in diam. and 0.04 μ thick; av. water-film thickness in the plastic condition 0.005 μ, or about 60 mol. layers. Under conditions of permeable pressing, the thickness of the film varied inversely with the pressure up to 600 lbs/in^2, above which distortion of the particles occurred.

3063. PAVELKA, FRITZ. **Protective film on Al. III. Observations on the quantitative procedure of precipitation of hydrated aluminum oxide in aqueous solution.** *Kolloid-Z.* 107, 139-41 (1944).—*C.A.* 39, 11^9.

The quant. pptn. of hydrated Al_2O_3 was detd. with a photometer. About half of the stoichiometric requirement of base (NH_4OH or NaOH) was required to ppt. the Al_2O_3 from $Al_2(SO_4)_3$ soln. Each addn. of the base caused localized pptn. followed by redispersion of the Al_2O_3 as further small quantities were added. The complete pptn. occurred quite suddenly upon slow progressive addn. of the base.

3064. PENG, C. AND CHU, T. S. **A method for determining the total exchangeable bases of soils.** *Soil Sci.* **58**, 205-8 (1944).—*C.A.* **39**, 571^3.

A method was suggested for detg. the total exchangeable bases of soils in which the soil was extd. with 0.1 *N* AcOH. The extn. was carried out overnight in an electrically heated Soxhlet app.

3065. RYDALEVSKAYA, M. D. AND TISHCHENKO, V. V. **Cation exchange of humic acid of various soil types.** *Pedology (U.S.S.R.)* **1944**, No. 10, 491-8 (English summary, 98-9).—*C.A.* **39**, 4179^8.

Humic acid extd. from podzols, chernozem, and peats was titrated with $Ca(CH_3COO)_2$ or $BaCl_2$ at pH 8.1 to det. the cation-exchange capacity. Also detd. were the ash content and empirical compn. of the humic acid from the 3 sources. For detn. of the participation of the H of the phenol groups, the humic acid was methylated with CH_3OH to eliminate the H of the carboxyl groups.

3066. SHUKLA, K. P. **Influence of exchangeable ions on the dispersion of soil.** *Current Sci.* **13**, 45 (1944).—*C.A.* **38**, 5037^3.

The dispersion of soil colloids produced by shaking Ca soil with the carbonates of alkali metals was due to the gradual replacement of exchangeable Ca by alkali cation.

3067. UCHIDA, MUNEYOSHI. **Test methods for bentonite. I. Determination of imbibition. II. Correlation of imbibition value and coagulation volume. III. Classification of bentonite.** *J. Japan. Ceram. Assoc.* **52**, 2-5, 39-41, 91-5 (1944).—*C.A.* **45**, 7760*d*.

Two methods of detg. the imbibition of water by bentonite were the filter paper method and the coagulation by NaCl. Place 0.5 g of dried bentonite in a glass cylinder 50 mm in diam. and 25 mm high, to the bottom of which a hard filter paper was attached by a rubber band. Place this cylinder on a porous plate half immersed in water. After 24 hrs the amt. of water absorbed by bentonite was measured by weight increase, recalcd. to 1 g of the sample, and defined as the imbibition value. The coagulation vols. of sand, kaolinite, and bentonite of low, medium, and high qualities were 0.5-1, 1-2, 2-5, 5-7, and 9-12, resp. Clay was activated by heating in a soln. of *N* NaCl and NaOH for 1 hr.

3068. VOLLMAR, HANS. **The limits of applicability of the immersion method for the determination of dielectric constant of porous solid materials.** *Z. Elektrochem.* **50**, 150-2 (1944).—*C.A.* **40**, 4582^7.

The dielec. const. of silica gel and fuller's earth gave contradictory results. The cause was shown to be adsorption of one component of the liquid mixt. used for comparison. The possible application to studies of adsorption and diffusion was indicated.

3069. ATTOE, O. J. AND TRUOG, EMIL. **Exchangeable and acid-soluble potassium as regards availability and reciprocal relationships.** *Soil Sci. Soc. Am., Proc.* **10**, 81-6 (1945) (Pub. 1946).—*C.A.* **41**, 2193*c*.

A study was made of the factors involved in the reciprocal transformations of exchangeable and fixed K. The extn. of a soil with 0.5 *N* HCl for 1 hr at room temp. removed (in addn. to the exchangeable or readily available K), a certain amt. of the fixed form which, because of being quickly dissolved, was considered moderately available. The amts. of this form extd. from various soils ranged up to 90% of that in exchangeable form. The storage in pots in moist condition of Spencer silt loam fertilized with 100 to 3200 lb per acre of K as KCl resulted in little or no fixation of K after 18 months. However, when the samples were dried at room temp. after storage, fixation took place in every case.

3070. BROAD, D. N. AND FOSTER, A. G. **Comparative isothermals of water and deuterium oxide on porous solids.** *J. Chem. Soc.* **1945**, 372-5.—*C.A.* **39**, 3786^2.

The adsorption isothermals of H_2O and D_2O were compared at 25°C on silica and Fe_2O_3 gels and on charcoal. On each adsorbent the relative pressure-vol. curves for the 2 liquids were identical. The results on the whole tended to support the capillary theory, although the behavior of H_2O on charcoal presented certain anomalies.

3071. DROUINEAU, G. AND GUÉDON, A. **Determination of exchangeable magnesium.** *Ann. agron.* **15**, 129-30 (1945).—*C.A.* **40**, 7055^2.

A method was described for detg. exchangeable Mg by pptg. it as Mg hydroxyquinolate. The soil was percolated with neutral NH_4OAc, and the Ca was pptd. as the carbonate. Three cc. of 5 *N* NaOH was added, and the Mg was pptd. by adding 2.5 cc. of a freshly prepd. 2% alc. soln. of a-hydroxyquinoline. The quinolate and the $CaCO_3$ were dissolved in HCl, and the latter was repptd. by adding $NaHCO_3$. After centrifuging, a 5-cc. aliquot of supernatant liquid was treated with AcOH and $Fe(ClO_4)_3$, from which the Mg reppts.

3072. ELMORE, KELLY L.; MASON, CHARLES M., AND HATFIELD, JOHN D. **Precipitation of alumina from sodium aluminate solutions.** *J. Am. Chem. Soc.* **67**, 1449-52 (1945).—*C.A.* **39**, 5156^3.

The pH of Na aluminate solns. was detd. during pptn. of alumina and the detn. of the mechanism of pptn. at 60°C. A cell using a H_2-Ag, AgCl system was developed for measurement of the pH of alk. solns. contg. CO_2 without their contamination by silica. The equation $2AlO_2^- + 2H_3O^+ \rightarrow Al_2O_3.3H_2O$ was found to represent the mechanism of the pptn. of alumina from Na aluminate solns. by CO_2 at 60°C.

3073. FIALKOV, YA. A. **Adsorption properties of kaolin.** *J. Applied Chem. (U.S.S.R.)* **18**, 221-9 (1945) (English summary).— *C.A.* **40**, 3035^9.

The acid treatment led to improved adsorption of acid dyes, negatively charged colloidal Ag, and I_2, while the adsorption of basic dyes, alkaloid salts, and other basic substances was decreased.

The basic treatment led to reverse results. When the kaolin was treated with 0.1-1.0 *N* HCl, there was no adsorption of procaine, dicaine, and corrosive sublimate.

3074. Gorbunov, N. I. and Tsyurupa, I. G. **Cation exchange with variable ratios of solution to solid phase.** *Pedology (U.S.S.R.)* **1945**, 369-74 (English summary).—*C.A.* **40**, 1959^4.

With an increase in the ratio of the solvent, from 0.3:1 to 50:1 the quantity of cations increased. As the replacing agent was dild. the quantity of cations replaced decreased, irrespective of the total amt. of salt used. Some soils gave up more cations as the time of contact was prolonged.

3075. Harman, C. G. and Parmelee, C. W. **Fundamental properties of raw clays influencing their use.** *J. Am. Ceram. Soc.* **28**, 110-18 (1945).—*C.A.* **39**, 2183^3.

Cation-adsorption capacity and the nature of the adsorbed cation were closely related to the heat of wetting, pH, and equil. moisture. For a given adsorbed cation these properties related directly to the intensity of adsorption of the ion. The existence of org. ions or ionized groups (from the soln. of org. matter) might be postulated to explain the anomalous behavior of clays contg. org. matter. Properties of clays might be defined as functions of ion-sorption capacity, nature of the adsorbed cation, and packing.

3076. Hendricks, Sterling B. **Base exchange of crystalline silicates.** *Ind. Eng. Chem.* 37, 625-30 (1945).—*C.A.* **39**, 3864^5.

Zeolites depended on neg. portions in the lattice framework and multiconnected voids large enough for ionic migration. The metal: SiO_2 ratio approached unity when addl. neg. groups replaced water in the voids. With montmorillonite types external cations were principally on the cleavage surfaces, with kaolin types on the lateral surfaces. In glauconite and illite, which were micaceous, both types contributed to cation exchange.

3077. Hofmann, U. and Hausdorf, A. **The settling volume and swelling of bentonite.** *Kolloid-Z.* **110**, 1-17 (1945).—*C.A.* **43**, 4537*h*.

The vol. of sediment (*SV*) depended on the diam. of individual crystals and the duration depended on the over-all structure of the bentonite. Exchange cations greatly affected the *SV* and owed their effect to the amt. of their hydration. Ca-, K-, Na-, Li-, NH_4-, Mg-, and Ba-bentonites were studied. The H-bentonite was prepd. by dialysis. Alkali-and alk. earth-bentonites showed very different results in the presence of electrolytes. Li caused the greatest change. Particles were much more disperse in the alkali- than in the alk. earth-bentonite. Energy relations were considered with respect to the double layer between solid and soln. Swelling decreased with decreases in degree of hydration at const. concn. of exchange cation.

3078. Jacobs, P. W. M. and Tompkins, F. C. **Inorganic chromatography. I. Static adsorption measurements.** *Trans. Faraday Soc.* 41, 388-94 (1945).—*C.A.* **39**, 5156^9.

Concordant results in aq. solns. at 26.5°C were obtained with Al_2O_3. The adsorbent (5 g), prewashed with 100 ml distd. water, was heated for 1 hr at 480°C, cooled over satd. salt/sugar soln., and used immediately. Isotherms for both cations and anions were approx. expressed by the Freundlich equation and by the equation $O = k_1 + k_2 \log C$. The adsorbates were $CuCl_2$ and the sulfates of Cu, Cd, Zn, Ni, Co, Mn, Mg, and NH_4. The cation was more strongly adsorbed than the anion, because of addnl. cation exchange adsorption.

3079. Lawande, Y. V. and Karve, D. D. **Adsorption of mercuric chloride by colloids. I.** *Proc. Indian Acad. Sci.* **21A**, 41-4 (1945).—*C.A.* **39**, 3990^1.

The adsorption of $HgCl_2$ from dil. soln. by dry gels of $Fe(OH)_3$, silica, $Al(OH)_3$, and Acticarbon tended to be apolar. At higher concns. of $HgCl_2$ the adsorption was polar. Addn. of NaCl retarded the adsorption of $HgCl_2$.

3080. Martin, J. C.; Overstreet, R., and Hoagland, D. R. **Potassium fixation in soils in replaceable and nonreplaceable forms in relation to chemical reactions in the soil.** *Soil Sci. Soc. Am., Proc.* **10**, 94-101 (1945) (Pub. 1946).—*C.A.* **41**, 2192*i*.

Certain cations when present in the exchange complex of some soils could pass from a loosely held state to a very strongly held state. The fixation of K involved first an adsorption in exchange for other adsorbed cations and then a fixation which resulted in a reduction in the total exchangeable cations of the soil. Cations known to undergo this change of state are K, Rb, Cs, and possibly H. The degree to which the above process took place depended on the concn. of the reacting ion in the soil soln. and on its amt. in the exchange complex of the soil. The most pronounced fixation of K occurred under conditions which would favor a dehydration of the reacting ions or of the clay minerals.

3081. McGeorge, W. T. **The base exchange-pH relationships in semiarid soils.** *Soil Sci.* **59**, 271-5 (1945).—*C.A.* **39**, 5023^8.

The pH of the soil increased with increase in the percentage of Na in the complex and the relation between the 2 values was significant and linear. When the base-adsorbing complex of semiarid soils was completely satd. with Na, all soils had nearly the same hydrolytic pH at the 1:10 soil:water ratio regardless of the milliequiv. adsorption capacity per 100 g of soil.

3082. Mukherjee, J. N. and Chatterjee, B. **Electrochemical properties of silicic acid sols.** *Nature* **155**, 85-6 (1945).—*C.A.* **39**, 2021^8.

Silicic acid sols after prolonged electrodialysis had free acidities of 0.0001 N caused by mobile H^+ assocd. with the colloidal particles. The sol behaved as a strong acid as judged from the form of the titration curves with small addns. of very dil. bases, and by the manner of variation with diln., temp. of the free acid and the total acid at the first inflection point. The amt. of acid liberated from the sol by neutral salts followed the lyotrope series Ba > Ca > K > Na > Li.

3083. MUKHERJEE, J. N. AND CHATTERJEE, B. **Liberation of H^+, Al^{+++}, and Fe^{+++} ions from H clays by neutral salts.** *Nature* **155**, 268-9 (1945).—*C.A.* **39**, 2442^6.

At const. pH the amt. of displaced Al^{+++} increased with concn. of the added salt. At a given equil. pH, $BaCl_2$ liberated more Al^{+++} than did HCl. The evidence favored a direct exchange of Al^{+++} for the cation of the salt, instead of their liberation by a secondary soln. process. At low values of C, very few Al^{+++} and mainly H^+ ions were exchanged. The H^+, Al^{+++}, and Fe^{+++} leached from 2 H-clays by *N* $BaCl_2$ decreased to negligible values.

3084. MUKHERJEE, J. N.; MITRA, R. P., AND MANDAL, S. S. **Effect of concentration on the free and titratable acids of hydrogen bentonite sols.** *Nature* **155**, 329-30 (1945).—*C.A.* **39**, 2685^7.

The effect of the concn. (0-16.2%) of a H-bentonite on H-ion concn. was shown graphically. The effect on the titratable acidity was given at selected points. The bentonite contained only montmorillonite.

3085. MUKHERJEE, J. N. AND MUKHERJEE, S. K. **Effects of H-ion concentration on cation exchange in clay salts.** *Nature* **155**, 49 (1945).—*C.A.* **39**, 2021^6.

The lyotrope series was usually observed in the exchange of cations from clays and permutites. Deviations disappeared when symmetry values measured at pH 6.0-7.0 were compared. At pH 3.0-5.0 all cations had the same symmetry value, and the cation effect on the lyotrope series disappeared. At pH 3.0 HCl alone gave a higher symmetry value than when used in conjunction with the salts. Al^{+++} ions were exchanged at this pH for the cations of the added salt.

3086. NIKOLAEV, L. A. AND KOBOZEV, N. I. **Peroxidase function of silica gel.** *J. Phys. Chem. (U.S.S.R.)* **19**, 562 (1945).—*C.A.* **40**, 3046^8.

Silica gel adsorbed Cr^{+++} quantitatively from very dil. $Cr_2(SO_4)_3$ solns. One g of silica gel adsorbed at 11°C 3×10^{-4} and at 26°C 6×10^{-4} g/mol. H_2O_2. When H_2O_2 was added to a silica gel contg. adsorbed Cr^{+++}, the latter was oxidized to CrO_4^{--}, which went into the soln. The evolution of O_2 was small. In the absence of silica, Cr^{+++} was only very slowly oxidized by H_2O_2.

3087. NIKOL'SKII, P. AND GRIGOROV, O. N. **Dependence of the adsorption of barium ions by silica gel on the pH and the concentration of the solution.** *Doklady Akad. Nauk S.S.S.R.* **50**, 325-7 (1945).—*C.A.* **43**, 2498*f*.

The adsorption of Ba^{++} ions (g-equiv. per kg silica gel) was insignificant up to pH 8 and then rose rapidly with rising pH. This was consistent with previous findings with Na^+ and Ca^{++} ions.

3088. OVERSTREET, ROY. **Ionic reactions in soils and clay suspensions: the significance of soil filtrates.** *Soil Sci.* **59**, 265-70 (1945).—*C.A.* **39**, 5023^6.

Because of the inequalities in the chem. potentials of the diffusible ions, an examn. of the soil soln. in many cases would not give a correct picture of the chem. properties of the corresponding soil suspension.

3089. PEECH, MICHAEL. **Determination of exchangeable cations and exchange capacity of soils-rapid micromethods utilizing centrifuge and spectrophotometer.** *Soil Sci.* **59**, 25-38 (1945).—*C.A.* **39**, 1951^8.

Colorimetric methods were outlined for detg. adsorbed ammonium by direct nesslerization and Na by a modification of the Darnell and Walker method.

3090. SCHOLLENBERGER, C. J. AND SIMON, R. H. **Determination of exchange capacity and exchangeable bases in soil-NH_4OAc method.** *Soil Sci.* **59**, 13-24 (1945).—*C.A.* **39**, 1951^7.

Addnl. methods of analysis for the ingredients in the ammonium acetate method were given for H and Mn.

3091. TRUOG, EMIL. **A proposed system of names, abbreviations, symbols, and formulas for designating the soil base-exchange substances and their acids and salts.** *Soil Sci. Soc. Am., Proc.* **10**, 341-3 (1945) (Pub. 1946).—*C.A.* **41**, 2829*a*.

A simple system of nomenclature was proposed to designate the base-exchange substances or complexes variously satd. with cations.

3092. BEECH, D. G. AND FRANCIS, MARCUS. **Properties and testing of bentonite.** *Trans. Brit. Ceram. Soc.* **45**, 148-60 (1946).—*C.A.* **40**, 6762^9.

The swelling properties depended to some extent on the nature of the exchangeable cations. The material obtained commercially was in a very fine state of division, which accounted in part for its power of forming moderately stable suspensions and its high exchange capacity. Various properties of bentonite suspensions were discussed.

3093. GLAESER, RACHEL. **Determination of the base-exchange capacity in montmorillonite.** *Compt. rend.* **222**, 1179-81 (1946).—*C.A.* **40**, 7457^8.

The base-exchange capacity of montmorillonite was detd. and the results plotted graphically. The method with certain precautions was found to be rapid and convenient.

3094. GLAESER, RACHEL. **Effect of acid treatment on the base-exchange capacity of montmorillonite.** *Compt. rend.* **222**, 1241-2 (1946).—*C.A.* **40**, 6932^1.

The x-ray patterns of 2 montmorillonites remained unaffected after treatment of the samples with 30% H_2SO_4 until 80% of the (Al + Fe + Mg) was extd. (12-20 hrs). The pattern then disappeared. The exchange capacity, calcd. as the no. of valence bonds per "unit flakelet" (a = 5.20 A., b = 8.96 A.) was a linear function of the Mg content, passing through the origin. Exchange capacity, plotted vs. the (Al + Fe + Mg) content, gave a much greater scattering of the points.

3095. HAUSER, E. A. AND LE BEAU, D. S. **Colloid chemistry of clay minerals and clay films.** *Colloid Chemistry* **6**, 191-213 (1946).—*C.A.* **40**, 2372^7.

Chem. and thermal analysis coupled with x-ray diffraction data revealed lattice-structure differences and also cases of atomic substitutions. Base exchange and its effect on practical properties were considered, also particle size and its detn., as well as the concept of the double layer, stability of clay sols, their gelation and coagulation.

3096. Heidel, Robert H. **Direct photoelectric spectrochemical determination of exchangeable bases of soils.** *Proc. Iowa Acad. Sci.* **53**, 211-23 (1946).—*C.A.* **42**, 4298*i*.

Simultaneous analysis of the Ca, Mg, Na, K, and Mn in the exchangeable base series was accomplished by combining the use of conventional spectrographic methods and instruments with the methods of flame photometry.

3097. Hurd, Charles B. and Merz, Paul L. **Silicic acid gels. XIV. Dialysis of silica hydrosol and hydrogel.** *J. Am. Chem. Soc.* **68**, 61-4 (1946).—*C.A.* **40**, 1378^1.

The dialysis through collodion membranes was studied of sodium silicate solns., of silica hydrosol, and silica hydrogel. Essentially all of the silica in 1.35 *N* sodium silicate soln. was found capable of dialyzing through the membrane. Although a freshly formed silica hydrosol contained much of its silica in a form capable of dialyzing through the membrane, this fraction decreased with lapse of time. A small fraction remained able to diffuse through the membrane, even in the gels after setting.

3098. Marshall, Charles E. and Ayers, Alvin D. **Clay membrane electrodes for determing calcium activities.** *Soil Sci. Soc. Am., Proc.* **11**, 171-4 (1946) (Pub. 1947).—*C.A.* **42**, 2375*e*.

Membranes with high neg. charges were desirable because they acted as if they were impermeable to anions when used in solns. of low concn. Heating the clay membranes to 600°C tended to increase the effective ionic charge and to increase their mech. stability. For the cations H, Na, NH_4, K, and Ca, the montmorillonite typified by Wyoming bentonite was consistently more ionized than the beidellite typified by Putnam clay.

3099. Marshall, P. **Zeolite minerals as original components of igneous rocks.** *New Zealand J. Sci. Technol.* **28B**, 37-52 (1946).—*C.A.* **41**, 5823*a*.

Various tests involving ion-exchange and staining were developed to indicate the presence and extent of zeolite and related minerals in thin sections. Some interstitial zeolite underwent exchange processes with dyes even without previous acid treatment. A natural exchange of Na and probably K and Ca for Fe^{++} occurred in the interstitial zeolites; the feldspar microlites, aegirine, aegirineaugite, and cossyrite remained fresh even after the exchange process and the subsequent oxidation of the ferrous zeolite was well advanced to limonite. The Na-Fe exchange was well developed in chabazite, ameletite, and interstitial zeolite, but slow in analcite and natrolite. Further weathering and disintegration were greatly speeded up by the exchange.

3100. Mikhal'chenko, V. A. **Composition of the products of absorption of lime by silica.** *J. Applied Chem. (U.S.S.R.)* **19**, 1364-70 (1946).—*C.A.* **41**, 5781*f*.

Addn. of $Ca(OH)_2$ to silica gel contg. 94.61% H_2O in simple CaO/SiO_2 ratios from 3:1 to 1:3, resulted in solid ppts. with generally different ratios. Through arbitrary interruption of the reaction at a chosen stage, ppts. could be obtained corresponding to those of known minerals, $CaO.SiO_2$, $4CaO.5SiO_2$, $2CaO.3SiO_2$, $4CaO.7SiO_2$, $CaO.2SiO_2$, $CaO.3SiO_2$, but $3CaO.2SiO_2$ or any CaO-richer compn. could not be attained.

3101. Mitra, R. P. **Broken bonds as seats of ion exchange in crystalline silicates.** *J. Indian Chem. Soc.* **23**, 386-7 (1946).—*C.A.* **41**, 6106*g*.

Kaolinite had a greater capacity for cations after grinding. If this was due to an increase in the no. of broken bonds, the broken bonds would also tend to bind an equal no. of anions, i.e., the minerals must be considered amphoteric and not merely acidic. Further study is needed to prove this point.

3102. Mukherjee, S. K. and Gupta, S. L. **Limiting value of the base-exchange capacity of soils and clays.** *Indian J. Agr. Sci.* **16**, 442-4 (1946).—*C.A.* **43**, 9316*a*.

Repeated treatment with p-nitrophenol-lime soln. gave a higher base-exchange capacity than a single treatment. The amt. of lime taken up by the soil and the clay from a phenol-lime soln. at pH 8.5 was higher than obtained by the p-nitrophenol-lime method at pH 7.1. The base-exchange capacity calcd. from the amt. of Mg adsorbed from a neutral satd. soln. of $MgSO_4$ was lower than that detd. by Parker's method. The base-exchange capacity calcd. from the amt. of Ba adsorbed from a neutral satd soln. of $Ba(CNS)_2$ was the highest obtained with a H bentonite.

3103. Reitemeier, R. F. **Effect of moisture content on the dissolved and exchangeable ions of soils of arid regions.** *Soil Sci.* **61**, 195-214 (1946).—*C.A.* **40**, 3551^9.

The study was based on Ca, Mg, Na, K, NH_4, CO_3-HCO_3, SO_4, Cl, NO_3 and PO_4 ions of 6 soils detd. at 4 soil moisture levels, field moisture, satn. percentage, 200%, and 500%. With the exception of SO_4 in one soil, the sol. contents of all ions in all soils changed to some degree on diln. Na, K, NH_4, CO_3-HCO_3, PO_4, and SO_4 (with the 1 exception) increased with increasing moisture content. Exchangeable Na decreased continuously on diln., by percentages ranging from 32 to 58. The ratio of exchangeable Ca to Mg in 2 gypsiferous soils increased tremendously on diln.

3104. Schmah, Hans. **Simple preparation of well-crystallized bayerite.** *Z. Naturforsch* **1**, 323-4 (1946).—*C.A.* **41**, 5359*h*.

Al foil (99.99%) was cut up and degreased with freshly distd. acetone. The pieces were then amalgamated in 0.1 *N* $HgCl_2$ soln., thoroughly washed with distd. H_2O, then with conductivity H_2O. The Al slowly reacted with H_2O and separated as a grayish-colored product which became pure white when the reaction was complete in about a day. This amorphous α-gel on standing passed over to γ-$Al(OH)_3$, bayerite.

3105. Shishniashvili, M. and Kargin, V. **The electrochemical properties of highly purified ferrialuminosilica gels and sols.** *Acta Physicochim. U.R.S.S.* **21**, 705-22 (1946) (in English).—*C.A.* **41**, 1528*g*.

Highly purified $Al_2O_3.4SiO_2$, $Al_2O_3.2SiO_2$, $Al_2O_3.2Fe_2O_3$, which changed compn. to $Al_2O_3.2.2SiO_2$

and $Al_2O_3.1.6SiO_2$, resp., on continued electrodialysis, contained no free electrolyte or oppositely charged ions. The addn. of 1 micromole per liter of electrolyte imparted a pos. charge which decreased on further electrolyte addn. until coagulation occurred.

3106. Shishniashvili, M.; Kargin, V., and Batzanadze, A. **The action of electrolytes on highly purified ferrialuminosilica gels.** *Acta Physicochim. U.R.S.S.* **21,** 869-84 (1946) (in English).—*C.A.* 41, 2300*i*.

The adsorption of phosphate ions on Al_2O_3 gel required repeated treatment and equalization of pH between soln. and Al_2O_3 gel. Suspensions of pure aluminosilica gels treated with phosphate soln. in 0.2 *N* $BaCl_2$ were prepd. Adsorption of Ba ions was considerable at pH below 6 and increased rapidly at pH above 7, but no adsorption was evident in the absence of phosphate solns. When highly purified Al_2O_3 gels were acted upon by neutral salts, they display mol. adsorption of electrolytes, plus hydrolytic adsorption of acids and bases. Upon prolonged treatment of Al_2O_3 gel with neutral salt soln. the equil. shifts, so that the gel acquires exchange-adsorption properties. The hydrolytic adsorption of acids on pure aluminosilica gel was attended by a chem. reaction between adsorbed acid and Al_2O_3 resulting in formation of Al compds.

3107. Wiklander, Lambert. **Studies on ionic exchange with special reference to the conditions in soils.** *Kgl. Lantbruks Hogskol. Ann.* **14,** 1-171 (1946).—*C.A.* 41, 3561*i*.

Exchange materials studied included: humus, litter of beech leaves, $AlPO_4.FePO_4$, Al silicates, ferric silicates, zeolite, bentonite, kaolinite, bleaching earths, and 4 mineral soils. The exchange resins studied were Wolfatit K and M. Vardsberg clay and ordinary bath sponge were also included. The various exchange series closely followed the type $Li < Na < K < Mg < Ca < Sr < Ba < La$. The H^+ appeared between La and Na or farther down the series depending on the nature of the various exchange materials.

3108. Antipov-Karataev, I. N. and Kader, G. M. **The nature of the uptake of ions by clays and soils. I. Uptake of univalent and multivalent cations by bentonitic clay and natrolite.** *Kolloid, Zhur.* **9,** 81-96 (1947).—*C.A.* 47, 805*e*.

K bentonite (5 g) was equilibrated with 100 cc. 0.0125 *N* KCl + 0.0125 *N* NaCl, then 50 cc. supernatant soln. was withdrawn, 50 cc. of a soln. contg. more NaCl and less KCl at the same total concn. (0.025 *N*) added, etc. The ratio Na:K was then gradually reduced in the same manner. The displacement of K by Na was reversible as was that of K by NH_4 and of Ca by Mg, Ba, or Pb. Displacement of Ca by Cu^{++} was irreversible on bentonite and reversible on askangel. In EtOH Ca^{++} was adsorbed by bentonite more strongly that Cu^{++}, and the adsorption was irreversible. Natrolite exchanged its Na for K or NH_4 but not for Ca, Mg, or Ba.

3109. Antipov-Karataev, I. N. and Kader, G. M. **The nature of the uptake of ions by clays and soils. II. Uptake of univalent and bivalent cations by kaolin clay.** *Kolloid. Zhur.* **9,** 161-8 (1947).—*C.A.* 47, 805*h*.

Displacement of K by NH_4 in K kaolin was reversible and satisfied the mass action law. Displacement of K by Na and of Ca by Mg or Ba was reversible but more difficult the greater the degree of displacement. The uptake of Cu^{++} and Hg^{++} by Ca kaolin was irreversible, and of Pb^{++} poorly reversible. It decreased from Hg to Cu to Pb.

3110. Berger, G. **The structure of montmorillonite. Preliminary communication of the capacity of clay and clay minerals to be methylated.** *Compt. rend. conf. pédol. méditerran. (Alger-Montpellier)* **1947,** 119-22 (in English).—*C.A.* 43, 6347*g*.

Pure montmorillonite (2 microns) was treated with excess 0.1 *N* HCl, filtered, washed free of chloride, dried at 150°C, treated with an etheral soln. of diazomethane and dried by KOH 5 to 6 days when no more N_2 appeared. The sample was filtered, washed with abs. ether and petr. ether and dried in vacuum over P_2O_5 and the methoxyl content detd. Exchange capacity of montmorillonite and bentonites amounted to about 100 milliequiv. per 100 g dry matter. Weakly acid OH groups were present in montmorillonite and that base exchange took place at and because of OH groups. Common silica gel proved easy to methylate.

3111. Dean, L. A. and Rubins, E. J. **Anion exchange in soils. I. Exchangeable phosphorus and the anion-exchange capacity.** *Soil Sci.* **63,** 377-87 (1947).—*C.A.* 41, 7603*i*.

The essential features of the method used to det. the anion-exchange capacity of soil with different combinations of anions were enumerated. Soils were shown to have an anion-exchange capacity in that they could be alternately satd. with arsenate and phosphate ions. More phosphate than arsenate was always retained by soils as exchangeable anions. The phosphate retained by soils as an exchangeable anion was virtually completely removed by fluoride, hydroxide, and citrate solns.

3112. Francis, M. **Experimental determination of the influence of adsorbed ions on the ceramic properties of clays.** *Verre silicates ind.* **12,** 1-6 (1947); *Chimie & industrie* **58,** 165 (1947).—*C.A.* 42, 4318*c*.

The ion-exchange capacity varied with the exposed surface, the ratio of SiO_2 to $Al_2O_3 + Fe_2O_3$, and the org. matter content. The crystal network expansible by water also exerted an influence. A special study was made of the effect of Na_2O on the slip. Replacement of Ca and Mg by Na increased the fluidity.

3113. Gapon, E. N. **Electrochemical method for determining the surface of adsorbents and colloids.** *Kolloid Zhur.* **9,** No. 1, 29-36 (1947).—*C.A.* 41, 4350*h*.

The cation adsorption by soils was studied. An equation was developed whereby the normal potential, the surface area, and the capacity of the elec. double layer may be detd. From available data for humus, peat, kaolin, bentonite, and 20 soils, the surfaces (m^2 per g) decreased in the order: chernozem > red soils > podzolic soils > chestnut and grey forest soils.

3114. GRAHAM, R. P. AND HORNING, A. E. **Interaction of hydrous alumina with salt solutions.** *J. Am. Chem. Soc.* **69**, 1214-15 (1947).—*C.A.* **41**, 4395*i*.

Addn. of hydrous Al_2O_3 to 0.1 *M* solns. of K salts at pH 7.00 ± 0.01 at 25.0 ± 0.1°C caused the following max. pH: KF 9.6, K oxalate (0.05 *M*) 8.6, K_2SO_4 (0.05 *M*) 8.0, KNO_3 7.3, KCl 7.3, $KClO_4$ 7.1, K phosphate 7.0. Data were given also for the vaiation in concn. of K oxalate, variation in the mass of Al_2O_3, and variation in the nature of the Al_2O_3. The increase in pH was attributed to displacement of OH groups from the surface of the hydrous Al_2O_3 due to the tendency of anions to bind coördinately to the Al.

3115. GRIM, R. E.; ALLAWAY, W. H., AND CUTHBERT, F. L. **Reactions of clays with organic cations in producing refractory insulation.** *J. Am. Ceram. Soc.* **30**, 142-5 (1947).—*C.A.* **41**, 4902*d*.

An underclay from Grundy County, Ill., composed predominantly of kaolinite, and with base-exchange capacity of about 11 milliequivs. of exchange capacity per 100 g of clay, was used. A 1.0% soln. of each of the many org. compds. tested was employed in the expts. Results showed that porous clay bodies which did not lose their porous nature or shape could be prepd. by mixing air into clay slips that contained compds. which furnished a large org. cation.

3116. HAYNES, HAROLD G. **Precipitation of aluminum hydroxide.** *Pharm. J.* **158**, 446-7 (1947).—*C.A.* **41**, 7199*f*.

The pH curves corresponding to the pptn. of $Al(OH)_3$ with alkalies could be used to give an accurate measure of the degree of adsorption of anions at the point of min. soly. of the hydroxide, which occurred with less than 3 equivs. of alkali. The addn. of 3 equivs. reduced adsorption at the expense of a considerable loss of Al as aluminate. Adsorption of Cl^- was greater than that of the SO_4^{--},

3117. HAZEL, FRED. **Effect of freezing on the stability of colloidal dispersions. Silica sols-A preliminary report.** *J. Phys. & Colloid Chem.* **51**, 415-25 (1947).—*C.A.* **41**, 3344*d*.

Silica sols of known pH were prepd. by treating Na silicate solns. (3.3 mols. SiO_2 per mol. Na_2O) with acidic ion-exchange resins. On freezing for 15 min. at -10 °C, all sols were flocculated except those in the pH range 2.5-3.5. Diln. of the sols caused the zone of no flocculation to be extended to higher pH values. Increasing the freezing time or aging the sols before freezing narrowed the range of stability. At pH values where flocculation just occurred, stability varied with the age of the Na silicate soln. used in prepg. the sol.

3118. JARKA, JOSEF. **Composition and cation-exchange capacity of bentonite from Braňany (near Most in northwest Bohemia).** *Acad. tchèque sci., Bull. intern., Classe sci. math. nat. et. méd.* **48**, 71-6 (1947) (Pub. 1950) (in English).—*C.A.* **47**, 7179*g*.

The bentonite was mostly montmorillonite clays contg. Ca and Mg as more than 80% of the total exchangeable cations. The cation-exchange capacity was detd. by equilibrating the bentonite (dried at 105°C) with 1*N* NH_4Cl, the excess NH_4Cl removed with 70% EtOH, and the adsorbed NH_3 developed with NaOH and $Ca(OH)_2$, distd., and detd. by titration.

3119. KUBLI, H. **Information on the separation of anions by adsorption on alumina.** *Helv. Chim. Acta* **30**, 453-63 (1947) (in German).—*C.A.* **41**, 4406*i*.

The adsorption on acid-washed alumina was detd. for: OH^-, PO_4^{-3}, $C_2O_4^{-2}$, F^-, [SO_3^{-2}, $Fe(CN)_6^{-4}$ and CrO_4^{-2}], $S_2O_3^{-2}$, SO_4^{-2}, [$Fe(CN)_6^{-3}$ and $Cr_2O_7^{-2}$], [NO_3^- and CNS^-], I^-, Br^-, Cl^-, NO_3^-, MnO_4^-, ClO_4^-, AcO^-, and S^{-2}. The sensitivity for analysis of many of these ions by adsorption and subsequent developing by another reagent was detd.

3120. LEVINE, A. K. AND JOFFE, J. S. **Fixation of potassium in relation to exchange capacity of soils. V. Mechanism of fixation.** *Soil Sci.* **63**, 407-16 (1947).—*C.A.* **41**, 7604*f*.

Evidence was presented in support of the contention that K was fixed between the layers of layer-lattice minerals. Expts. using a soln. of KCl with pyrophyllite, the basic unit of bentonite or montmorillonite, further demonstrated that K must first enter the exchange complex before being fixed, and that it must be in contact with pyrophyllite over an extended period of time for fixation to occur. When fixed, K became part of the mineral structure and a shrinkage in the basal spacing of the mineral occurred.

3121. MANUELE, RÁUL. **Evaluation of the adsorptive power of argil by polarography of manganese.** *Rev. facultad cienc. quim.* **22**, 55-65 (1947).—*C.A.* **44**, 11050*f*..

Treat a 0.1-0.2 g sample of a clay with 10 ml *N* $MnCl_2$ soln. centrifuge and decant. Repeat 4 times, and wash 3 times with 9-10 ml portions of 80% alc. Displace the adsorbed Mn^{++} from the satd. clay by 4 treatments with 7 ml 1 *N* KCl soln.; agitate, centrifuge, and decant each time into a 50 ml graduated flask. Fill the flask to 50 ml with KCl soln., and transfer aliquots into the cathodic tube of a polarograph standardized against various concns. of $MnCl_2$ in 1 *N* KCl. Measure Mn^{++} concn. under N_2. A clay was found to have an adsorptive power of 16.1 milliequiv. Mn/100 g, and of 15.6 milliequiv. Ca/100 g when the clay was acid-regenerated.

3122. MARSHALL, CHARLES E. AND McLEAN, E. O. **The activities of calcium and potassium ions as related to concentration and drying in clay suspensions.** *Soil Sci. Soc. Am. Proc.* **12**, 172-5 (1947) (pub. 1948).—*C.A.* **43**, 1132*i*.

K- and Ca-ion activities showed marked increase with clay concn. for montmorillonite (Wyoming bentonite), beidellite (Putnam clay), illite (grundite), and kaolinite. The percentage ionization varied relatively little with clay concn. Montmorillonite and beidellite showed definite evidence of a reduction in K-ion activity owing to previous drying, illite only slight reduction, and kaolinite not at all. Only montmorillonite clearly showed such an effect with Ca.

3123. MUKHERJEE, J. N.; CHATTERJEE, B., AND BANERJEE, B. M. **Liberation of hydrogen, aluminum, and ferric ions from hydrogen clays by neutral salts.** *J. Colloid Sci.* **2**, 247-56 (1947).—*C.A.* **41**, 4902*f*.

The liberation of Al^{+++} and Fe^{+++} by the action of a neutral salt on a H-clay was investigated to det. if there was a limit to the amt. of Al^{+++} and Fe^{+++} present at the surface. For both montmorillonitic and kaolinitic clays the amt. of Fe^{+++} and Al^{+++} decreased markedly after the first cycle, but an appreciable amt. of each ion was liberated in all succeeding cycles. With montmorillonitic clays, the amt. of Al^{+++} liberated increased after the 4th cycle. The sum of the displaced Al^{+++} and Fe^{+++} ions decreased but approached const. values with repeated treatment of both clays. Montmorillonitic and kaolinitic clays behaved quite differently during treatment to displace Al^{+++} and Fe^{+++} ions.

3124. PLANK, C. J. **Differences between silica and silica-alumina gels. II. A proposed mechanism for the gelation and syneresis of these gels.** *J. Colloid Sci.* **2**, 413-27 (1947).—*C.A.* **42**, 437*b*.

The extremely rapid gelation of SiO_2 and SiO_2-Al_2O_3 hydrosols under certain conditions and the sensitivity of gelation time to pH was demonstrated experimentally. The results suggested that the gelation reaction was ionic in nature.

3125. POLYAKOV, YU. A. **Thermodynamics of exchange adsorption of potassium and ammonium ions in soils.** *Kolloid. Zhur.* **9**, 439-46 (1947).—*C.A.* **43**, 7621*b*.

For 3 soils the validity of the equation $K = x^2/(g - x)(b - x)$ was established; x was the amt. of K adsorbed by an NH_4 soil, g the exchange capacity, and b the amt. of K in the soln. before adsorption. K was 1.4-1.9 and almost independent of temp. (18-70 °C). As the exchange adsorption was a reversible phenomenon, from the value of K the heat content, the free energy, and the entropy of the process were calcd.

3126. REID, A. AND SEN GUPTA, N. C. **Effect of sodium hexametaphosphate on the yield value and viscosity of a hydrogen bentonite suspension.** *Nature* **159**, 336-7 (1947).—*C.A.* **41**, 4994*i*.

The phosphate reduced both the yield value and the viscosity but the effect was greater on the former. More importantly, if the suspension was allowed to stand, the yield value did not increase.

3127. RENDIG, V. V. **Rapid determination of the base-exchange capacity of soils with the flame photometer.** *Soil Sci. Soc. Am., Proc.* **12**, 449-51 (1947) (Pub. 1948).—*C.A.* **43**, 2721*g*.

The soil was first base-satd. with neutral KOAc soln. and the excess salt was removed by washing with water and alc. The exchangeable K was extd. with a soln. of ammonium and Mg acetates and the amt. of K in the ext. was detd. with the flame photometer. In general, the results were slightly higher than those obtained by the NH_4OAc method and somewhat lower than by the $Ca(OAc)_2$ method.

3128. ROST, RUDOLF. **Clay minerals. II.** *Vestnik Stat. Geol. Ustavu Rep. Cekoslov.* **22**, 328-35 (in English 334-5) (1947).—*C.A.* **42**, 5381*i*.

An analysis, optical and dehydration data were given for montmorillionite from Kutna Hora. Base exchange expts. with NH_4NO_3 soln. on 2 montmorillionites and a beidellite showed 60-100% exchange of the CaO present, but only 14-30% exchange of the Mg present.

3129. RUSH, R. I.; WALKUP, J. H.; JOHNSON, FRANCES C., AND QUAST, ANN. **Banding of basic mercuric chloride in silica gel.** *J. Chem. Education* **24**, 238-9 (1947).— *C.A.* **41**, 4695*i*.

Bands of basic mercuric chloride in silica gel increased in no. from pH 7.0 to 9.0

3130. SEAY, W. A. AND WEEKS, M. E. **The fractionation and properties of clays from the surface soils of the Pearman and Maury series.** *Soil Sci. Soc. Am., Proc.* **12**, 24-8 (1947) (Pub. 1948).—*C.A.* **43**, 795*d*.

The clay was sepd. into 5 fractions. The SiO_2 decreased from the 1-2 μ fraction down to the 0.1-0.05 μ fraction. Base- and anion-exchange capacities increased directly with decrease in particle size. It appeared that the clays contained a mixt. of 1:1 and 2:1 type of clay minerals with the 2:1 type in greater proportion where the particle-size was smallest.

3131. SERB-SERBINA, N. N. AND REBINDER, P. A. **Structure formation in aqueous suspensions of bentonite clays.** *Kolloid. Zhur.* **9**, 381-91 (1947).—*C.A.* **43**, 5257*i*.

Thixotropic properties of 3 kinds of domestic clays were detd. by viscometry in a capillary plastometer and by tangential displacement of a thin Pt foil. Three types of shearing stress curves corresponded to 3 different mechanisms of structure formation and perturbation, the 1st to brittle rupture, the 2nd to thixotropic structure formation with plastic rupture, the 3rd to plastic flow.

3132. SIEFERT, A. C. AND HENRY, E. C. **Effect of exchangeable cations on hydrophylic nature of kaolin and bentonite.** *J. Am. Ceram. Soc.* **30**, 37-48 (1947).—*C.A.* **41**, 2868*b*.

The affinity of H_2O for a S. Carolina kaolin and Wyoming bentonite satd. with H, Ca, Na, and K was studied by 3 methods. The H and Ca clays showed a greater affinity for H_2O than the Na and K clays. Although the bentonite evolved more heat and sorbed more H_2O per g of clay, it evolved less heat and sorbed less H_2O per milliequiv. of exchangeable cation than did the kaolin.

3133. TEICHNER, STANISLAS. **Substitution of ions in montmorillonite.** *Compt. rend.* **225**, 1337-9 (1947);.—*C.A.* **42**, 2895*g*.

Retention of adsorbed H_2O and the specific surfaces were detd. of natural montmorillonite and of

Na-substituted montmorillonite, obtained by treating natural montmorillonite with dil. acid and neutralizing with soda. At room temp. natural montmorillonite retained 3 mols. of adsorbed H_2O per Ca^{++}, while Na-substituted montmorillonite retained 1 mol. of adsorbed H_2O per Na^+. This H_2O was given off only at about 90°C. At dehydration temps. of 20° and 180°C, resp. the B.E.T. surfaces (m^2 per g) were for natural montmorillonite 48 and 52; for Na-substituted montmorillonite 13.6 and 88. The H_2O adsorbed on natural montmorillonite appeared not to interfere with N_2 adsorption, while that on Na-substituted montmorillonite prevents adsorption of N_2 at centers where H_2O was located.

3134. Vettori, Leandro. **Determination of the need of soils for lime (determination of exchangeable hydrogen).** *Anais Assoc. Quim. Brasil* **6**, 167-80 (1947).—*C.A.* **42**, 5148*i*.

Percolate 10 g soil with 250 ml *N* $Ba(OAc)_2$ whose pH has been brought to 7 with AcOH, titrate 100 ml with 0.1 *N* NaOH to rose (5 drops 3% phenolphathalein) and subtract the vol. 0.1 *N* NaOH needed to bring 100 ml *N* $Ba(OAc)_2$ to rose.

3135. Aleshin, S. N. **Change of montmorillonite into hydro-mica.** *Doklady Akad. Nauk U.S.S.R.* **61**, 693-5 (1948).—*C.A.* **43**, 2549*f*.

The cation-exchanging part of the clay minerals in soils was usually detd. by electrodialysis and titration of the cations with HCl, with phenolphthalein as indicator. It was observed after this treatment and the exchange of the H^+ for K^+ from *N* KCl soln. that the base-exchange capacity of the product changed after repeated electrodialysis.

3136. Asselmeyer, Fritz. **Structure investigation of γAl_2O_3-gibbsite.** *Z. Angew. Physik* **1**, 26-35 (1948).—*C.A.* **43**, 3319*c*.

Eu nitrate in HNO_3 was mixed with suspended γ-Al_2O_3 in a ratio of 1 Eu ion to 200 Al ions. The prepn. was then ignited and stored over P_2O_5 until used. The ignited sample was irradiated with ultraviolet radiation and the fluorescent spectrum photographed. This method was based upon the fact that the streams of atoms in an electromagnetic field have their spectral lines split. In another method, perylene dissolved in cyclohexane was adsorbed on gibbsite and exposed to ultraviolet radiation and the resultant fluorescent spectrum photographed. The perylene spectrum showed, in the temp. region of the "fine structure," a clear displacement of intensities towards the short-wave region.

3137. Barbier, Georges and Chabannes, Jean. **Role of exchangeable cations in the adsorption of anions by clays.** *Compt. rend.* **226**, 749-51 (1948).—*C.A.* **42**, 5144*i*.

The amts. of PO_4 fixed by a suspension of kaolinite, previously treated to remove all free sesquioxides, increased with increasing pH. At a pH of 7.4, the amts. fixed varied in a manner indicative of adsorption.

3138. Barriol, Jean; Bloch, Jean Michel, and Kayser, Fernand. **Measurement of the thixotropy of suspensions of bentonite.** *Compt. rend.* **226**, 1899-1901 (1948).—*C.A.* **42**, 7601*f*.

A discussion of the comparison of results of thixotropy measurement on aq. suspensions of bentonite by a procedure which used a brass cylinder and another which used a torsion couple. Use was made of a set of hollow brass cylinders of mean d. d_c. The max. pressure that the gel can support was related to the height of emergence.

3139. Fricke, R. and Schmah, H. **The water solubility and alkali and zeolitic properties of aluminum hydroxide.** *Z. anorg. Chem.* **255**, 253-68 (1948).—*C.A.* **43**, 2070*g*.

The surface had basic properties and showed hydrolytic adsorption of KCl, K_2SO_4, and $KClO_4$ up to pH 9.5. Ion exchange with Ag occurred. With increasing age of the $Al(OH)_3$ prepn., these effects decreased. $Al(OH)_3$ could be used for chromatographic sepn. of $Fe_2(SO_4)_3$, $CuSO_4$, and $CoSO_4$. The Fe salts were in the upper zone, Cu in the middle, and Co below, as expected from their base strengths.

3140. Ganguly, A. K. and Gupta, S. L. **Hydration of exchangeable cations of clay minerals and synthetic resins.** *Science and Culture* **14**, 81-2 (1948).—*C.A.* **43**, 921*i*.

Exchangeable cations, including H, of oven-dry clay minerals were present in hydrated form. When clay minerals were converted into their resp. H systems, the exchangeable cations were replaced by H ions. On ignition of the oven-dry material, the original unconverted mineral lost a certain amt. of moisture as a result of the expulsion of the OH groups. The observed moisture loss was greater than that calcd. by assuming the exchangeable H to be present as H^+, but a close agreement was obtained if it was assumed to be hydrated as H_3O^+.

3141. Hoyos, Angel de Castro and Pascual Talavera, M. **Effect of pH on the properties of suspensions of clay materials.** *Anales inst. espan. edafol., ecol y fis vegetal* **2**, 273-313 (1948).—*C.A.* **43**, 4638*d*.

The vol. of sediment and time required for settling were specific for each material. There was a pos. relation between the properties of these suspensoids and their thixotropy and base-exchange capacity. Their properties as colloids varied with the pH and the concns. and natures of the electrolytes in the buffered solns. used. In most cases except clays and kaolins, where the ultimate particle was greater than 1.12 μ, the dispersion was max. around pH 7.8-7.9 where the concn. of electrolytes was small and dispersion was high on account of Na ions, and min. around 9.1 with high concns. of Cl and NH_4 ions.

3142. Kayser, Fernand and Bloch, Jean M. **The fixation of inorganic molecules upon bentonite.** *Compt. rend.* **226**, 251-3 (1948).—*C.A.* **42**, 4816*i*.

To fix AgCl, the clay in the Na form was agitated with $AgNO_3$ soln. and then treated with NaCl soln. In such a process 74 milliequivs. of Ag and 69 milliequivs. of Cl were fixed per 100 g of clay. In the Ag form, the Ag could easily be exchanged for K by washing with KNO_3 soln.; however, no exchange was observed after the AgCl had been formed. The ZnS and CdS bentonites were prepd. by the action of H_2S on the corresponding Zn and Cd bentonites.

3143. KIEFER, CHARLES. **The possibilities of bonding and of orientation of molecules of a liquid upon a solid.** *Compt. rend.* **226**, 1602-3 (1948).—*C.A.* **42**, 7600*i*.

The apparent viscosity depended principally on the quantity of free H_2O. Thixotropy occurred when the clay suspension contained only bound H_2O. The plasticity was explained by the friction between particles being that of H_2O upon H_2O. The variations in vols. of sediments depended partly on the proportion of bound H_2O.

3144. MIKHAL'CHENKO, V. A. **Volume change of various forms of silica on treatment with lime solution.** *Kolloid. Zhur.* **10**, 441-7 (1948).—*C.A.* **43**, 7777*f*.

The sedimentation vol. of a silica gel powder kept for days in H_2O or org. liquids did not change. The increase of sedimentation vol. produced by $Ca(OH)_2$ was greatest for silica gel fractions 10-50 μ and 100-250 μ (225% in 180 days), smaller for finer fractions, and smaller still for crushed quartz and sand, whose fraction 5-10 μ "swelled" more than the coarser and the finer fractions. In 100 days, the 1-5 μ fractions of SiO_2 gel, sand, and crushed quartz took up 0.943, 0.096, and 0.046 g CaO.

3145. MIKHAL'CHENKO, V. A. **Effect of the degree of hydration on the rate of absorption of lime by silica.** *Zhur. Priklad, Khim. (J. Applied Chem.)* **21**, 1025-31 (1948).—*C.A.* **44**, 403*d*.

The rate of absorption of lime by silica depended considerably, in addn. to other factors, upon the extent of hydration of the silica. Gel-like strongly hydrated silica absorbed lime intensively, whereas absorption by anhyd. silica was several times slower. Generally, the absorption of lime by silica had the character of a chem. process. By decreasing the hydration, the rate const. increased; for a specific degree of hydration the rate decreased with time (the measurements were taken over a 10-day period).

3146. MITRA, R. P. AND RAJAGOPALAN, K. S. **Electrical charges in layer-lattice silicates in relation to ionic exchange.** *Indian J. Phys.* **22**, 129-40 (1948).—*C.A.* **42**, 8562*f*.

Many layer-lattice silicates such as the micas and the clay minerals, when in a finely divided state, showed a marked capacity for ion exchange. The mechanism of this exchange and the nature and origin of the surface charges which held the exchangeable ions in the liquid phase at some distance from the surfaces of the crystallites were discussed. The most polar ions or groups on the surface were exchanged under suitable conditions for similarly charged ions in the liquid phase.

3147. SHAROV, V. S. **Clay as surface electrolyte and its electrolysis.** *Doklady Akad. Nauk S.S.S.R.* **60**, 829-32 (1948).—*C.A.* **42**, 8573*f*.

Diffusion of cations in clay was demonstrated by the penetration of Cu^{++} ions from a Cu-bentonite clay onto Ca-bentonite clay, both samples contg. 80% moisture and kept in close contace for 500 hrs; the depth of penetration of Cu^{++}, 0.5 cm, corresponded to a rate of diffusion of 0.001 cm/hr. The layer close to the cathode was colored blue-green by pptd. $Cu(OH)_2$ and could thus be sepd. and analyzed; its Cu content was found to be 49.8 mg, almost equal to the 50.9 mg Cu deposited in $CuSO_4$. Transference detns. between clays with various cations, Ca^{++}, Mg^{++}, Ba^{++}, Cu^{++}, all with 80% moisture, showed that, under 1 v./cm, the mobilities of these ions in clay were about 17 times lower than in dil. aq. soln.

3148. SIEWERT, GERHARD AND JUNGNICKEL, HORST. **Ion exchange in commercial aluminum oxides.** *Z. anorg. Chem.* **257**, 215-22 (1948).—*C.A.* **43**, 4076*c*.

Com. Al_2O_3 contained Na_2CO_3 and $NaHCO_3$ which could be removed by washing. Some samples thereby lost their adsorptive properties for salt solns., whereas others developed a capacity for anion exchange and could release bases such as quinine or NH_3 from their salts.

3149. YARUSOV, S. S. **A study of exchange acidity.** *Doklady Vsesoyuz Akad. Sel'sko-Khoz. Nauk im. V. I. Lenina 13, No.* **1**, 14-21 (1948).—*C.A.* **42**, 6481*d*.

By using NaF on a soil extd. after having been treated with $Ca(OH)_2$, the exchangeable Al could be titrated according to the following equations: $Al^{+++} + Ca(OH)_2 \rightarrow$ Ca soil $+ Al(OH)_3$; $Al(OH)_3 + 6\ NaF \rightarrow Na_3AlF_6 + 3\ NaOH$. It was considered that the exchange acidity in the surface horizons depended primarily on adsorbed H ions.

3150. BARSHAD, ISAAC. **Vermiculite and its relation to biotite as revealed by base-exchange reactions, x-ray analyses, differential thermal curves, and water content.** *Am. Mineral.* **33**, 655-78 (1949).—*C.A.* **43**, 8987*i*.

K-satd. vermiculite closely approximated biotite. Hydrobiotite was converted to vermiculite by leaching with $MgCl_2$ soln. The exchangeable bases of vermiculite occupied interlayer positions. Base-exchange expts. showed that vermiculite, even in large flakes, had high base-exchange capacity. The exchangeable cation was Mg only in some samples, Mg and Ca in others.

3151. BERTHIER, PAULETTE. **Variation of the refractive index of colloidal hydrosols under different influences.** *Rev. Sci.* **86**, 679-80 (1949).—*C.A.* **44**, 3768*i*.

The n of Al_2O_3 sols contg. up to 0.05 N KCl was additive; this fact indicated that within exptl. error very little KCl was adsorbed by the Al_2O_3 particles. ThO_2 sols + KCl showed comparable results. Al_2O_3 + tannin, Al_2O_3 + blood albumin, and ThO_2 sols + SiO_2 sols all showed additive values for n. The adsorption of Na_3PO_4, K_2SO_4, and tannin by Al_2O_3 sols when the sol was flocculated was detd. by calcg. the variation of n that corresponded to the amt. of electrolyte adsorbed by the Al_2O_3 particles.

3152. BHATTACHARYA, ABANI K. **The composition of ferric arsenite and ferrous arsenate. II. Composition of the so-called ferric arsenite (product of mixing ferric chloride and sodium metarsenite).** *J. Indian Chem. Soc.* **26**, 99-102 (1949).—*C.A.* **43**, 8296*c*.

When aq. solns. of $FeCl_3$ and $NaAsO_2$ were mixed at high concns., a mixt. of arsenite and arsenate of Fe was obtained with some free Fe_2O_3 and adsorbed arsenite. When $FeCl_3$ was added in more than its equiv. amt. to $NaAsO_2$, a colloidal soln. was obtained.

3153. Boutaric, Augustin and Berthier, Paulette. **Interference refractometry of colloidal solutions.** *Compt. rend.* **228**, 1009-11 (1949).—*C.A.* **43**, 6040*c*.

Transparent colloidal solns. of Al_2O_3, ThO_2, and SiO_2 were heated at 75°C. The solns. gradually became cloudy. With Al_2O_3, flocculation finally occurred, accompanied by a sharp decrease in viscosity. The additivity law held for the addn. of electrolytes as long as flocculation did not occur. For flocculated Al_2O_3 hydrosols at low electrolyte concns., all the electrolyte was apparently fixed on the flocculate.

3154. Buzágh, Aladár and Kugler, Elvira. **The effect of electrolytes on the strength of bentonite films. Effect of electrolytes on the strength of bentonite membranes.** *Magyar Kém. Lapja* **4**, 466-72 (1949); *Kolloid-Z.* **115**, 155-60 (1949).—*C.A.* **44**, 4749*f*; **45**, 21*g*.

Bentonite films were prepd. as follows: A 0.5% soln. of stearic acid in EtOH was poured onto a glass plate and the excess soln. poured off. After drying of this film 37 ml of a 3% bentonite soln., prepd. as above, in NaCl, $MgCl_2$, $AlCl_3$, NaOH, Na_2CO_3, Na_2SO_4, or Na_3PO_4 was poured onto each 100 cm^2 surface and dried in a horizontal position at room temp. Films of bentonite could be sepd. from the plate and from the fat layer easily; their thickness averaged 0.1 mm. The strengths obtained with increasing amts. of electrolytes gave curves of max.-min. character but with two maximums. For NaCl, Na_2SO_4, $MgCl_2$, and $AlCl_3$ the value of the first max. was the highest observed strength, the min. was low and broad.

3155. Caillère, S. and Hénin, S. **Transformation of minerals of the montmorillinite family into 10-A micas.** *Mineralog. Mag.* **28**, 606-11 (1949).—*C.A.* **43**, 6121*f*.

Attempts were made to alter montmorillonite, nontronite, and vermiculite with KCl and KOH solns. and to follow changes by x-rays and differential thermal analysis. Attempts were also made to transform phlogopite and illite into montmorillite and to follow these changes by x-rays.

3156. Davydov, A. T. and Lisovina, G. M. **The exchange adsorption of cations by bentonite.** *Kolloid. Zhur.* **11**, 308-10 (1949).—*C.A.* **44**, 900*d*.

A bentonite from Crimea, which passed through a sieve having 900 openings/cm^2 and was dried at 50°C, increased in vol. 2.5 times in H_2O in 0.1 *N-N* solns. of NaCl and $CaCl_2$. For the cation exchange between bentonite satd. with Mg, Ca, Sr, or Ba and NaCl or KCl, an equation was: $(1/a_2) = (1/S) + [ka^{1/2}/(c_o - a_1)]$; a_1 was the amt. of bivalent cation remaining in bentonite, a_2 the amt. displaced (both in mg equiv. per 100 g bentonite), $S = a_1 + a_2$, c_0 the original concn. of the univalent cation, and k a const.

3157. Gabbard, James L. and Thompson, Maurice R. **The effect of sodium hydroxide upon the electrodeposition of electrodialyzed kaolin.** *J. Electrochem. Soc.* **95**, 329-43 (1949).—*C.A.* **43**, 6091*c*.

Fractions of Georgia kaolin of definite particle-size range were suspended for use in pH titration curves with NaOH as base. The corresponding yield in g/coulomb upon electrodeposition was detd. by using the same partly neutralized suspension from the pH measurements. Addnl. evidence was obtained that clay acted similarly to a weak monobasic acid upon titration, and that a hyperbolic relation held approx. for the yield upon electrodeposition at any pH.

3158. Gad, G. M. and Barrett, L. R. **Constitution of some Egyptian clays.** *Mineralog. Mag.* **28**, 587-97 (1949).—*C.A.* **43**, 6121*b*.

Chem. analyses for SiO_2, Al_2O_3, and H_2O base-exchange measurements, x-ray powder data, rates of dehydration on heating, and differential thermal analysis data were given for White and for Red Aswan clay and for Sinai kaolin.

3159. Ganguly, A. K. **Base-exchange properties of quartz and silica gel.** *Science and Culture* **14**, 337-8 (1949).—*C.A.* **43**, 5885*f*.

Finely divided silica gel and quartz both showed base exchange capacities when titrated with 0.005 *N* KOH in the presence of KCl, but little with NH_4OH in the presence of NH_4Cl. Quartz showed less capacity than silica gel.

3160. Ganguly, A. K. **Reactivity of exchange spots of silicate minerals.** *Science and Culture* **14**, 341-2 (1949).—*C.A.* **43**, 5885*g*.

Presence of 3 types of bonding sites in silicate minerals was confirmed by low-concn. reagent studies of absorption and exchange.

3161. Goldschmidt, W. B. **The practical importance of cation-exchange studies in Lowveld soils.** *S. African J. Sci.* **46**, 159-63 (1949).—*C.A.* **44**, 7473*b*.

The exchange of Ca, Mg, K, and Na and the easily sol. Fe and Al were detd. in 15 Lowveld soils by leaching with 0.05 *N* HCl. Results obtained by using 1.0 *N* NH_4Cl were inconsistent. In the high-rain fall areas, all values were low except Al, which was high.

3162. González, F. García. **Effect of pH on the cation-exchange capacity of montmorillonite and kaolinite.** *Anales real soc. españ. fís. y quím.* **45B**, 1067-74 (1949).—*C.A.* **44**, 7617*f*.

The exchange capacity of the bentonites and kaolins was const. for pH from 4.5 to 8.5; different samples of bentonite had values from 55 to 95 and kaolins 6 or 19 milli-equiv./100 g. Capacities of the clays increased with increasing pH (20-30 or 30-50 milliequiv./100 g).

3163. Hazel, Fred; Parker, J. A., and Schipper, Edgar. **Low-temperature studies with colloidal silicic acid.** *Science* **110**, 161-2 (1949).—*C.A.* **43**, 8800*i*.

The rate of thawing had a profound effect on colloidal silicic acid systems frozen at temps. below -55 C. Slow thawing permitted the formation of crystals resulting in the dehydration of colloid particles thus providing loci for coagulation. In the case of rapid freezing and thawing there was no time for this phenomenon to occur.

3164. Hazel, Fred; Schock, Richard U. Jr., and Gordon, Maxwell. **Interaction of ferric ions with silicic acid.** *J. Am. Chem. Soc.* **71**, 2256-7 (1949).—*C.A.* **43**, 8237*d*.

Sols of silicic acid prepd. by ion exchange were used to titrate solns. of various salts:

$BaCl_2$, $LaCl_3$, $CuSO_4$, $CrCl_3$, $Al_2(SO_4)_3$, $AlCl_3$, and $FeCl_3$. Interaction was greatest with the last two, as shown by an increase in H-ion concn., and, in the case of the $FeCl_3$, by a discharge of the color of the soln. As the sol was aged, its activity decreased.

3165. Koganovskiĭ, A. M. **The sorption of colloids. II. Isotherms of sorption of hydrophobic colloids by gels of iron and aluminum hydroxides.** *Kolloid. Zhur.* **11**, 417-19 (1949).—*C.A.* 44, 2819*g*.

The amt. adsorbed (x/m) increased with the equil. sol concn (c) for the sorption of Ag and Ag_2O sols by Al_2O_3 gel contg. 87% H_2O; x/m as function of c had at least one max. and one min. for the sorption of gum arabic and $Al(OH)_3$ by Fe_2O_3 gel (contg. 90% H_2O) and of $Fe(OH)_3$ by Al_2O_3 gel. In one instance the sudden decrease of x/m was assocd. with change of dispersity of the gel.

3166. Krishnamoorthy, C. and Overstreet, Roy. **Theory of ion-exchange relationships.** *Soil Sci.* 68, 307-15 (1949).—*C.A.* 44, 2156*c*.

A theory of ionic distribution as applied to mineralogically pure systems was presented in which the ion-exchange process was at equil. and was completely reversible. The treatment was in terms of the partial free energies of the ions involved in the exchange process. For a system of 2 phases the partial molal free energy of any free electrolyte must have been the same in both phases at equil.

3167. Malquori, Alberto and Marimperti, Luigi. **The surface activity of argillaceous materials. V. Fixation of phosphorus on different types of clay.** *Ann. chim. applicata* **39**, 453-9 (1949).—*C.A.* **45**, 9785*e*.

The clay was treated for 24 hrs with a soln. of $Ca(H_2PO_4)_2$ in a satd. soln. of $CaSO_4$. At pH 7.2-7.4 the quantity adsorbed was different for every type of clay. The adsorption curve for every clay as a function of the pH passed through a max. at pH 3.2-3.5. The fixation at this point was an anion exchange.

3168. Perkins, Alfred T. **Reactions of muscovite, bentonite, and their treated residues.** *Soil Sci.* 67, 41-6 (1949).—*C.A.* 43, 3957*f*.

Grinding greatly increased the base-exchange capacity of muscovite and its reaction with acid and base. It activated bentonite so that aggregation or polymerization occurred when the mineral was suspended in water. Base-exchange capacity was decreased by prolonged grinding, which indicated decompn. of the mineral. Reaction with acid and base was greatly increased, and swelling in water suspension was decreased.

3169. Sato, Koichi. **Reversible coagulation of thixotropic gels.** *J. Sci. Research Inst. Tokyo* 44, 14-22 (1949) (in English).—*C.A.* 44, 905*i*.

A cyclic process could be observed with the thixotropic gels of V_2O_5 and Fe_2O_3, but not with bentonite, Al_2O_3, and agar-agar gels, in which the gel would transform into the state of "reversible coagulate" by slow pitching and rolling motion, thence into the sol by vigorous shaking, and from there return to the gel form either reversibly by further mech. agitation or by standing (rheopexy). If the process was repeated too often, the reversible coagulate turned into an irreversible one. Coagulation of the V_2O_5 sol by dil. H_2SO_4 was observed with crossed polaroids.

3170. Schikore, Werner and Pankow, Traute. **Adsorptive purification in phosphorescence chemistry. II. Removal of traces of manganese from zinc sulfate solutions.** *Z. anorg. Chem.* **258**, 15-17 (1949).—*C.A.* 43, 5688*g*.

$ZnSO_4$ soln. was freed from a trace of Mn by heating to the b.p. with colloidal PbO_2, freshly prepd. by hydrolysis of $(NH_4)_2PbCl_6$, letting stand overnight, and filtering. Traces of Pb in the filtrate could be removed by adsorption on Al_2O_3. $ZnSO_4$ was then recovered from the filtrate by evapn. and heating to 500°C. The product gave clear white cathodic fluorescence and a white phosphorescence but no red fluorescence such as was obtained in the presence of Mn.

3171. Schofield, R. K. **Effect of pH on electric charges carried by clay particles.** *J. Soil Sci.* **1**, 1-8 (1949).—*C.A.* 44, 2683*f*.

The clay was treated repeatedly with 50 ml portions of a soln. 0.2 N in NH_4Cl and 0.001 N in HCl, until the decanted soln. regained its original pH, and contained no exchangeable cations. The clay was washed 5 times with 50 ml portions of 0.2 N KNO_3. The combined washings were titrated with alkali to a pH of 6 and then analyzed for NH_4^+ and Cl^-. In the pH range of 6 to 7.5, Cl^- was not adsorbed on the clay, and the increase in net neg. charge was due to an increase in the no. of neg. charges. From a pH of 6 to 2.5, the amt. of Cl^- adsorbed increased from zero to 1.5 milliequiv./100 g of oven-dried soil and a decrease in the net neg. charge was due to an increase in pos. charges rather than a decrease in the no. of neg. charges.

3172. Sen-Gupta, N. C. and Indra, M. K. **A comparative study of the electrochemical and other properties of clays.** *J. Indian Chem. Soc., Ind. and News Ed.* **12**, 100-2 (1949).—*C.A.* **44**, 9213*a*.

Buffer-capacity curves of bentonite clay suspensions resemble viscosity and yield-value curves. When the concn. of the colloid remains const., the viscosity may increase because of (a) increased hydration of the colloid or (b) the colloid may undergo partial flocculation.

3173. Sharov, V. S. **Rate of motion of cations in a clay suspengel during electrolysis.** *Kolloid, Zhur.* **11**, 283-6 (1949).—*C.A.* 44, 404*i*.

Elec. field of 5 v./cm was applied for 2-3 hrs to the cell Pb/M bentonite/Cu bentonite/M bentonite/Pt; the clays contained 80% moisture. The penetration of M^{++} into Cu bentonite and of Cu^{++} into M bentonie was detd. by "development" with $K_4Fe(CN)_6$. The mobility was 28, 32, 30 and 28×10^{-6} cm/sec per v./cm for Cu^{++}, Ba^{++}, Ca^{++}, and Mg^{++}.

3174. Sinha, S. K. **Turbidity of colloidal suspensions of layer lattice minerals.** *J. Indian Chem. Soc.* 26, 221-6 (1949).—*C.A.* 44, 2328*d*.

The variation of turbidity with diln. was measured for 3 series of aq. suspensions of prepd. dispersions of montmorillonite, kaolinite, and muscovite of controlled exchange base content. In each system turbidities increased with diln. along hyperbolic curves, attained max. at concns. of the order of ½ to 2 or 3 g/10 liter, and fell off sharply with further diln. For bentonite, with exchange base equal to exchange capacity, concns. at the max. were Na > K > Ba > H, for kaolinite, K > Ba > Ca, and for muscovite, K > Na.

3175. TOTH, S. J. AND PRINCE, A. L. **Estimation of cation-exchange capacity and exchangeable calcium, potassium, and sodium contents of soils by flame photometer techniques.** *Soil Sci.* 67, 439-45 (1949).—*C.A.* 43, 7620*i*.

The flame photometer could be adapted to soil analysis if the general nature of the soil exts. was known. The Na concn. normally found in podzolic soils was not high enought to interfere with the Ca test. The standard K curve was not affected by Na concn. up to 50 p.p.m. or Ca concn. up to 100 p.p.m.

3176. VECCHI, GASTONE. **Method for determining the swelling of bentonites.** *Chimica e industria* (Milan) **31**, 351-7 (1949).—*C.A.* 46, 1224*e*.

The sample was put into a 500-cc. glass cylinder which was then filled with distd. water. After shaking, the height of sedimentation was measured as a function of time. The best value of the ratio water to bentonite was 3. Max. swelling was obtained when the shaking time exceeded 12 hrs.

3177. VOLKRINGER, H. AND VALLADAS-DUBOIS, SUZANNE **Influence of adsorption on the absorption spectra of neodymium.** *J. chim. phys.* 46, 388-95 (1949).—*C.A.* 44, 428*b*.

The visible spectrum of Nd adsorbed on Al_2O_3 corresponded with that of freshly pptd. $Nd(OH)_3$, with displacement of the bands (about 20 A.) toward shorter wavelengths. The displacement was not the same for all bands. On MgO, the adsorbed Nd gave a spectrum almost identical with that of $Nd(OH)_3$ except for addnl. bands at 4290-300 and 4310 A. Nd salts, both cryst. and dissolved, gave spectra unlike either $Nd(OH)_3$ or the adsorbed ions. A mixt. of Al_2O_3 and cryst. salt gave the spectrum of the salt.

3178. WIKLANDER, LAMBERT. **Adsorption equilibria between ion exchangers of different nature. I. Release of cations from soil by adsorption on exchange resins.** *Kgl. Lantbruks Hogskol. Ann.* 16, 670-82 (1949).—*C.A.* 44, 778*g*.

The distribution of a univalent ion in equil. with H ion between two acidoids of different properties mixed in different proportions was calcd. on the basis of theory. By an appropriate choice of proportions of the mixt. the ion could be almost completely adsorbed on the stronger ion. The effect of the time of contact, grain size of the resin, and the proportions of the mixts. was studied with a mineral soil satd. with various cations and a sulfonated ion-exchange resin "Wolfatit K."

3179. BARR, MARTIN AND GUTH, EARL P. **The pH of suspensions of Volclay bentonite in distilled water and Clark-Lubs buffer solutions.** *J. Am. Pharm. Assoc.* 39, 646-7 (1950).—*C.A.* 45, 928*b*.

Suspensions of Volclay bentonite in distd. H_2O were alk. by hydrolysis; the pH fell as the bentonite to H_2O ratio increased, and the suspensions were resistant to acid buffering with Clark-Lubs buffers because of the cation exchange property of the bentonite.

3180. BARRIOL, JEAN AND BLOCH, JEAN MICHEL. **The thixotropy of suspensions of montmorillonite.** *Compt. rend.* 230, 2211-13 (1950).—*C.A.* 44, 10453*a*.

Montmorillonite gels showed a thixotropy characterized by the relation $F = \mu\ a_o$, where μ was the modulus of rigidity referred to the elastic deformation, F the tangetial force capable of rupturing the gel, a_o the angle at which rupture first occurred. A series of gels of varying concn. with varying from 250 to 22,000 c.g.s. gave the same value for a_o of 0.025 radian, indicating the same internal structure.

3181. BARSHAD, ISAAC. **The effect of the interlayer cations on the expansion of the mica type of crystal lattice.** *Am. Mineral.* 35, 225-38 (1950).—*C.A.* 45, 505*h*.

The interlayer expansion of air-dry vermiculite and montmorillonite satd. with Mg, Ca, or H ions was equal to two unimol. layers of H_2O, but those satd. with Ba, Li, or Na ions were equal to one unimol. layer of H_2O. Air-dry vermiculite satd. with K, NH_4, Rb, or Cs showed no expansion, whereas montmorillonite satd. with respect to ions showed expansion of one mol. layer of H_2O. When immersed in hot anhyd. glycerol, Mg, Ca, Ba, H, Li, or Na vermiculite showed expansion of one layer of glycerol mol.; respective montmorillonites showed expansion of two layers.

3182. BIRKS, L. S. AND SCHULMAN, J. H. **The effect of various impurities on the crystallization of amorphous silicic acid.** *Am. Mineralogist* 35, 1035-8 (1950).—*C.A.* 47, 6827*e*.

Carbonates of Mg, Ca, Sr, Ba, and Mn, when added as impurities to amorphous silicic acid, caused it to transform to quartz several hundred degrees above its stability limit.

3183. BLOCH, J. M. **The effect of grinding on the crystal structure and on the properties of montmorillonite.** *Bull. soc. chim. France* **1950**, 774-81.—*C.A.* 45, 2288*h*.

Under the influence of prolonged grinding the montmorillonite lost its capacity for fixing and exchanging cations. A certain proportion of the Al_2O_3, the MgO, and all the inter-cryst. OH ions were progressively liberated. X-ray examn., electron micrographs, and the chem. studies indicated that the cryst. structure of the montmorillonite was destroyed by the grinding.

3184. BLOCH, J. M. **The fixation of silver halides on montmorillonite.** *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* 3, 32-4; 4, 61 (1950) (in French).—*C.A.* 47, 941*a*.

Complexes of montmorillonite-AgCl with NH_4, Na, Li, Ni, and Hg were obtained by treating montmorillonite-Ag with the corresponding metal chloride. They have the same chem. properties. When the NH_4 complex is heated, NH_4Cl is volatilized. Decompn. by heat occurred at 400 °C.

3185. Booth, A. H. **Thickening of sodium chloride crystallization layers by specific adsorption of foreign ions.** *Nature* **165**, 968-9 (1950).—*C.A.* 44, 9761*h*.

On NaCl crystals growing in the presence of Cd or Pb ions, the layers were frequently observed to be more than 25,000 A. thick and clearly visible under transmitted light with magnifications less than 100 X. In the absence of foreign ions the layers were visible only under dark-field illumination and high magnification. By use of radioactive isotopes of high specific activity, it was shown that Cd, when present in a concn. of less than 1 γ/ml in a crystg. soln. of NaCl, was carried down almost completely by the first 5% of the crystals, but Zn, Mn, and Bi remain completely in soln.

3186. Borland, J. W. and Reitemeier, R. F. **Kinetic exchange studies on clay with radioactive calcium.** *Soil Sci.* **69**, 251-60 (1950).—*C.A.* 44, 9601*e*.

The Ca in soln. was in kinetic equil. with the Ca of Ca-satd. clays replaceable by NH_4OAc. The radioactive Ca added to soln. equilibrated with solid Ca of the clay after shaking for ½ hr. The exchange was effective for kaolinite, halloysite, hydrous mica, beidellite, and montmorillonite.

3187. Broda, E. and Erber, J. **Manganese dioxide as a radiocolloid.** *Monatsh.* **81**, 53-60 (1950).—*C.A.* 44, 8737*g*.

Neutron irradiation of cryst. or aq. $KMnO_4$ produced Mn^*O_2 radiocolloid (* denotes radioactivity). In constrast to $Po^*(OH)_x$ and $Pb^*(OH)_2$, Mn^*O_2 was also stable in acid soln. and was irreducible. Mn^*O_2 sepd. from the soln. by filtration in which the colloidal material was adsorbed. Addn. of certain ions (e.g. phosphate) prior to irradiation stabilized the colloid and increased the dispersion so that sepn. by simple filtration was no longer possible.

3188. Burriel, F. and Caldas, E. Fernandez. **Coprecipitation phenomena in analysis. I. Coprecipitation of vanadium by the hydroxides of iron, chromium, and aluminum.** *Anales real soc. expan., fis. y quim.* **46B**, 37-46 (1950).—*C.A.* 44, 9863*i*.

The disturbing effect of V (as VO_3^-) in the analysis of Ba was eliminated by copptn. with $Al(OH)_3$. Al was added to a soln. contg. groups III, IV, and V before neutralization; upon adding NH_4OH, all the VO_3^- was adsorbed on the $Al(OH)_3$. The amt. of VO_3^- retention for 0.046 g Fe, Cr, and Al was 0.015, 0.031, and 0.062 g, resp.

3189. Buzágh, Aladár. **The properties of bentonite sols and bentonite gels.** *Magyar Kem. Folyoirat* **56**, 7-10 (1950).—*C.A.* 45, 5383*d*.

The correlation of activity of H ions to the concn. of suspensions was an exponential function in H-montmorillonite suspensions. Cond. of such suspensions depended not only on the size but also on the form of the particles. The stability of such suspensions in relation to increasing NaOH concns. showed a characteristic curve with one max. This max. depended on the dispersity grade of the suspension, although the amt. of NaOH required to neutralize the montmorillonite was independent of the dispersity grade.

3190. Canals, E.; Marignan, R.; Cordier, S., and Bonnier, J. **Adsorption of some metallic ions in dilute solutions. III. Effect of temperature.** *Ann. pharm. franc.* **8**, 372-5 (1950).—*C.A.* 44, 9769*e*.

The adsorption increased with temp. The laws deduced from the previous data were confirmed experimentally.

3191. Chatterjee, B. and Marshall, Charles E. **The ionization of magnesium, calcium, and barium clays.** *J. Phys. & Colloid Chem.* **54**, 671-81 (1950).—*C.A.* 44, 8199*e*.

Hydrogen bentonite membranes, pretreated at 410°C were used to det. the ion activities. In the activity curves presented for montmorillonite, beidellite, illite, and kaolinite clays 3 distinct regions were readily apparent and 2 other regions could be inferred. Over a broad zone in the middle range, varying in extent with the specific clay and the cation, addn. of a bivalent base caused practically no increase in cationic activity. Starting at 70-80% neutralization a region of very rapid increase of cationic activity occurred, extending through the point of equivalence and somewhat beyond it. With still further addns. of base the slope of the activity curve decreased again.

3192. Dekker, A. J. and Urquhart, Helén M. A. **Capacity of porous alumina layers.** *Can. J. Research* **28B**, 541-50 (1950).—*C.A.* 45, 2795*a*.

Porous Al_2O_3 layers could be formed by anodic oxidation in H_2SO_4. The porosity was detd. by capacity measurements in a satd. soln. of boric acid plus ammonia. Expts. showed that the base of the pores was sepd. from the metal by a thin insulating barrier layer and that the ultimate thickness of the barrier layer remained const. after a crit. value was reached.

3193. Elving, Philip J. and Van Atta, Robert E. **Precipitation in homogeneous solution. Separation and determination of barium, strontium, and calcium.** *Anal. Chem.* **22**, 1375-8 (1950).—*C.A.* 45, 1461*c*.

Ba, Sr, and Ca could be sepd. quantitatively as readily filterable SO_4 ppts. by digestion of an aq. MeOH soln. contg. Me_2SO_4. Hydrolysis of the latter furnished the pptg. SO_4 ion. Small amts. of Sr interfered, but large amts. of Ca, Al, Fe, and NH_4, and moderate amts. of Na, K, and Mg did not. Ba could be detd. precisely in mixts approximating the compn. of barytes samples. Sr and Ca could be pptd. by modified procedures in higher concns. of MeOH.

3194. Eriksson, Erik. **The determination of pH in in colloidal suspensions.** *Kgl. Lantbruks Hogskol. Ann.* **17**, 92-100 (1950).—*C.A.* 45, 5488*b*.

The activity of ions, particularly H^+ was discussed thermodynamically. Expts. with H-ion-satd. bentonite, electrodialyzed Molner humus, Amberlite IR-100 resin satd. with H-ions and Amberlite IR-400 resin satd. with OH-ions showed that as the suspensions settled, differences could be observed in the pH of the soln. if the satd. KCl junction was moved into and out of contact with the settling particles. The same kind of movements of the glass electrode had no such effect.

3195. EVVA, FERENC. **Grain-size distribution investigation in suspensions of alumina hydrate.** *Aluminium* **2**, 276-8 (1950).—*C.A.* **45**, 8324*a*.

As an av. of 25 expts. the value of k could be calcd. from the equation $k = 1.00 - 0.096s$, where s denoted the vol. d. in %. A method was described for the detn. of the d. of Al_2O_3 hydrate with a standard volumetric flask instead of a pycnometer. The actual d. values of 2 samples from an Al_2O_3 plant were 2.17 and 2.26 g/ml.

3196. FORSLIND, ERIK. **The interaction between the exchangeable ions and the adsorbed water layers in montmorillonite.** *Trans. Intern. Congr. Soil Sci. 4th Congr., Amsterdam 1950*, **I**, 110-13, 427; **IV**, 58.—*C.A.* **46**, 1199*a*.

The interaction mechanism between the exchangeable ions, e.g., Na, K, Li, Mg, Ca, and the H_2O lattice (a cryst. structure of the H_2O adsorbed on montmorillonite was assumed), was considered from the wave-mech. point of view. The exptl. work was carried out to test the validity of the theoretical predictions.

3197. FRICKE, R. AND NEUGEBAUER, W. **Chemical and physical ion adsorption from aqueous solution on aluminum oxide.** *Naturwissenschaften* **37**, 427 (1950).—*C.A.* **45**, 4522*b*.

With 99.996% pure γ-Al_2O_3 (1 g) and 50 ml of 0.1 *M* pure $CuCl_2$ soln. adsorption equil. at 20°C was not attained after 120 hrs. Initially, the adsorbed amt. showed a dip followed by a steady rise. The chem. adsorption of Cu (total adsorption minus Cu equiv. of adsorbed Cl equiv.) as a percentage of total Cu adsorption increased from 27 to 50% during the 120-hr period. Chemically adsorbed Cu was replaced by dissolved Al. The adsorption was about double that of Brockmann Al_2O_3 (contg. Na).

3198. GRUNER, E. **Hydrodynamic properties of clay minerals.** *Ber. deut. keram. Ges.* **1950**, 81-99.—*C.A.* **44**, 10456*f*.

Cation adsorptions and dipole mols. detd. swelling characteristics and other hydrodynamic properties. Thixotropy was essentially a function of nonpolar mols.

3199. GRUNER, E. AND VOGEL, R. E. **Swelling behavior of calcium and sodium bentonites and its explanation.** *Kolloid-Z.* **118**, 100-10 (1950).—*C.A.* **45**, 1406*h*.

There was a range of OH-ion concn. in which Ca and Mg bentonites were more swellable than Na bentonite slimes. A difference in swelling was noted between freshly formed bentonite salts and natural or aged bentonites.

3200. HAUTH, W. E. JR. **Behavior of the alumina-water system.** *J. Phys. & Colloid Chem.* **54**, 142-56 (1950).—*C.A.* **44**, 3769*c*.

In suspensions of Al_2O_3 H^+ ions were adsorbed by the O of the Al_2O_3 by broken surface bond forces to form a unimol. layer. These Al_2O_3 colloidal particles had a pos. charge. In suspensions deflocculated by $(CH_3)_4NOH$, OH^- ions surrounded the Al_2O_3 particles giving them a neg. charge. The viscosity of dry-ground suspensions was highest around a neutral pH and was higher for suspensions of higher sp. gr. At the same pH and sp. gr., wet-ground suspensions had a higher viscosity.

3201. HAZEL, J. FRED AND SCHIPPER, EDGAR. **Low-temperature studies with colloidal silicic acid.** *J. Colloid Sci.* **5**, 532-40 (1950).—*C.A.* **45**, 3688*f*.

Silica sols prepd. from Na silicate with mineral acids and with ion-exchange resins were frozen at from -15° to -65°C and at -190°C, and the extent of flocculation after thawing was detd. The stability of the colloidal systems increased with decreasing temp. of freezing or aging, with increasing rate of thawing, or with addn. of LiCl or $CaCl_2$.

3202. HOFMANN, ULRICH AND KLEMEN, RICHARD. **Loss on heating of the ability of lithium ions to exchange in bentonite.** *Z. anorg. Chem.* **262**, 95-9 (1950).—*C.A.* **44**, 7618*b*.

On heating to 105 to 125°C the inner-cryst. expansive capacity of exchangeable Li ions in bentonite was lost. At 105°C half the Li ions lost their ability to exchange, whereas the OH ions of the silicate layers remained intact at 200°C. H, Ca, and Na ions showed similar effects, but at higher temps.

3203. HONDA, MASATAKE. **Exchange equilibrium of weak electrolytic ion exchangers. I. Equilibrium of chloride, acetate, and sulfate ions.** *J. Chem. Soc. Japan, Pure Chem. Sect.*, **71**, 405-7 (1950).—*C.A.* **45**, 6456*c*.

Mixts. of Cl^- and OAc^- were adsorbed on anion exchanger ROH in the presence of Na salts. Relations between exchange capacity $E = E_{Cl^-} + E_{OAc^-}$ and $pH + p(Cl^- + OAc^-)$ and $pH + \frac{1}{2}\ p(SO_4)$ were expressed in graphs.

3204. HOYOS, ANGEL DE CASTRO. **Influence of the fixation of potassium on the hydration of montmorillonite.** *Anales edafol. y fisiol. vegetal Madrid* **9**, 381-429 (1950); *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* **2**, 73-4; **4**, 61 (1950).—*C.A.* **45**, 6322*b*.

The effects of successive substitution of K for H ion, effects of fixation and nature of fixation on the amt. of H_2O adsorbed, and the mechanism of the imbibition were studied. K was fixed preferentially between the lamina, and, on a smaller scale, between the particles. Capillary imbibition was considered to consist of various partial phenomena, one of which was the sepn. of the particles.

3205. JEPHCOTT, C. M. AND JOHNSON, J. H. **Solubility of silica and alumina.** *Arch. Ind. Hyg. Occupational Med.* **1**, 323-40 (1950).—*C.A.* **44**, 4311*i*.

All forms of Al_2O_3 depressed markedly the soly. of quartz and diatomaceous earth. The forms of Al_2O_3 that were the most effective in depressing SiO_2 soly. were those for which the solubilities were least affected by SiO_2. The ability of different forms of Al_2O_3 to depress the soly. of SiO_2 was not proportional to their own soly.

3206. KRISHNAMOORTHY, C. AND OVERSTREET, ROY. **An experimental evaluation of ion-exchange relationships.** *Soil Sci.* **69**, 41-55 (1950).—*C.A.* **44**, 4750*a*.

Ion-exchange equations were subjected to exptl. test with one bentonite clay, 3 soil colloids, and 3 synthetic resins. Unsatisfactory values were obtained when H was one of the ions considered or when adsorbents were mixed together.

3207. KRISHNAMOORTHY, C. AND OVERSTREET, ROY. **Behavior of hydrogen in ion-exchange reactions.** *Soil Sci.* **69**, 87-95 (1950).—*C.A.* **44**, 6995*d*.

The H ion acted differently than other ions in exchange reactions of soil colloids. Ion-exchange constants for ion pairs involving H could be calcd. by the use of an abitrarily defined and experimentally detd. (f)H (adsorbed). The ion-exchange const. found for the H-Cs pair on 1.15 g of Utah bentonite was 0.225; for the H-Ca pair on 1.0 g of cation exchange resin IR-100 it was 6.65×10^{-3}

3208. LÓPEZ CASTRO, TOMÁS. **Identification of a Portugese montmorillonite.** *Rep. Port., Ministerio econ., Dir.-geral minas e serv. geol., Estud., notas e trabal., Serv. fomento mineiro* **6**, 132-44 (1950) (English summary).—*C.A.* **46**, 6044*c*.

Clay from Gueral, Barcelos, was shown by chem. analysis, dehydration data, and base exchange to be slightly impure montmorillonite.

3209. MANEGOLD, I. E. **Spontaneous and prepared suspensions. I. II.** *Kolloid-Z.* **118**, 11-26; 93-100 (1950).—*C.A.* **45**, 1406*d*.

Spontaneous or free suspensions occurred when there was no difference in d. of dispersed particles and dispersing medium, whether gaseous or liquid. In thixotropic gels electrostatic repulsion was a factor and became greater than the force of gravity. Thixotropy was discussed with particular reference to bentonite.

3210. MCLEAN, E. O. **Reciprocal effects of magnesium and potassium as shown by their cationic activities in four clays.** *Soil Sci. Soc. Am., Proc.* **14**, 89-93 (1949) (Pub. 1950).—*C.A.* **45**, 1711*e*.

The clay systems were prepd. from electrodialyzed montmorillonite, beidellite, halloysite, and grundite-illite suspensions. The presence of Mg in the system was accompanied by an increase in the activity and the fraction active of the K when compared to K-H systems. The montmorillonite displayed a greater fraction active of the K present as the latter was displaced by more Mg than the other clays. The other clays showed a decreased fraction active as lower satns. with K were encountered. Very small satns. with K caused the activity of Mg to drop to very low values in the montmorillonite.

3211. MCLEAN, E. O. **Interrelations of potassium, sodium, and calcium as shown by their activiities in a beidellite clay.** *Soil Sci. Soc. Am., Proc.* **15**, 102-6 (1950) (Pub. 1951).—*C.A.* **46**, 206*c*.

Increasing the base satn. of beidellite clay increased the cationic activities so that the active fraction of the total present was increased. Na exerted striking effects upon K and Ca. Na had a greater activity than K at all satn. levels except the lowest, which means that Na has on an av. a slightly lower mean free bonding energy than K. When identical equivs. of Na and K were added to the clay suspension, both where their totals equaled 100% base satn. and below, the Na activity was from 4 to 8 times that of K.

3212. MENZEL, R. G. AND JACKSON, M. L. **Mechanism of sorption of hydroxy cupric ion by clays.** *Soil Sci. Soc. Am., Proc.* **15**, 122-4 (1950) (Pub. 1951).—*C.A.* **46**, 206*e*.

Cupric solns. equilibrated with K clays often showed (a) increase in H-ion concn. and (b) sorption of more meqs. of Cu by the clay than the no. of meqs. of K released. Hydroxy cupric ion constituted at least 50% of the Cu sorbed by kaolinite or montmorillonite from cupric solns. only 1% hydrolyzed. Hydroxy cupric ion sorption was increased by increasing cupric ion concn. or increasing the pH of the cupric soln.

3213. MERRILL, REYNOLD C. AND SPENCER, ROBERT W. **Gelation of sodium silicate—effect of sulfuric acid, hydrochloric acid, ammonium sulfate, and sodium aluminate.** *J. Phys. & Colloid Chem.* **54**, 806-12 (1950).—*C.A.* **44**, 8739*d*.

The times required for mixts. of a 3:3 ratio sodium silicate with H_2SO_4 and HCl, $(NH_4)_2SO_4$, and Na aluminates to form gels at various concns. and ratios of gelling agent to silicate were given. Different mechanisms were involved in gelation by acids, NH_4 salts and Na aluminate.

3214. M'EWEN, MARJORIE B. AND MOULD, D. L. **Gelation of montmorillonite.** *Nature* **166**, 437-8 (1950).—*C.A.* **45**, 2288*i*.

The combination of optical and elastic studies on sols of Wyoming bentonite contg. particle sizes 15-20 mμ showed that the gelation was due to the formation of a fibrillar network in which the plates were aggregated end to end into the form of flat, ribbon-like filaments. The effect of the addn. of uni- and bivalent electrolytes on the rigidity made it possible to discriminate between the random-mesh and the elec. theories that have been proposed to explain the gelation of a lyophobic sol.

3215. MOOKERJEE, SHANKARANANDA. **Ionic antagonism in cation-exchange reactions. I.** *Science and Culture* **15**, 361-2 (1950).—*C.A.* **45**, 4112*h*.

Various cations, both as individuals and as mixts., were added to montmorillonite satd. with a different cation, and the amts. entering the clay by exchange estd. The observed total exchange was found in many cases to be less (antagonism) or greater (superadditivity) than the exchange calcd. by additivity.

3216. MUKHERJEE, S. K. AND GHOSH, S. **Cation exchange with the colloidal clay salts of silver.** *J. Phys. & Colloid Chem.* **54**, 1110-21 (1950).—*C.A.* **45**, 1406*f*.

Two Ag clays, a bentonite and a kaolinite, were prepd. and their properties studied in the presence of KNO_3, $Ba(NO_3)_2$, and $Th(NO_3)_4$. The Ag^+ activity was measured with the Ag-AgCl electrode. The Ag colloids were stable; the Ag bentonite was 9% dissocd. throughout 70 days and the Ag kaolinite was initially 42.6% dissocd. to a value of about $\frac{1}{3}$ this value in 47 days. Equil. values were obtained only after 5-7 days of reaction. Results indicated that exchange probably took place discontinously and at stages that were characterized by different equil. consts.

3217. Olphen, H. van. **Stabilization of montmorillonite sols by chemical treatment. I. Properties of sodium and calcium montmorillonite sols. II. Effect of polymetaphosphates, sodium metasilicate, oxalate, citrate, and orthophosphate on sodium and calcium montmorillonite sols.** *Rec. trav. chim.* **69**, 1308-12 (1950), *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* **3**, 63-5 (1950).—*C.A.* **45**, 2745*e,f*.

From ultramicroscopic and relative-viscosity data, the micelles were found to be minute flat crystal plates with an av. thickness of about 5 crystal lattice layers and an av. diam.-thickness ratio of a few hundred. This was verified by electron-microscope and x-ray studies. The following factors contributed to stabilization by polymetaphosphates (Calgon), Na metasilicate, and Na oxalate: (a) a charging effect due to adsorption of the anions to the edges of the micelles, (b) a decrease in the Na ion activity in the mixt. of stabilizer and flocculating salt, and (c) an inactivation of strongly flocculating Ca ions by complex formation or pptn.

3218. Shukla, G. K. and Ghosh, G. **Relation between viscosity and gelation of an iron silicate sol.** *J. Indian Chem. Soc.* **27**, 323-30 (1950).—*C.A.* **45**, 1843*e*.

The viscosity and structural flow of a ferric silicate sol. prepd. from $FeCl_3$ and Na silicate solns. increased with increasing purification by dialysis. With increased dialyzing time the Cl content decreased to a small const. value, the Fe content continuously decreased and the SiO_2 content remained nearly const.

3219. Terem, Haldun N. **The system aluminum oxide-water.** *Rev. faculté sci. univ. Istanbul* **15A**, 343-62 (1950) (in French).—*C.A.* **45**, 6898*i*.

The hydration of Al_2O_3 obtained by pptn. with NH_4OH from an aq. soln. of an Al salt depends upon the salt used. The samples prepd. from $Al_2(SO_4)_3$ contained no definite hydrate, any water present apparently being adsorbed. The chloride produced the dihydrate, the nitrate both the di- and monohydrate. Hydrates were identified by inspection of the temp.-water content curves. As the pH of pptn. increased, the size of the micelles of colloidal Al_2O_3 decreased.

3220. Twyurupa, I. G. **Desorption of cations from soils and clays.** *Trudy Pochvennogo Inst. im. V. V. Dokuchaeva Akad. Nauk S.S.S.R.* **31**, 5-72 (1950).—*C.A.* **47**, 240*g*.

The desorption of exchangeable cations, especially Ca and Mg, diminished with the narrowing of the ratio between the soln. (with a constant concn. of cations) and sorbent, (different sources of kaolinite, and montmorillonite). A sharp decline in desorption took place when the ratio dropped below 5:1. Replacement of bivalent cations by a univalent cation decreased sharply with diln., i.e. a constant quantity of cations but of variable concn. The removal of cations from the lower horizons of the soil profile was much faster than from the upper layers contg. more org. matter. Slightly decompd. org. matter of a young meadow on a chernozem-like soil had no influence on the desorption of exchangeable Ca.

3221. Berestneva, Z. Ya.; Koretskaya, T. A., and Kargin, V. A. **The mechanism of formation of colloidal particles of aluminum hydroxide.** *Kolloid. Zhur.* **13**, 323-6 (1951).—*C.A.* **46**, 2375*f*.

$Al(OH)_3$ sols were prepd. by mixing of $AlCl_3$ and NH_3 solns. and subsequent dialysis. Fresh sols contained spheres (visible in an electron microscope) showing no crystallinity (electron-diffraction patterns). A few days later the sol contained honeycomb structures. Some weeks later, microcrystals of hydrargillite were identified.

3222. Donges, E. **Sodium thiohydroxyferrate gel.** *Z. anorg. u. allgem. Chem.* **267**, 131-6 (1951).—*C.A.* **46**, 5402*i*.

A dark-green, rigid, stable gel corresponding to $Na(S_2Fe^{II}OH.xH_2O)$ was formed at room temp. when dil. aq. $FeSO_4$ and excess dil. aq. Na_2S_2, in concn. ranges shown, were mixed. The pH range for stable gel formation was 10.5-11.5.

3223. Edel'man, L. I. and Rebinder, P. A. **Structure formation and elastic-plastic properties of aluminum hydroxide gels.** *Kolloid. Zhur.* **13**, 142-50 (1951).—*C.A.* **45**, 6008*f*.

The starting $Al(OH)_3$ sols were prepd. by hot hydrolysis of Al diacetate and aging for 3 months or 3 yrs or by peptizing pptd. $Al(OH)_3$ with HCl and dialysis. The 0.5% sols became thixotropic on addn. of 0.25-0.6 mole NaCl, 0.003-0.02 mole Na_2SO_4, or 0.002-0.003 mole Na_2HPO_4/liter. The mech. behavior of the gels between two concentric cylinders of which one, on a torsion wire, was turned from the equil. position, could be described by means of 5 independent parameters. The increase of the gel concn. from 0.2% to 1% increased all these parameter about 20-50 fold.

3224. Ganguly, A. K. **Base-exchange capacity of silica and silicate minerals.** *J. Phys. & Colloid Chem.* **55**, 1417-28 (1951).—*C.A.* **46**, 2875*b*.

The base-exchange capacity of the H-ion systems of quartz, mica, silica gel, kaolinite, montmorillonite, and their sedimented clay fractions (less than 2 μ) was detd. by reacting with an equal vol. of satd. KCl overnight with occasional shaking and titrating with 0.05 N KOH. The exchange spots on the lattice surface were not of equal value, and there were definite levels of energy of interaction. The H ion of OH groups bonded to Si, Al, and Mg showed decreasing acid function in the order mentioned.

3225. Ganguly, A. K. and Mukherjee, S. K. **The cation-exchange behavior of heteroionic and homoionic clays of silicate minerals.** *J. Phys. & Colloid Chem.* **55**, 1429-46 (1951).—*C.A.* **46**, 2875*d*.

Colloidal salts were prepd. by the addn. of the desired base to the H-clay fractions of bentonite, kaolinite, illite, and mica. Symmetry values for Na, K, NH_4, Ca, and Ba colloidal salts were detd. on exchange with chlorides of Na, K, NH_4, Ba, Ca, and Mg. The symmetry values against all cations increased with diminishing pH. If the values were corrected for H ions, the lyotrope effect persisted to pH 3.0. Exchange isotherms over a range of

0.25 to 4 times the symmetry concn. were characterized by well-defined inflections.

3226. GLAESER, RACHEL. **Determination of the base-exchange capacity in montmorillonite.** *Mem. services chim. état* **36**, No. 1, 65-7 (1951).—*C.A.* **46**, 10502*i*.

With NaOH or LiOH, a large excess of base must be added to overcome the effects of the alk. hydrolysis of the montmorillonite.

3227. GRASSHOF, H. **The adsorption of inorganic ions on alkali-free aluminum oxide.** *Angew. Chem.* **63**, 96-7 (1951).—*C.A.* **45**, 3682*e*.

Data were reported which showed that there was no difference in the behavior of alkali-free and alkali-contg. Al_2O_3 towards inorg. ions.

3228. MACKENZIE, ROBERT C. **A micromethod for determination of cation-exchange capacity of clay.** *J. Colloid Sci.* **6**, 219-22 (1951).—*C.A.* **45**, 9822*f*.

The NH_4OAc method for detg. the cation-exchange capacity of clay was modified to permit detns. on 10-50 mg samples. Results agreed within a few percent with those obtained by the usual macromethod.

3229. MALQUORI, ALBERTO. **Stability of the adsorbent mineral complex of the soil.** *Chimica e industria* **33**, 15-17 (1951).—*C.A.* **45**, 7283*d*.

Hydrous silicates of the 2:1 lattice type were less stable than those of the 1:1 type. The products of degradation or regeneration coating the particles detd. much of the colloidal behavior of clay. The inorg. adsorbent complex of a healthy mature soil was in dynamic equil., and when satd. with Ca its base-exchange capacity was const.

3230. MUKHERJEE, S. K. AND RAO, VENUGOPAL. **Turbidity of aqueous suspensions of bentonites in relation to cation exchange.** *Indian Soc. Soil Sci. Bull.* No. **6A**, 115-20 (1951).—*C.A.* **47**, 6078*d*.

Suspensions of fixed colloid content of the various homoionic bentonite salts had turbidities which varied irregularly for several days, but finally attained steady values which followed the lyotropic series: turbidity being high for strong absorption and low for weak. For varied concns. in the Ba/NH_4-system, high turbidities correlated with strong Ba adsorption; i.e., at a given concn. a Ba-clay with NH_4Cl gave higher turbidity than an NH_4-clay with $BaCl_2$.

3231. OTSUBO, YOSHIO. **Decomposition mechanism of montmorillonite by acid.** *J. Chem. Soc. Japan,* Pure Chem. Sect. **72**, 573-7 (1951).—*C.A.* **46**, 3465*c*.

It was postulated that the treated clay was made up of a complex mixt. of montmorillonite and special silicic acid which was formed by the partial decompn. of clay particles. Two general types of structural formulas of acid- and acid-alkali-treated clays were compared with each other.

3232. PIRET, EDGAR L.; EBEL, R. A; KIANG, C. T., AND ARMSTRONG, W. P. **Diffusion rates in extraction of porous solids. I. Single-phase extractions.** *Chem. Eng. Progress* **47**, 405-14 (1951).—*C.A.* **45**, 8323*b*.

Aq. solns. of KCl, NaCl, K_2CrO_4, $CuSO_4$, and AcOH were extd. from three types of carrier solids of increasing complexity: single capillaries, tubes contg. beds of small glass beads and porous alumina spheres. The transfer mechanism was verified as diffusional. Equations were derived for the extn. of a single-phase solute from spheres in the case of batchwise, countercurrent, and parallel operation. Validity of the equation for batchwise operation was verified by extns. from porous Al_2O_3 spheres under several conditions of concn., solvent vol, and temp.

3233. SAMSON, H. R. **A note of the fluorescence of Wyoming bentonite.** *Am. Mineralogist* **36**, 160-61 (1951).—*C.A.* **47**, 6831*f*.

Fluorescence of clays moistened with a soln. of Zn uranylacetate was due to Na Zn uranylacetate, a strongly fluorescent salt, pptd. by the exchangeable Na^+ of the clay mineral. Naturally occurring montmorillonites fluoresced more or less intensely, depending on the quantity of Na^+ present. A sample of Wyoming bentonite leached with $CaCl_2$ soln. to remove all cations other than Ca^{2+} was nonfluorescent.

3234. SCHUYLENBORGH, J. VAN. **The electrokinetic behavior of freshly prepared γ-AlOOH, α- and γ-Al(OH)$_3$.** *Rec. trav. chim.* **70**, 985-8 (1951) (in English).—*C.A.* **46**, 6900*a*.

Isoelec. pH values, x-ray diffraction patterns, dehydration temps. (by differential thermal analysis), and phosphate adsorption values were reported for 3 Al hydroxides prepd. under various conditions. More complete crystn. of the Al and Fe hydroxides was assocd. with lower values for the isoelec. pH and the phosphate adsorption.

3235. SLABAUGH, W. H. AND CULBERTSON, J. L. **The effect of certain reagents on the properties of bentonite colloids. I. Inorganic salts.** *J. Phys. & Colloid Chem.* **55**, 744-57 (1951).—*C.A.* **45**, 6814*h*.

When various salts were added to H bentonite the viscosity of the system showed a sharp min. The addn. of electrolytes produced partial neutralization of the adsorbed diffuse layer, base-exchange equil. between the electrolyte and the H bentonite, and modification of the forces which det. the structure of the colloid.

3236. SPENCER, R. W.; MIDDLETON, A. B., AND MERRILL, R. C. **Gelation times of various silica sols; effect of low temperatures.** *Ind. Eng. Chem.* **43**, 1129-32 (1951).—*C.A.* **45**, 6458*i*.

Gelation times at 8°C and 25°C were detd. for mixts. of dil. H_2SO_4 or $(NH_4)_2SO_4$ with a dil. $Na_2O.3.3SiO_2$ contg. 1-6% silica. For each silica concn. the gel times of the solns. with the higher sulfate-silicate ratios are longer at 8°C than at

25°C, whereas the solns. of lower sulfate-silicate content required longer times to gel. At both temps., the gel time was more sensitive to slight changes in H_2SO_4 concn.

3237. Tewari, Swarup Narain and Ghosh, Satyeshwar **Hydrated aluminum oxide. I. Precipitation of the hydrated oxide by alkali solutions under various conditions.** *Kolloid-Z.* **124**, 69-72 (1951).—*C.A.* **46**, 2945*b*.

$AlCl_3$ was treated with NaOH, alone and in the presence of NaCl and Na_2SO_4, and with NH_4OH to obtain complete pptn. of the $Al(OH)_3$, and the amt. of alkali required for this pptn. was detd. The alkali demand approached the theoretical equiv. as the starting concn. of $AlCl_3$ was reduced. Larger than necessary amts. of alkali favored adsorption of the cation (OH^-, Cl^-). The adsorption capacity of the hydrous oxide was lowered as the temp. of pptn. was raised.

3238. Tukh, I. I.; Tugusheva, K. I., and Karisma, N. E. **Beneficiation of refractory clay by electroösmosis.** *Steklo i Keram.* **8**, No. 8, 10-12 (1951).—*C.A.* **46**, 3230*h*.

Electroösmosis of 15 kg of clay for 6 hrs yielded 19.5 kg of clay having 42.4% moisture. Further osmosis for 2 hrs did not yield addnl. results. The moisture content could be reduced to 40% by increasing c.d. Best results were obtained without addn. of electrolyte.

3239. Vecchi, G. **Swelling of bentonites. II. Effects of grinding.** *Chimica e industria* (Milan) **33**, 705-8 (1951).—*C.A.* **46**, 3721*h*.

Bentonite from Puglia was suspended in distd. H_2O in the wt ratio 1:3, ground in 3-liter jars with flint balls, and rotated at 3000 rotations/hour. The swelling was measured by the vol. increase of suspensions in 500-ml cylinders after 48 hrs. Const. temp. was important. Since the natural bentonite studied contained about 10% CaO, the soln. of Ca^{2+} during grinding brought about the evident effects on swelling, namely a partial flocculation when the Ca^{2+} concn. reached a critical value. When the Ca^{2+} was leached away by dil. HCl (1:12) the sedimentation time increased so greatly that the swelling could not be measured.

3240. Venturello, Giovanni and Burdese, Aurelio. **Absorption spectra of ions adsorbed on pure activated alumina.** *Ann. Chim. (Rome)* **41**, 148-54 (1951).—*C.A.* **45**, 9367*c*.

Pure Al_2O_3 was prepd. from Al-Hg. The absence of a chem. interaction between adsorbed ion and Al_2O_3 to give metal-O bonds was shown. Al_2O_3 of "chromatographic grade" behaved differently.

3241. Venturello, Giovanni and Burdese, Aurelio. **Reversibility of the adsorption ions by activated alumina.** *Ann. chim.* **41**, 155-62 (1951).—*C.A.* **45**, 9334*f*.

The adsorption of Cu^{++} by pure Al_2O_3 was only partly reversible; the amt. irreversibly bound increased with the length of time allowed for adsorption, and was larger when the adsorbent was activated at a higher temp. The change from reversible to irreversible adsorption was thought to involve a gradual loss of coördinated H_2O mols. on the part of the adsorbed ion, resulting in stronger interaction with the adsorbent.

3242. Yeager, E.; Bugosh, J., and Hovorka, F. **The measurement of ultrasonic vibration potentials (Debye effect) with pulse techniques.** *Proc. Phys. Soc.* (London) **64B**, 83-4 (1951).—*C.A.* **46**, 8466*f*.

Measurements were reported for solns. of KCl and with colloidal suspensions of silica.

3243. Beyer, Gerhard H.; Jacobs, Alfred, and Masteller, Richard D. **Production of a hafnium concentrate by adsorption.** *J. Am. Chem. Soc.* **74**, 825-7 (1952).—*C.A.* **46**, 5398*b*.

Hf was concd. from a naturally occurring feed material contg. 2 wt % HfO_2 (based on Hf and Zr content) to an approx. 90 wt % HfO_2 in 2 cycles. Adsorption and differential stripping with mineral acids was used at room temp. Each cycle consisted of the absorption of $HfCl_4$ and $ZrCl_4$ in MeOH soln. on activated silica gel, subsequent stripping of the gel using a MeOH-HCl strip soln., and finally a H_2SO_4 strip soln. Approx. 70% of the original Hf adsorbed could be recovered as high-Hf concentrate.

3244. Burriel, F.; Ramírez-Muñoz, J., and Fernández-Caldas, E. **Inhibiting effect of aluminum on the masking of barium by vanadate ions during analysis.** *Anal. Chim. Acta* **6**, 197-207 (1952) (in English).—*C.A.* **46**, 7462*a*.

The adsorbing power of $Al(OH)_3$ for vanadate ions was used to avoid the masking of Ba^{2+} resulting from the presence of vanadate ions in test material of qual. analysis, where the latter hindered the detection of Ba at the corresponding point during the systematic analysis. Various exptl. conditions were studied at concns. corresponding to those of the macro-, semimicro-, and microanalytical type.

3245. Delgado Rodriguez, Miguel. **The characteristics of a bentonite from Spanish Morocco.** *Anales edafol. y fisiol. vegetal* (Madrid) **11**, 141-50 (1952).—*C.A.* **47**, 4808*i*.

A salmon-colored, friable bentonite from Villa Sanjurjo, Spanish Morocco, contg. thin plates of biotite had the compn.: SiO_2 50.21, Al_2O_3 25.23, Fe_2O_3 2.27, MgO 1.84, CaO 1.53, K_2O 3.03, TiO_2 0.29, H_2O 15.40. Its H_2O imbibition (60 min.) was 81.7%, its cation-exchange capacity (meq.) 79%.

3246. Duval, J. E. and Kurbatov, M. H. **The adsorption of cobalt and barium ions by hydrous ferric oxide at equilibrium.** *J. Phys. Chem.* **56**, 982-4 (1952).—*C.A.* **47**, 2012*i*.

A study of the adsorption of Ba and Co ions in quantities less than 10^{-8} g per 30 cc. soln. showed that, under comparable conditions, the ratio of the amt. of Co ion to the amt. of Ba ion adsorbed was greater than 1 and sometimes as large as 4. At pH values higher than 6.5 the log of the amt. of the radioactive Co and Ba adsorbed was linear with respect to pH.

3247. Gutierrez Rios, Enrique and Lopez-Gonzalez, Juan de D. **Action of strong acids on the silicates of the isomorphous montmorillonite-beidellite series. I. Characterization, constitution, and modifications in chemical composition.** *Anales edafol. y fisiol. vegetal* (Madrid) **11**, 225-54 (1952).—*C.A.* **47**, 2092*f*.

Two samples of minerals of the montmorillonite group from Spanish Morocco were studied. Solns.

of HCl and H_2SO_4 destroyed to some extent the cryst. structure of the silicates. The products formed from the acid treatment retained certain characteristics of the original material, as evidenced by the dehydration curves. The extent of this similarity depended on the concn. and nature of the acid used. As the crystn. structure was destroyed, the Si which had formerly been combined with Al, Fe, and Mg was deposited on the surface of the crystal in "open" structure and was easily sol. in a boiling 5% Na_2CO_3 soln.

3248. GUTIÉRREZ RIOS, ENRIQUE AND LOPEZ-GONZÁLEZ, JUAN DE D. **Action of strong acids on the silicates of the isomorphic montmorillonite-beidellite series. II. Modification of the superficial physicochemical properties.** *Anales edafol. y fisiol. vegetal* (Madrid) **II**, 527-38 (1952).—*C.A.* 47, 4254*e*.

Detns. of Ba^{++} cation exchange and hydration capacties and methylene blue adsorption were made in aq. media on 2 Spanish bentonites previously treated with H_2SO_4 and HCl solns. in the concn. range 5-20%. In general, these values dropped as percentage of free SiO_2 increased, i.e. as a function of acid strength employed. One bentonite showed a sharp rise in the range 5-10% H_2SO_4, possibly because of an increase of neg. charges on the surface of the crystal layers after removal of cations from the silicate without sensible modification of the crystal structure.

3249. HÖPPLER, F. **Measurement of the rheologic and thixotropic behavior of bentonite suspensions.** *Kolloid-Z.* **128**, 87-92 (1952).—*C.A.* 47, 3084*f*.

Hydrogels of a Wyoming montmorillonite and a synthetic bentonite were observed in a *rheoviscometer*. In this instrument a 2-cm sphere on a rod was passed downward through a gel or soln. in tubes of graduated sizes under different loads. The distance of travel of the sphere was shown on a dial, and time was measured with a stop watch. Flow curves for 4-day-old gels were quite different for the 2 kinds of bentonites.

3250. ILER, R. K. **Polymerization of silicic acid; catalytic effect of fluoride.** *J. Phys. Chem.* 56, 680-3 (1952).—*C.A.* 46, 8943*d*.

The observed max. stability of silicic acid in aq. soln. at about pH 1.5 was due to the catalytic effect on polymerization and gelation of the hydroxyl ion above this pH and of the fluoride below it. The catalytic action of fluoride was inhibited by traces of Al, Be, Th, and Fe which formed complex fluorides.

3251. KEYSER, WILLY L. DE AND AMELICKX, SEVERIN. **Polytypes of argillaceous and micaceous minerals.** *Compt. rend.* **234**, 446-8 (1952).—*C.A.* 46, 8454*g*.

A study of the mechanisms of crystal growth by the successive building up of unit structures and the effects of the O—OH bonds between layers of atoms on the cryst. symmetry.

3252. KOBOZEV, N. I.; EVDOKIMOV, V. B.; ZUBOVICH, I. A., AND MAL'TSEV, A. N. **Magnetochemistry of active centers. I. Magnetic and catalytic properties of dilute layers.** *Zhur. Fiz. Khim.* 26, 1349-73 (1952).—*C.A.* 47, 5745*b*.

The susceptibility χ_1 of the catalytically active layer was found. With $CoCl_2.6H_2O$ adsorbed on SiO_2gel, $\bar{\chi}_a$ was practically equal to the susceptibility (χ_s) of the pure salt $= 47 \times 10^{-6}$, at surface coverage (α) down to about 0.01, but then increased rapidly as α decreased. With $Ni(NO_3)_2.6H_2O$ on SiO_2gel, χ_a coincided with $\bar{\chi}_s$ only at high $\alpha \sim 0.14$; at $\alpha = 0.01$, $f = \chi_a/\chi_s = 2.3$ the increase of χ_a with the diln, was particularly marked with $Ni(NO_3)_2.6H_2O$ on charcoal. With Pt on Al_2O_3 gel, f increased from 1300 to 36,000 with α decreasing from 0.006 to 0.0001. The catalytic activity (a) of Ag on $BaSO_4$ or $BaCO_3$ with respect to decompn. of H_2O_2 showed paramagnetism. For dil. layers of Fe^{+++} on charcoal (up to 0.1% Fe), both χ_1 and a pass through 2 maxima. There was a definite relation between the catalytic activity and the paramagnetism of the adsorbed active substance.

3253. MATSUKURA, SHÔICHI AND NAIKI, TOSHIO. **Physicochemical properties of clay. I. The sedimentation volume of bentonite suspension.** *Oyô Butsuri* (J. Applied Phys.) **21**, 204-5 (1952).—*C.A.* **46**, 11613*c*.

The sedimentation vol. V of dry bentonite in H_2O was measured as a function of time t at various concn. c. An empirical formula, $V = a + b \log t$, was found, a and b being const. dependent on the sample and on c. As c was increased, the suspension changed abruptly from sol to gel state at a certain c.

3254. MIESSEROV, K. G. **Exchange adsorption of aluminum on silica gel.** *Doklady Akad. Nauk S.S.S.R.* **87**, 809-12 (1952).—*C.A.* 47, 4165*i*.

Samples of the same silica gel were treated 24 hrs with $Al(NO_3)_3$ solns. of a stated conc., washed, dried, and heated 3 hrs at 450-500 C. Treatment with $Al(NO_3)_3$ resulted in adsorption of Al and increase of exchange acidity with hydrolytic acidity remaining practically unchanged. These results were interpreted on the assumption of 2 terminal HO groups at each Si atom on the surface of silica gel. The no. of HO groups, calcd. by the surface area of the silica gel, was 1100 milliequiv./100 g, whereas the max. amt. of active HO groups detd. by the expts. was not over 29. The activity of a silica gel was detd. by the no. of pairs of HO groups. The adsorption of Al consisted not in direct replacement of H ions by Al ions but rather in a reaction between the Ho groups and basic forms of Al in the soln. with elimination of H_2O.

3255. MITRA, R. P. AND MATHUR, H. B. **Titration curves of the clay minerals attapulgite and nontronite.** *J. Phys. Chem.* **56**, 633-7 (1952).—*C.A.* 46, 8459*h*.

Hydrogen attapulgite and hydrogen nontronite showed three inflections in their potentiometric and conductometric titration curves, indicating three stages of neutralization with the base. All H ions on the surface, including those dissocd. from the available OH groups were replaced by Ba ions by treating hydrogen attapulgite with a N $BaCl_2$ soln. of pH 9.0.

3256. OHTA, NOBUTO. **Catalytic hydrolysis of chlorobenzene to phenol in the vapor phase. IV. Method of adding the copper component to the silica gel catalyst.** *Repts. Govt. Chem. Ind. Research Inst. Tokyo* 47, 51-4 (1952).—*C.A.* 47, 3100*h*.

The rapid deterioration of silica gel-$CuCl_2$ catalyst was found to be due to the effect of Cu^{++}. A more stable and almost equally active catalyst was obtained by mixing silica gel dried at 110 °C with a wet gel of $Cu(OH)_2$ (nonelectrolyte) aged (necessary) suitably (possible to add as much as 20% as CuO).

3257. ONO, SOZABURO AND WATANABE, TAKEHIKO. **Colloidal properties of bentonite. III. Influence of electrolytes on the coagulation states of bentonite.** *J. Chem. Soc. Japan*, Pure Chem. Sect. **73**, 844-7 (1952).—*C.A.* **47**, 6106*f*.

The electrolytic coagulation of a suspension of bentonite from Yamagata Prefecture was observed. In one case coagulation took place through the rapid dehydrating acting of the cation; there was a linear relation between the hydrated ionic radius of the cation and the min. concn. of the cation which caused coagulation.

3258. PARKS, W. L. AND WHITE, J. L. **Boron retention by clay and humus systems saturated with various cations.** *Soil Sci. Soc. Am. Proc.* **16**, 298-300 (1952).—*C.A.* **47**, 242*i*.

Under moist conditions base-satd. kaolinite and bentonite clays retained more B than H-satd. clays, except in the NH_4 bentonite. Drying the clays resulted in more retention in the H-satd. clays than in the basic systems, except for Mg bentonite.

3259. PENDLETON, JOHN D. **Dissociation and diffusion of electrolytes from clays as determined by the Donnan membrane equilibrium.** *Virginia J. Sci.* **3**, 178- 201 (1952).—*C.A.* **47**, 940*i*.

Montmorillonite and Mardin clays were studied and the diffusion and membrane potentials were interpreted in light of the probable components.

3260. PENNER, S. S. **The effect of silica gel on the decomposition of hydrogen peroxide.** *J. Am. Chem. Soc.* **74**, 2754-7 (1952).—*C.A.* **46**, 9399*g*.

A study of the thermal decompn. of H_2O_2 in basic silica gels, formed by the addn. of Na silicate to H_2SO_4, showed that the formation of the gel had no effect on the stability of H_2O_2 at room temp. The existence of reaction chains was indicated in the thermal decompns. in the gel by a wall effect and in the photodecompns. by quantum yields that were appreciably greater than one. The 1st-order rate of the decompn. of H_2O_2 and the rate const. for the decompn. in the presence of the Cl-Cl couple were the same in silica sol and gel. Estimates of quantum yields of H_2O_2 decompn. at a band near 3650 A. in silica gel were 6.9 and 10.7; the same order of magnitude as those found in silica sol, 5.0 and 6.5

3261. PLANK, C. J. **Activity of silica-alumina cracking catalysts—a simple pH test.** *Anal. Chem.* **24**, 1304-6 (1952).—*C.A.* **46**, 10821*h*.

The pH of an NH_4OAc soln. was affected by the adsorption of NH_4^+ ions on silica-Al_2O_3 gels and was a quant. measure of the cracking activity as detd. by the CAT-A test. There was very little correlation between surface area and activity with silica-Al_2O_3 catalysts.

3262. RAO, BALABHEEM. **Exchangeable bases in clays in relation to their ceramic properties. I. Clays of Hyderabad.** *Trans. Indian Ceram. Soc.* **11**, 216-19 (1952).—*C.A.* **47**, 5653*h*.

The clay samples were mixed with *N* $NH_4C_2H_3O_2$, shaken, and centrifuged. The sepd. liquid was removed, and the clay was washed with alc. and again centrifuged. Washing was repeated until the filtrate was free from NH_4. Total exchange capacity was detd. by estg. NH_4 in the treated clays. All clays tested were practically nonacid. High water of plasticity and poor casting properties of Kamthana clay were caused by high content of exchangeable Ca^{++} and sol. sulfates.

3263. SCHUYLENBORGH, J. VAN AND VERVELDE, G. J. **Titration curves of dialyzed clay minerals.** *Rec. trav. chim.* **71**, 609-22 (1952) (in English).—*C.A.* **46**, 11015*g*.

Titration expts. were carried out on dil. suspensions of dialyzed samples of kaolinite, illite, and bentonite clays. NaOH and KOH solns. were used as titrants and the H and Na or K ion activities were measured with glass electrodes. The titration curves were analyzed on the basis of a theory describing the clay suspensions as a system of 2 solns., one of which was the clay particle which may be considered an "island" of a soln. of a weak clay acid surrounded by the aq. "external" soln. Theoretical titration curves for the clays were calcd. and found to be in good agreement with the exptl. curves.

3264. SOSINSKII, M. L. **Study of the particle size and shape in bentonite hydrosols by means of dynamic and electric birefringence.** *Kolloid. Zhur.* **14**, 192-6 (1952).—*C.A.* **46**, 8465*a*.

The extinction angle ψ of the streaming birefringence of dil. bentonite suspensions was $>45°$; hence the suspension was polydisperse. Fractions of bentonite obtained by centrifuging for t min. were approx. unidisperse. The coeff. D of rotational diffusion, calcd. from ψ, increased from 0.5 sec^{-1} at $t=3$ to 2.7 sec^{-1} at $t=40$ min.

3265. TEWARI, SWARUP NARAIN AND GHOSH, SATYESHWAR **Hydrated aluminum oxides. II.** *Kolloid-Z.* **127**, 27-30 (1952).—*C.A.* **46**, 8999*a*.

Samples of hydrated Al_2O_3 with different chem. characteristics were prepd. by mixing solns. of $AlCl_3$ and NaOH, using 10% excess alkali, exact equivs., and 10% less than equiv. alkali. OH ion was preferentially adsorbed on the last and H ion on the first. The degree of adsorption of these ions decreased with rising temp. and increasing aging.

3266. TRAMBOUZE, YVES; MOURGUES, LOUIS DE, AND PERRIN, MARCEL. **Acidities of mixed silica-alumina gels.** *Compt. rend.* **234**, 1770-2 (1952).—*C.A.* **46**, 8463*f*.

By measuring the protonic acidity and the Lewis acidity of several mixed silica-alumina gels, it was shown that the acidity was max. for a gel of about 25% Al_2O_3 corresponding to the formula $Na_2O.Al_2O_3.6SiO_2$. The ratio of Na/Al in the gel was about 1 for low values of Al_2O_3 and decreased almost linearly with increasing Al_2O_3.

3267. WHITNEY, ROBERT S. AND PEECH, MICHAEL. **Ion activities in sodium-clay suspensions.** *Soil Sci. Soc. Am., Proc.* **16**, 117-22 (1952).—*C.A.* 46, 8302*h*.

A study was made of dissocn. and hydrolysis of Na-clay as a function of the degree of Na^+ satn. of the clay and the concn. of NaCl in the clay suspension. The activities of Na^+, H^+, HCO_3^-, and Cl^- in the clay suspension were measured by the Donnan equil. method. From the Donnan distribution of ions between the 2 phases, it was possible to apportion the observed Na^+ activity in the clay suspension to Na^+ dissocd. from the clay and to diffusible Na salts present in the clay suspension.

3268. BARBIER, GEORGES AND CHABANNES, JEAN. **The adsorption of borates by clay.** *Compt. rend.* **236**, 966-7 (1953).—*C.A.* 47, 6077*b*.

Adsorption of borates was studied in order to foresee the effect of periodic addns. of borate to cultivated soils. The quantity adsorbed passed through a min. at about pH 5.2; it increased strongly with increasing pH. The adsorption was reversible, but on drying the clay soil a part of the adsorbed borate was fixed.

3269. COOK, MELVIN A.; CUTLER, IVAN B.; HILL, GEO. RICHARD; WADSWORTH, MILTON E., AND OBLAD, ALEX G. **A mechanism of cation- and anion-exchange capacity.** *J. Phys. Chem.* **57**, 1-6 (1953).—*C.A.* 47, 4688*f*.

The cation exchange capacity of dialyzed clay minerals was attributed to an acid-base ion-pair adsorption process in which one ion of the ion-pair was adsorbed on the solid or colloidal particle in the compact double layer, while the other remained hydrated and occupied the diffuse double layer. In cation exchange the compact double layer was the OH ion; in anion exchange of polyamine resins the H ion was the compact double layer.

3270. CUTLER, IVAN B. AND COOK, MELVIN A. **A theory of cation-exchange reactions with clay minerals.** *J. Am. Ceram. Soc.* **36**, 165-70 (1953).—*C.A.* 47, 6624*h*.

The clay minerals kaolinite, montmorillonite, beidellite, and illite, and the bases NaOH KOH, and NH_4OH were used. The results showed that at least 3 equil. reactions were involved in base exchange. They were equil. between active and inactive sites, free and adsorbed H ions, and free and adsorbed cations other than H ions. Free energy computations supported the accuracy of the derived equil. consts. The weak-acid properties of the clay minerals were due to the instability of the active site assocd. with a H ion, and (or) forces other than ionic that bind the H to the active site.

3271. DMITRENKO, O. I. AND RYABININA, A. A. **Effect of accompanying electrolytes on the molecular adsorption of silver salts by mixed gels of silicic acid and sesquioxides of iron and aluminum.** *Kolloid. Zhur.* **15**, 29-35 (1953).—*C.A.* 47, 4685*g*.

More of Ag^+ was adsorbed from an acetate buffer (pH 4.63) than from a $AgNO_3$ soln. at the same pH. This was due to formation of AgOAc which was less sol. and, hence, better adsorbed than $AgNO_3$. The adsorption from a soln. of AgOAc only was even greater because in the reaction between $AgNO_3$ and acetate buffer HNO_3 formed. Adsorption of Ag_2SO_4 was greater still. This inverse relation between adsorption and soly. showed that mols. rather than ions were adsorbed. $Fe_2O_3.2SiO_2$ and $Al_2O_3.2SiO_2$ were used as adsorbents.

3272. GAINES, GEORGE L. JR. AND THOMAS, HENRY C. **Adsorption studies on clay minerals. II. A formulation of the thermodynamics of exchange adsorption.** *J. Chem. Phys.* **21**, 714-18 (1953).—*C.A.* 47, 6735*a*.

Formulas were given summarizing the methods for the computation of the requisite activity coeffs. The effects of the solvent, which was considered as an independently variable component, were taken into account.

3273. GINELL, W. S. AND SIMON, G. P. **Preparation of tagged spherical clay particles.** *Nucleonics* **11**, No. 3, 49-51 (1953).—*C.A.* 47, 6268*f*.

The naturally occurring exchangeable cations in montmorillonite clay could be replaced by fission-product cations. When the mineral structure was altered by heating at 900-1000 °C, exchange properties were lost and radioactive ions were rigidly bound within the mineral. Spherical beads from 0.5 to 20 μ in diam. could be prepd. by passing the clay, suspended in a stream of O_2, through a gas torch. Inactive cations could be introduced into the clay, the spheroidizing process carried out, and the spheres irradiated in a nuclear reactor to produce spheres tagged with cations other than fission-product cations.

3274. HÉNIN, STÉPHANE AND LE BORGNE, EUGÈNE. **Causes of magnetic properties of certain soils.** *Compt. rend.* **236**, 736-8 (1953).—*C.A.* 47, 5594*h*.

When certain soils were fractionated into sand, mud, and clay it was found that the magnetic susceptibility (x) of the clay was by far the greatest. The Fe compd. causing the susceptibility could be extd. with aq. HCl. The magnetic properties of soils were therefore ascribed to γ-Fe_2O_3 on the clay fraction rather than Fe_3O_4 in the sand.

3275. NEIMARK, I. E. AND SHEINFAIN, R. YU. **The effect of the washing liquid on the formation process of the structure of silica gel.** *Kolloid. Zhur.* **15**, 45-50 (1953).—*C.A.* 47, 4685*f*.

Silica gels were made by adding H_2SO_4 to water glass to pH 3.5, washing, and drying at 200 °C. The porosity was detd. from the apparent sp.gr. and the adsorption of MeOH. It was approx. 0.33 cc/g when distd. H_2O or acidified tap water was used for washing, but exceeded 0.6 cc/g when tap water or a soln. of $Ca(HCO_3)_2$ in distd. H_2O was used.

3276. PLANK, C. J. **The adsorption of ions from buffer solutions by silica, alumina, and silica-alumina gels.** *J. Phys. Chem.* **57**, 284-90 (1953).—*C.A.* 47, 6214*c*.

Silica gel adsorbed NH_4^+ ions from NH_4OAc and $(NH_4)_2HPO_4$ solns. Al_2O_3 gel showed both anion and cation adsorption. SiO_2-Al_2O_3 gel had the properties of a polybasic acid in which the acid sites varied over a wide pK_a range. It adsorbed only NH_4^+ ions from acetate and sulfate solns. With $(NH_4)_2SO_4$ solns. the equil. distribution of NH_4^+ and H^+ between gel and soln. was similar to that shown by a true strong acid exchanger. With both acetate and sulfate solns. the total adsorption capacity of SiO_2-Al_2O_3 gel increased rapidly with increasing ionic strength of the soln.; this showed increased ionization of the weak acid sites on the catalyst. SiO_2-Al_2O_3 gel adsorbed both NH_4 and HPO_4^{--} from $(NH_4)_2HPO_4$ solns.

3277. SCHMALZ, W. **The sorption of phosphoric acid ions on calcium and ammonium bentonite.** *Z. Pflanzenernahr. Dung. Bodenk.* **60**, 181-94 (1953).—*C.A.* **47**, 7143*h*.

Ca-bentonite and NH_4-bentonite were prepd. by repeated treatment of bentonite with 0.1 *N* $Ca(OAc)_2$ and NH_4OAc, resp. Solns. of $(NH_4)_2HPO_4$, KH_2PO_4, and Na_2HPO_4 of concns. 0.1, 0.05, and 0.01 mg P_2O_5/cc were percolated through columns of Ca-bentonite and $Ca(H_2PO_4)_2$, KH_2PO_4, and Na_2HPO_4 solns. of concn. 0.1 mg P_2O_5/cc through NH_4-bentonite. More P_2O_5 was taken up by Ca-bentonite from more concd. solns., but the more dil. solns. were relatively faster exhausted. The exchange of K or Na from Ca was not equiv., owing to the loosely bound Ca, the participation of H_2 (as shown by the difference in pH changes during expts. with KH_2PO_4 and Na_2HPO_4, and expts. with H_3PO_4), and the formation of Ca phosphates. The cation exchange did not affect P_2O_5 sorption.

3278. WILLIAMS, F. J.; NEZNAYKO, M., AND WEINTRITT, D. J. **The effect of exchangeable bases on the colloidal properties of bentonite.** *J. Phys. Chem.* **57**, 6-10 (1953).—*C.A.* **47**, 4688*h*.

General base-exchange processes were detd. for purified clays. In the absence of excess electrolytes the viscosity and filter losses were a function of the exchangeable Na, but the relation was not linear. For systems contg. Na and Ca salts the viscosity and gel strength passed through maxima characteristic of flocculation phenomena corresponding to a Na/Ca ratio of 40/60, though high quantities of total salts may likewise cause flocculation.

II-5. Inorganic Solids With Organic Solutions

3279. DUMAZERT, C. AND MEMMI, A. **Adsorption and elution of small quantities of glucides.** *Trav. membres soc. chim. biol.* **23**, 1094 (1941).—*C.A.* **37**, 54[4].

Some sugars were adsorbed from dilute solutions by a mixt. of $Ca(OH)_2$ and $Cu(OH)_2$. To isolate glucose (0.25 to 0.75 g/liter); dissolve 2 g of cryst. $CuSO_4$ in half of the soln. and suspend 5 g of CaO in the remainder. Mix the 2 portions and shake or stir rapidly for at least 30 min. Filter or centrifuge, and treat the ppt. with 100 cc. of 2 *N* H_2SO_4. Filter off the $CaSO_4$, ppt. the Cu with H_2S, remove the H_2SO_4 with $CaCO_3$ and evaporate *in vacuo*. The recovery was 67-76% of the original glucose.

3280. SUZUKI, KEIZO. **Sedimentation volumes of some inorganic powders in organic liquids.** *J. Chem. Soc. Japan* **62**, 888-95 (1941).—*C.A.* **41**, 5360*g*.

The sedimentation vols. of finely powdered inorg. substances such as ZnO, PbO, Fe_2O_3, Al_2O_3, SiO_2, $PbSO_4$, $BaSO_4$, $PbCO_3$, $CaCO_3$, Na_2CO_3, $PbCl_2$, NaCl, S, C, PbS, ZnS, and $CuFeS_2$, in pure org. liquids such as C_6H_6, $C_6H_5NO_2$, $C_6H_5NH_2$, and $C_5H_{11}OH$, as well as in their satd. aq. solns., were detd. From the results the lyophilic tendency of the substances was discussed.

3281. AKAMATSU, HIDEO. **Adsorption at the solid-liquid interface. I. Adsorption of some fatty acids by glass.** *Bull. Chem. Soc. Japan* **17**, 141-6 (1942).—*C.A.* **41**, 4349*g*.

A method of detg. relatively small amts. of adsorption was devised. To measure the change of concn. of soln. before and after the adsorbing procedure, the d. detn. using the float method was applied. Expts. were described on the adsorption of some fatty acids from toluene by glass powder.

3282. AKAMATSU, HIDEO. **Adsorption at the solid-liquid interface. II. The thickness of the adsorption layer.** *Bull. Chem. Soc. Japan* **17**, 161-5 (1942).—*C.A.* **41**, 4349*h*.

Spherical particles of glass were prepd. The sp areas, microscopically detd., were 1810 cm^2 for one portion of the powder and 4690 cm^2 for another. Benzoic and palmitic acids were adsorbed from benzene solns. The area occupied by one mol. proved to be 25-38 $A.^2$ for benzoic acid and 40-70 $A.^2$ for palmitic acid. The thickness of the adsorption layer was monomol. and, in most cases, the layer was not so closely packed as anticipated for the insol. films on water.

3283. AKAMATSU, HIDEO. **Adsorption at the solid-liquid interface. III. Polar and nonpolar adsorption.** *Bull. Chem. Soc. Japan* **17**, 260-7 (1942).—*C.A.* **41**, 4350*a*.

Carboxylic acids were readily adsorbed at a glass-benzene interface even in low concn. Alcs. were also adsorbed, but were not as easily adsorbed as carboxylic acids, and the adsorption did not take place until the concn. of the soln. increased beyond a certain range. Nitrobenzene, aniline, and $CHCl_3$ were not adsorbed at the glass-benzene interface when the concn. of the soln. was about 0.1 *M*. Crushed glass powder adsorbed benzoic acid ten times as much as did spherical glass powder with the same surface area.

3284. BARTELL, F. E. AND BENNER, FRANK C. **Adsorption at solid-liquid interfaces. Determination of adsorption by adhesion-tension and interfacial-tension measurements on binary organic liquid systems.** *J. Phys. Chem.* **46**, 847-59 (1942).—*C.A.* **37**, 1911[5].

Data were obtained at the solid-liquid interface by measurement of adhesion-tensions against silica for the entire concn. range of the binary org. solns. isooctane-isoamyl alc., and isooctane-cyclohexanol. The values showed that for a given alc., the adsorption was very nearly the same at the silica-isooctane and at the water-isooctane interfaces. The calcd. surface concn. of alc. indicated that the surface layer need not be more than of unimolecular thickness.

3285. HARKINS, WILLIAM D. AND LIVINGSTON, H. K. **Energy relation of the surfaces of solids. II. Spreading pressure as related to the work of adhesion between a solid and a liquid.** *J. Chem. Phys.* **10**, 342-56 (1942).—*C.A.* **36**, 4388^3.

The total energy required to sep. H_2O from solids of the general type of $BaSO_4$, TiO_2 and $ZrSiO_4$ was 600-1000 ergs/cm^2, whereas to sep. C_8H_{18} from these solids required 150-250 ergs/cm^2. The work of adhesion was the sum of 3 terms which might be detd. exptly.: (1) The solid, initially in a vacuum, was immersed in the vapor of the liquid with a decrease of free energy. (2) The free energy of transfer of the solid from the interior of the liquid to the interior of the satd. vapor, without a change in any other interfacial areas than that of the solid represented by S, and that of the solid-liquid interface. (3) The free surface energy of the liquid.

3286. KAMAYACHI, Z.; KAMISEKI, E., AND MITACHI, K. **Improvement on the crystallizing process of Rochelle salt crystal to be used as piezoelectric vibrating elements.** *J. Inst. Elec. Engrs. Japan* **62**, 17 (1942).—*C. A.* **42**, 14*d*.

The crystal could be made to develop artificially in a desired direction by suppressing its development in another direction by using a glass plate. The development was carried out by the temp.-decrease method. The products were almost equal to the ordinary semicrystal with respect to the crystal capacity and the inner state of the crystal by photographic observation.

3287. KARLOVITZ, LÁSZLÓ. **Activated adsorption of indicators on efflorescent crystal surfaces.** *Magyar Chem. Folyoirat* **48**, 115-21 (1942); *Chem. Zentr.* **1943**, **I**, 1360.—*C.A.* **38**, 3567^4.

Indicators (dimethyl yellow, aminoazobenzene, methyl red, alizarin and crystal violet) were adsorbed on efflorescent crystal surfaces (bole, talc, fuller's earth, efflorescent Ca, Al, Zn sulfates, etc.) from solns. in benzene and also in the dry state with production of the acid (red) color. On uneffloresced surfaces adsorption took place with yellow color (e. g., dimethyl yellow on $Al_2(SO_4)_3$, $MgCO_3$, etc.).

3288. LANGER, A. **Exchange of radioactive silver with silver chloride suspensions.** *J. Chem. Phys.* **10**, 321-7 (1942).—*C.A.* **36**, 4411^1.

Ag ions in soln. exchanged constantly with Ag ions in AgCl. The exchange was not limited to the surface of the crystals, but was propagated into the ppt., probably by self-diffusion. The time necessary to obtain a given fraction of complete exchange for a given amt. of ppt. depended mainly on the area of the crystal surface.

3289. MONJI, M. AND SHIMODA, M. **Growing velocity of the Rochelle salt crystal.** *J. Inst. Elec. Engrs. Japan* **62**, 214 (1942).—*C.A.* **42**, 14*c*.

To find the conditions necessary to prep. a complete Rochelle salt crystal, the growing velocity of the crystal was studied with a microscope. The crystal was prepd. by the temp.-decrease method by varying the temp. very slowly. The velocity was not equal in the 3 directions and decreased at the Curie point.

3290. NICHOLSON, DOUGLAS G. **Adsorption of simple and complex cobalt ions on titanium dioxide.** *J. Am. Chem. Soc.* **64**, 2820-2 (1942).—*C.A.* **37**, 814^9.

The data indicated that TiO_2 suspended in water or glacial acetic acid solutions of cobalt acetate adsorbed cobalt ions in a relatively short time. Coordination of cobalt ions with o-phenanthroline materially reduced this adsorption tendency. o-Phenanthroline formed a coordination compound with cobalt acetate in glacial acetic acid.

3291. SAKAGUCHI, TAKEICHI. **Adsorption indicators for silver titration.** *J. Pharm. Soc. Japan* **62**, 404-14 (1942).—*C.A.* **45**, 2362*c*.

Indicators used for the microdetn. of proteins could be used for titration of Ag halides. For estn. of chlordide ion tetrabromophenolphthalein ester was used as an indicator. The end point was a change to purple from yellow-green. Tetrabromobenzaurin changed to purple from greenish blue. 2,6-Dichlorophenolindophenol changed to reddish purple from blue. For titration of iodide ion tetrabromophenolphthalein ester, tetrabromobenzaurin, and tetrabromorosolic acid were excellent when the soln. was acidified with AcOH. 2,6-Dichlorophenolindophenol could be used for titration of 0.0025 *N* KI with 0.1 *N* $AgNO_3$ with a color change of red to green.

3292. BODFORSS, SVEN. **Adsorption of amine ions on colloidal silver iodide.** *Kgl. Fysiograf. Sällskap. Lund Handl.* **54**, No. 12, 20 pp. (1943).—*C.A.* **41**, 2958*f*.

Metaniline yellow colored an acid AgI hydrosol blue by adsorption on the deformed micelles and served simultaneously as a protective colloid to make the sol. very stable. Other Ag halides also gave adsorption pigments with metaniline yellow but to a lesser degree. Org. amines (as hydrochlorides) displaced metaniline yellow, giving a red color. The displacement effect of a series of amines could be detd. by titration to a color change.

3293. GIBADLO, FRANK. **Estimation of colloidal properties of ferric oxide and iron oxide purifying material.** *Gas Age* **91**, No. 9, 24-5, 42-3 (1943).—*C.A.* **37**, 3992^7.

A method for estg. and rating the colloidal properties of Fe_2O_3 and Fe oxide purifying materials by treatment with K tartrate and KOH soln. was examd. The oxides went into soln., the amt. dissolved depending on the temp. to which they had previously been subjected. Expts. showed that the method gave comparable results with the adsorption of malachite green, but possessed the advantages that it was direct and was not affected by substances normally present in spent oxides.

3294. GROTE, FRIEDRICH. **The adsorptive properties of lead chromate and its effect on the determination of lead as chromate.** *Z. anal. Chem.* **126**, 129-32 (1943).—*C.A.* **38**, 697[3].

If Pb^{++} was pptd. as $PbCrO_4$ by the addn. of $Cr_2O_7^{--}$ to a buffered AcOH soln., the theoretical factor for converting the wt of $PbCrO_4$ to Pb was 0.6411, but after drying at 105° and 160°C, the factor 0.6378 was better if the conditions stated were followed. The pos. error was believed caused by adsorption of CrO_4^{--} by the $PbCrO_4$ ppt. which lowered the % of Pb in the ppt. Expts. showed that the adsorption was proportional to the quantity of Pb^{++} present so that an empirical factor was justifiable.

3295. HEDVALL, J. A. AND NORD, S. **The influence of stoichiometric variations on photoactivated adsorption.** *Z. Elektrochem.* **49**, 467-71 (1943).—*C.A.* **38**, 5150[6].

Black HgS showed practically no difference in adsorptive power whether or not it was illuminated, while red HgS adsorbed up to 6 times as much phenolphthalein when illuminated as in the dark. These different behaviors were undoubtedly assocd. with the different electronic structures of the 2 modifications. Black HgS was a conductor, while the red modification exhibited the internal photoelec. effect, i.e., it was an insulator in the dark and a conductor when illuminated.

3296. HEDVALL, J. A. AND NORD, S. **Photoadsorption effects in the system pigment-fluid phase.** *Arkiv Kemi, Mineral. Geol.* **17A**, No. 11, 11 pp. (1943).—*C.A.* **39**, 2694[1].

The adsorption by red and black HgS of phenolphthalein from aq. EtOH and by CdS of α-naphtholphthalein from similar solns. were investigated under varying light conditions. Light had little effect on adsorption by black HgS, but red HgS adsorbed six times as much phthalein in light as in darkness. Black HgS and irradiated red HgS were conductors, whereas in darkness red HgS was an insulator. CdS adsorbed phthalein much more when irradiated than in darkness.

3297. KISTIAKOWSKY, G. B. AND VAN WAZER, JOHN R. **The radioactive exchange and adsorption of methyl bromide with several inorganic bromides.** *J. Am. Chem. Soc.* **65**, 1829-34 (1943).—*C.A.* **38**, 20[2].

For $AlBr_3$, which was an active catalyst for reactions of MeBr, the activation energy for the exchange with MeBr was 4.6 kg-cal. For $BaBr_2$, which was a less-active catalyst, the activation energy for the exchange was 12 kg-cal; and for KBr, which was not a catalyst, the rate of exchange was too slow to detect. From detns. of the adsorption of MeBr on $BaBr_2$, the differential heat of adsorption was found to be about −3 kg-cal.

3298. NUTTING, P. G. **Adsorptive forces active through glass.** *Science* **97**, 74-5 (1943).—*C.A.* **37**, 1316[9].

A piece of hard-glass tubing (0.8 mm diam., 100 cm long, wall thickness 0.1 mm) was mounted vertically. The time of flow was 50-500 sec. A S-free crude oil gave a time of flow of 110 sec with a water jacket, and 103 sec without. The adsorbed layer was calcd. to be about 0.0065 mm with water outside the tube, or about 100 mols. in thickness. The adsorption of OH^- or other anions on one side of a glass wall would enhance the adsorption of an electropos. material on the opposite side by a measurable amt. through at least 0.1 mm of glass.

3299. TAI, A. P. AND CHEN, C. L. **Effect of salts on the adsorption of erythrosin on silver halides.** *J. Chinese Chem. Soc.* **10**, 22 (1943).—*C.A.* **38**, 4490[7].

Using AgBr, AgCNS and AgCl as adsorbents, the effect of K halides on the adsorption of erythrosin was studied. The order of halide ions arranged according to their dye-displacing effect was irregular and did not follow Paneth-Fajans' rule.

3300. WILLEMS, J. **Oriented intergrowths of phenols with carbonates of the calcite group and $NaNO_3$.** *Z. Krist.* **105**, 53-68 (1943).—*C.A.* **38**, 671[5].

The correlation of parallel orientation with approx. coincidence of common lattice dimensions was discussed for α-hydroquinone with all members of the calcite group and $NaNO_3$; for *p*-hydroxybiphenyl, 3-hydroxypyrene, *d*-glucose and succinic acid with calcite alone; for napthazarin with dolomite and magnesite; and salicylic acid with siderite.

3301. WILLEMS, J. **Oriented growth of hydroquinone on mica.** *Z. Krist.* **105**, 144-8 (1943).—*C.A.* **38**, 2867[5].

Crystals of α-hydroquinone from C_6H_6 or $CHCl_3$ soln. on basal cleavages of muscovite were oriented with the *c* axis [0001] of hydroquinone parallel to [100], (110) or (110) of the mica. The differences in lattice spacing for the 2 substances for the parallel positions vary from 8.5% to 5.8%. Oriented growths were obtained with margarite, lepidolite and zinnwaldite.

3302. WILLEMS, J. **Oriented growth of urotropine on gypsum.** *Z. Krist.* **105**, 149-54 (1943).—*C.A.* **38**, 2867[4].

The crystals of urotropine were not sharp, but approx. measurements showed that they were oriented on the (010) cleavage of gypsum with (110) parallel to gypsum (010), and [110] parallel to gypsum [301].

3303. WILLEMS, J. **Oriented growth of hydroquinone on barite and celestite.** *Z. Krist.* **105**, 155-7 (1943).—*C.A.* **38**, 2867[6].

The *c* [0001] distance of 5.62 A. in α-hydroquinone was only 3.3% and 4.8% greater than that of the [010] direction of barite and celestite, resp., and the needle-like crystals oriented themselves parallel to [010] on the (001) cleavages of barite and clestite.

3304. ABELIUK, R. C. **Application of adsorption indicators in volumetric precipitation.** *Anales quim. y farm.* **1944**, 4-8, 11-14 (in *Rev. quim. farm.* (Santiago, Chile) No. 24, 4-14 (1945)).—*C.A.* **39**, 2707[7].

The methods of Fajans and Kolthoff were found the most accurate provided the soln. was not acidic; the ppts. were colloidal and small amts. were detd. with pre-formed ppts. These methods were exact and rapid and were suited for the detn. of halogens in water.

3305. Damerell, V. R. and Mattson, Raymond. **Effect of surface-active agents upon dispersions of calcium carbonate in xylene.** *J. Phys. Chem.* **48**, 134-41 (1944).—*C.A.* **38**, 3532[8].

The degree of dispersion of $CaCO_3$ in xylene (judged by sedimentation and ultramicroscopic analysis) was improved by the addn. of surface-active agents; Zn dioctyl sulfosuccinate, Aerosol OT, Ba dioctyl sulfosuccinate, Aerosol MA (Na dihexyl sulfosuccinate), lecithin and Mg oleate were most effective. The colloidal particles were positively charged in these systems except when lecithin was the dispersing agent.

3306. Romanovski, Vsevolod. **Effect of organic liquids on the packing of quartz powder.** *Compt. rend.* **218**, 278-9 (1944).—*C.A.* **40**, 1377[4].

Quartz particles with a mean diam. of 7 μ were allowed to settle from aniline, acetone, MeOH, EtOH, HOAc, Et_2O, xylene, C_6H_6, $CHCl_3$, and CCl_4 at 18°C, and the vol. of the packed quartz was detd. Gray gels were obtained in the last 4 liquids. The "indexes of free space" were much larger than those obtained in the presence of ions, so that the mechanism proposed for the adsorption of ions could not apply to adsorption of org. liquids.

3307. Sheppard, S. E.; Lambert, R. H., and Swinehart, D. **The adsorption of gelatin to silver bromide.** *J. Chem. Phys.* **13**, 372-7 (1945).—*C.A.* **39**, 5150[8].

Exptl. data were presented illustrating a specific case of amphipathic adsorption--of gelatin to AgBr. There was mutual coagulation of the Ag hydrosol and protein, followed by peptization in excess of dissolved protein.

3308. Tarte, P. **Adsorption of amino acids by barium sulfate.** *Rev. can biol.* **4**, 477-87 (1945).—*C.A.* **40**, 2054[8].

The adsorption of the Ba salts of amino acids by $BaSO_4$ in aq. soln. revealed a very definite parallel between the adsorbability and the soly. of the salts. For sepn. of aspartic from monocarboxylic amino acids, the mixt. (a few mg) was adsorbed on $BaSO_4$, and then eluted with 2 × 100 cc. double-distd. water (which removed monocarboxylic acid) and then with 3 × 100 cc. 0.02 *N* AcOH (which removed aspartic acid). For the sepn. of aspartic and glutamic acids, the elution was performed with 4 × 100 cc. 0.001 *N* AcOH (which removed glutamic acid), and then with 3 × 100 cc. 0.02 *N* AcOH.

3309. Tarte, P. **The adsorption of amino acids by barium sulfate.** *Bull. soc. roy. sci. Liège* **14**, 231-42 (1945).—*C.A.* **43**, 3687a.

$BaSO_4$ (15 μ) was aged 15 days in water, activated by treatment with 1% $BaCl_2$, and washed with water until the filtrate was Ba-free. The surface did not absorb glycine, alanine, leucine, valine, serine, methionine, cystine, phenylalanine, tyrosine, typtophan, histidine, lysine, or arginine, but did adsorb glutamic acid and aspartic acid. Glutamic acid was slowly eluted by water, rapidly by 0.001 *N* AcOH. Aspartic acid was not eluted by either water or 0.001 *N* AcOH, but was eluted by 0.01 *N* AcOH.

3310. Bigelow, W. C.; Pickett, D. L., and Zisman, W. A. **Oleophobic monolayers. I Films adsorbed from solution in nonpolar liquids.** *J. Colloid Sci.* **1**, 513-38 (1946).—*C.A.* **41**, 2948*e*.

Certain types of polar org. mols. were adsorbed from solns. in nonpolar solvents onto rigorously cleaned solid surfaces to form well-oriented monolayers that imparted pronounced oleophobic as well as hydrophobic properties to the surfaces. In order for a compd. to adsorb as an oleophobic monolayer, the mols. must have a polar group at one extremity and a Me group at the opposite extremity and must be capable of forming a close-packed orientation

3311. Cohn, Charlotte. **Adsorption by hydrosols.** *Compt. rend.* **223**, 1022-4 (1946).—*C.A.* **41**, 1907[a].

Studies were made of colloidal $Fe(OH)_3$ and $Th(OH)_4$, $Fe_4[Fe(CN)_6]_3$ and $Cu_2Fe(CN)_6$, and As_2S_3 as adsorbents. In general, triphenylmethane dyes (fuchsin, malachite green) were feebly adsorbed. However, 10 mg of As_2S_3 in aq. soln. took up 12 mg of phenosafranine and 10 mg of $Fe_4[Fe(CN)_6]_3$ or $Cu_2Fe(CN)_6$ took up 11 mg of Victoria Blue. Congo Red could be almost completely adsorbed, as could tannin. Simply rinsing with alc. was often sufficient for elution. Lactoflavin, saffron, alizarin, orcein, cochineal, and blue litmus were all adsorbed strongly by As_2S_3 and much less by the ferrocyanides.

3312. Lyalikov, K. S. **An experimental verification of Ostwald's formula.** *Compt. rend. acad. sci. U.R.S.S.* **52**, 425-7 (1946).—*C.A.* **41**, 1531a.

Rates of growth of AgBr crystals suspended in 1% gelatin soln. were detd. by statistical analysis of photomicrographs. The existence of a linear relation between the rate of growth and $1/r^2$ (r = crystal radius) led to the conclusion that the relation between the soly. and crystal size of AgBr was in accordance with Ostwald's law.

3313. Mehrotra, R. C. **Adsorption indicators. II. Dyes derived from cinchomeronic acid and quinolinic acid as adsorption indicators in argentometric titrations.** *Proc. Natl. Acad. Sci. India* **15A**, 148-52 (1946); **16A**, 31-6 (1947).—*C.A.* **44**, 3397*f*.

At the end point with resorcinolquinolein and resorcinolcinchomeronein the color changed from light pink to deep pink when titrating Cl^- against Ag^+ within the pH 2-12. The indicators were suitable for argentometric titration of $(SCN)^-$, Br^- (not in ammoniacal soln. or at pH > 6) and I^- (sensitive as low as 0.001 *N*). When a neutral soln. of KI was titrated against $AgNO_3$, tetrabromoresorcinolquinolein of tetrabromoresorcinol-cinchomeronein indicated the end point as a disappearance of pink; in acidic or ammoniacal soln. the suspension changed from yellow to pink at the equiv. point.

3314. Mushran, Sukhdeo Prasad and Prakash, Satya. **Negatively charged colloidal solutions of various ferric salts. IV. Negatively charged ferric tungstate sol.** *J. Indian Chem. Soc.* **23**, 445-50 (1946).—*C.A.* **42**, 808*d*.

Negatively charged ferric tungstate sols were prepd. by mixing solns. of $FeCl_3$, Na tungstate, NaOH, and glucose or glycerol. Conds. and extinction coeffs. of the dialyzed sols were obtained.

3315. Sheppard, S. E.; O'Brien, A. S., and Beyer, G. L. **Amphipathic adsorption. I. The adsorption of polyvinyl alcohol on silver bromide.** *J. Colloid Sci.* **1**, 213-20 (1946).—*C.A.* **40**, 4932^5.

A standard AgBr sol. that adsorbed 10 mg of 3,3′-diethyl-9-methylthiacarbocyanine bromide per g of AgBr at satn. adsorbed 13-14 mg of polyvinyl alc. per g. The polyvinyl alc. used had a mol. wt of approx. 40,000 (100 times the mol. wt of the org. Br). Adsorbed org. Br was not displaced by polyvinyl alc. but adsorbed polyvinyl alc. was very largely displaced by org. Br.

3316. Faĭdysh, V. P. **Stabilizing action of the anions of monobasic fatty acids on arsenic trisulfide hydrosol.** *Kolloid. Zhur.* **9**, 151-6 (1947).—*C.A.* **47**, 946*a*.

K salts of fatty acids increased the concn. (c_0) of KCl required for coagulating an As_2S_3 hydrosol (3 g/liter), due to the OH^- present in soap solns. If c was the concn. of KCl, corrected for the OH^- effect, required in the presence of x millimol./liter of K salt, then $c - c_0$ increased by the factor 1.3 when the chain length of the acid increased by one C. Thus $c - c_0$ was (at $x = 20$) 17.9, 22.3, 29.7, and 37.3 for K formate, acetate, propionate, and butyrate, resp.

3317. Hutchinson, E. and Rideal, E. K. **Adsorption and lubrication at crystal surfaces. I. Boundary lubrication of sodium nitrate.** *Trans. Faraday Soc.* **43**, 435-8 (1947).—*C.A.* **42**, 1477*e*.

For clean dry crystals of $NaNO_3$ and NH_4NO_3 the coeff. of friction was 0.50 ± 0.05. Results for various solns. of surface-active compds. in nitrobenzene showed that at low concns. the coeff. of friction was markedly dependent on the concn. of lubricant. In sufficiently concd. solns., however, all straight-chain paraffin derivs. gave more or less the same coeff. of friction, 0.12. The adhesion of the film to the surface may be effected by the use of polymeric materials contg. a large no. of adsorbable polar groups.

3318. Hutchinson, E. **Adsorption and lubrication at crystal surfaces. II. Adsorption of paraffin chain compounds on sodium nitrate.** *Trans. Faraday Soc.* **43**, 439-42 (1947).—*C.A.* **42**, 1477*g*.

Solns. of nitroöctadecane, stearic acid, octadecyl alc., and Et heptadecyl ketone in benzene, CCl_4, or petr. ether were used. The adsorption did not follow a simple Langmuir isotherm. The free energy change was greater for the more readily adsorbed mols. Boundary lubrication of $NaNO_3$ crystals was achieved through the adsorption of a boundary film.

3319. Mehrotra, R. C.; Tiwari, R. D., and Dube, H. L. **Resorcinol-succinein as adsorption indicator in argentometric titrations.** *Current Sci. (India)* **16**, 119 (1947).—*C.A.* **41**, 5049*h*.

Two drops of the indicator (0.2% alc. soln.) sufficed for 20 cc. of titration mixt. Comparison was made with fluorescein. Titration was possible in neutral or just alk. solns., but failed in acid solns.

3320. Mehrotra, R. C.; Tiwari, R. D., and Dube, H. L. **Adsorption indicators. I. Resorcinol-succinein as adsorption indicator in argentometric titrations.** *J. Indian Chem. Soc.* **24**, 165-6 (1947).—*C.A.* **42**, 5373*f*.

A 1% soln. in 50% EtOH was used as indicator. The indicator compared favorably with ordinary fluorescein as an adsorption indicator. In titrating Cl^-, 0.1 *N* $AgNO_3$ should be used. With I^- the reagent could be 0.1-0.00025 *N*.

3321. Zocher, Hans. **Anisotropy of crystal surfaces.** *Anais acad. brasil cienc.* **19**, No. 1, 43-50 (1947).—*C.A.* **42**, 5295*e*.

Coatings of methylene blue or neutral red dyes on crystal surfaces, particularly the micas, exhibited films of pronounced dichroism. Heating, or boiling in acids, except HF, did not alter the surface state.

3322. Damerell, V. R. and Vogt, M. J. **The effect of surface-active agents upon dispersions of lead monoxide in xylene.** *J. Phys. & Colloid Chem.* **52**, 363-7 (1948).—*C.A.* **42**, 2837*f*.

Sedimentation analysis of suspensions of PbO in xylene showed that S, lecithin, oleic acid, and sodium dioctyl sulfosuccinate (Aerosol OT) were effective in lowering the av. size of the PbO particles. Analysis was made on suspensions of 0.5 g of PbO in 500 ml of xylene and 0.001 mol. of the surface-active agent.

3323. Dreyer, John F. and Ertel, Charles W. **Orientation of the surface of glass.** *Glass Ind.* **29**, 197-8 (1948).—*C.A.* **42**, 4317*d*.

A thin amorphous layer capable of orientation by rubbing could be developed on glass and many other solids. The surface of glass must be clean and basic in character before being rubbed with the slurry. A polarization soln. of dichroic materials was then flooded on, which when dry, produced a polarized film.

3324. Ernsberger, F. M. and France, Wesley G. **Some physical and chemical properties of weight-fractionated lignosulfonic acid, including the dissociation of lignosulfonates.** *J. Phys. & Colloid Chem.* **52**, 267-76 (1948).—*C.A.* **42**, 2491*f*.

Lignosulfonic acid was prepd. from the waste liquor of a sulfite pulp process by using ion exchange. By means of fractional diffusion, 3 fractions were obtained. Studies of the adsorption isotherms on Portland cement, for instance, indicated a pronounced increase of surface activity with increasing mol. wt. The dissocn. of the acid and of its NH_4, Na, Ba, and Ca salts were detd. by cond. measurements and led to moderate degrees of dissocn. (20-60%).

3325. Kameyama, K and Okabe, H. **Adsorption of ripening retarders by the silver halide grains.** *J. Soc. Sci. Phot. Japan* **11**, No. 3, 1-6 (1948); *Science et inds. phot.* **21**, 88 (1950).—*C.A.* **44**, 4354*f*.

Cystine, glutathione, and Vitamin B_1 were strongly adsorbed by AgBr and could cover it with a unimol. layer; methionine and lanthionine, which were not adsorbed, were not ripening retarders.

3326. KOSHURNIKOV, G. S. AND MOKIEVSKII, V. A. **Effect of organic additions on the crystallization of alkali metal halides.** *Zhur. Obshchei Khim.* **18**, 569-71 (1948).—*C.A.* **43**, 13*c*.

The crystal forms appearing on evapn. of satd. solns. of NaCl, KCl, and KI at room temp. were observed under the polarizing microscope. In the presence of PhBr. about 60-70% of the NaCl crystals were cut along the octahedron plane, with many crystals cut on both sides along one of the ternary axes, oriented perpendicularly to the surface of the soln.; the same effect, but to a lesser extent, was found with KCl, no effect with KI. Addn. of $PhNH_2$ or of PhOH to NaCl, KCl, and KI resulted in a similar picture. The effect was explained by adsorption of the org. matter on planes with the greatest surface energy.

3327. MEHROTRA, R. C. **Congo red as an adsorption indicator.** *Anal. Chim. Acta* **2**, 36-44 (1948).—*C.A.* **43**, 61*a*.

Congo red was proposed as a new adsorption indicator for argentometric titrations. It had both acidic and basic properties, and by being adsorbed by both positively and negatively charged particles with different colors, the color change was particularly sharp (blue to red). The addn. of dextrin as a protective colloid made the color changes even sharper. It was readily reversible, and was applicable to the titration in either direction. The best pH range was 3-5.

3328. MUELLER, GRETCHEN B. **The mechanism of adsorption of some dyestuff anions on silver halides.** *Univ. Microfilms Pub.* **No. 1066**, 88 pp (microfilm $1.10, paper enlargements $8.80); Microfilm Abstracts **8**, No. 2, 35-6 (1948).—*C.A.* **43**, 4536*i*.

3329. NEWTON, AMOS. S. **Artificial radioelements as tracers in the study of the adsorption of eosin and erythrosin on silver bromide.** *Univ. Microfilms Pub.* **No. 1067**, 32 pp (microfilm $1.65, paper enlargements $13.20); Microfilm Abstracts **8**, No. 2, 139-40 (1948).—*C.A.* **43**, 4536*i*.

3330. SISLER, HARRY H.; BUSH, JACK D., AND ACCOUNTIUS, OLIVER E. **Addition compounds of chromic anhydride with some heterocyclic nitrogen bases.** *J. Am. Chem. Soc.* **70**, 3827-30 (1948).—*C.A.* **43**, 2534*b*.

The reactions of CrO_3 with pyridine, α-picoline, β-picoline, γ-picoline, quinoline, and isoquinoline were studied. CrO_3 was almost completely reduced by isoquinoline at room temp. α-Picoline was more easily oxidized by CrO_3 than was β- or γ-picoline or pyridine, and tended less to coordinate with CrO_3. $CrO_3 \cdot 2C_5H_5N$, $CrO_3 \cdot 2C_6H_7N$ (β), and $CrO_3 \cdot 2C_6H_7N$ (γ) reacted with liquid NH_3 at −33°C in a manner similar to CrO_3.

3331. THIELE, HEINRICH AND LUCK, HANS. **The directive effect of various ions on anisotropic colloids.** *Z. Naturforsch.* **3b**, 393-402 (1948).—*C.A.* **44**, 405*a*.

Addn. of surface-active substances to sols. of V_2O_5, Fe_2O_3, 3-hydroxy-mercuri-5-sulfosalicylic acid inner salt (Hg sulfosalicylic acid) and benzopurpurin produced transitory double refraction without gelation. Electrolytes diffusing from a dissolving crystal oriented the particles in Fe_2O_3 and V_2O_5 sols either radially or tangentially. If the cation had the higher mobility, it led the anion in the diffusion front and pulled the elongated neg. V_2O_5 particles into a radial orientation. If the anion had the higher mobility the orientation was tangential and the birefringence pos. Since the Fe_2O_3 sol was pos., it showed the opposite behavior.

3332. VENTURELLO, G. AND BURDESE, A. **II. Discontinuous adsorption of purpurin in aqueous solution on calcite and on aragonite.** *Gazz. chim. ital* **78**, 271-5 (1948).—*C.A.* **42**, 8576*i*.

Two forms of $CaCO_3$ were chosen in a study on the influence of cryst. structures with identical chem. compns. Discontinuous isotherms were obtained, particularly in the isotherm of purpurin on pptd. $CaCO_3$. However, the isotherms of aragonite showed a greater no. of discontinuties than those of calcite.

3333. ZUEV, YU. S. **Effect of surface-active substances on the mechanical properties of concentrated zinc oxide suspensions.** *Kolloid. Zhur.* **10**, 413-5 (1948).—*C.A.* **43**, 7777*i*.

The yield stress of 78 wt % suspensions of ZnO in liquid petrolatum was reduced by addn. of a few % of "aerosol OT," oleic acid, and particularly of oxidized petrolatum. The yield stress of 78% ZnO in linseed oil was slightly increased by "aerosol OT;" much increased by oleic acid and reduced by oxidized petrolatum.

3334. ANDERSON, SCOTT. **Orientation of methylene blue molecules adsorbed on solids.** *J. Optical Soc. Am.* **39**, 49-56 (1949).—*C.A.* **43**, 5665*i*.

The orientation of methylene blue mols. adsorbed on rubbed glasses was detd. Reflection spectra made with polarized visible radiation demonstrated that the long axis of the mols. was perpendicular to the direction in which the glass was originally rubbed.

3335. BIRD, L. H. **Adsorption of quinine from fluorimetric standard solutions.** *New Zealand J. Sci. Technol.* **30B**, 334-5 (1949).—*C.A.* **45**, 5059*i*.

Quinine, when used as a standard fluorescing soln., gave trouble by adsorbing to the tubes and causing the concn. in the soln. to fall progressively. This could be prevented by (1) satg. the adsorptive capacity of the tubes with quinine sulfate, stirring, discarding, and refilling with fresh soln. (2) Rendering the tubes nonadsorptive by filling with 30% NaOH and raising the temp. to the b.p. for 1 min., followed by washing and drying.

3336. BUCKLEY, H. E. **Habit modification in crystals as a result of the introduction of impurities during growth.** *Discussions Faraday Soc.* **1949**, No. 5, 243-54.—*C.A.* **44**, 2316*b*.

No direct relation could be traced between deposition of impurity on certain crystal faces and modification of habit. The concn. of dye and the crystal faces developed were given for a large no. of dyes and K_2CrO_4, K_2SO_4, $KClO_4$, and NH_4ClO_4 crystals.

3337. Butchart, A. and Whetstone, J. **The effect of dyes on the crystal habit of some oxy-salts.** *Discussions Faraday Soc.* **1949**, 254-61.—*C.A.* **44**, 2322*h*.

The effect of a large no. of dyes on the habit of NH_4NO_3, $(NH_4)_2SO_4$, KNO_3, and $NaNO_3$ was investigated. No theory involving the fitting of these dyes on one given crystal plane for each salt was found capable of explaining the facts. In all cases, the crystal planes on which growth was limited by the dyes consisted of alternate pos. and neg. ions.

3338. Chu, Jean Chien-Han. **The influence of excess ions on the adsorption of dye ions on crystallized silver bromide and lead sulfate. Solubility and electrical conductance of some lithium salts in ethyl ether.** *Univ. Microfilms* (Ann Arbor, Mich.) *Pub.* **No. 1169**, 167 pp. (microfilm $2.09, paper enlargements $16.70); Microfilm Abstracts **9**, No. 2, 31-2 (1949).—*C.A.* **43**, 8790*g*.

3339. Ewles, J. and Farnell, G. C. **The luminnescence of wetted solids.** *Proc. Phys. Soc.* (London) **62A**, 216-24 (1949).—*C.A.* **44**, 443*d*.

The luminescent spectra of water, heavy water, and alcs., as well as some other liquids with different neg. radicals when adsorbed by various finely divided ionic solids were detd. The adsorbed mols. had very abnormal adsorption regions indicating considerable changes in energy levels. Luminescence bands made at low temps. were reported for the following water-wetted solids: SiO_2, $SiO_2(D_2O)$, CaF_2, LiF, NaF, NaCl, KCl, BeO, Al_2O_3, $CaCO_3$, and $HgCl_2$; wetted by alcs., SiO_2, $SiO_2(D_2O)$, CaF_2, LiF, NaF, NaCl, KCl, BeO, Al_2O_3, $CaCO_3$, $HgCl_2$. $SiO_2(CH_3OH)$, $SiO_2(C_2H_5OH)$, $KCl(C_2H_5OH)$, $NaCl(CH_3OH)$, and $NaCl(C_2H_5OH)$.

3340. Fenimore, Charles P. and Thraikill, Arthur. **The mutual habit modification of sodium chloride and dipolar ions.** *J. Am. Chem. Soc.* **71**, 2714-17 (1949).—*C.A.* **43**, 7772*d*.

Glycine, pyridine, betaine, and β-alanine in aq. NaCl solns. modified the crystal habit of growing NaCl; the first caused the formation of dodecahedra, the other 2 give octahedra. Glycine and β-alanine were themselves modified by NaCl.

3341. Greiner, Leonard and Vold, Robert D. **Suspension of manganese dioxide in detergent solutions.** *J. Phys. & Colloid Chem.* **53**, 67-88 (1949).—*C.A.* **43**, 3688*h*.

The non-ionic detergent, alkaryl polyethoxyethanol, showed no suspending power, whereas cationic $[(C_8H_{17}C_6H_4OC_2H_4OC_2H_4)Me_2(PhCH_2)NCl]$ and anionic [Na oleate, $(NaSO_3C_6H_4C_{12}H_{25})$, (Na dioctylsulfosuccinate), and p-$MeC_6H_4SO_3H$] agents suspended powd. MnO_2 at low concns.

3342. Krasnovskii, A. A. and Gurevich, T. N. **Desorption of gas on wetting powders.** *Kolloid. Zhur.* **11**, 172-5 (1949).—*C.A.* **43**, 7289*h*.

When dry powder was wetted by a liquid, gas was evolved. TiO_2, FeO, and two specimens of Fe_2O_3 adsorbed palmitic acid from toluene solns. (0.12 *M* or greater). Assuming that 1 mol. of palmitic acid occupied 20.5×10^{-16} cm^2, the surface areas of the powders were 8.9, 6, and 6.7-7.3 m^2/g, resp. One mol. of evolved gas was present per $24\text{-}32 \times 10^{-16}$ cm^2 of the powder surface. The gas contained no CO_2, but was not analyzed otherwise. Wetting TiO_2 by H_2O, 0.1 *N* H_2SO_4, or 0 1 *N* NaOH liberated less gas (1/20 to 1/2, approx.) than wetting with palmitic acid + toluene. The vol. desorbed could be used for characterizing powders.

3343. Kukharenko, T. A. and Borozdina, L. A. **The nature of the exchange reaction between humic acid and calcium acetate.** *Kolloid. Zhur.* **11**, 244-50 (1949).—*C.A.* **44**, 405*e*.

The rate of reaction between 2 specimens of humic acid (63.8 and 65.7% C) and $Ca(OAc)_2$ solns. increased with temp. (20-100°C), but the final amt. of AcOH liberated was independent of temp. It increased with the concn. of $Ca(OAc)_2$ and was not affected by addn. of $CaCO_3$. Hence, $Ca(OAc)_2$ reacted with the CO_2H groups of humic acid without affecting its OH groups.

3344. MacEwan, D. M. C. and Talib-Uddeen, O. **Adsorption complexes of α-zinc hydroxide.** *Nature* **163**, 177-8 (1949).—*C.A.* **43**, 3308*e*.

α-$Zn(OH)_2$ showed interlayer adsorption such as some clays. A complex was formed with 8-hydroxy-5,7-dinitro-2-naphtholsulfonic acid. This complex also adsorbed water, MeOH, EtOH, ethylene glycol, glycerol, acetonitrile, and propionitrile.

3345. Mehrotra, R. C. **Argentometric titrations of thiocyanate ions with adsorption indicators.** *Anal. Chim. Acta* **3**, 69-72 (1949) (in English).—*C.A.* **43**, 8300*b*.

Three new adsorption indicators, bromothymol blue, bromocresol purple, and bromophenol blue, were compared with fluorescein in their applicability to the titrations of CNS^- against Ag ions. The first 2 gave sharp end-points in dilns. up to 0.02 *N* and 0.01 *N*, resp.

3346. Mehrotra, R. C. **Tetrabromophenolsulfonpthalein as adsorption indicator. I. Volumetric estimation of thallium.** *Anal. Chim. Acta* **3**, 73-7 (1949) (in English).—*C.A.* **43**, 8300*c*.

A new method was described for detg. Tl with bromophenol blue as adsorption indicator. The color change, yellow to green, was sharpest (over a pH range 4-8) when Tl nitrate or sulfate was added to the iodide, and when the concns. of the titrating solns. were 0.04-0.2 *N*. The reverse titration, though less satisfactory could be carried out if some care was taken. Pb^{++} interfered, but this could be prevented by previous pptn. as $PbSO_4$; CNS^- and CrO_4^{--} also interfered.

3347. Mehrotra, R. C. **Tetrabromophenolsulfonpthalein as adsorption indicator. II. Volumetric estimation of silver and thallium.** *Anal. Chim. Acta* **3**, 78-82 (1949) (in English).—*C.A.* **43**, 8300*e*.

Ag and Tl together could be detd. as follows: first, ppt. both ions with an excess of KI, and titrate the excess with $TlNO_3$, in the presence of bromophenol blue as adsorption indicator. Ag alone could then be detd. in another sample by adding a known vol. of KCNS, and titrating the excess with Ag^+ and with bromophenol blue as adsorption indicator. Tl^+ did not interfere with this titration. The detn. of Br^- and I^- by titration with Ag^+ ions in ammoniacal soln., with bromophenol blue as adsorption indicator, was also described.

3348. Mehrotra, R. C. **Phenyl-1-naphthylamine-azobenzene-p-sulfonic acid as adsorption indicator.** *J. Indian Chem. Soc.* **26**, 511-14 (1949).—*C.A.* 44, 6334*i*.

The dye in pH 3-5 indicated the end point in argentometric titrations with very sharp and reversible color change both in the titrations of halide ions against Ag ions, as well as in the reverse titrations of Ag ions against halide.

3349. Robinson, James V. **Viscosity of suspensions of spheres.** *J. Phys. & Colloid Chem.* **53**, 1042-56 (1949).—*C.A.* 44, 904*d*.

The viscosities of suspensions of glass spheres in various media, such as S.A.E. No. 30 and 50 motor oils, castor oil, corn sirup, polyethylene glycol, and sucrose soln., were detd. by means of rotational viscometers at 35°C. The sp viscosity of the suspensions was directly proportional to the vol. concn. and inversely proportional to the vol. of free liquid in the suspension.

3350. Schafer, Harold. **N-Methyldiphenylamine Red as adsorption indicator in the argentometric determination of chloride and bromide in an acid solution.** *Z. anal. Chem.* **129**, 222-9 (1949).—*C.A.* 44, 69*h*.

In strongly acidic solns., N-Methyldiphenylamine Red was a good adsorption indicator for titrating Cl^- or Br^- with Ag^+. When the halogen anion was in excess, the indicator was adsorbed by AgCl, giving a blue-gray color with a slightly violet tinge. Exactly at the equiv. point a red-violet color was obtained. The reagent acted as oxidation-reduction indicator when in the reduced condition and as adsorption indicator in the oxidized form.

3351. Ukihashi, Hiroshi and Kikuchi, Shinichi. **Adsorption of resorcinol on silver bromide.** *J. Chem. Soc. Japan, Ind. Chem. Sect.* **52**, 240-2 (1949).—*C.A.* 45, 4155*g*.

The adsorption of resorcinol on AgBr of uniform grain was studied. The adsorption followed Freundlich's adsorption isotherms, and the adsorbed quantity corresponded to a unimol. layer on the surface of AgBr.

3352. Washburn, E. Roger; Eby, Harold H., and Skiles, B. F. **Colloidal barium sulfate in acetic acid.** *J. Phys. & Colloid Chem.* **53**, 1190-5 (1949).—*C.A.* 44, 2329*g*.

Sols. and gels of $BaSO_4$, prepd. by mixing $Ba(OAc)_2$ and H_2SO_4 each in HOAc soln. (concns. from 0.477 to 0.005 *M*) were observed over periods up to 1 year. No visible settling occurred. Percentage of incident light transmitted was detd. As the sols. aged, increased cloudiness was noted. The most concd. sols. gelled in 12-14 days.

3353. Whetstone, J. **The effect of crystal-habit modification on the setting of inorganic oxy-salts.** *Discussions Faraday Soc.* **1949**, No. 5, 261-6.—*C.A.* 44, 2322*i*.

Expts. were reported on the changes in crystal habit of NH_4NO_3, $(NH_4)_2SO_4$, and KNO_3 crystals by dyes. The effect of the dyes most effective in reducing setting (Acid Magenta for NH_4NO_3, Amaranth for $(NH_4)_2SO_4$, and Na 1,4-diaminoanthraquinone-2-sulfonate for KNO_3) was due to the extreme thinness and fragility of the platy crystals produced in their presence. No dye was found that would reduce the caking tendency of $NaNO_3$ or modify its crystal habit.

3354. Barrington, M. G.; Fleet, D. E., and McLaughlin, R. R. **The water repellency of silicone-treated sintered glass plates.** *Can. J. Research* **28F**, 461-3 (1950).—*C.A.* 45, 2724*e*.

Pyrex sintered glass funnels of fine, medium, and coarse porosity, made water-repellent by treatment with Dow-Corning fluids DC 500 or DC 200, were subjected to hydrostatic pressure by means of water or water and Hg columns and a leveling bulb. Plates of fine porosity withstood heads of approx. 300 cm of water.

3355. Buckley, H. E. **The growth and habit modifications of crystals.** *Mem. Proc. Manchester Lit. & Phil. Soc.* **92**, 77-123 (1950-51).—*C.A.* 46, 5922*i*.

The effects of 488 dyes on the crystal growth of KCl, $KClO_3$, K_2SO_4, K_2CrO_4, NH_4ClO_4, $K_2Cr_2O_7$, potash, alum, and borax were tabulated. The relative effectiveness of the dyes in causing habit modification was measured in terms of the weight of inorg. substance modified by one grain of dye.

3356. Cruse, K. and Mittag, R. **Color formation by adsorption.** *Z. Elektrochem.* **54**, 418-21 (1950).—*C.A.* 45, 4996*d*.

By adsorption on MgO and elution with benzene, *m*-dinitrobenzene(DNB) could be sepd. from *s*-trinitrobenzene(TNB). On MgO adsorbed DNB was blue, and adsorbed TNB red. The formation of a red adsorption band of TNB and a deep red color when a benzene soln. of TNB was treated with Na alcoholate was attributed to formation of an excited state due to polarization of the nitro group by the MgO dipole in the first case and the Na alcoholate dipole in the second.

3357. Danilov, V. I. and Ovsienko, D. E. **Crystallization of hydroquinone on single crystals of calcite.** *Dopovidi Akad. Nauk Ukrain.* R.S.R. **1950**, 205-8.—*C.A.* 46, 6455*h*.

Hydroquinone, which could be supercooled 15-20°C, was supercooled 3-4°C in the presence of calcite. When hydroquinone crystals were exposed to calcite for 25 days, supercooling was only 1.5-2.0°C; on heating 40-50°C above the m.p., supercooling of 3-4°C was again attained.

3358. Engel, W. and Holzapfel, L. **Organic compounds of silicic acid. XVIII. Organic silicates.** *Kolloid-Z.* **119**, 160-4 (1950).—*C.A.* 45, 4523*a*.

The adsorption of sugar on quartz from aq. soln. showed highest results with galactose. It was bound tighter to the quartz surface than others such as glucose. Proteins were adsorbed only in the presence of glycocoll which lowered the adsorption value of galactose.

3359. Figurovskiĭ, N. A. and Ushakova, N. N. **Regulation of dispersion of barium sulfate precipitate by organic addends.** *Zavodskaya. Lab.* **16**, 1063-71 (1950).—*C.A.* 45, 1843*a*.

Increase of particles size and narrowing of the range of the disperse state of $BaSO_4$ was achieved by addn. to the soln. of picric acid, pyridine, or salicylic acid. Na oleate led to particle-size increase accompanied by coagulation of the highly disperse portion of the ppt.

3360. KAINUMA, YOSHIRO AND UYEDA, RYOZI. **The structure of adsorbed organic long-chain molecules on the cleavage surface of molybdenite.** *J. Phys. Soc. Japan* **5**, 199-200 (1950) (in English).—*C.A.* **45**, 1836*a*.

Unidentified patterns observed in the electron-diffraction photographs of the cleavage surface of Mo were caused by the adsorption of long-chain hydrocarbon mols. The plane of the chain was parallel to the surface, and the individual chain links were parallel to the sides of the hexagon of the base crystal.

3361. KIRIYAMA, RYOITI. **Velocities of crystal growth. II. Adequate velocities of crystal growth of strontium formate dihydrate and of barium formate.** *J. Chem. Soc. Japan*, Pure Chem. Sect., **71**, 125-7 (1950).—*C.A.* **45**, 4534*g*.

From the assumption that the velocity of growth at a certain temp. is proportional to the degree of supersatn. and the surface area of the crystal, it followed that the velocity had a max. at a certain concn.

3362. KIRIYAMA, RYOITI. **Velocities of crystal growth. III. Anisotropies of the velocities of crystal growth of strontium formate dihydrate.** *J. Chem. Soc. Japan, Pure Chem. Sect.*, **71**, 188-90 (1950).--*C.A.* **45**, 4534h.

Circular disks of Sr formate dihydrate crystals cut perpendicular to *b* or *c* axes were placed in slightly superstd. aq. solns., evapg. at a const. temp., and the resulting growth was detd. after a few days. The ratios $\Delta c/\Delta a$ and $\Delta b/\Delta a$ increased with temp. This anisotropy was discussed in connection with adequate velocity of crystal growth.

3363. KUL'BERG, L. M. AND BULANZHE, I. N. **Mixed adsorption indicators in precipitation methods.** *Zavodskaya Lab.* **16**, 387-97 (1950).—*C.A.* **44**, 10576a.

Investigation of titrations of Cl, Br, and I salts by $AgNO_3$, SO_4 by $BaCl_2$, and F salts by $Ca(NO_3)_2$ with mixed indicators resulted in selections of several combinations which gave the most sharp color changes (best shown in $AgNO_3$ titrations); each combination had a best pH range and usually elevated temp. caused increased errors. A temp. under 35°C was recommended. Protective colloids were investigated; of those studied (gelatin, dextrin, and starch), gelatin showed the best effect and 0.1-10 ml. 1-2% soln. prevented coagulation of the colored ppts. and eliminated color change at the equivalence point.

3364. MACAROVICI, CONST. GH. AND CEAUSESCU, D. **Sulfamides. IV. Titration of sulfamides with silver nitrate in the presence of adsorption indicators. V. Control of sulfamides used as drugs.** *Analele Acad. Rep. Populare Romane, Ser.: Mat., Fiz., Chim.* **3**, Mem. 21, 1-27 (1950).—*C.A.* **45**, 8403*a*.

Sulfanilamide in alk. EtOH soln. could be titrated with 0.1 *N* $AgNO_3$ with dephenylcarbazone as adsorption indicator (color of ppt. changes to blue) providing too much NaOH was not present (0.05 *N* alcholic sulfanilamide, *N* aq. NaOH, 0.1 *N* $AgNO_3$, 8 drops 0.3% alcoholic diphenylcarbazone). Sulfathiazole (0.02 *N*) in neutral EtOH could also be titrated with a 0.5% aq. soln. of sol. eosin as adsorption indicator. The end point was reached when the ppt. and soln. were pink. It was possible to titrate not only pure sulfamides but also com. products used as drugs.

3365. MANNELLI, GIOVANNI AND ROSSI, M. L. **Adsorption indicators. I. II. III.** *Ann. chim. (Rome)* **40**, 163-5; 166-74; 175-80 (1950).—*C.A.* **45**, 10123*a*.

Martius Yellow was proposed in argentometry which gave a brick-red color in presence of excess Ag^+. Experiences with adsorption indicators (Trypan Blue, Fuchsin, and Neutral Red) furnished a variety of color changes in the argentometric detn. of halide ions. Bordeaux Red and Orange II were preferentially adsorbed on AgI over AgCl and could be utilized for a simultaneous detn. of I^- and Cl^- in a single operation. The first end point was yellow-orange for AgI, the second deep rose for AgCl.

3366. MEHROTRA, R. C. **Argentometric titrations of thiocyanate ions with adsorption indicators.** *Anal. Chim. Acta* **4**, 38-42 (1950).—*C.A.* **44**, 6346*i*.

The useful range of applicability of 6 new adsorption indicators for the titration of thiocyanate ions was discussed. Bromocresol green which can be used over a pH range 2.0-4.5, served as a very sharp indicator and gave well-defined end points for concns. as low as 0.002 *N* in the presence of 0.001-0.005 *N* HNO_3 soln. The supernatant suspension was yellow and the coagulation of AgCNS began quite early, but the particles remained colorless up to the equiv. point, when they developed a deep blue shade. The end point was very sharp and quite reversible.

3367. MEHROTRA, R. C. **Titrimetric precipatation of mercurous ions with the aid of adsorption indicators.** *Z. anal. Chem.* **130**, 390-5 (1950).—*C.A.* **44**, 8824*c*.

The indicator, tetraiodophenolsulfophthalein, was better than bromophenol blue for titrating Cl^- or Br^- with $HgNO_3$ soln. It helped to coagulate the ppt. of mercurous halide and imparted to it a pale yellow color which at the end point changed to deep violet.

3368. PUTSEĬKO, E. K. AND TERENIN, A. N. **Accumulation of electrons of a semiconductor in organic dyes adsorbed thereon.** *Doklady Akad. Nauk S.S.S.R.* **70**, 401-4 (1950).—*C.A.* **45**, 5018*e*.

Adsorption of methylene blue on TlI (40° to 70°C) gave rise, in addn. to the proper photocond. of TlI (max. in the 4000-A. region), to a sensitized photocond. in the range of absorption of the dye (around 6500 A.). If, in addn. to intermittent illumination with light absorbed by the adsorbed methylene blue, TlI was simultaneously exposed to const. illumination with wave lengths (4358 and 4047 A.) and photocond. was measured by the condenser method, without application of an elec. field, the spectral curve was unchanged, but the magnitude was substantially increased. Similar observations were made with phosphors ZnS:CdS(Cu), with crystals of CdS, PbO, TlBr + TlI, etc. Evidently, in TlBr and HgI_2 the trapping levels preexist in the semiconductor, independently of adsorption.

3369. Sass, O. E. and Bertram, Fritz. **Acid violet 4BL as an adsorption indicator.** *Chem.-Ztg.* 74, 734 (1950).—*C.A.* **45**, 5060*e*.

Acid violet 4BLwas a good argentometric adsorption indicator for detg. Cl^-. The chloride titration could be done in a soln. contg. up to 3%HNO_3. The end point was blue-green → violet. The titration was successful in solns. contg. excess of Na_2HPO_4, Na_2SO_4, NH_4NO_3, CH_3COONa, $CuSO_4$, $Cr_2(SO_4)_3$, and $Al_2(SO_4)_3$. The dye could be used with solns. contg. as little as 0.001% Cl^-.

3370. Schulek, E. and Pungor, E. **Argentometric determination of chloride, bromide, and thiocyanate by back-titration with adsorption indicators.** *Anal. Chim. Acta* 4, 109-17 (1950).—*C.A.* **44**, 9867*d*.

To det. (0.3-1.5 mg) Cl^-, (0.8-4.0 mg) Br^-, or (0.6-3.0 mg) CN^- in an aq. soln., add 1 drop of p-ethoxy- or p-methoxychrysoidine indicator soln., neutralize carefully, and add a measured vol. of 0.01 *N* $AgNO_3$. Coagulate the ppt. by warming and shaking with 1 g of KNO_3 or NH_4NO_3, cool, dil. to 80-100 ml, add 6-8 drops more of the indicator soln. and titrate the excess Ag^+ with 0.01 *N* KI soln. The color change was red to yellow, and the ppt. a deep raspberry red at the end point.

3371. Schulek, E. and Pungor, E. **Theory of adsorption indicators. Dye adsorbates as acid-base indicators.** *Anal. Chim. Acta* 4, 213-27 (1950).—*C.A.* 44, 10575h.

$AgNO_3$ solns. were titrated with alkali chlorides in the presence of p-ethoxysoidine as indicator. Dyestuff-adsorbates were formed, the colors of which depended on the properties of the surface, the ions already present, and their concns. These adsorbates were sensitive to pH, and could therefore serve as indicators for acid-base reactions. This behavior seemed to be the most characteristic of the adsorbates on AgI with which the sharpest color change could be observed.

3372. Sierra, F and Hernández Cañavate, J. **The cupric-o-dianisidine system as an oxy-adsorption indicator in silver determinations.** *Anales real soc. espan. fis. y quim.* **46B**, 557-68 (1950).—*C.A.* 45, 5060*f*.

A mixt. of aq. 1% $Cu(NO_3)_2$ soln. and o-dianisidine in 95% EtOH (1g/100 ml) was used as an indicator in detns. of 0.001-0.1 *N* Ag with standard KCNS solns. This indicator gave satisfactory results in the presence of Pb, Cu, Cr, Co, and Ni, and in the presence up to 20% of concd. HNO_3 for 0.1 *N* Ag solns. and up to 5% for 0.01 *N* Ag solns.

3373. Boer, J. H. de and Houben, G. M. M. **Misleading color reactions.** *Proc. Koninkl. Nederland. Akad. Wetenschap.* **54B**, 421-9 (1951).—*C.A.* 46, 10875*c*.

The adsorption of dyes on the surface of inorg. salts caused a shift of the dye-absorption spectra to longer wave lengths. Any Al oxide, sufficiently dried, adsorbed *p*-nitrophenol from solns. in org. solvents with a yellow, phenolphthalein with a red, and *o*-nitrophenol with a deep-orange color. The fewer the OH groups on the surface and the less polar the solvent, the stronger and deeper was the color of the adsorbed dye layer. Water, if present, was preferentially adsorbed and no color appeared.

3374. Buzágh, Aladár. **Influence of polar and nonpolar compounds on the adhesivity of quartz particles.** *Acta Chim. Hung.* **1**, 182-95 (1951) (in German).—*C.A.* 45, 10008*f*.

The adhesivity, the cataphoretic migration velocity, and the sediment vol. of homodisperse quartz particles of microscopic size were detd. in primary alcs., in alc. solns. of electrolytes, and in mixts. of polar and nonpolar compds. Adhesivity increased, and cataphoretic migration velocity diminished when the alc. concn. in aq. alc. solns. was reduced. The effect on the adhesivity depended definitely upon the no. of C atoms in the alc. Quartz showed strong adhesivity in nonpolar liquids, such as aliphatic and aromatic hydrocarbons. Polar groups, such as OH, CHO, CO_2H, and NO_2, had a reducing effect on adhesivity. In mixts. of nonpolar and polar compds. the adhesivity diminished as the concn. of polar components increased.

3375. Chang, Y. L. **Orientation of methylene blue molecules adsorbed on solids and crystallized in a membrane.** *Science Record* (China) 4, 134-47 (1951).—*C.A.* **46**, 4882*d*.

A drop of a 4% MeOH soln. of methylene blue was allowed to fall on different types of substrates, and the orientation of the methylene blue mols. was detd. by examg. the surfaces through a Polaroid screen. Highly oriented films were obtained on both muscovite and lepidolite. The methylene blue mols. lay flat on the (010) face of a gypsum crystal with the long axis of the mol. parallel to the intersection between (010) and (111) faces. On the faces surrounding (010) the mols. were oriented with their long axis perpendicular to the resp. faces and with the *c* axis parallel to the lines of intersection between (010) and the resp. face.

3376. Green, R. W. and Walsh, J. P. **Protection of of the wet enamel surface by adsorbed films.** *J. Dental Research* **30**, 218-24 (1951).—*C.A.* 45, 5878*e*.

The power to protect the intact dental enamel surface from decalcification by acid was possessed by primary aliphatic amines, contg. 8, 10, 12, 14, 16, 18 C atoms, resp., and was exerted from soln. in either H_2O or paraffin oil. Powd. Ca phosphate was similarly protected.

3377. Hanson, Roberta M. and Gould, C. W. **Talc as an adsorbent for sulfonated azo dyes.** *Anal. Chem.* **23**, 670-3 (1951).—*C.A.* **45**, 6384*g*.

The adsorptive behavior of talc toward pairs of similar sulfonated azo dyes was compared. Aq. pyridine solns. 0-10 % served as developer. In some cases the column was pre-washed with 5 *M* aq. NaOH. Adsorption depended on the no. and positions of the anionic functional groups in the mol.

3378. HERNÁNDEZ CAÑAVATE, JUAN. **New argentometric determinations with adsorption indicators.** *Anales univ. Murcia* (Spain) **10**, 275-362 (1951-52).—*C.A.* **47**, 5301*i*.

Good results were obtained with the Cu^{2+}-benzidene system in a weakly citric acid soln. as indicator. The detns. could be made in the presence of Pb^{2+} and Cu^{2+} and in the presence of 20 times as much Cu as Ag. Good results were also obtained with Cu^{2+}-toluidine in citric acid or dil. H_2SO_4 as indicator.

3379. HIRST, W. AND LANCASTER, J. K. **Effect of water on the interaction between stearic acid and fine powders.** *Trans. Faraday Soc.* **47**, 315-22 (1951).—*C.A.* **45**, 8331*d*.

The interaction between stearic acid in PhH and the evacuated powders TiO_2, SiO_2, TiC, SiC, Cu, Cu_2O, CuO, Zn, and ZnO were investigated at 18°C, with dry soln. and those contg. traces of water, and with powders whose surfaces were covered by adsorbed layers of water. No attempt was made to remove oxide films. For TiO_2, SiO_2, TiC, and SiC, the shape of the desorption isotherm was characteristic of phys. adsorption and the presence of water merely reduced the amt. of acid adsorbed. On the reactive dry powders Cu, Cu_2O, CuO, and Zn, the acid was physically adsorbed; the water initiated chem. reaction. The initial rate of reaction depended on the quantity of water present, and with Cu_2O, the presence in soln. of about 1 part water in 10^5 increased the amt. of acid taken up in the first two hrs by a factor of 15 compared with dry conditions. The ZnO powder reacted even under the driest conditions obtainable.

3380. KISELEV, A. V. AND KRASIL'NIKOV, K. G. **Uni- and multimolecular adsorption from solution on a nonporous adsorbent.** *Doklady Akad. Nauk S.S.S.R.* **77**, 831-4 (1951).—*C.A.* **45**, 6455*e*.

Adsorption isotherms from solns. of PhOH in C_7H_{16} on $BaSO_4$ powder of surface area 9.7 m^2/g were detd. At 20°C, the isotherm leveled off at a relatively low concn., 25 millimole/liter (i.e. 0.1 of satn.) and the adsorption remained practically unchanged up to satn. of the soln. At 40°C, the isotherm was S-shaped, beginning to rise at approx. a relative concn. $c/c_s = 0.6$ ($c_s = 1.3$ mole/liter). From this point on, adsorption was multimol. A similar isotherm was found with MeOH in C_7H_{16} on $BaSO_4$.

3381. KUL'BERG, L. M. **Adsorption-topochemical reactions for the identification of fluorides of calcium, barium, and strontium.** *Doklady Akad. Nauk S.S.S.R.* **76**, 73-6 (1951).—*C.A.* **45**, 5568h.

Bromophenol blue, bromocresol purple, alizarin, and phenol red were satisfactory. Change in color of indicator during adsorption on fluorides was not directly related to the pH of their satd. solns. Indicator solns. were prepd. from 1-2 mg of indicator and 10 ml alc. and used: (1) Identification of CaF_2, SrF_2, and BaF_2. (2) Differentiating synthetic from natural CaF_2. (3) Differentiating freshly made from "old" CaF_2. (4) Detection of CaF_2 impurity in SrF_2 and BaF_2.

3382. SIERRA, F. AND HERNÁNDEZ CAÑAVATE, J. **New silver determinations with Cu^{2+}-tolidine and Cu^{2+}-benzidine as oxi-adsorption indicators.** *Anales real soc. españ. fís. y quím.* **47B**, 269-76 (1951).—*C.A.* **45**, 8937h.

The Cu^{2+}-tolidine oxi-adsorption system as an indicator was recommended as being much more sensitive than Cu^{2+}-benzidine, and results were much more reproducible with it in all concns. of Ag.

3383. SIERRA, F. AND HERNÁNDEZ CAÑAVATE, J. **III. Determinations with Cu^{2+}-*o*-dianisidine as the oxi-adsorption indicator.** *Anales real soc. españ. fís. y quím.* **47B**, 277-80 (1951).—*C.A.* **45**, 8938*a*.

Ag solns. were evaluated with Br^- and I^- in strongly acid media with Cu^{2+}-ω-*o*-dianisidine as the indicator: To 5-10 ml Ag soln. add 2 drops $Cu(NO_3)_2$ soln. (contg. 1% Cu), 2 ml *N* HNO_3, and 6 drops *o*-dianisidine. An equal vol. H_2O was then added, and then dropwise the evaluated KI or KBr soln.

3384. SIERRA, F. AND HERNÁNDEZ CAÑAVATE, J. **New argentimetric determination of chlorides, with meriquinonoid derivatives of benzidine, tolidine, and *o*-dianisidine as adsorption indicators.** *Anales real soc. españ. fís. y quím.* **47B**, 439-45 (1951).—*C.A.* **46**, 379*i*.

The ferric complexes of benzidine, tolidine, and *o*-dianisidine acted as adsorption indicators on AgCl. The resistance to HNO_3 of these indicators was much greater than that of phenosafranine. The adsorbed colors were blue or violet in all cases.

3385. SIERRA, F. AND SÁNCHEZ, J. A. **Adsorption indicators in determinations involving mercurous ions and bromides.** *Anales real soc. españ. fís. y quím.* **47B**, 446-52 (1951).—*C.A.* **46**, 380a.

The ferric complexes of *o*-tolidine, benzidine, and *o*-dianisidine acted as adsorption indicators in the titration of Hg_2^{++} with Br^-. The indicators were reversible and the changes sharp; the 1st and 2nd changed from blue to rose and the 3rd from violet-blue to violet with Br^-.

3386. SUBRAHMANYA, R. S.; ROA, M. R. A., AND DOSS, K. S. GURURAJA. **The effect of wetting agents on the adsorption of crystal violet by glass.** *Proc. Indian Acad. Sci.* **34A**, 324-8 (1951).—*C.A.* **47**, 6734*i*.

The effect of Igepon T and Aerosol O T on the adsorption of crystal violet from aq. soln. by 100-150-mesh glass powder was studied over a pH range of 3.7 to 9.1. With no wetting agent adsorption rose from 0.013 mg of dye per g of glass powder at pH 3.7 to 0.089 mg/g at pH 9.1. In acid soln. dye adsorption rose sharply with small addn. of wetting agent and then decreased slowly to zero at high concn.

3387. WEST, W. AND CARROLL, B. H. **Energy transfer in the photosensitization of silver halide photographic emulsions: optical sensitization, supersensitization, and antisensitization.** *J. Chem. Phys.* **19**, 417-27 (1951).—*C.A.* **45**, 9405*d*.

Dyes in the cooperative state were most susceptible to the increase of sensitization caused by supersensitizers. Exptl. evidence was furnished, including correlations between optical sensitization and supersensitization with the type of absorption spectrum of the adsorbed dye.

3388. WHETSTONE, J. **Modification of crystal habit of inorganic salts with dyes.** *Nature* **168**, 663-4 (1951).—*C.A.* **46**, 2869*e*.
The modification of crystal habit of many inorg. salts by dye mols. may be due to the incorporation of dye mols. in one or more of the edge-faces of these layers, retarding the growth of a crystal face.

3389. ADITYA, S. AND GHOSH, B. N. **Stannic oxide. I. Adsorption of monobasic organic acids and the effect of salts on it.** *J. Indian Chem. Soc.* **29**, 92-6 (1952).—*C.A.* **46**, 8929*h*.
The adsorptions of hydroxyacetic, chloroacetic, trichloroacetic, formic, propionic, and acetic acids and mixts. with their Na salts and NaCl or Na_2SO_4 on β-stannic oxide hydrate, 33.4% H_2O, were detd. The extent of adsorption depended on the anion, the H-ion activity and the effect of the electrolyte system on the pos. charge.

3390. ADITYA, S. AND GHOSH, B. N. **Stannic oxide. II. Adsorption of polybasic acids and the effect of salts on it.** *J. Indian Chem. Soc.* **29**, 123-6 (1952).—*C.A.* **46**, 8929*i*.
Adsorption of polybasic acids on SnO_2 was markedly greater than that of monobasic acids; it decreased in the order: citric acid, oxalic, tartaric, malic, fumaric and maleic, malonic, succinic.

3391. BORIN, A. V. **Absorption spectra of dibenzothiacarbocyanin dyes on the boundary surface between silver bromide and gelatin gel.** *Doklady Akad. Nauk S.S.S.R.* **86**, 1141-3 (1952).—*C.A.* **47**, 5796*h*.
A layer of gelatin (10% soln.) was poured on a layer of fused AgBr and the set gelatin film was stripped; a drop of a soln. of 3,3′-dimethyl-9-ethyl-4,4′,5,5′-dibenzothiacarbocyanine in MeOH was then placed either on the side of the gelatin film having faced the AgBr (side I) or on the opposite side, and the absorption spectra of the dye in the 2 instances were compared. The spectrum on side I showed increased absorption in band β (around 540 mμ) and decreased absorption in the *J* band (around 650 mμ) as compared with the spectrum of the opposite side.

3392. CUNNINGHAM, W. A.; DUNHAM, R. M., AND ANTES, L. L. **Hydration of gypsum plaster.** *Ind. Eng. Chem.* **44**, 2402-8 (1952).—*C.A.* **47**, 288*a*.
Photomicrographic studies indicated that the hydration of the hemihydrate occured by the process of first dissolving and then crystg. as needle-like gypsum ($CaSO_4 \cdot 2H_2O$) crystals. The rate of soln. was affected by the addn. of accelerators, such as NaCl, and retarders, such as glue, gelatin, borax, citric acid, and hog bristles.

3393. DARUWALLA, E. H. AND NABAR, G. M. **Behavior of a mixture of negatively charged colloidal iron and chromium hydroxides.** *Kolloid-Z.* **127**, 33-8 (1952).—*C.A.* **46**, 8466*d*.
The stability of $Fe(OH)_2$, $Fe(OH)_3$, and $Cr(OH)_3$, prepd. by reaction of $FeSO_4$, $FeCl_3$, $Cr_2(SO_4)_3$ with definite amts. of NaOH, was detd. in the presence of nonelectrolytes, (peptizing agents, sugar, glycerol) and electrolytes (pptg. agents, Na_2SO_4, $MgSO_4$, $Al_2(SO_4)_3$). Glycerol was unsuitable for peptizing $Fe(OH)_2$, but it could peptize $Cr(OH)_3$ even at relatively high concns. However, $Fe(OH)_2$ could be easily peptized by glycerol in the presence of $Cr(OH)_3$.

3394. GAUDIN, A. M. AND CHANG, C. S. **Adsorption on quartz, from an aqueous solution, of barium and laurate ions.** *Trans. Am. Inst. Mining Met. Engrs., Tech. Pub.* No. **3244B** (in *Mining Eng.* **4**, 193-201) (1952).—*C.A.* **46**, 2350*f*.
Radioactive Ba and radioactive-carbon-labeled lauric acid were used to study the adsorption of Ba and laurate at equil. on a sample of ground quartz. Quartz adsorbed Ba from soln. The presence of Na up to 6 millimol. per liter did not materially affect Ba adsorption at Ba concn. of 0.06 millimol. per liter. Quartz adsorbed laurate from soln., the adsorption being a function of laurate concn. but independent of pH (8.8 to 11.4). Laurate adsorption increased slightly with increase of Na concn., and rapidly with Ba concn.

3395. JACOBI, BERNHARD. **The colloid chemistry of emulsion polymerization.** *Angew. Chem.* **64**, 539-43 (1952).—*C.A.* **47**, 344*f*.
The growth of colloidal particles was treated and an adsorption-titration method for detg. the growth was described in detail. Detns. of the inner surface of emulsions were reported by means of electron-microscope photographs, ultracentrifuge measurements, and N_2 adsorption by the B.E.T. method.

3396. JAMES, T. H. AND VANSELOW, W. **Chromatographic study of the adsorption of various substances by silver bromide.** *Colloque sensibilité phot., Paris, 1951, Science et inds. phot.* **23A**, 122-5 (1952).—*C.A.* **47**, 4774*c*.
Ag ion displaced adsorbed 3,3′-diethyloxacarbocyanine ion from AgBr surface, whereas bromide ion caused the dye to be more strongly held. Conversely, bromide displaced the merocyanine dye, 4-[2-(3-ethyl-2-benzothiazolinylidene)ethylidene]-3-methyl-1-(*p*-sulfophenyl)-5-pyrazolone and Ag ion caused it to be held more tightly.

3397. JAMES, T. H. AND VANSELOW, W. **Chromatographic investigations related to photographic theory. II. Adsorption of developing agents and sodium sulfite.** *J. Am. Chem. Soc.* **74**, 2374-6 (1952).—*C.A.* **47**, 6799*e*.
The previous investigation was extended to include dyes which did not have a pos. charge and hence would not attract the negatively charged developer ions. *p*-HOC_6H_4OH, *o*-HOC_6H_4OH, and H_2NOH displaced some adsorbed dyes from the AgBr surface and hence must themselves become adsorbed in ionized form by that surface.

3398. KOSHURNIKOV, G. S. **Effect of organic additives on solution of crystals.** *Zhur. Priklad. Khim.* **25**, 1316-18 (1952).—*C.A.* **47**, 4173b.
Crystals of $CuSO_4$(3-3.5 mm) were added to a satd. soln. of $CuSO_4$ in H_2O, and the system was

treated with the additives while the cell was traversed with d.c. at 6×10^{-5} amp. $PhNH_2$ retarded soln. but $PhNO_2$ accelerated it and PhBr had little effect. The results were apparently caused by differential adsorption of the org. materials on crystals faces.

3399. MANNELLI, GIOVANNI AND ROSSI, M. L. **Adsorption indicators. IV.** *Anal. Chim. Acta* **6**, 333-6 (1952) (in French).—*C.A.* **46**, 7460g.

A new adsorption indicator, Red Acid 6B, was used for the argentometric titration of halide ions. It is applicable for very dil. solns. of I^-.

3400. O'CONNOR, D. J. AND BRYANT, F. **Adsorption of amino acids on sparingly soluble inorganic solids.** *Nature* **170**, 84-5 (1952).—*C.A.* **46**, 9378*h*.

Aspartic acid and glycine were adsorbed on synthetic zeolite and the following inorg. compds.: natural ZnS, PbS, $PbMnO_4$, $PbSO_4$, $BaSO_4$, $PbCrO_4$, and fused $PbCrO_4$, by column operation, and on the zeolite, fused $BaCrO_4$, and natural and synthetic inorg. compds. by batch operation. In each case the zeolite adsorbed the most acid.

3401. POURADIER, JACQUES AND ROMAN, JANINE. **Factors influencing the adsorption of gelatin by the surface of crystalline silver halide.** *Science et inds. phot.* **23**, 4-13 (1952).—*C.A.* **46**, 2433e.

Adsorbed gelatin was defined as that not removed from the AgBr by washing in water at 50°C. The adsorption isotherm for a de-ashed gelatin at 40°C was detd. with pptd. AgBr at pAg 6. At low concn. adsorption of gelatin from the soln. was nearly complete. No desorption of gelatin was observed when AgBr pptd. in the presence of gelatin was dild. with water and agitated for 5 days at 40°C. The amt. of gelatin adsorbed increased with increasing mol. wt, but the amt. of fraction 190,000 was only roughly double that of 30,000.

3402. SCHULEK, E. AND PUNGOR, E. **Adsorption phenomena on the surface of nascent silver iodide particles.** *Anal. Chim. Acta* **7**, 243-54 (1952) (in German).—*C.A.* **47**, 4685*i*.

AgI crystals were quickly obtained upon pptn. in the presence of *p*-ethoxychrysoidine; they were stable in the beginning, aged spontaneously with time, or coagulated with the help of artificial means in such a manner that only a few of their active spots were lost in the process.

3403. SEIFERT, H. **Modification of the habit of growing crystals by impurities [considered] as an adsorption problem.** *Z. Elektrochem.* **56**, 331-8 (1952).—*C.A.* **46**, 10765*d*.

The effect of glycine on NaCl crystals was described. When grown at 40°C from solns. contg. more than 12 g glycine per 100 g satd. NaCl soln., the NaCl crystals tended toward (rhombic) dodecahedra. The approx. fit of the 110 planes of NaCl with the 100 planes of glycine could not explain the detailed observations.

3404. WEISS, ARMIN AND HOFMANN, ULRICH. **Reactions inside the layer lattice of carnotite.** *Z. Naturforsch.* **7b**, 362-3 (1952).—*C.A.* **47**, 4166h.

A synthetic carnotite of the cation exchange capacity of 220 meq./100 g air-dry powder exchanged its K^+ against Na^+, Mg^{2+}, Ni^{2+}, arginine, lysine, and aromatic amines. The Ni ions were pptd. and fixed with a MeOH soln. of $(MeC{:}NOH)_2$. In both cases H ions instead of the metal ions were exchangeable after the pptn. α-Benzil dioxime, however, was incapable of pptg. the Ni inside the layers.

3405. WEST, W.; CARROLL, B. H., AND WHITCOMB, D. H. **Adsorption of sensitizing dyes in photographic emulsions.** *J. Phys. Chem.* **56**, 1054-67 (1952).—*C.A.* **47**, 4772a.

Many sensitizing cyanine dyes were adsorbed to the grains of photographic emulsions according to the Langmuir equation, the mols. in the satd. monolayer being oriented. Less well adsorbed dyes often exhibited a discontinuity between adsorption as isolated mols. and a coöperative phase with different spectral characteristics. Polylayer adsorption also occurred, and merocyanines conformed to Langmuir of approx. Freundlich curves, according to the class.

3406. BEISCHER, D. E. **Radioactive monolayers: a new approach to surface research.** *J. Phys. Chem.* **57**, 134-8 (1953).—*C.A.* **47**, 6725*f*.

C^{14}-tagged stearic acid monolayers could be formed on the surfaces of various solid materials and heated so that the monolayers reacted with the solid surfaces. When the excess unreacted monolayers were removed by benzene, there remained a radio-autograph on the surface. Results were reported for Pt, vitreous SiO_2, glass, mica, Cu, Pb, molybdenite, and brucite surfaces.

3407. DUNBAR, J. C. AND MITCHELL, T. J. **Electrodeposition of powdered inorganic materials from suspension in organic liquids.** *J. Sci. Food Agr.* **4**, 190-6 (1953).—*C.A.* **47**, 6275*c*.

The amt. of deposit increased with increasing dielec. const. in the series $MeCO_2Et$, AmOH, BuOH, PrOH, EtOH, MeOH. The deposition of $MgCO_3$ from cyclohexanone was in agreement with the dielec. const. of the liquid, but $CaCO_3$ did not electrodeposit from this compd.

3408. EWING, WARREN W. AND LIU, FRED W. J. **Adsorption of dyes from aqueous solutions on pigments.** *J. Colloid Sci.* **8**, 204-13 (1953).—*C.A.* **47**, 6215*a*.

Anatase, rutile, and ZnO with surface areas known from electron-microscope or B.E.T. measurements were used as adsorbents for purified Crystal Violet and purified Orange II from aq. solns. at room temp. One isotherm was also detd. at 60°C and 93°C. The data were consistent with the B.E.T. theory of multilayer adsorption. The areas calcd. for the adsorbents were consistent with the known values if the cross-sectional areas of the adsorbates were 80 A.^{2} for Crystal Violet and 70 A.^{2} for Orange II.

II-6. Inorganic Solids With Inorganic Solutions

3409. Bradley, R. S. **Surface reaction between oxonium ions and mica.** *Trans. Faraday Soc.* **35**, 1361-6 (1939).—*C.A.* **34**, 1532^4.

Sheets of freshly cleaved muscovite were immersed for short times in solns. of pH between 2.5 and 6 at 25°C; they were then quickly withdrawn and plunged into KOH to check the reaction and then washed with distd. water. A drop of dil. NH_4I was allowed to dry slowly on the mica and the crystals formed differed from the oriented tetrahedral crystals found on untreated mica surfaces. A mixture of oriented tetrahedra and unoriented cubes occurred, the proportion of the latter increasing with the time of immersion in the acid soln.

3410. Polesitskii, A. **Exchange of bromine-ions between silver bromide and a bromine solution.** *Compt. rend. acad. sci. U.R.S.S.* **24**, 668 (1939).—*C.A.* **34**, 1902^3.

Exchange of Br ions between freshly coagulated AgBr and KBr soln. was studied. The exchange was found to proceed very rapidly at first (10% exchange in the first min.) then the ratio dropped abruptly, requiring 20 to 30 hrs to reach completion. This was attributed to aging of the ppt. "Preaged" ppts. were found to have slower rates of exchange, and melted AgBr showed no exchange.

3411. Ruyssen, R. and Verstraete, E. O. K. **Streaming potential and surface conduction in the sulfur diaphragm.** *Natuurw. Tijdschr.* **22**, 93-103 (1940).—*C.A.* **37**, 2978^4.

Calcn. of the "wall cond." of the S showed that Ba^{++} was distinctly less adsorbed than K^+; at higher concns. the "wall cond." in the presence of K^+ and Ba^{++} was practically additive. The av. ζ-potential of S in pure water was −50 mv.; the S was still not discharged by 1000 μ-equiv. of $BaCl_2$, but was discharged by 500 μ-equiv. of KCl 500 μ-equiv. of $BaCl_2$. The active surface of the S was 700 m^2/kg.

3412. Balarev, V. D. **Disperse structure of solid systems and its thermodynamic foundation. V. VI. Application of the Gibbs-Thomson equation for crystals.** *Kolloid-Z.* **97**, 300-4 (1941); **98**, 43-5 (1942).—*C.A.* **36**, 5689^9.

Observations on petization and turbidity phenomena were reported for $BaSO_4$. The order of magnitude of the sepd. particles was 0.1μ. The equil. dimensions of the free $BaSO_4$ particles were approx. 1/10th that of the prepd. KCl crystal. The thermodynamic treatment was based on ideal crystals in 3 directions. In reality, not only real intergrown conglomerates but also the real uncombined crystals capable of existence, had to be differentiated from the ideal.

3413. Gleditsch, Ellen and Rona, Elisabeth. **Investigation of the exchange of ions between salts and saturated solutions.** *Arch. Math. Naturvidenskab.* **44**, 53-62 (1941).—*C.A.* **38**, 1938^4.

The exchange of Cu in the systems $CuSO_4$-satd. $CuSO_4$ soln., CuI-satd. $CuSO_4$ soln., and CuBr-satd. $CuSO_4$ soln. and that of the halogens in the systems CuI-NaI soln. and CuBr-NaBr soln. were investigated. The corresponding radioisotopes were used for the solns., and the activities of the solid phases were detd. after varying intervals.

3414. Kerékgyartó, Jenö. **Radioactive-kinetic research on the exchange process on heteropolar crystal surfaces.** *Magyar Chem. Folyóirat* **47**, 121-48 (1941).—*C.A.* **38**, 3903^9.

The dissolved ions were either adsorbed directly on the surface or the surface particles were exchanged for them. The first was true adsorption and was, among other things, responsible for charging of the surface, but the exchange of ions could be evaluated by the detn. of the abs. interfacial surface. The exchange process for detg. interface had been tested from 3 points of view. First, the surface phenomena mentioned above were sepd. from each other. Second, the magnitude of the exchange capacity of the surface was detd. The 3rd question was whether the sum of the elementary surfaces of the surface mols. capable of exchange agreed with the total surface or not. The facts found so far showed that in many cases the entire surface was not exchanged.

3415. Orr, W. J. C. **An attempted isotopic separation by fractional crystallization.** *Trans. Faraday Soc.* **37**, 587-90 (1941).—*C.A.* **36**, 1544^3.

A continuous flow of satd. NaCl soln. in a 9% CH_3OH-water mixt. moved upward in a long column, while a continuous stream of NaCl crystals, pptd. from the satd. soln. as it reached the top, passed down the column. After one month's continuous operation the shift in the at. wt of Cl was less than 0.05 of an at.-wt unit.

3416. Verstraete, E. O. K. **Determination of the adsorbed and free polythionic compounds in colloidal sulfur.** *Meded. Kon. Vlaamsche Acad. Wetensch., Letteren Schoone Kunsten Belgie, Klasse Wetensch.* **3**, 3-10 (1941).—*C.A.* **37**, 4288^9.

In the prepn. of colloidal S from H_2SO_4 and $Na_2S_2O_3$, large amts. of polythionic compds. always appeared, particularly pentathionic compds., which acted to stabilize the sol. After purification and prolonged electrodialysis there was in the sol. an equio. between adsorbed and free $H_2S_5O_6$ and $Na_2S_5O_6$, the development of which could be followed by acidimetric and iodometric titration of the sol., the ultrafiltrate (the filtrate after pptn. with KNO_3), and by detn. of the residue of ash in the ppt. so obtained.

3417. Bachelet, Maurice. **Chemical process of extraction and determination of radioactinium.** *J. phys. radium* [8], **3**, 171-6 (1942).—*C.A.* **38**, 4190^2.

The sepn. of Rd-Act from solns. of rare earth elements was based on its being carried down with $La(OH)_3$ during its partial pptn. The first 4% of $La(OH)_3$ contained 97% of the Rd-Act. If Fe was present, the ppt. also contained Fe $(OH)_3$, but treatment with a mixt. of alkali carbonates and sulfides brought only the Rd-Act into soln.

3418. Baur, Emil. **The behavior of sodium chloroaurate of extreme dilution and the separation of gold from sea water.** *Helv. Chim. Acta* **25**, 1202-25 (1942).—*C.A.* **37**, 5898^7.

Adsorption of gold from dil. solns. (several mg Au/m^3) by glass, zeolite, charcoal, coke, cellulose, sawdust, PbS, and sulfur sol was discussed. Many of the published values for gold content of sea water may be in error owing to adsorption of the metal by the glass walls of the vessel in which the samples were stored. A method of analysis for these small amts. of gold was given. Extn. of gold from sea water by means of adsorbents was considered.

3419. Boutaric, Augustin and Berthier, Paulette. **Test of the addition rule for magnetic properties during adsorption phenomena.** *J. chim. phys.* **39**, 129-33 (1942).—*C.A.* **38**, 3173^9.

In mixts. of colloidal solns. of $Fe_2(OH)_6$ and in those of Fe_2Cl_6 with adsorbed substances, it was shown that the frequently confirmed addn. rule for magnetic susceptibilities lost its applicability. The rule could be sustained only on the assumption that the magnetic susceptibility of the dissolved subs. decreased as a result of the adsorption.

3420. Dolique, R. and Macabet, L. **Ion exchange on zeolites in toxicology.** *Bull. sci. pharmacol.* **49**, 161-4 (1942).—*C.A.* **38**, 5447^4.

A zeolite filter retained Zn, Pb and Ba as well as Ca. Pb and Ba were adsorbed in even larger quantities. However, these metals were more easily released from the filter. Hg as a salt with a strong acid was not retained by zeolites.

3421. Føyn, Ernst andGleditsch, Ellen. **The ion exchange between salts and their saturated solutions.** *Arch. Math. Naturvidenskab* **45**; 91-9 (1942).—*C.A.* **38**, 2542^4.

The exchange velocities of Cu^+, Pb^{++}, Cl^-, Br^- and I^- in satd. solns. were studied by means of radioactive tracers. The exchange velocity of Cu^+ was 20 times that of the halide ions. For the lead halides, the exchange velocities of Pb^{++} and Br^- were about equal, but greater than that of I^-.

3422. Kargin, V. A. and Tolstaya, M. A. **Exchange adsorption of AgI sols.** *J. Phys. Chem. (U.S.S.R.)* **16**, 115-23 (1942).—*C.A.* **37**, 6515^7.

Exptl. data were given for the ph and the amts. of NaOH and of $AgNO_3$ adsorbed on the sol and in the ultrafiltrate both before and after coagulation. The adsorption of HI on AgI was weaker than that of BaI_2 either alone or as a mixt

3423. Kurzke, H. and Rottgardt, J. **Decolorization of alkali halide crystallites. II. Decolorization studies of microcrystalline layers colored by cathode rays.** *Ann. Physik* **41**, 584-96 (1942).—*C.A.* **37**, 4946^9.

Micro-crystals of KBr were prepd. either by pptn. from a suspension or by condensation from vapor, preferably the latter. Coloring was produced by 16-kv. cathode rays. Decolorization was accelerated by moisture and by high temp., and was slower in large crystals. The decolorization time increased linearly with the amt. of exposure used to produce the initial color.

3424. Tendeloo, H. J. C. and Voorspij, A. J. Zwart. **Adsorption electrodes. IV. Glass electrodes.** *Rec. trav. chim.* **61**, 531-8 (1942).—*C.A.* **37**, 5912^6.

Membranes made of CaF_2 and Corning glass 015 showed a certain activity as Ca electrodes; however, the observed e.m.f.'s did not agree with the theoretical values. Studies were made of the behavior, as electrodes, of glasses consisting of 6% CaO and variable amts. of Li_2O, Al_2O_3 and SiO_2, fused onto glass tubes as thin, very fragil membranes. Measurements in KCl, then in $CaCl_2$ and then in KCl soln. again, indicated that adsorption phenomena play a significant role in the potential values of a glass membrane.

3425. Težak, Božo. **The process of precipitation. II. Relation between the phenomena of precipitation and the fine structure of the electrokinetic double layer on silver chloride surfaces in aqueous sodium chloride solutions.** *Z. physik. Chem.* **A190**, 257-71 (1942).—*C.A.* 37, 4609^9.

The time-pptn. curves (detd. by Tyndall measurements) of $AgNO_3$ solns. of const. concns. in relation to the changing concn. of the NaCl solns. were used to study crystal boundaries. Below 20°C with systematic change in the concn. of the NaCl solns. from 0.1 to 0.0001 *N* a periodic connection existed between the stability of the AgCl particles and the NaCl concn. The pptn. curve showed 2 distinct max. at 0.04 and 0.004 *N* as well as 2 min. at 0.02 and 0.002 *N*. These could be explained by a consideration of the effects of the direct particle growth and the enlargement of the secondary particles through coagulation.

3426. Težak, Božo. **Information on precipitation reaction. III. The effect on the size and valence of the cations on the electrokinetic double charge on AgCl surfaces in aqueous solutions.** *Z. physik. Chem.* **191A**, 270-83 (1942).—*C.A.* **37**, 6519^1.

The speed of pptn. of AgCl from solns. of $AgNO_3$ by reaction with various concns. of Li, Na, K, Rb, Cs, Mg, Ca, Se, Ba, Al and Th chlorides was detd. Math. equations were derived relating the effect of the size and charge of the metal ion.

3427. Troelstra, S. A. and Kruyt, H. R. **Electrophoretic measurements on hydrophobic colloids.** *Kolloid-Z.* **101**, 182-9 (1942).—*C.A.* **38**, 4850^7.

Exptl. results on sols of AgI and Fe_2O_3 were reported. The electrophoretic curves of AgI sol with the nitrates of Ba, Mg, Al, La and Th were very uniform. The various valence groups were distinctly sepd., since also the relaxation effect was eliminated to a large extent in the medium of relatively high electrolyte content. For the sake of comparison the results of extinction measurements on the coagulation of a AgI sol with various salts were considered.

3428. Daudel, Raymond. **Exchange reactions.** *Compt. rend.* **216**, 666-7 (1943).—*C.A.* **38**, 2283^7.

To det. concn. of solute *A*, add an excess of radioactive reagent B^* to produce ppt. AB^*. Then add *BC* (sol., not radioactive) which comes quickly to equil. with B^*, but reacts slowly if at all with AB^*. Sep. BC, det. its radioactivity, thereby the amt. of free B^*, and, therefrom, A.

3429. Hafner, Harold C. and Jones, Frank L. **Adsorption of ions by leached surface films on glass.** *J. Am. Ceram. Soc.* **26**, 55-6 (1943).—*C.A.* **37**, 2147^9.

The leaching of glass by acid or neutral solns. may be complicated by the selective adsorption of certain ions within the hydrated SiO_2 film formed on the glass surface. The rate of release of acid-sol. elements to the attacking soln. was therefore not necessarily in accordance with the amts. present in the body of the glass.

3430. Krestinskaya, V. N. **Adsorption of ions during the coagulation of ferric hydroxide sol.** *J. Gen. Chem. (U.S.S.R.)* **13**, 780-9 (1943) (English summary).—*C.A.* **39**, 854^6.

On coagulation of three positively charged sols of $Fe(OH)_3$ by electrolytes, no adsorption of cations (NH_4, Mg, Ba, Na) took place. Sols of $Fe(OH)_3$ having counter ions (NO_3^-) showed adsorption, in equivalent amts., of anions: Cl, SO_4, oxalate and OH.

3431. Kuroya, Hisao; Aimi, Masasuke, and Tsuchida, Ryutaro. **Asymmetric adsorption of complex salts on quartz. II. Asymmetric adsorption and configuration of complex salts.** *J. Chem. Soc. Japan* **64**, 995-8 (1943).—*C.A.* **41**, 4731*i*.

The adsorption of the 8 complexes, $[Co(en)_3]Br_3.3H_2O$, $[Cr(en)_3]Cl_3.3.5H_2O$, *cis*-$[Co(en)_2(NO_2)_2]NO_3$, $[Co(en)_2ox]Br$, $[Co(en)_2CO_3]Cl.H_2O$, α-$[Co(glycine)].2H_2O$, *cis*-$[Co(en)_2NH_3Br]Br_2.2H_2O$, $[Co(oxin)_3]$ (ox = oxalate radical, oxin = 8-hydroxyquinoline) by fine *d*-quartz powder were studied. A close relation was confirmed between the adsorption and the spatial configuration of the complex.

3432. Langer, A. **Exchange of radioactive silver and bromide with silver bromide suspensions.** *J. Chem. Phys.* **11**, 11-15 (1943).—*C.A.* **37**, 815^8.

The exchange of radioactive Ag^+ and Br^- ions with aq. AgBr suspensions was studied. Both constituents of the AgBr lattice exchanged with the ions in soln. A strong dependence of the exchange rate on the amt. of surface of the ppts. used, for both Ag^+ and Br^-, was observed. A pronounced difference was found in the exchange rate for Br^- if dye mols. were adsorbed on the ppt. prior to the exchange expts. The rate for Ag was not affected by the presence of the adsorbed dye mols.

3433. Lyle, A. K. **Theoretical aspects of chemical attack of glasses by water.** *J. Am. Ceram. Soc.* **26**, 201-4 (1943).—*C.A.* **37**, 4213^5.

The effect of time and temp. on the chem. attack of glasses by water was represented by the equation: $a \log N = \log \theta - b/T + c$, where N = attack, θ = time, T = abs. temp. °K, a, b, and c were experimentally detd. consts. The const. b was independent of the glass compn. and of the size and shape of the sample being tested, and had a value of 5080 for tests of ordinary glass containers.

3434. Sata, Naoyasu and Ito, Shigeru. **The irregular series of colloidal solutions due to electrolytes. VII. Comparative experiments on the adsorption of silver nitrate upon various sulfide precipitates.** *Bull. Chem. Soc. Japan* **18**, 131-3 (1943).—*C.A.* **41**, 4357a.

Adsorption of $AgNO_3$ by HgS and As_2S_3 ppts. was studied. The adsorption by HgS was nonpolar, whereas that by As_2S_3 was an exchange adsorption of As and Ag. The adsorbed quantity of $AgNO_3$ was analyzed by Volhard's method. The intensity of the adsorption was far greater by As_2S_3 than by HgS.

3435. Schwab, Georg-Maria and Schwab-Agallidis, Elly. **Kinetics of reprecipitation.** *Kolloid-Z.* **104**, 67-78 (1943).—*C.A.* **38**, 2871^7.

The velocity of the transformation of $PbCrO_4$ to $PbSO_4$ in H_2SO_4 soln. was proportional to the 1.65-power of the H-ion concn. The increase in rate with increasing SO_4^{--} was due to adsorption. The velocity was inversely proportional to the CrO_4-ion concn. The soln. equil. was strongly repressed by the presence of SO_4^{--} owing to their adsorption on the $PbCrO_4$. The growth of $PbSO_4$ nuclei occurred partly in the free soln. and partly at the surface of the $PbCrO_4$.

3436. Taboury, Martial F. and Queuille, Jean. **Adsorption of selenious ion on various precipitates. Application.** *Compt. rend.* **217**, 150-2 (1943).—*C.A.* **38**, 5470^5.

Se in the form of selenious ions could be detd. by adsorption on Fe_2O_3. A soln. of $FeCl_3$ which would give 60-240 mg Fe_2O_3 was added to 1 liter of H_2O contg. 0.2-20 mg Se. The soln. was boiled and NaOAc added to give an easily filterable ppt. The ppt. was dissolved in HCl and the soln. reduced by $SnCl_2$ after which the Se was detd. colorimetrically. The adsorption followed the equation $x/m = Kc^{1/n}$, where $1/n = 0.5$. Na_2SO_4 reduced the quantity adsorbed. Similar results were obtained with Cr salts but about 10 times the quantity of NaOAc was necessary. With Cr salts, $1/n = 0.6$.

3437. Tendeloo, H. J. C. and Voorspuij, A. J. Zwart. **Adsorption electrodes. V. Glass electrode, ion exchange and electrode properties.** *Rec. trav. chim.* **62**, 784-92 (1943) (in English).—*C.A.* **39**, 1107^8.

With Corning 015 glass, H ions formed a firm bond to the glass surface and the electrode behaved as a practically ideal H electrode up to high pH values. Alteration in the proportion of Na, K or Ca in the original glass caused no fundamental change in the electrode properties. Incorporation of Al_2O_3 in a network of SiO_4 tetrahedra had a marked influence on the electrode properties of a glass in that the appearance of mixed or Na-electrode functions occurred at lower pH values.

3438. Težak, Božo. **Precipitation processes. IV. The relation between crystallization and coagulation phenomena in the precipitation of AgCl.** *Z. physik. Chem.* **192**, 101-11 (1943).—*C.A.* **38**, 2545^4.

$BaCl_2$ solns. of varying concns. were added to $AgNO_3$ solns. of const., low concn. and the pptn.

process was studied tyndallometrically. A characteristic pptn. max. (max. turbidity at the end of 30 min.) was found in the region of concns. approx. 10 times those necessary to satisfy the soly. product const. On one side of this max. (region of high Cl^-) a large no. of small particles appeared, whereas on the other side (region of low Cl^-) the particles were larger.

3439. VENTURELLO, GIOVANNI. **Ion adsorption by aluminum hydroxide.** *Atti reale accad. sci. Torino, Classe sci. fis. mat. nat.* **79**, 275-87 (1943-44).—*C.A.* **41**, 4992e.

When a soln. of $Al_2(SO_4)_3$ contg. Cu and Ni ions was pptd. with NH_4OH, the adsorption of the ions by the ppt. followed the law of Freundlich if the soln. was sufficiently dild. In the presence of high amts. of NH_4OH or NH_4 salts, the adsorption decreased probably because of the formation of complex ions (as $Cu(NH_3)_4^{++}$) which had a greater ionic radius and were less adsorbed. The ppt. and washed $Al(OH)_3$ had a lower adsorbing power.

3440. VERSTRAETE, E. O. K. **Ionic exchange by colloidal sulfur. I. Exchange in lyophobic colloidal systems.** *Kolloid-Z.* **102**, 251-67 (1943).—*C.A.* **37**, 5899⁹.

An analytical procedure for detg. pentathionates in both free and bound conditions enabled both the acid and salt to be estd. The degree of dispersion of the S particle was considered as well as its shape and size. The influence of cations on coagulation varied over a wide range and the valence rule held except for Th. Anion effects were also indicated. Other influences studied were diln., H_2S, H^+ and OH^-.

3441. VERSTRAETE, E. O. K. **Ionic exchange for colloidal sulfur. II. Ionic exchange for lyophobic colloidal systems.** *Kolloid-Z.* **103**, 25-42 (1943).—*C.A.* **38**, 2542⁶.

The ionic exchange of H^+ with other cations for "Selmi" type S sols was investigated. Pentathionic and tetrathionic only were present as shown by described tests. Data on ion exchange depended largely on the concn. of the electrolyte present. For alk. cations exchange was $K > Na > Li$ and for alk. earths $Ba > Sr > Ca > Mg$.

3442. YADAVA, B. P. AND CHATTERJI, A. C. **Charge and stability of colloids. I. Adsorption of oppositely charged ions under different conditions.** *J. Indian Chem. Soc.* **20**, 25-32 (1943).—*C.A.* **37**, 6519².

The adsorption of Ba^{++} on As_2S_3 and SO_4^{--} on $Fe(OH)_3$ were analytically detd. for concns. necessary for coagulation, and for equiv. concns. in the presence of previously coagulated sols. The differences were utilized to calc. charge per particle. Charges were about 7×10^{-5} e.s.u. on both 75-mμ As_2S_5 and 50-mμ $Fe(OH)_3$ particles, and were increased to about 8×10^{-5} e.s.u. by stabilization with carbohydrates or with H_2S or HCl, resp.

3443. YADAVA, B. P. **Charge and stability of colloids. VI. Study of the adsorption of precipitating and stabilizing ions by As_2S_3 and $Fe(OH)_3$ sols at their coagulating concs.** *J. Indian Chem. Soc.* **20**, 223-6 (1943).—*C.A.* **38**, 1934⁸.

The adsorption of K, Ba and Al on As_2S_3 and of Cl, SO_4, Fe $(CN)_6^{III}$ and $Fe(CN)_6^{IV}$ on Fe $(OH)_3$ sols was detd. for a series of coagulating concns. The trends in mol. ratios were of the order: K:Ba:Al adsorbed = 50:5:1 from coagulating concns. K:Ba:Al = 330:10:1 and similarly for the anions 50:5:1.1:1 from 660:5:1.8:1.

3444. AUSTIN, A. T.; HARTUNG, E. J., AND WILLIS, G. M. **Membrane permeability. IV. Improved apparatus for measuring diffusion rates, and the permeability of Cu ferrocyanide to eleven solutes.** *Trans. Faraday Soc.* **40**, 520-30 (1944).—*C.A.* **39**, 2241³.

The effect of surface charge in detg. the selectivity of $Cu_2Fe(CN)_6$ was shown. Where enhanced selectivity was due to adsorbed $Fe(CN)_6^{-4}$, it might be reduced by reaction of these ions with Cu^{++}. Diffusion rates in millimols./hr through $Cu_2Fe(CN)_6$ from M/5 solns. at 25°C were tabulated for KCl, KNO_3, KIO_3, KOAc, KBr, KI, KCNS, K_2SO_4, $K_2C_2O_4$. Sucrose and $K_4Fe(CN)_6$ showed no diffusion and a trace of diffusion, resp.

3445. IIJIMA, S. **Occlusion of potassium chromate by an aluminum hydroxide precipitate.** *Bull. Inst. Phys. Chem. Research (Tokyo), Chem. Ed.* **23**, 99-106 (1944).—*C.A.* **43**, 7775*a*.

By means of a specially designed balance, occlusion of K_2CrO_4 by $Al(OH)_3$ ppts. was detd. Freundlich's isothermal adsorption equation could be applied for the relation between the amt. of K_2CrO_4 occluded and its concn. The amt. of K_2CrO_4 occluded by 1 g $Al(OH)_3$ at 25°C was 0.19 and 0.05 g when its concn. was 0.1 and 0.034 *N*, resp.

3446. IMRE, L. **Applicability of the radioactive-indicator method to the determination of the surface area of solids. II.** *Kolloid-Z.* **106**, 39-46 (1944).—*C.A.* **38**, 3531¹.

The exchange adsorption of K_2CrO_4 and of $Pb(NO_3)_2$ on $BaSO_4$ and the adsorption of $Pb(NO_3)_2$ on $PbCrO_4$ and PbS were detd. for various ratios of adsorbed material to adsorbent. An activation factor was defined by means of the following equation: $X^* = X.\exp^{E/RT}$, where X was the total no. of ions (exchangeable) in the solid wall and the soln., and X^* was the no. of active exchange positions on the surface. The numerical value of E was calcd. from the variation in the exchange adsorption with temp. From this the total no. of surface mols. were calcd. The results agreed with those obtained by microscopic methods.

3447. KRESTINSKAYA, V. N. AND KHAKIMOV, Z. V. **Mechanism of adsorption of silver sulfate on sols of ferric hydroxide.** *J. Gen. Chem. (U.S.S.R.)* **14**, 70-6 (1944) (English summary).—*C.A.* **39**, 854⁴.

Adsorption of Ag_2SO_4 on 4 sols of $Fe(OH)_3$ was studied. In no instance was there observed a mol. adsorption; only SO_4 ions were adsorbed. Ag^+ was not adsorbed by the micelles. $Fe(OH)_3$ sol prepd. from the nitrate did not display this, because it lacked the Cl^-. Ultrafiltrates of the sols showed the presence of FeO only; thus, basic Fe salts were apparently the stabilizers in these sols.

3448. NIKOLAEV, A. V. **Protective films on salts and their utilization.** *Vestnik Akad. Nauk. S.S.S.R.* **1944**, No. 4-5, 57-61.—*C.A.* **39**, 1584³.

The soly. of NaCl in satd. Glauber salt soln. was greatly reduced if the soln. was added to NaCl that was not powd. The result was due to formation of a protective film of solid Na_2SO_4. Gypsum, calcite and slaked lime exhibited the same effect with numerous salt solns.

3449. Polesitskiǐ, A. E. and Murin, A. **Diffusion in the solid phase in the ionic exchange between the precipitates of silver halides and aqueous solutions.** *Doklady Akad. Nauk S.S.S.R.* **45**, 254-6; *Compt. rend. acad. sci. U.R.S.S.* **45**, 238-40 (1944).—*C.A.* **39**, 5147⁵.

The rate of diffusion of Ag ions in cryst. AgCl and AgBr was at least 1000 times larger than that of the Cl and Br ions. Diffusion of Ag ion within the solid probably played an important role in interchange of Ag ions between pptd. Ag halides and surrounding soln. Exchange of Ag ions was hindered only slightly, whereas exchange of Br ions was decreased sharply, when recrystn. of pptd. AgBr was inhibited by adsorbed dye.

3450. Schwab, Georg-Maria. **Oriented films on thallium halides.** *Naturwissenschaften* **32**, 32-3 (1944).—*C.A.* **40**, 2730³.

TlCl or TlBr monocrystal cylinders were treated with Br, I, or Ag ions in soln. TlBr would grow on TlCl in films oriented parallel to the base lattice; at first at 50% mixed crystal was formed. TlI grew poorly on TlCl and only amorphously. TlBr in I soln. covered itself with an oriented film of a 70% TlI mixed crystal. AgCl grew with orientation on TlCl in a few min., likewise AgBr on TlBr.

3451. Spaulding, G. H. and McNabb, W. M. **Removal of Hg from solutions of Hg $(NO_3)_2$ by HgS.** *J. Franklin Inst.* **237**, 207-12 (1944).—*C.A.* **38**, 2542³.

The data indicated that the removal of Hg from dil. solns. of Hg $(NO_3)_2$ by HgS was an adsorption process which followed a Freundlich isotherm. At higher concns. of Hg ion, compd. formation took place, yielding a compd. of the possible formula $2HgS.Hg(NO_3)_2$.

3452. Steinour, Harold H. **Rate of sedimentation.** *Ind. Eng. Chem.* **36**, 840-7 (1944).—*C.A.* **38**, 6019⁷.

Sedimentation rates were observed in nonflocculated suspensions of 2 fine, emery-powder fractions (prepd. by air sepn.) in water alone or water contg. 0.12% of Na hexametaphosphate as dispersant and of a coarse emery powder (prepd. by sieving) in diethyl phthalate. Similar observations were made for flocculated suspensions of the 2 fine powders and a still finer com. emery in 0.12% $ZnSO_4$ soln. In concd. suspensions of either kind liquid must flow past the individual, ultimate particle during sedimentation.

3453. Yadava, B. P. and Chatterji, A. C. **Charge and stability of colloids. IX. The release of counter ions from ferric hydroxide sol on the addition of pairs of electrolytes.** *J. Indian Chem. Soc.* **21**, 357-63 (1944).—*C.A.* **39**, 2685⁵.

The release of Cl^- from $Fe(OH)_3$ sol upon addn. of the paired combinations of KIO_3, K_2SO_4 and K citrate solns. was observed. In nearly all cases the release was greater than an additive value for the individual electrolytes.

3454. Yadava, B. P. **Charge and stability of colloids. X. The release of counter ions from chronic hydroxide sol on the addition of pairs of electrolytes.** *J. Indian Chem. Soc.* **21**, 364-9 (1944).—*C.A.* **39**, 2685⁶.

The Cl^- release from $Cr(OH)_3$ sol was parallel with that from $Fe(OH)_3$.

3455. Jones, Grinnell and Wood, Lloyd A. **The measurement of potentials at the interface between vitreous silica and solutions of KCl by the streaming-potential method.** *J. Chem. Phys.* **13**, 106-21 (1945).—*C.A.* **39**, 2257⁸.

Improvements in the technique for the detn. of the zeta potential at the interface between a nonconducting solid and an aq. soln. of an electrolyte were developed. Zeta-potentials of vitreous silica capillaries in contact with solns. of KCl 10^{-3}, 10^{-4}, and 10^{-5} *N* were detd.

3456. Kolb, Harry J. and Comer, Joseph J. **Habit modification of ammonium dihydrogen phosphate crystals during growth from solution.** *J. Am. Chem. Soc.* **67**, 894-7 (1945).—*C.A.* **39**, 3475⁵.

The habit modification was explained by adsorption of foreign metal ions on the crystal surface, and the degree of tapering may be correlated with the soly. product of the metal hydroxide. Reticular densities of the $NH_4H_2PO_4$ crystal planes were presented to illustrate the compatibility of the adsorption theory with the crystal structure.

3457. Kurbatov, J. D.; Kulp, J. L., and Mack, Edward, Jr. **Adsorption of strontium and barium ions and their exchange on hydrous ferric oxide.** *J. Am. Chem. Soc.* 67, 1923-9 (1945).—*C.A.* **40**, 785³.

The adsorptions at different concns. of Sr and Ba on hydrous ferric oxide at pH 8 and 25°C were compared. Two procedures were used: (1) the copptn. procedure and (2) the adsorption procedure. Radioactive-tracer technique was used. The quantity of adsorbent, temp., pH, salt concn., time, and procedure were maintained const. The ratio of adsorbed g atoms of Sr or Ba to their g ions in soln. increased with diln. The time interval between titration of the sample and removal of soln. for measurement was 30 min. The Sr adsorption was irreversible in 30 min. if the concn. of Sr in soln. was reduced. No exchange between adsorbed Sr and Ba ions in soln. was detected. However, exchange of adsorbed Sr occurred if Ba ions were introduced into the soln.

3458. Sierra, F. and Monllor E. **Some case of adsorption by interchange.** *Anales fis y quim. (Madrid)* **41**, 234-48 (1945).—*C.A.* **44**, 3333b..

A preliminary note describing the formation by pptn. of double salts of the type $M_1Hg(SCN)_4 \cdot M_2Hg(SCN)_4$ and the possibility of their modification through interchange of ions with others present in the soln. Data were given for the effect of concn. of ions of M_1 and M_2.

3459. Veiler, S. Ya. and Rebinder, P. A. **The elasto-plastic properties and the thixotropy of disperse systems.** *Compt. rend. acad. sci. U.R.S.S.* **49**, 345-8 (1945).—*C.A.* **40**, 5963⁵.

A thin plate of mica attached to a glass thread was suspended from a quartz spring in a vessel contg. the liquid to be investigated. A motor lowered the vessel continually at a const. speed of 3.3 μ/sec. The mica plate was immersed in the suspension and the extension of the spring at any given displacement of the plate was read with a microscope. The ultimate shearing stress was independent of the dimensions of the plate and shape of the vessel.

3460. Barbier, Georges; Chabannes, Jean, and Miallet, P. **Adsorption of phosphate ions at the surface of clay colloids by the medium of the alkaline earth metals.** *Ann. agron.* **16**, 7-33 (1946).—*C.A.* **40**, 7467^4.

Compds. formed by the adsorption of phosphate ions from soln. by clay particles contg. adsorbed Ca ions could be easily distinguished from true Ca phosphates by working at concns. of P_2O_5 sufficiently low to prevent pptn. of Ca phosphates even in alk. media. These compds. differed from other adsorbed phosphates (such as ferric) by the speed of formation: equil. was attained in hrs rather than in months as with ferric and years in neutral solns. Adsorption of P_2O_5 by Ca clays was initially more rapid than by Ba, Sr, and Mg clays in that order, maintained a higher level, and was increased by alkalization between pH 7.0 and 8.0.

3461. Dankov, P. D. **The crystalochemical mechanism of the iuteraction between a crystal surface and foreign elementary particles.** *J. Phys. Chem. (U.S.S.R.)* **20**, 853-67 (1946) (in Russian).—*C.A.* **41**, 2295*f*.

Orientation took place when the difference between the lattice spacings of the two crystals was smaller than $[2a\sigma/(C_1 + C_2)]^{1/2}$, a being the relevant lattice spacing of the new crystal, σ its surface tension and C_1 and C_2 its moduli of elasticity. When ionic crystals grew on metals or vice versa, the results depended on whether the interaction between new and old crystal faces had an at. or an ionic mechanism.

3462. Dey, Arun K. and Ghosh, Satyeshwar. **The amphoteric nature of hydrated stannic oxide and the determination of its isoelectric point.** *Proc. Natl. Acad. Sci. India* **15A**, 143-7 (1946).—*C.A.* **44**, 3335*b*.

Hydrated SnO_2 was prepd. by pptn. from $SnCl_4$ soln. with NH_4OH. To 2 cc. samples of the suspension (0.2225 g atom Sn/liter) various amts. of 0.01 *M* NaOH or H_2SO_4 were added, and $K_4Fe(CN)_6$, $AgNO_3$, Orange II, and methylene blue were used as adsorbates. When the alkali concn. was higher than 1×10^{-4} *M*, the basic groups were adsorbed, and the acidic groups were adsorbed when the alkali concn. was lower than this value.

3463. Douglas, G. Vibert; Goodman, N. R., and Milligan, G. C. **The nature of replacement.** *Econ. Geol.* **41**, 546-53 (1946).—*C.A.* **42**, 8718*g*.

Expts. were performed to explain the process by which chalcocite replaced pyrite. A crystal of pyrite set in a bakelite mold had a connecting "well" of dist. water made conducting by 1 drop of HCl. The Pt cathode of a 6-v. dry-cell series was placed in the well, but not in contact with the crystal. The bakelite block was immersed halfway in satd. $CuSO_4$ soln. with a Cu grid just below. After 90 hrs the Cu plating was removed from the crystal. The crystal showed distinct alteration tentatively identified as chalcocite.

3464. Krishna, Bal and Ghosh, Satyeshwar. **The kinetics of reduction between resorcinol and silver tartrate in the light of catalytic activity of colloidal silver.** *Proc. Natl. Acad. Sci. India* **15A**, 153-60 (1946).—*C.A.* **44**, 3341*h*.

The kinetics of reduction of Ag tartrate indicated that the reaction was autocatalytic and unimol. with respect to the Ag salt. The temp. coeff. of the reaction for 10°C was approx. 2.5, the addn. of colloidal Ag increased the unimol. velocity consts. by 2 to 3 times, and the induction period disappeared and H^+ acted as a retarding agent. AgOH was the most probable intermediate product in the reduction of Ag salts.

3465. Mukherjee, N. R. **The theory of crystal growth and its application to the design of industrial crystallizers.** *J. Imp. Coll. Chem. Eng. Soc.* **2**, 68-75 (1946).—*C.A.* **41**, 5002*d*.

The main processes concerned with crystal formation were diffusion, lattice formation, and adsorption. Fundamental data required for crystallizer design included detns. of heats of crystn. and soln., of work required to form crystal surfaces, and of rate of nucleus formation as a function of super-satn.

3466. Mushran, Sukhdeo Prasad and Prakash, Satya. **Negatively charged colloidal solutions of various ferric salts. III. Negatively charged mixed sol of ferric oxide and ferric molybdate.** *J. Indian Chem. Soc.* **23**, 413-19 (1946).—*C.A.* **42**, 16*h*.

Negatively charged ferric molybdate sols were prepd. by petizing freshly pptd. ferric molybdate with caustic soda in the presence of glucose or glycerol. The sols obeyed the Schulze-Hardy coagulation rule and had pH values lying between 7.39 and 7.64.

3467. Nasanen, Reino. **The effect of acid and base addition on the precipitation curve of barium carbonate.** *Suomen Kemistilehti* **19B**, 24-6 (1946) (in German).—*C.A.* **41**, 5365*b*.

There was a marked deviation, increasing with NaOH, between the observed and calcd. values of P, the reciprocal of the slope of the tangent of inflection (in the pptn. of $BaCO_3$ by titration of Na_2CO_3 soln. with 0.2 *N* $BaCl_2$ soln. in the presence of HCl or NaOH). The deviation was concluded to be due to adsorption of the base by the ppt.

3468. Ratner, A. P. and Kantor, T. V. **Adsorption of mesothorium II on barium sulfate.** *Compt. rend. acad. sci. U.R.S.S.* **52**, 47-50 (1946) (in English).—*C.A.* **41**, 1906*f*.

Ms-Th II was prepd. from a soln. of Ms-Th I, contg. Ra and an excess of Ba salts, by adding $La(NO_3)_3$ and pptg. $La(OH)_3$ with NH_3. The ppt. was dissolved in HCl, and repptd. to purify it of Ra and Ms-ThI, washed, dissolved in a satd. soln. of $BaSO_4$ in HCl of the concn. desired for the expts., and dild. with the same soln. until the concn. of $La(NO_3)_3$ was 1×10^{-4} g per 10 ml. The expts. consisted in mixing this soln. with specially prepd. $BaSO_4$ suspensions, centrifuging, and comparing the radioactivity of the supernatant liquid with that of the original. Preliminary expts. showed that adsorption equil. was established in about 10 min.

3469. Royer, Louis. **A new mode of KCl overgrowth on mica.** *Compt. rend.* **226**, 95-6 (1946).—*C.A.* 42, 2832*a*.

Some KCl crystals, obtained during the same expt., were joined along an octahedral face, in one of the two right-angle positions. It was necessary to prove that there was no substance in the soln. capable of modifying the crystal form and that the new orientation was always along a plane of the KCl cube, *p*(001), regardless of what crystal faces were developed externally.

3470. Sierra, F. and Monllor, E. **The effect of certain factors in crystalline precipitation.** *Anales fís y quím. (Madrid)* **42**, 303-14 (1946).—*C.A.* **41**, 6797*e*.

When Zn^{++} was added as acetate, tartrate, citrate, or oxalate to ppt. $ZnHg(SCN)_4$, the speed of pptn. decreased in the above order, owing to variation in the strength of complexing of Zn^{++} by the anion, and to adsorption of the latter. The shape and habit of the crystals formed were affected by both the anion of the Zn salt and the cation of the $Hg(SCN)_4^{--}$ salt.

3471. Süe, Pierre. **Colorimetric microchemical analysis of a precipitate adsorbed by an adsorber.** *Ann. chim. anal.* **28**, 26 (1946).—*C.A.* **40**, 2765[7].

Five γ of Ag or 1 γ of Ni could be detd. by pptg. AgI or the Ni dimethylglyoxime together with several times as much $BaSO_4$– ($BaCl_2$ + $(NH_4)_2SO_4$) in 3.5 ml of soln. The white $BaSO_4$ helped to collect the smaller ppt. and the color could serve for detg. Ag or Ni. Similarly, Ag_2S could be deposited on $BaSO_4$.

3472. Wood, Lloyd A. **The measurement of the potential at the interface between vitreous silica and pure water.** *J. Am. Chem. Soc.* **68**, 437-41 (1946).—*C.A.* **40**, 2711[2].

An app. for the production of streaming potentials was described in which the liquid was in contact only with SiO_2 and Pt, suitable for measurements with water of high purity. The zeta-potential of vitreous SiO_2 in contact with water of high purity was probably about -177 millivolts.

3473. Zimens, Karl E. **Exchange reactions with solids.** *Arkiv Kemi, Mineral. Geol.* **A21**, No. 16, 32 pp. (1946) (in German).—*C.A.* **41**, 904[d].

The kinetics of heterogeneous exchange reactions were considered, and applications to problems of corrosion, reactions of solids, and heterogeneous catalysis were cited. The use of a self-diffusion coeff. was suggested for the study of disorders in crystal lattices.

3474. Andreasen, A. H. M.; Krebs, K.; Dalsgaard-Pederson, N. Aa.; Damradt-Petersen, E., and Kjaer, B. **Production of monodispersed particle systems of barium sulfate, copper oxide, and mercuric iodide.** *Inst. Chem. Engrs. and Soc. Chem. Ind., Road and Bldg. Materials Group, Symposium on Particle Size Analysis Feb. 4,* **1947**, 4-13 *Suppl. to Trans. Inst. Chem. Engrs.* **25**, (1947).—*C.A.* **44**, 5183*i*.

It was shown that the transmitted light intensity passed through a min. at almost the particle size where the scattered light intensity passed through a max. This particle size was near the wave length of the light used (e.g. 0.4-0.8 μ) for white substances, but considerably smaller for colored particles (e.g. 0.07 to 0.2 μ for pyrolusite).

3475. Canal, P. **Selective coloration of polished calcite surfaces.** *Rev. inst. franc. pétrole* **2**, 235-43 (1947).—*C.A.* **42**, 4015h.

Calcite and dolomite were distinguished by selective staining of polished calcite surfaces by a large no. of inorg. reagents. The nature of stains produced by $FeCl_3 + (NH_4)_2S_x$, $AgNO_3 + KCrO_4$, $Ni(NO_3)_2$, and $Zn(NO_3)_2$ was investigated by x-ray diffraction methods. A stable, durable, colored film resulted only if the coloring agent crystd. in similar form to the calcite.

3476. Cottin, Maurice and Haïssinsky, Moïse. **Exchange in binary and ternary systems: periodate-iodine.** *Compt. rend.* **224**, 1636-8 (1947).—*C.A.* **41**, 7219*e*.

By use of radioactive Na, the exchange between $NaIO_4$ and $NaIO_3$ in 0.02 *N* HNO_3 soln. was investigated. I_2 acted as a catalyst, but other reduction-oxidation catalysts such as $Ce(NO_3)_3$ and $KReO_4$ acted more as inhibitors for the reaction. The strong catalytic action of I_2 therefore implied exchange in the systems IO_3^-/I_2 and IO_4^-/I_2.

3477. Dey, Arun K. and Ghosh, Satyeshwar. **The conditions of precipitation of cupric hydroxide from cupric salts by soluble hydroxides. I. Reaction between solutions of cupric sulfate and sodium hydroxide.** *J. Indian Chem. Soc.* **24**, 181-4 (1947).—*C.A.* **42**, 6216*c*.

The amt. of NaOH needed for the complete pptn. of Cu in soln. was about 10% less than the equiv. quantity, and this behavior was explained on the basis of hydrolytic adsorption of the SO_4^{--} by $Cu(OH)_2$. This type of adsorption occurred at 30°C, but at 50°C and 80°C became negligible, and complete pptn. occurred practically with equiv. quantities.

3478. Ethrington, C. G. and Hughes, J. W. **Determination of small quantities of manganese in caustic soda.** *Analyst* **72**, 472-5 (1947).—*C.A.* **44**, 9862*f*.

The method depended on the complete adsorption of Mn on $Mg(OH)_2$ pptd. by addn. of 15 ml of 10% $MgSO_4$ soln. to 10% aq. NaOH. The $Mg(OH)_2$ was sepd. by reverse filtration and the Mn detd. by the periodate method.

3479. Glazman, Yu. M. and Tartakovskaya, B. E. **The adaptation phenomenon in the coagulation of hydrophobic colloids by electrolytes.** *Kolloid. Zhur.* **9**, 241-54 (1947).—*C.A.* **47**, 947*c*.

To a neg. AgI sol (0.002 *M*) *m* drops of salt soln. were added, the ppt. was filtered 24 hrs later, and the turbidity *a* of the filtrate detd. The curve *a* vs. *m* was an inverted S. When the sol. was coagulated by adding 1 drop of coagulant soln. every 24 hrs for *n* days, and then filtered 24 hrs after the last drop, a predetd. value of *a* was reached when *n* was less than *m* ("neg. adaptation"). The ratio $(m-n)/m$ was 0.18-0.22, independently of the value of *a* (which was varied 8-fold) and of the coagulant (KCl, KNO_3, $BaCl_2$ $Ba(NO_3)_2$, and $CeCl_3$); *n* varied from 14 to 24.

Diln. of the AgI sol. slightly raised the coagulating concn. of $CeCl_3$ and $BaCl_2$ and slightly lowered that of KCl.

3480. Gorodetskaya, A. V.; Frumkin, A. N., and Titievskaya, A. S. **Adhesion of mercury to glass in electrolyte solutions.** *J. Phys. Chem. (U.S.S.R.)* **21**, 675-88 (1947) (in Russian).—*C.A.* **42**, 2159*h*.

A horizontal glass plate was slowly lowered onto a Hg meniscus in an aq. electrolyte soln., and the time detd. that was required by Hg to displace the aq. film and to make contact with the glass. After the contact was established, the plate was lifted, and the max. values of the contact angle θ between glass, Hg, and soln. detd. In solns. of Na_2SO_4, NaOH, and H_2SO_4 the time was smaller and θ greater, the more dil. the soln.

3481. Grimley, T. B. and Mott, N. F. **The contact between a solid and a liquid electrolyte.** *Discussions Faraday Soc.* No. **1**, 3-11 (1947).—*C.A.* **42**, 8579*e*.

The difference of elec. potential between the Ag and solid AgBr was of the order of 1.4 v.; the distribution of the charge in the double layer was also discussed. In the region of the phase boundary area, calcns. showed that the concn. of vacant lattice points exceeded by several powers of ten the concn. in the bulk of the crystal.

3482. Harbury, Lawrence. **Solubility and melting point as functions of particle size. II. The induction period of crystallization.** *J. Phys. & Colloid Chem.* **51**, 382-91 (1947).—*C.A.* **41**, 3677*f*.

The theoretical aspects of crystn. from supersatd. solns. were discussed, considering selective adsorption, impurities, mobility on crystal surfaces, blocking agents, and lattice defects.

3483. Hubicki, Wlodzimierz. **The mechanism of precipitation of lead phosphate.** *Ann. Univ. Mariae Curie-Sklodowska Lublin-Polonia, Sec.* **AA**, 2, 103-23 (1947).—*C.A.* **43**, 3305*c*.

The reaction between $Pb(NO_3)_2$ and Na_2HPO_4 or Na_3PO_4 in soln. was investigated by conductometric and potentiometric analysis. The ions of Pb which disappeared during this reaction were compensated by ions of H and Na in accordance with the theory of the mobility of ions in an infinitely dil. soln. The pH of the soln. of Na_3PO_4 titrated by means of $Pb(NO_3)_2$ was lower than that of the $Pb(NO_3)_2$ soln. used because of ion adsorption on the surface of the amorphous $Pb_3(PO_4)_2$.

3484. Jacobi, E. **Adsorption of artificially radioactive cadmium ion on silver chloride.** *Helv. Phys. Acta* **20**, 166-72 (1947).—*C.A.* **41**, 5388*g*.

Adsorption increased with neg. charge of the surface owing to Cl^- and decreased with increasing soly. of the adsorption complex and temp. In the presence of HNO_3, 2 effects occurred: (1) coagulation of the ppt. by the acid; (2) low soly. of the adsorption complex. In dil. soln., quant. pptn. required 0.25 *N* acid and boiling temp. for min. adsorption. The tracer was 6.7-hr Cd.

3485. Kurbatov, M. H. and Kurtabov, J. D. **Adsorption isotherm for determination of barium in quantities as low as 10^{-10} gram atom.** *J. Am. Chem. Soc.*, **69**, 438-41 (1947).—*C.A.* **41**, 3394*e*.

An adsorption isotherm for Ba on hydrous Fe_2O_3 could, with proper precautions as to pH and salt concn., be used for analysis of solns. of $BaCl_2$ contg. as little as 10^{-10} g atoms.

3486. Mather, Katharine. **Relation of absorption and sulfate test results on concrete sands.** *A.S.T.M. Bull.* **144**, 26-31 (1947).—*C.A.* **41**, 2548*a*.

Statistical analysis of absorption and $MgSO_4$ test values for 409 sand samples showed a high correlation; 60 to 65% of the variation in sulfate test results was attributable to variation in adsorption.

3487. Mushran, S. P. and Prakash, Satya. **Negatively charged colloidal solutions of various ferric salts. V. Negatively charged ferric arsenate sol.** *J. Indian Chem. Soc.* **24**, 389-95 (1947).—*C.A.* **42**, 5304*c*.

Sols were prepd. by mixing solns. of $FeCl_3$, KH_2AsO_4, NaOH, and glucose or glycerol. Conductance and extinction coeffs. of the dialyzed sols were obtained. Positively charged ferric arsenate sols were also prepd.

3488. Mushran, S. P. **Negatively charged colloid solns. of various ferric salts. VI. Negatively charged ferric phosphate sol.** *J. Indian Chem. Soc.* **24**, 396-402 (1947).—*C.A.* **42**, 5304*d*.

Sols were prepd. by mixing solns. of $FeCl_3$, KH_2PO_4, NaOH, and glucose or glycerol. Conductance and extinction coeffs. of the dialyzed sols were obtained.

3489. Pieruccini, Renzo. **Introducing aluminum, iron, lead, and molybdenum into synthetic apatites.** *Mem.* **54**, 12 pp. (1947).—*C.A.* **42**, 3290*h*.

Minor constituents of apatites (Al, Fe, Pb, and Mo) were introduced synthetically into the crystals, where they were found to be contained, resp., as Al_2O_3 1.88, Fe_2O_3 0.03-0.05, PbO 0.07, and MoO_3 0.01%. However, some intensely colored crystals may contain up to 2% Fe_2O_3. Al replaced Ca and P.

3490. Shapiro, I. and Kolthoff, I. M. **Aging of precipitates and coprecipitation. XXXIX. Low-temperature conductivity of silver bromide.** *J. Chem. Phys.* **15**, 41-6 (1947).—*C.A.* **41**, 2300*g*.

An expression was proposed for the elec. cond. of AgBr. In agreement with theoretical expectations, $x = 3.0 \times 10^5 \exp(-18{,}000/RT) + A_i \exp(-8300/RT)$, in which A_i varied in proportion in the active surface of the product. A pellet prepd. from freshly pptd. AgBr had about 500 times as large a cond. as a pellet prepd. from fused AgBr. The temp. effect was accounted for by the contribution of the active surface.

3491. SIERRA, F. JIMENEZ. **The physicochemical study of hydrolytic adsorption from the viewpoint of chemical analysis.** *Anales univ. Murcia (Spain)* **1947/1948**, 859-91.—*C.A.* **43**, 6882*h*.

The pH evolved in the formation of $BaSO_4$ was measured in pptn. from (a) solns. of Na_2SO_4 and K_2SO_4, with the gradual addn. of $BaCl_2$; (b) the same solns. in the presence of KCl; and (c) solns., resp., of Rb_2SO_4, Cs_2SO_4, Li_2SO_4, and $MgSO_4$. There was formed a polar network contg. some surface spots occupied by K^+, SO_4^{--} ions superficially attached, sufficient quantities of H^+ and K^+ counter-ions to neutralize the elec. charge caused by the excess SO_4^{--}.

3492. TAYLOR, C. B. **Reduction of potassium permanganate in the presence of glass.** *Nature* **160**, 56-7 (1947).--*C.A.* **41**, 7212*c*.

O_2 was absorbed by distd. H_2O from 0.0125 *N* $KMnO_4$, acidified with H_2SO_4, in the presence of glass beads, crushed plate, crushed bottle, and crushed Pyrex glass, and crushed Vitreosil. With 100 g of each, crushed to comparable dimensions, the amt. absorbed was 0.63-0.87 p.p.m. If once-used glass was washed with distd. H_2O and reused, no O_2 was absorbed. Glass was reactivated by drying in thin layers in air at 30° and 140°C, and in N_2 or O_2 at 140°C.

3493. TENDELOO, H. J. C. **The potential of ion-exchanging substances.** *Discussions Faraday Soc.* No. **1**, 293-8 (1947).—*C.A.* **42**, 8581*b*.

Depending on its compn., a glass could function nearly exclusively as an electrode for H ions or for other ions as well, if it contained Al_2O_3. A "dissocn. const." of the glass could be calcd.; this appeared to be greater for glass contg. Al_2O_3 than for Corning glass 015. A theory based on ion-exchange and the adsorption formula of Langmuir was developed for the potential of a glass electrode, and was in accordance with exptl. results.

3494. WEYL, W. A. **Some practical aspects of the surface chemistry of glass. IV.** *Glass Ind.* **28**, 408-12, 428, 430, 432 (1947).—*C.A.* **42**, 2412*d*.

Base-exchange reactions of wet glass surfaces and reactions with water, acids, and alk. solns. were described. The behavior of Be^{2+}, Al^{3+}, and Zr^{4+}.as neg. catalysts in the chem. attack and mech. abrasion of glass was an important phenomenon of surface chemistry.

3495. ZETTLEMOYER, A. C.; ZETTLEMOYER, E. A., AND WALKER, W. C. **Active magnesia. II. Adsorption of fluoride from aqueous solutions.** *J. Am. Chem. Soc.* **69**, 1312-15 (1947).—*C.A.* **41**, 5772*e*.

Studies of the adsorption of F^- from solns. of NaF on a series of activated MgO showed that the rates of F^- adsorption and of hydration increased with increasing surface area for powdered magnesia. However, no correlation was found between surface area and the equil. amounts of F^- adsorbed.

3496. ARTÉS, OCTAVIO CARPENA. **Volumetry and potentiometry of sulfates as affected by hydrolytic adsorption.** *Anales univ. Murcia*, **1948-49**, 288-355.--*C.A.* **44**, 4371*i*.

The pH changes occurring during the pptn. of $BaSO_4$ were detd. upon the gradual addn. of $BaCl_2$ at 18°C to the sulfates of Li, Na, K, Rb, Cs, Mg, Ni, and Zn and to mixts. of some of these with KCl, LiCl, HCl, and colloids. The reaction of $Ba(NO_3)_2$ and $Ba(AcO)_2$ with K_2SO_4, and the reverse reactions were studied in the same manner. For the analysis of the sulfates of NH_4, Ca, and Mg it was recommended to adjust the pH to between 5 and 8 by addn. of 0.1 *N* HCl or KOH, and to titrate 20 to 100 ml with any of the above electrodes. For the analysis of $NiSO_4$ or $ZnSO_4$ the pH was adjusted to between 4 and 6.

3497. BARRER, R. M. **Synthesis of a zeolitic mineral with chabazitelike sorptive properties.** *J. Chem. Soc.* **1948**, 127-32.—*C.A.* **42**, 4423*a*.

A new group of minerals having rectangular crystals, nearly isotropic, weakly birefringent, was synthesized from analcite, leucite, and pptd. alumino-silicates by autoclaving a mixt. of the aluminosilicate an equal vol. of $BaCl_2$, $BaBr_2$, KCl, or KBr, and H_2O equal to the apparent vol. of the solids in a stainless steel autoclave at 180-220°C for 2-6 days.

3498. BUCHANAN, A. S. AND HEYMANN, E. **Electrokinetic potential and surface structure of barium sulfate.** *Nature* **161**, 649, 691 (1948).--*C.A.* **42**, 5302*h*.

Zeta potential of recrystd. $BaSO_4$ against satd. soln. was of the order of + 25 mv. and reproducible to 1 mv. for each sample. That of natural barite was much less. The difference was ascribed to the structure of the surface (much more regular for the natural product) as shown by optical and electron microscopes.

3499. BUCHANAN, A. S. AND HEYMANN, E. **The electrokinetic potential of barium sulfate.** *Proc. Roy. Soc. (London)* **A195**, 150-62 (1948).—*C.A.* **43**, 4924*a*.

The electrokinetic potential of recrystd. $BaSO_4$ was investigated against its satd. soln. in water by the streaming potential method. The potential was pos. The potential of natural barite was also pos. but smaller. The difference was due to irregularity of surface and consequent distortion of the lattice for the recrystd. variety. The results could not be explained by selective adsorption of ions from soln.

3500. COHN, CHARLOTTE. **Adsorption by hydrosols.** *Compt. rend.* **226**, 1819-21 (1948).—*C.A.* **42**, 7130*e*.

Certain hydrosols (thorium hydroxide, arsenic sulfide, and ferric and copper ferrocyanides) were capable of concg. particles suspended in various aq media. A suspension of polishing rouge so fine as to appear blue by transmitted light and which did not settle out after 24 hrs was cleared up by the addn. of 8 mg As_2S_3 and a few drops of satd. alum to a liter of the suspension. After 12 to 24 hrs, the flocculate was collected, the As_2S_3 dissolved in several drops of NaOH soln., and the rouge thus concd. to a vol. one thousandth that of the original.

3501. DEY, ARUN K. AND GHOSH, SATYESHWAR. **The nature of hydrated ferric oxide. II. Adsorption of various ions by the hydrated oxide in**

acidic, alkaline, and neutral media. *Proc. Natl. Acad. Sci. India* **17A**, 93-9 (1948).—*C.A.* **45**, 9411*d*.

The adsorption of Na^+, Cu^{++}, Cl^-, $C_2O_4^{--}$, $Fe(CN)_6^{----}$ by hydrated Fe_2O_3 depended on pH. In alk. soln. adsorption of cations was prominent. In acid soln. anions mainly were adsorbed.

3502. Erdey-Grúz, Tibor; Hunyár, Andor; Pogány, Eva, and Váli, Alajos. **Differences of concentrations caused by diffusion and the effect of glass diaphragms on diffusion rate.** *Hung. Chim.* **1**, No. 3, 7-26 (1948).—*C.A.* **43**, 8773*g*.

Diffusion expts. were carried out with electrolytes (KCl, LiCl, NMe_4Cl, KBr, $LiC_2H_3O_2$, $BaCl_2$, and $MgCl_2$) in the presence of PrOH, sucrose, AcOH, propionic acid, butyric acid, crotonic acid, succinic acid, malic acid, citric acid and As_2O_3. The electrolyte was present at the beginning of the expt. only in the soln. on one side of the diaphragm. The concn. of the various added org. substances (excepting As_2O_3) seemed to grow in that part towards which the ions were diffusing. The quantity of transported substances was higher than the quantity of water transported by the diffusing ions at the same time with their hydrate sphere.

3503. Fricke, R. **Study of chemical properties of surfaces of difficultly soluble substances by combined physical and chemical adsorption.** *Naturwissenschaften* **35**, 344-5 (1948).—*C.A.* **44**, 2819*i*.

Pure hydroxides of La, Sm, Er, and Y were prepd. by pptn. of nitrates with NaOH, crystn. of the hydroxides and washing followed by dehydration (all in Ag crucibles) and rehydration. Upon treatment of the hydroxides with a HCl soln. the adsorbed total Cl was detd. electrometrically, the chemically adsorbed Cl by pH detn. The chem. adsorption (normal KCl soln.) decreased in the series from La to Y from 6.7% of the total to 0.4%.

3504. Fuks, G. I. **Structured ferric hydroxide sols obeying Poiseuille's law.** *Kolloid Zhur.* **10**, 155-8 (1948).—*C.A.* **43**, 5259*a*.

$Fe(OH)_3$ hydrosols of 6.2-8.6% Fe_2O_3 prepd. by diln. of old concd. sols showed initially a drop in viscosity η over 3-10 days. At the end of that period slow increase of η set in again and was observed for 6 months; however, η did not attain the initial value of the freshly dild. sols. Addn. of 12-20 milliequiv. NaCl to the normal sols raised η and developed anomalous viscosity; addn. of 5% EtOH or heating at 80°-100°C had the same effect.

3505. Garrels, R. M. and Stine, L. O. **Replacement of calcite by atacamite in copper chloride solutions.** *Econ. Geol.* **43**, 21-30 (1948).—*C.A.* **42**, 8721*a*.

Calcite rhombs were suspended in Cu chloride soln., heated to 55°C and moving at a const. rate of approx. 0.3 cm per second. A film of atacamite formed on the rhombs replacing calcite, although not in quantities equiv. to the amt. of $CaCO_3$ dissolved, and not as a result of a straightforward chem. reaction. At the surface of the calcite, the H ion was tied up by the carbonate ion, which gave a high local concn. of hydroxyl ion.

3506. Goetz, Alexander and Inn, Edward C. Y. **Reversible photolysis of silver sorbed on colloidal metal oxides.** *Rev. Modern Phys.* **20**, 131-142 (1948).—*C.A.* **42**, 4465*i*.

AgO (av. particle size 0.3μ) and the two allotropic modifications of TiO_2, anatase and rutile (max. particle size for both about 0.3μ), were used as substrates. A gel-like suspension of the substrate in distd. water contg. a known amt. of Ag_2O was violently agitated in high-speed homogenizers until microscopic examn. indicated the disappearance of the major portion of the Ag_2O crystals. After exposure of the slurry to 45-55°C for several hrs for attainment of equil., it was dried at 50-60°C in an air stream, ground, and stored in dark-glass containers. Surface reaction proceeded very rapidly since these prepns. became photosensitive within the first few min. of homogenization.

3507. Hebert, Jean and Bioschot, Pierre. **Fixation of arsenic by calcium carbonate.** *Compt. rend.* **226**, 747-9 (1948).—*C.A.* **42**, 5299*i*.

In 5 solns. each contg. 20 g of $CaCO_3$ with amts. of As_2O_5 increasing from 1.25 to 20.0 mg, the percentage of the latter fixed by the $CaCO_3$ was const. The amt. of As_2O_5 fixed after agitation of 1 g of $CaCO_3$ with 25 mg of As_2O_5 in 100 g of water increased with time. The phenomenon was one of reversible adsorption.

3508. Hensley, James W.; Long, Arthur O., and Willard, John E. **Reactions of ions in aqueous solution with glass and metal surfaces.** *J. Am. Chem. Soc.* **70**, 3146-7 (1948).—*C.A.* **43**, 2066*e*.

The extent of sorption of radioactivity tagged ions on flat surfaces was studied by using the Geiger-Muller counter to det. radioactive intensity. Results of sorption of Na, Ag, and Cs ions on glass under varying conditions as well as sorption of Na ions on steel, Al, Ag, and Pt surfaces were reported.

3509. Ishikawa, Fusao; Haga, Hideo, and Haga, Yoshiko. **Stabilization of hydrogen peroxide by colloidal tin oxide. I.** *J. Chem. Soc. Japan, Pure Chem. Sect.* **69**, 35-7 (1948).—*C.A.* **46**, 8485*c*.

SnO_2 sol or gel obtained by the hydrolysis of $SnCl_4$ was a very effective stabilizer for H_2O_2 up to a concn. of 80%.

3510. Kharin, A. N. **Ion exchange in fresh and aged hydrosols of arsenic trisulfide.** *Kolloid Zhur.* **10**, 159-67 (1948).—*C.A.* **43**, 5258*g*.

Ion exchange between the As_2O_3 sol and added $BaCl_2$ or $MgCl_2$ was detd. In young sols, the amts. of Ba or Mg adsorbed coincided with the amt. of acid formed, indicating absence of binding by the intermicellar liquid and absence of mol. adsorption of the chlorides on the micelles; the process, in this case, was pure ion exchange.

3511. Klaarenbeek, F. W. **Chemical properties of glass.** *Verres et refract.* **2**, 293-300 (1948).—*C.A.* **43**, 2745*i*.

The destruction of the glass network by acidified H_2O was due to the absorption of the base by bound O; this was prevented by the presence of preferably absorbed ions such as Be. The penetration of the glass surface by H_2O and acids resulted primarily in an ion exchange and hydration of basic cations. Ca ions were more difficultly exchanged that Na ions and the water penetration impeded by the bivalent ions.

3512. Krige, G. J. R. and Arnold, R. **The aging of aqueous suspensions of magnesium hydroxide.** *J.S. African Chem. Inst.* **1**, 61-75 (1948).—*C.A.* **43**, 8236*d*.

The aging of $Mg(OH)_2$ was studied through the cond. changes occurring in suspensions prepd. by adding Mg amalgam or MgO to water. The measurements were made at 20°C except for 2 with the amalgam at 10°C and 2 at 30°C. The peak cond. was reached rapidly, followed by a slow decrease in cond. coincident with the decrease in soly. of the $Mg(OH)_2$. In the case of the amalgam, greater concn. gave a higher initial cond. and a higher value throughout the aging process, whereas greater concn. of MgO gave a higher initial cond. and a much faster drop in cond. during the aging process.

3513. Kuhnel-Hagen, S.; Hofman-Bang, Niels, and Gjertsen, Poul. **Determination of small quantities of tin in alloys. Isolation by adsorption of stannic acid on manganese dioxide.** *Acta. Chem. Scand.* **2**, 343-51 (1948).—*C.A.* **43**, 2889*h*.

Small amts. of Sn were sepd. from Fe, Cu, and Pb. The Sn was adsorbed on MnO_2. Heat, filter, and dissolve ppt. in 10 ml concd. H_2SO_4. Wash the beaker with 5 ml concd. HNO_3 contg. 2 drops 30% H_2O_2. Reduce stannic ions with Al and titrate with KIO_3 or $KBrO_3$ under anerobic conditions.

3514. Lashkarev, V. E. and Kosonogova, K. M. **Photoelectromotive forces in cuprous oxide.** *Zhur. Eksptl. Teoret. Fiz.* **18**, 927-36 (1948).—*C.A.* **44**, 4772*b*.

The photo-e.m.f. of Cu_2O with Au electrodes was variable. Samples freshly prepd. (by oxidation of Cu at high temp. and quenching in H_2O) and coated with Au by evapn. show often, in light of $\lambda > 0.61\,\mu$, a distinctly pos. (+) effect, which increased on 1-2 hrs heating at 250-350°C *in vacuo* before coating with Au; their photoactivity improved with time. The back side showed also a (+) effect, but 5-20% as large. Heating in air annulled the (+) effect and changed it to a (−) effect owing to accumulation of CuO.

3515. McBain, James W. and Dunn, Robert C. **Sorption from solution by active magnesium oxide.** *J. Colloid Sci.* **3**, 303-11 (1948).—*C.A.* **43**, 17*a*.

The sorption of I_2 from CCl_4 solns. on light-burned com. MgO at 25°C was not complete in 24 hrs. Sorption of I_2 vapor was more direct and significant than sorption from soln. The adsorption of hexadecanol on light-burned MgO at 25°C was studied with $CHCl_3$, EtOH, BuOH, tert-BuOH, C_6H_6, and C_6H_{12} as solvents. Sorption from C_6H_6 and C_6H_{12}, solns. was complete in 2 hrs, but sorption from $CHCl_3$ soln. was slower. The dye 1-o-tolylazo-2-naphthol was sorbed rapidly from CCl_4 soln. on light-burned MgO. The surface area indicated by sorption from soln. was a small fraction of that found by adsorption of N_2 or I_2 vapors.

3516. Mitra, R. P. and Rajagopalan, K. S. **Titration curves of hydrogen micas.** *Nature* **162**, 104-5 (1948).—*C.A.* **42**, 7644*b*.

The H mica was titrated potentiometrically with KOH. First inflection was at pH 6.15-7.3; the 2nd and 3rd were at pH 9.0 and 10.5. The acidity values for the specimen studied were 16.0 and 47.5 milliequiv./100 g dry matter for the 2nd and 3rd inflections.

3517. Mitter, R. P. and Rajagopalan, K. S. **The apparently tribasic acid character of hydrogen mica.** *J. Indian Chem. Soc.* **25**, 591-2 (1948).—*C.A.* **43**, 7302*f*.

Finely ground muscovite was leached with dil. HCl to obtain H-mica by the replacement of exposed K ions by H ions. Aq. suspensions of this H-mica were found to behave as weak tribasic acids from their potentiometric titration curves with NaOH and KOH. The inflections in the curves occurred at pH 7.0, 9.0, and 10.5. The presence of H ions in 3 distinct affinity levels on the surface was indicated.

3518. Nagasawa, Shin. **Stabilization of hydrogen peroxide by colloidal tin dioxide. II. Effect of heavy metal ions on the stability of hydrogen peroxide. III. Effect of colloidal tin dioxide on the behavior of metallic ions.** *J. Chem. Soc. Japan, Pure Chem. Sect.* **69**, 72-5 (1948).—*C.A.* **46**, 9400*a*.

The effect of various metallic ions on the decompn. of H_2O_2 was studied at 50°C. The presence of Fe^{++}, Cu^{++}, or Cr^{+++} gave rise to serious decompn. of H_2O_2. Their amt. should be less than 10^{-6} mol./liter. The presence of SnO_2 gel or sol. prevented the decompg. action of metallic ions.

3519. Paneth, F. A. **Exchange of ions between crystal surfaces and solutions.** *J. chim. phys.* **45**, 205-11 (1948).—*C.A.* **43**, 6047*e*.

3520. Royer, Louis. **Orientation of potassium chloride on the cubic face of mica.** *Compt. rend.* **226**, 262-4 (1948).—*C.A.* **44**, 9764*c*.

The face of a KCl crystal formed on a cubic mica face must be octahedral in order to follow the mica structure. The occurrence of orientated cubic KCl crystals was attributed to small cubic crystals formed in the liquid phase falling onto the mica surface and taking up a preferred orientation.

3521. Shapiro, I. and Kolthoff, I. M. **Aging of precipitates and coprecipitation XLII. Aging of silver bromide and the dry state.** *J. Phys. & Colloid Chem.* **52**, 1319-31 (1948).—*C.A.* **43**, 2071*a*.

Sp. cond. was detd. for compressed AgBr pellets. With well-aged AgBr the log of the sp. cond. was an inverse linear function of the pressure up to at least 3000 atm. provided the effective ratio of length of conductance path to cross-sectional area was used. With freshly pptd. AgBr the above relation was not linear. The sp. cond. decreased very rapidly at low pressures and then approached the behavior of well-aged AgBr at high pressures.

3522. TEŽAK, BOŽO. **Coprecipitation and the relationship between adsorption, occlusion, and mixed-crystal formation.** *Arhiv Kem.* **20**, 16-25 (1948).—*C.A.* 44, 6233*a*.

The x-ray diffraction patterns of cryst. ppts. showed that substitution was more frequent the higher the concn. of the foreign ion in the soln., and that the lattice spacings of primary particles were expanded in proportion to the foreign-ion content. Contamination must be considered as similar to an occlusion, both phenomena being governed by the law of adsorption. The radius of the adsorbing ion in the primary lattice was a factor favoring the formation of two-dimensional crystal films. Another factor was the similarity between the structural pattern of the adsorbing ion and that of the adsorbed ion.

3523. TEŽAK, BOŽO; MATIJEVIC E., AND SCHULZ, K. **Coagulation of silver halides by electrolytes and the Wolfgang Ostwald theory of the activity coefficient.** *Arhiv Kem.* **20**, 1-15 (1948).—*C.A.* **44**, 6234*h*.

The constancy of the activity coeff. was approx. const. and held best for concns. greater than 10^{-2} *N*, and for the univalent coagulating cations. Choice of the concn. range 10^{-5}–10^{-3} *N* avoided the disadvantages of working with high concns. of the sol. For Ag halides at low sol concn. the activity coeff. varied for a given stabilizing ion with the concn. and with the valence of the coagulating cation. The chem. nature of the stabilizing ion was another factor significantly affecting the linearity of the activity coeff. as a function of sol concn., the valance being next in importance. The relative constancy of f_k at sol concns. higher than 10^{-2} was due to a slight effect of adsorption, namely, the dominant cation was adsorbed on the colloidal particle.

3524. THOMSON, G. P. **The growth of crystals.** *Proc. Phys. Soc.* **61**, 403-16 (1948).—*C.A.* **43**, 3684*f*.

New work bearing on the question of the reality of the Volmer layer was described; the data were obtained by interferometric methods. The rate of growth of faces was discussed, and a survey made of epitaxis and of its implications. Earlier results reported for the deposition of different metals on Cu were discussed.

3525. TULLER, ELIZABETH F. AND FULMER, E. I. **Coagulation of hydrous ferric oxide by electrolytes.** *J. Phys. & Colloid Chem.* **52**, 787-808 (1948).—*C.A.* **42**, 5304*e*.

The progress of agglomeration was followed by detg. the change in transmission of light. A uniform method of mixing the colloid with the coagulating electrolyte was employed. It was found that crit. times may be used in detg. the relation of the sol concn. to the coagulation values of an electrolyte.

3526. BIRNBAUM, S. M. AND SHCHIGOL, M. B. **Potentiometric determination of calcium ion in the presence of magnesium ion.** *Zavodskaya Lab.* **15**, 402-4 (1949).—*C.A.* 43, 6938*d*.

The Ca was pptd. from a hot soln. with standard $Na_2C_2O_4$, and the excess back-titrated in ammoniacal soln. with $AgNO_3$. If the oxalate ppt. was not removed, adsorption took place. If Mg concn. did not exceed Ca by over 300%, the Ca detn. was readily made as the Mg remains in soln.

3527. BOURDON, DANIEL AND COTTE, JOANNES. **Adsorption of molybdic acid by ammonium phosphomolybdate.** *Bull. soc. chim. France* **1949**, 429.—*C.A.* **43**, 8971*e*.

The fraction of MoO_3 fixed by NH_4 phosphomolybdate was const. at high acidity (5 *N*) and excess molybdate (4-7% soln. in MoO_3).

3528. BUCHANAN, A. S. AND HEYMANN, E. **Electrokinetic potential of barium sulfate.** *Nature* **164**, 29 (1949).—*C.A.* **43**, 8800*e*.

Freshly ignited $BaSO_4$ either pptd. or recrystd., had a well-reproducible pos. potential against its satd. soln. in water and in alc.-water mixts. However, surface-active impurities, which may originate from rubber joints or filter paper, must be entirely absent. Impurities caused a decrease in pos. potential and even a change to neg. potantial. Ignition to 500-700°C or treatment with hot concd. HNO_3 would restore the original pos. potential of contaminated $BaSO_4$.

3529. BUNN, C. W. AND EMMETT, H. **Crystal growth from solutions. I. Layer formation on crystal faces.** *Discussions Faraday Soc.* **1949**, 119-32.—*C.A.* **44**, 2312*a*.

A 17-year study of the growth of crystals under a microscope was discussed. Crystals in general grew by the spreading of discrete layers one after another across the faces. Layers very often started, not from edges or corners of crystals, but from the centers of faces, spreading outwards towards the edges. The thickness of the layers on many crystals increased as the layers approached the edges of the crystal faces. Dissolved impurities may strongly affect the thickness and the shape of the layers, the effect being highly specific.

3530. BUNN, C. W. **Crystal growth from solutions. II. Concentration gradients and the rates of growth of crystals.** *Discussions Faraday Soc.* **1949**, 132-44.—*C.A.* **44**, 2312*d*.

A concept of crystal growth was developed similar to the current concept of certain chain polymerization reactions, in which the reaction depended on activated mols. and its continuation depended on the maintenance of activated chain-ends. In crystal growth, high-index surfaces appeared to the active surfaces that were capable of adding further mols.

3531. CANALS, E.; MARIGNAN, R., AND CORDIER, S. **Adsorption of some metal ions in very dilute solutions.** *Ann. pharm. franc.* 7, 502-9 (1949).—*C.A.* **44**, 1777*h*.

The adsorption of small quantities of Zn and Cu on $CaCO_3$ was studied. One liter of redistd. H_2O contg. known quantities of the metals was boiled one hr with 50 mg $CaCO_3$, decanted after 10 min., the ppt. centrifuged, dissolved in 0.1 *N* HCl, adjusted to pH 6.7 (bromothymol blue), brought to pH 6.9 by the addn. of Na_2SO_4 and analyzed by polarography. Working at dilns. of 10^{-7} to 2×10^{-6} ion-g/liter, the percentage of adsorbed ions decreased as the concn. increased. In mixed solns. of Cu and Zn, Cu diminished the adsorption of Zn to a degree to make it negligible.

3532. CHERNIKOVA, T. N. AND GAPON, E. N. **Distribution of electrolytes between solid and liquid phases. I. Uptake of silver sulfate by ferric hydroxide.** *Kolloid Zhur.* **11**, 120-6 (1949).—*C.A.* **43**, 6885*i*.

Ag was adsorbed from Ag_2SO_4 solns. by dialyzed $Fe(OH)_3$ sols prepd. from $FeCl_3$, but not by those prepd. from $Fe(NO_3)_3$ or $Fe_2(SO_4)_3$. Electrodialysis reduced the amt. of Ag adsorbed by $Fe(OH)_3$ from $FeCl_3$ 10 to 15 times. Ag was "adsorbed" because it was pptd. as AgCl. SO_4^{++} was taken up from Ag_2SO_4 solns. by $Fe(OH)_3$ sols from $FeCl_3$ and $Fe(NO_3)_3$ because of ion exchange.

3533. COOKE, STRATHMORE R. B. AND DIGRE, MARCUS. **Studies on the activation of quartz with calcium ion.** *Am. Inst. Mining Met. Engrs., Tech. Pub.* No. **2606-BH**, *Mining Eng.* **1**, No. 8, 299-305 (1949).—*C.A.* **43**, 6953*h*.

All cations in the solution tended to adsorb quartz on the surface in the preferential sequence H^+, Ca^{++}, and Na^+. To displace the adsorbed hydrogen ion to any degree, the calcium concn. must be more than 10^5 times the H^+ concn., and the Na^+ concn. must be more than 10^9 times the H^+ concn. Na^+ will commence to displace Ca^{++} at a concn. about 10^3 times the Ca^{++} concn.

3534. D'ALCONTRESS, GUGLIELMO S. **Adsorption by barium sulfate.** *Gazz. chim. ital.* **79**, 609-13 (1949).—*C.A.* **44**, 1778*c*.

The $BaCl_2$ that accompanied ppts. of $BaSO_4$ in gravimetric analyses formed true adsorption compds. between the $BaSO_4$ and excess Ba. The system was studied by adding the theoretical proportion and various excesses of 0.04 *M* $BaCl_2$ to 0.04 *M* Na_2SO_4, allowing to stand 8 hrs, washing the ppts. free of the Cl^-, and analyzing both ppts. and filtrates. With increasing excess of $BaCl_2$, the proportion of adsorbed $BaCl_2$ increased progressively to a max. above which it was const., independent of the excess of $BaCl_2$ originally present.

3535. DEY, ARUN K. **The conditions of precipitation of cupric hydroxide from cupric salts by soluble hydroxides. II. Role of hydration in determining the chemical character of the hydrated oxide.** *Current Sci. (India)* **18**, 123-4 (1949).—*C.A.* **43**, 8295*h*.

Pptd. $Cu(OH)_2$ from $CuSO_4$ and NaOH retained more adsorbed sulfate, when the amt. of alkali used was less than the theoretical equiv. Besides the variation in compn. and phys. character of the ppt., the soly. in NH_4OH also changed. An excess of NaOH produced a ppt. totally insol. in NH_4OH. Aging for a month had no perceptible effect on the hydration of cupric oxide.

3536. DUKE, FREDERICK R.; BEVER, ROBERT J., AND DIEHL, HARVEY. **The rate of precipitation of barium sulfate.** *Iowa State J. Sci.* **23**, 297-300 (1949).—*C.A.* **43**, 6941*f*.

The apparent end point when $Ba(OAc)_2$ was added to a dil. soln. of K_2SO_4 depended on the time elapsing between the addn. of reagent and reading of the app. The rate of pptn. of $BaSO_4$ was represented by: $dP/dT = kS[Ba^{++}]\ [SO_4^{--}]$, where *P* was the no. of moles of $BaSO_4$/liter, k= sp rate const., and *S* was the surface area of the ppt. The assumptions, that ion pairs were precursors of the crystals, that the no. of particles was set by the original concns. of Ba^{++} and SO_4^{--}, and that the particles grew at the same rate, seemed to be justified by the results.

3537. EVANS, U. R. AND PRYOR, M. J. **Passivity of metals. IX. The solubility product of freshly precipitated ferric hydroxide.** *J. Chem. Soc.* **1949**, S157-60.—*C.A.* **43**, 7789*d*.

A value of $10^{-35.5}$ at 20°C was obtained for the soly. product of "gelatinous" $Fe(OH)_3$ by an electrometric method. Pptn. first occurred at pH 3.00.

3538. FRICKE, R. **Influence of adsorption and capillary condensation upon the emanation method of Otto Hahn.** *Z. anorg. Chem.* **259**, 299-302 (1949).—*C.A.* **44**, 4341*e*.

The emanating power of finely divided prepns. labeled with radio-Th first rose with increasing H_2O adsorption and capillary condensation, then dropped. The decline occurred sooner if the prepn. was compressed strongly.

3539. FRICKE, R. AND LÖFFLER I. **Measurements of the basicities of the surfaces of rare earth hydroxides by combined physical and chemical adsorption.** *Z. Elektrochem.* **53**, 161-4 (1949).—*C.A.* **43**, 8244*g*.

Relative basicities of cryst. hydroxides of La, Sm, Er, and Y were measured by treatment with KCl soln. and detn. of loss of Cl ion (phys. adsorption) and change of pH (chem. adsorption).

3540. GALECKI, A. **Silver hydrosols. III. Preparation.** *Bull. soc. amis sci. Poznan, Ser. B, Sci. math. et nat.* No. **10**, 87-111 (1949).—*C.A.* **46**, 319*i*.

Nuclear Ag sols were produced from Ag_2O or $AgNO_3$ in the presence of small amts. of Na_2CO_3, K_2CO_3, KOH, or NH_3, with an ether soln. of P, aq. H_2SO_4, or hydrazine hydrate as reductor. Derived sols were prepd. contg. varying amts of added aq. HCHO. Some Au sols were also prepd. Most favorable titration conditions, possible trouble spots, and reproducibility of results were discussed. Color, fluorescence, opalescence, and ultramicroscope appearance were detd.

3541. GLEDITSCH, E. AND GAPPELEN, P. T. **Ion exchange in solid salts.** *Bull. soc. chim. France* **1949**, D64-7.—*C.A.* **43**, 4534*g*.

An intimate mixt. of an insol. salt with a sol. salt, one of them contaminated with Ra D, was heated and then sepd. by extn. with water. Exchange sets in only at high temps., depending on the m.p.; compression of the mixt. increased the amt. of exchange; regrinding also increased the amt. of exchange. The mixts. studied were $Pb{*}CrO_4Pb(NO_3)_2$, $Pb{*}CrO_4 - PbCl_2$, $PbCrO_4 - Pb{*}Cl_2$, and $Pb{*}SO_4 - PbCl_2$.

3542. HENSLEY, JAMES W.; LONG, ARTHUR O., AND WILLARD, JOHN E. **Reactions of ions in aqueous solution with glass and metal surfaces. Studies with radioactive tracers.** *Ind. Eng. Chem.* **41**, 1415-21 (1949).—*C.A.* **43**, 8233*g*.

The sorption by radio-Na^+ by soft glass was a function of the pretreatment received by the glass and increased with time of immersion, pH and temp. It varied from one to several monolayers; whereas sorption of Cs^+, Ag^+, Br^-, and CO_3^{--} was always less than one monolayer. Na^+ sorption on steel, Pt, Ag, and Al was generally less than one monolayer. A radioactive impurity in the Na_2CO_3 solns. was selectively adsorbed relative to the Na^+.

3543. Hermans, J. J. **Light scattering by charged particles in electrolyte solutions.** *Rec. trav. chim.* **68**, 859-70 (1949).—*C.A.* **44** 2824*b*.

From the assumption that a colloid particle with its double layer could be treated as a sep. unit, math. formulas were developed for compact spherical particles and random coils. The scattering power of ions were related to the *N* of the soln. Ions surrounding a colloid particle reduced the scattering power of the particle. The effect of ions on light scattering may become appreciable.

3544. Honda, Masatake. **Ion-exchange resins in analytical chemistry. II. Nephelometric determination of sulfate ion.** *J. Chem. Soc. Japan, Pure Chem. Sect.* **70**, 55-7 (1949).—*C.A.* **45**, 4169*g*.

Sulfate ion in water was detd. nephelometrically as $BaSO_4$ in the presence of gelatin. $CaSO_4$ in the gelatin was removed by ion-exchange resins.

3545. Humphreys-Owen, S. P. F. **Crystal growth from solution.** *Proc. Roy. Soc.* **A197**, 218-37 (1949).—*C.A.* **44**, 2318*d*.

Single crystals of the cubic form of $NaClO_3$ were studied in growth from aq. soln. An interferometric technique measured concns. and gradients of concn. contiguous to the crystal. The rates of advance of individual faces were compared with predictions derived from the Nernst supposition. Empirical equations were obtained for the functions that connect the rate of growth with the concn. and gradient distribution along the face.

3546. Imada, Fusao. **Carbons. XXI. Influence of the active carbons (of the anode mixture) on the electromotive force.** *Kogaku Iho, Kyushu Univ.* **20**, 61-8 (1949).—*C.A.* **47**, 5820*b*.

The e.m.f. was measured on a dry air-cell discharging repeatedly for 2-3 hrs at 0-3-hr intervals. The rate of decrease of the e.m.f. in the repeated discharge was proportional to e^{-n}, where n was the no. of discharge, and the rate of decrease with the discharge time was $E = t/(a + bt)$, where E was e.m.f., t was discharge time, and a and b were consts.

3547. Ionin, V. D.; Lubovnikov, M.; Neiman, B., and Nesmeyanov, An. N. **Isotopic exchange of phosphorus among H_3PO_2, H_3PO_3, and H_3PO_4.** *Doklady Akad. Nauk S.S.S.R.* **67**, 463-6 (1949).—*C.A.* **43**, 7815*a*.

In equimol. mixts. $NaH_2P^{32}O_4 + NaH_2PO_2$ (1, 0.025, or 0.1 *M*) heated 80 hrs in closed vessels, no isotopic exchange was detected by radioactivity measurements up to 280°C, at which temp. all the $H_2PO_2^-$ was oxidized to $H_2PO_4^-$. A similar neg. result was found with $H_3PO_4 + H_3PO_3$ up to 280°C, at which H_3PO_3 disappeared. Addn. of 0.0005 *M* NaOH accelerated the oxidation of H_3PO_2 and of H_3PO_3 to H_3PO_4, oxidation being complete at 195°C. On the other hand, addn. of 0.0005-0.001 *M* HCl increased the stability of NaH_2PO_2 which, in mixt. with $NaH_2P^{32}O_4$, could be detected and sepd. even after heating to 300°C.

3548. Jenkins, H. G.; McKeag, A. H., and Ranby, P. W. **Alkaline earth halophosphates and related phosphors.** *J. Electrochem. Soc.* **96**, 1-12 (1949).—*C.A.* **43**, 6925*d*.

White light was obtained in fluorescent lamps from alk. earth halophosphates activated with Sb and Mn. Luminescent properties were discussed as a function of compn. and several possible substitutions. The latter included substitution of Sr or Ba for Ca, of Cl or OH ion for F, of several primary activators in place of Sb, and of other activators in place of Mn in hydroxyapatites.

3549. Kauko, Y.; Hyyrylainen, E. S., and Holmen, H. **Adsorption, ion exchange, and neutralization process in the system slag-calcium hydroxide-water.** *Svensk Kem. Tid.* **61**, 128-40 (1949).—*C.A.* **44**, 505*e*.

The alk. reaction of mixts. of a blast-furnace slag contg. 45.5% CaO and H_2O was due to ion exchange between sol. cations and H ions. Upon addn. of $Ca(OH)_2$ the removed cations reverted to the slag, and at $pH \gtrsim 12.2$ $Ca(OH)_2$ was taken up by a neutralization process forming presumably ortho-silicates and ortho-titanates. Superimposed was the adsorption of cations, which was strongly dependent on the presence of O_2 or CO_2.

3550. Kenny, A. W. and Spragg, W. T. **Preparation of carrier-free phosphorous^{32} from pile-irradiated sulfur. I. Adsorption of phosphorus^{32} on ferric hydroxide and dialyzed iron.** *J. Chem. Soc.* **1949**, S326-S30.—*C.A.* **44**, 9812*i*.

The efficiency of adsorption of radiophosphate on $Fe(OH)_3$ decreased with increase of pH from 10.5 to 13.0. The presence of SO_4^{--} had little effect on the adsorption. On dialyzed Fe in the pH range 1.0-4.0, phosphate adsorption in the presence of sufficient sulfate to complete pptn. of the radiophosphate had been measured. Radiophosphate could be selectively adsorbed by dialyzed Fe from soln. containing Cr and Al at pH 2.0.

3551. Khlopin, V. G. and Merkulova, M. S. **Adsorption of radium on lead sulfate in the presence of surface-active substances.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim Nauk* **1949**, 460-72.—*C.A.* **44**, 6233*h*.

$PbSO_4$ was prepd. by pptn. of a dil. soln. of $Pb(NO_3)_2$ with an equiv. amt. of dil. $MgSO_4$, decanting and washing to const. elec. cond. of the satd. soln., 4.1×10^{-5}, and const. electrokinetic potential (in electroosmosis), 14.8 1.0 mv. Adsorption of Ra was detd. by the emanation method in 2 procedures. In the presence of Ponceau 4 R (P), adsorption equil. was reached in both procedures 20-25 min. faster.

3552. King, E. L. **Radiocolloidal behavior of neptunium and plutonium.** *Natl. Nuclear Energy Ser., Div. IV*, **14B**, *Transuranium Elements, Pt. I*, 434-44 (1949).—*C.A.* **44**, 7622*e*.

Pu(IV) at low acidity and in trace concn. formed a radiocolloid. Pu(IV) tracer could be centrifuged from soln. if the H-ion concn. was less than 0.01 *M*. Np(V) exhibited no radiocolloidal behavior even at a H-ion concn. of 10^{-4} *M*. The adsorption by glass of Pu(IV) in trace concn. increased as the H-ion concn. decreased.

3553. Kobayashi, Koichi. **Velocity of formation of fine crystals of silver chloride. I. and II.** *J. Chem. Soc. Japan, Pure Chem. Sect.*, **70**, 125-7, 179-81 (1949).—*C.A.* **45**, 4120*e*.

The time variation of the reaction between Ag^+ and Cl^- was studied by measuring the e.m.f. of concn. cells with respect to Ag^+ under the conditions: (a) with equiv. amts. of both ions, (b) with an excess of either ion, and (c) in the presence of crystal nuclei of AgCl with equiv. amts. of both ions. An equation was given for the reaction velocity between $AgNO_3$ and KCl. The interfacial tension between AgCl and its soln. at the initial state of reaction was detd. to be 20 dynes/cm.

3554. Kubal, J. V. **Properties of the positively charged sol of silver iodide.** *Collection Czechoslov. Chem. Communs.* **14**, 305-19 (1949).—*C.A.* **44**, 2328*i*.

The sol, AgI, was prepd. by mixing dil. solns. of $AgNO_3$ and excess KI, electrodialyzing, and converting to the pos. sol by adding a certain vol. of $AgNO_3$ of known pAg. These solns. were studied by coagulation, addn. of electroytes, and cataphoresis. The addn. of electrolytes increased the value of pAg, resulting in higher stability for the sol. An app. was described to measure the cataphoresis in the presence of electrolytes and in the absence of the products formed by the electrolysis.

3555. Kurbatov, M. H. **Rate of adsorption of barium ions in extreme dilution, by hydrous ferric oxide.** *J. Am. Chem. Soc.* **71**, 858-63 (1949).—*C.A.* **43**, 6035*i*.

The rate of adsorption of Ba ions from a soln. contg. 3×10^{-10} g atoms per liter was studied on a 1×10^{-5} g mole sample of hydrous Fe_2O_3. A steady state in the adsorption was reached after 40 to 60 hrs. The rate of adsorption increased as pH increased from 7.5 to 8.5; it also increased as the concn. of NH_4Cl increased from 3.8×10^{-3} to 0.3 *N*.

3556. Matsuno, Takeo. **Diaphragms for electrolysis. I. Effect of the diaphragm on the ionic diffusion.** *J. Chem. Soc. Japan, Ind. Chem. Sect.* **52**, 227-9 (1949).—*C.A.* **45**, 4115*e*.

A gel contg. NaCl or a mixt. of NaCl and NaOH was prepd. on which was placed a diaphragm, and distd. water poured carefully over it. When the standard sand from Ottawa was used as diaphragm, the diffusion of NaCl decreased logarithmically with increase in depth of the diaphragm. With quartz sand of various sizes, the diffusion of NaCl decreased asymptotically with decrease in particle size. Increase in concn. of NaCl in the gel increased its diffusion linearly up to 0.5 *N* and showed a satn. therefrom.

3557. Neuhaus, A. **Reaction kinetics of oriented precipitations.** *Fortschr. Mineral.* **28**, 58-63 (1949) (Pub. 1950).—*C.A.* **45**, 10017*b*.

If hard substances were first activated by heating, oriented overgrowths may be obtained. Thus, oriented overgrowths of NaCl were obtained on wollastonite and hornblende if these minerals were heated to 500°C, and similarly overgrowths of Ag on NaCl heated at 200-300°C.

3558. Perley, George A. **Composition of pH-responsive glasses.** *Anal. Chem.* **21**, 391-4 (1949)

Comparisons of pH glasses could best be made on the basis of mole per cent composition. The performance of a pH-responsive glass was in part dependent on the role of the ionic radii of the modifying atoms within the silicon-oxygen ($Si\text{-}O_4$) network. The stability, sodium errors, etc., should depend considerably on the electrostatic forces prevailing within the interstices of the network.

3559. Pick, Heinz. **Preparation of reflecting deposits by chemical reactions.** *Z. Physik* **126**, 12-19 (1949).—*C.A.* **43**, 8822*h*.

The deposition of PbS formed by the reaction between Pb acetate and thiourea was studied under a variety of conditions. If the reaction velocity was too great, an adherent deposit was not obtained, while if the concns. of the solns. used were too low, a poor, cryst. layer was formed. The addn. of a very small amt. of some salts such as $CuSO_4$ resulted in the formation of excellent reflecting surfaces.

3560. Pierron, P. **The evolution [of oxygen] from alkaline solutions of hydrogen peroxide and the effect of small quantities of metallic hydroxides or oxides on this evolution.** *Bull. soc. chim. France* **1949**, 754-8.—*C.A.* **44**, 2355*e*.

The rate of O_2 evolution from alk. H_2O_2 solns. was decreased by $Sn(OH)_4$ in all cases, by MgO, CaO, and BaO in a wide range of alkalinities, within a narrow range by ZnO, CdO, and Al_2O_3, and always by the oxides of Ni, Co, Fe, Cu, Pb, Mn, Ag, and Hg. In general, the rate of O_2 evolution was decreased the most by the most stable oxide and increased the most by the least stable oxide.

3561. Singleton, R. H. and Spinks, J. W. T. **Comparison of the direct and indirect radioactive methods for determining the surface area of a strontium sulfate precipitate.** *Can. J. Research* **27B**, 238-57 (1949).—*C.A.* **43**, 6490*c*.

The specific surface of a $SrSO_4$ ppt. was measured: (1) In the direct method of mixing a soln. of active $Sr(OAc)_2$ with a suspension of $SrSO_4$ and detg. the activity of original and final Sr^{90}; no significant corrections were needed for the aging of the ppt., adsorption of the Y^{3+} on the $SrSO_4$, the shaking methods, or the adsorption of Sr^{90} on flint glass. (2) In an indirect method Th B was adsorbed on $SrSO_4$ to give a calcd. surface of 30,800 cm² per g (3) In another indirect method Th B gave a calcd. surface of 21,300 cm² per g.

3562. Skvortsov, V. N. **Chemical reactions of colloidally dissolved substances. V. The zonal structure of silver hydrosol aggregates.** *Kolloid. Zhur.* **11**, 354-8 (1949).—*C.A.* **44** 904*e*.

A Kohlschütter sol contg. about equal amts. of Ag and Ag_2O (0.04 g/liter) was titrated with $FeCl_3$, and the amt. of total Ag that reacted was detd. The sol was titrated also with $KMnO_4$. Ag_2O reacted with $FeCl_3$ before Ag metal. The sol particles consisted of a Ag core covered with Ag_2O.

3563. Stow, R. M. and Spinks, J. W. T. **Exchange of ions between the surface of crystals and solutions.** *J. Chem. Phys.* **17**, 744 (1949).—*C.A.* 44, 408*d*.

Both radioactive anions and cations were used to measure the area of crystals of $SrSO_4$. The crystals prepd. by addn. of excess H_2SO_4 to $SrCl_2$ soln. were washed repeatedly with water and aged 2 yrs in contact with $SrSO_4$ soln. The area detd. with $(Sr^{90})^{++}$ was 14.9×10^3 cm²/g, whereas the area detd. by using $S^{35}O_4^{--}$ was 8.3×10^3 cm²/g. The difference in areas as measured by Sr^{90} and S^{35} was quite beyond the limits of exptl. error.

3564. Tolliday, J. D.; Woods, E. F., and Hartung, E. J. **Membrane permeability. V. Activation energy of diffusion and membrane potentials of potassium chloride through cupric ferrocyanide.** *Trans. Faraday Soc.* **45**, 148-55 (1949).—*C.A.* 43, 5257*b*.

The permeability of the membrane to electrolytes was detd. from 0° to 35°C. The permeability of a membrane at 18°C in 0.2 *M* KCl was 0.0474 millimol./hr. The potential thereafter was 37.6 (1st day) and 37.3 (2nd day) at 19°C. Treatment with Cu^{++} yielded membranes of higher permeability and correspondingly lower potentials and activation energies.

3565. Venturello, Giovanni and Burdese, Aurelio. **Activation of the oxides of magnesium.** *Ann. chim. applicata* **39**, 362-74 (1949).—*C.A.* 45, 8321*b*.

The quantity of I_2 adsorbed from 0.1 *N* solns. of I_2 in CCl_4 was detd. The adsorption of I_2 from a vaporized soln. of CCl_4 was measured to det. the sp surfaces of various types of strongly active MgO, and to compare the adsorbing capacities of the oxides prepd. by special methods. The effects of temp. and of duration of the activation upon the MgO were examd.

3566. Amelinckx, S. **Diffusion phenomena in the growth and solution of crystals in solution.** *J. chim. phys.* **47**, 208-12 (1950).—*C.A.* 44, 10424*c*.

Diffusion fields in these cases spread radially about a center point; and the rate of growth was proportional to $(C_k - C_o)$, where C_o was the satg. concn., and C_k some concn. intermediate between the bulk concn. and C_o. The calcd. distribution conformed with the photographs of Humphreys-Owen for growing $NaClO_3$.

3567. Basinska, Halina. **The stability of silver chloride and silver cyanide sols.** *Roczniki Chem.* **24**, 177-86, 188-91, English summaries 186-7, 191-2 (1950).—*C.A.* 46, 5400*f*.

The absorption of light by the pos. and neg. AgCl and AgCN sols was detd. at 0.1, 1.0, and 10 millimol./liter. The transparencies of the pos. and neg. sols for equal concns. and equal excess of KCl, KCNS, and $AgNO_3$ were compared. At 10 millimol. of AgCl/liter the pos. were more transparent and stable than the neg. ones. At 1 millimol. of AgCl/liter no distinct difference between the pos. and neg. sols were observed. At 0.1 millimol. AgCl/liter the neg. sols began to be more transparent and stable.

3568. Canals, E.; Marignan, R., and Cordier, S. **Adsorption of some metallic ions in dilute solutions. II. Adsorption coefficient; number of active cells.** *Ann. pharm. franc.* **8**, 368-72 (1950).—*C.A.* 44, 9769*e*.

The adsorption was detd. of Cu and Zn in concns. of 5 to 50×10^{-7} gram ion per liter on 50 mg $CaCO_3$ during 1 hr at 20°C. K, expressing the affinity of the adsorbent for the adsorbable substance, was for Cu 63×10^4, for Zn 6.3×10^4. The K at 100°C was 0.140×10^3 for Cu and 0.044×10^3 for Zn. Each active center fixed 5 Cu ions at high temp., and 2 centers fixed 3 Zn ions.

3569. Chassevent, Louis and Domine, Daniel. **The action of water on the structure of porous masses obtained by the hydration of pliant materials.** *Compt. rend.* **230**, 2096-8 (1950).—*C.A.* 44, 11056*c*.

Plasters of various compns., e.g. hydrated portland cements, were kept in water for extended periods. In the course of several days, phys. changes were observed which resulted in a decrease of resistance and an increase in the apparent vol. The resistance decreased rapidly in the first hrs following the end of the hydration. After 7 days the diminution was 30% after which it varied but little.

3570. Correns, Carl W. **The geochemistry of diagenesis. I. The behavior of calcium carbonate and silica.** *Geochim. et Cosmochim. Acta* **1**, 49-54 (1950) (in German).—*C.A.* 45, 3305*d*.

A discussion, based on soly. curves in H_2O and in sea water, of the soln. and pptn. of $CaCO_3$ and SiO_2 in sediments. Evolution of CO_2 caused pptn. of SiO_2; silicification of wood may be caused by evolution of CO_2 during the decompn. of the wood.

3571. Čůta, F. and Velebil, Z. **Potentiometric determination of hydroxide or bicarbonate in sodium carbonate by Winkler's method.** *Chem. Listy* **44**, 193-8 (1950).—*C.A.* 45, 5569*c*.

By elimination of CO_2 and efficient stirring, the titration of the hydroxide remaining after the pptn. with $BaCl_2$ was quant. Adsorption of the hydroxide on $BaCO_3$ or formation of acidic or basic Ba carbonates was not observed.

3572. Dey, Arun K. and Ghosh, Satyeshwar. **Studies in the nature of hydrated ferric oxide. I. Influence of temperature and concentration on the nature of the precipitate obtained by the interaction of solutions of ferric chloride and sodium hydroxide.** *J. Indian Chem. Soc.* **27**, 65-70 (1950).—*C.A.* 45, 1893*f*.

Hydrated Fe_2O_3 was completely pptd. by less than the theoretical amt. of NaOH. Adsorption of Cl^- decreased and that of Na^+ increased with increasing amt. of NaOH. The ppt. formed at higher temp. with excess NaOH was yellow and resistant toward acids.

3573. Donnet, J. B. **Birefringence of vanadium pentoxide sols.** *J. chim. phys.* **47**, 698-702 (1950).—*C.A.* 45, 4116*b*.

The difference in the exptl. and calcd. values of the diffusion coeff. was due to the combined effects of poly-dispersion, slow flocculation, and particle growth of colloidal V_2O_5 sols.

3574. DOUGLAS, H. W. AND WALKER, R. A. **Electrokinetic behavior of Iceland spar against aqueous electrolyte solutions.** *Trans. Faraday Soc.* **46**, 559-68 (1950).—*C.A.* **45**, 21*e*.

The zeta potential of pure Iceland spar was detd. against CO_2-free water, its own satd. soln., and the effect of increasing concn. of $CaCl_2$, $BaCl_2$, $Pb(NO_3)_2$, $MgCl_2$, NaCl, NaOH, Na_2CO_3, and $(NaPO_3)_6$. The initial potential and its variation with dissolved electrolytes depended on the pretreatment. In particular, etching of the spar with very dil. mineral acid caused the potential to shift irreversibly to more neg. values, an effect consistent with irregular pitting of the surface as shown by the electron microscope.

3575. DUBUISSON, A. **Study of plasters.** *Rev. materiaux construction trav. publ., Ed. C*, No. **418**, 228-32, 259-64, No. **420**, 282-7 (1950).—*C.A.* **45**, 4422*i*.

Dehydration of $CaSO_4 \cdot 2H_2O$ did not show evidence of formation of the intermediate compd. $CaSO_4 \cdot \frac{1}{2}H_2O$. Rehydration of sol. anhydrite in air at 17°C and 80% relative humidity produced the compd. $CaSO_4 \cdot \frac{2}{3}H_2O$. The mechanism for hydration of anhydrite was transformation directly into $CaSO_4 \cdot \frac{2}{3}H_2O$, with liberation of 2612 cal/g mol. wt, thence hydration to $CaSO_4 \cdot 2H_2O$, with liberation of 3480 cal/g mol. wt.

3576. FRICKE, R. **Hydrolytic adsorption on pure acid oxides.** *Naturwissenschaften* **37**, 428 (1950).—*C.A.* **45**, 4533*d*.

Pure amorphous titanic acid from its tetraethyl ester adjusted 1 N KCl soln. to pH slightly below 5; pure SiO_2 from the ortho ethyl ester gave pH from 3 to 4 with 1 N KCl.

3577. GAUR, HARISH CH. AND BHATTACHARYA, A. K. **Influence of adsorption of $Fe(CN)_6^{---}$ and Cd^{++} ions, and that of hydrolysis on the composition of cadmium ferricyanide.** *Current Sci.* **19**, 176-7 (1950).—*C.A.* **44**, 9852*b*.

A fairly stable sol of concn. 2.5 g/liter was prepd. by mixing $CdSO_4$ and $K_3Fe(CN)_6$ solns. in the mol. ratio 1:1.25. The sol was dialyzed for 5 days, and mixed with $CdSO_4$ and $K_3Fe(CN)_6$ solns., resp., at several concns. The release of $Fe(CN)_6^{---}$ per g of complex was much greater in the undialyzed sol. Both hydrolysis and adsorption contributed to variations in the compn. of the compd.

3578. GLAZMAN, YU. M. AND STRAZHESKO, D. N. **Investigation by the tracer method of the coagulation of lyophobic sols by electrolytes. Adsorption of ions of the same sign.** *Doklady Akad. Nauk S.S.S.R.* **75**, 411-13 (1950).—*C.A.* **45**, 3220*d*.

The amt. of neg. ions PO_4^{---} and SO_4^{--} adsorbed by the neg. hydrosols of AgI (0.01 *M*) and HgS and As_2S_3 (0.008 *M*) was detd. by tagging the anions with radioactive P^{32} and S^{35}, resp. The amts. adsorbed on HgS and As_2O_3 were ~0.8 and ~0.9 millimole/g, resp.; adsorption of SO_4^{--}, none on AgI or HgS, and ~2.1 millimole/g on As_2S_3. Pos. Sr^{++} ions (tagged with radioactive Sr^{89}) were adsorbed to the extent of 47.6 millimole/g on AgI, 16.8 on HgS, and 63.9 on As_2S_3.

3579. KIRIYAMA, RYOITI. **Velocities of crystal growth. IV. Final-stage velocity of crystal growth in the supersaturated solution.** *J. Chem. Soc. Japan, Pure Chem. Sect.* **71**, 243-5 (1950).—*C.A.* **45**, 4534*i*.

The rate of the increase of wt of crystal grains of Sr formate dihydrate and Ba formate in satd. solns. were detd. by means of a thermobalance at 25-50°C. The formal activation energy for the final stage of crystal growth of Sr formate dihydrate was 615 kcal./mol. at 27.3-52.0°C and that of Ba formate 3.7 kcal./mol. at 25.2-55.8°C. These reaction velocities were proportional to concn. and temp. and inversely to the viscosity of soln.

3580. KONDO, SEI-ICHI AND SUITA, TOKUO. **Absorption spectra of colored potassium chloride containing several kinds of impurities.** *J. Phys. Soc. Japan* **5**, 200-1 (1950) (in English).—*C.A.* **45**, 1868*h*.

The absorption curves and dielec. dispersion of KCl crystals contg. NaCl, AgCl, and TlCl were studied after irradiation with x-rays. The anomalous color found in these crystals, which disappeared upon exposure to light, was explained in terms of the dipolar rotation of pairs of vacancies in an elec. field.

3581. KOZAKEVITCH, PAUL. **The structure of adsorbed films formed by mineral substances.** *J. chim. phys.* **47**, 24-32, 600 (1950).—*C.A.* **44**, 6229*d*; *C.A.* **45**, 2742*a*.

The Schofield-Rideal equation was applied to the surface-tension measurements of various metal and metal oxide solns. Na on Sn formed a liquid layer, Ba on Hg formed a layer as in an ordinary cryst. structure, H_2O on $AgTl(NO_3)_2$ formed the tetrahedral structure, Na_2O, on FeO showed the 100 plane as in cryst. Na_2O, and P_2O_5 on FeO formed a plane tetrahedral network as in glassy P_2O_5. The surface covol. B was calcd. incorrectly in an earlier paper and the correct results were given here.

3582. MALKINA, A. D. AND DERYAGIN, B. V. **Adhesion of quartz fibers in aqueous media.** *Kolloid. Zhur.* **12**, 431-47 (1950).—*C.A.* **45**, 1841*i*.

A vertical quartz fiber 25-40μ thick was fixed vertically. A horizontal quartz fiber, 80-120μ thick, was pressed against it by a force *P* for a time *t*. When the latter was moved away, the former might follow it until the contact was severed by the elastic forces. Their magnitude was calcd. from the flexion of the fiber, and from them the specific adhesion energy *f* (ergs./cm²) was calcd. In water and aq. solns. *f* was independent of *P* (varied between 0.014 and 0.084 dynes) but increased with *t*. When a fiber was pressed against another, the hydrate layers between the solids gradually melted away; the distance between the solid surfaces decreased, and their attraction increased.

3583. Malquori, Alberto and Wiklander, L. **Influence of alternate wetting and drying on potassium and magnesium fixation and base-exchange capacity of synthetic aluminum and iron silicates.** *Trans. Intern. Congr. Soil Sci. 4th Congr., Amsterdam* **1950**, **I**, 141-6.—*C.A.* **46**, 1839*h*.

Alternate wetting and drying was used to simulate artificial aging. Both Al and Fe silicates fixed K (3.4-4.5% of that added) and particularly Mg (13-17%) in a nonexchangeable form, the degree of fixation reaching a practically const. value even after a few days. Al silicates fixed more Mg than did Fe silicates. The results also showed an increase in exchange capacity with increasing SiO_2:R_2O_3 ratio.

3584. Marques, Branca Edmée. **New data on the behavior of polonium in acid solutions.** *Rev. quim. pura e apl.* **33**, 123-47 (1950).—*C.A.* **47**, 3080*f*.

In acid soln. Po was adsorbed in paraffin. In wettable surfaces such as glass, mica, and quartz, adsorbed Po was distributed uniformly. The Po retained by the surface was proportional to the time the soln. of HNO_3 had been in contact with the surface and to the concn. of Po. Freundlich's law was valid at tracer-level concn. for Po.

3585. Martínez, Francisco Bermejo. **A new method for determining the ion-exchange capacity of artificial zeolites.** *Inform. quím. anal. (Madrid)* **4**, 1-8 (1950).—*C.A.* **44**, 6989*e*.

An improved method first sats. the zeolite with Ba ion by treating with N $Ba(OAc)_2$. Excess Ba^{++} was then eliminated by washing with water and with 95% EtOH. The Ba retained by the zeolite was displaced by washing with N NH_4Cl, and subsequently pptd. and weighed as $BaSO_4$. While previous methods required as long as 16 to 24 days, this method required less than two.

3586. Martínez, Francisco Bermejo. **Methods of obtaining, analysis, testing, and properties of zeolites.** *Anales edafol. y fisiol. vegetal* **9**, 29-81 (1950).—*C.A.* **44**, 10961*i*.

Several series of zeolites were prepd. by means of different known wet processes and chemically analyzed. All products agreed with the general formula $Na_2O.Al_2O_3.xSiO_2.y\ H_2O$. The activity of these products, based on the exchange capacity with respect to Ba^{++} was detd. No strict relation was found between the exchange capacity of bases and other properties of zeolites (chem. compn., adsorption of methylene blue, porosity, hygroscopicity).

3587. Murin, A. N. **Mechanism of the ion exchange between a solution and a precipitate.** *Doklady Akad. Nauk S.S.S.R.* **74**, 65-8 (1950).—*C.A.* **45**, 423*a*.

Rates of exchange of Ag^+ and Br^- were detd. with 3 types of AgBr: freshly pptd., aged, and fused. In the course of the exchange, the surface area of freshly pptd. AgBr, when stirred with a KBr soln., decreased to 30% of its initial value in 20 min. The exchange of Ag ions was quite fast with all 3 prepns. of AgBr. The exchange of Br^- took place through recrystn., whereas in the exchange of Ag^+, self-diffusion in the solid might be rate-detg. especially in the case of aged ppts.

3588. Okáč, A. and Bezděk, M. **Adsorption of bivalent metals during the precipitation of trivalent metals with ammonia.** *Chem. Listy* **44**, 300-5 (1950).—*C.A.* **45**, 3682*f*.

Adsorption of Co, Ni, Mn, Cu, Zn, and Cd by the ppts. of Fe, Al, and Cr hydroxides was followed exptly. in 3 pptns. The amts. of ions adsorbed after the 3rd pptn. are (in %) 20.7, 8.3, 17.7, 1.1, 1.2, 0 in $Fe(OH)_3$, 95.4, 93.1, 49.6, 0.8, 23.7, 0 in $Al(OH)_3$, and 46.9, 29.9, 58.1, 15.6, 38.0, and 12.9 in $Cr(OH)_3$.

3589. Okáč, A. and Bezděk, M. **Imperfections in systems of qualitative separation of cations.** *Pubs. faculté sci. univ. Masaryk* No. **319**, (Rada E4), 9-22 (1950) (Russian and French summaries).—*C.A.* **46**, 6039*b*.

The sepn. of trivalent metals (Fe, Al, Cr) and bivalent metals (Ni, Co, Cu, Mn, Zn, Cd) with NH_4OH was studied. $M(OH)_3$ and $[M(NH_3)_x]^{2+}$ were formed in excess NH_4OH. The copptn. of bivalent metals was least with $Fe(OH)_3$, where it was due mostly to adsorption, and adsorption isotherms of parabolic shape were obtained. The greatest adsorption was shown by metals which can be oxidized to the trivalent state in NH_4OH solns. (Co, Mn, Ni).

3590. Osawa, Toshiyuki. **Purity of precipitate and crystal. II. Coprecipitation of ferric ion and ammonium ion with calcium oxalate.** *J. Chem. Soc. Japan*, Pure Chem. Sect., **71**, 68-70 (1950).—*C.A.* **45**, 5001*b*.

There was a close relation between the soly. of a Ca oxalate and the quantity of pptn. of the coexisting ions such as ferric or NH_4 ions. At 20° the soly., 2×10^{-4} mol./liters corresponded to min. copptn.

3591. Osawa, Toshiyuki. **Purity of precipitate and crystal. III. The relation between the solubility of oxalates of Ca, Sr, Ba, Cd, Cu, Ag, Pb, and Zn and the coprecipitation with ferric ion.** *J. Chem. Soc. Japan, Pure Chem. Sect.* **71**, 191-4 (1950).—*C.A.* **45**, 5001*c*.

The soly. was studied for each of these oxalates for the min. amt. of copptn. of ferric ion, and the results were summarized.

3592. Ôsawa, Toshiyuki. **Purities of precipitate and crystal. IV. The investigation or presumption of solubility by coprecipitation phenomena.** *Bull. Chem. Soc. Japan* **23**, 244-7 (1950) (in English).—*C.A.* **46**, 2378*i*.

By comparison of its capacity to coppt. Fe^{+++} with that of other oxalates of known soly., the soly. of ZnC_2O_4 was inferred to be about 1.1 to 1.6×10^{-4} mol./liter at room temp.

3593. Pieruccini, R. **A sensitive method for the spectral detection and the determination of arsenic by means of adsorption in ferric hydroxide.** *Spectrochim. Acta* **4**, 189-99 (1950).—*C.A.* **45**, 2364*e*.

For the estn. of As in very dil. solns. use is made of the facility with which $Fe(OH)_3$ adsorbs As from solns. Arsenic-free $FeCl_3$ is added to the soln., followed by pptn. with NH_4OH and soln. of the ppt. in dil. acid. This soln. is absorbed by C electrodes and tested spectrographically. The method is applicable to 0.1 mg As in 24 liter of soln., and can be used to test the freedom of reagents from this element.

3594. SCHUYLENBORGH, J. VAN; ARENS, P. L., AND KOK, J. G. J. **Electrokinetic behavior of freshly prepared γ- and α- FeOOH.** *Rec. trav. chim.* **69**, 1557-65 (1950).—*C.A.* **46** 8466*b*.

The isoelec. curves of α-FeOOH and γ-FeOOH, prepd. in different ways, and of $Fe(OH)_3$ were detd. The isoelec. point (pH) decreased as the moist ppts. were dried and as the soln. from which they were pptd. became more dil. It was concluded that α-FeOOH, γ-FeOOH, and Al hydroxides were forming very slowly in the soil, and were aging at the same time, consequently mutual pptn. with negatively charged SiO_2 was very improbable.

3595. SEN, BINAYENDRA NATH. **Asbestos partition chromatography.** *Australian J. Sci.* **13**, 49-50 (1950).—*C.A.* **45**, 1901*g*.

Qual. sepn. of some cations, e.g. Cu-Cd and As-Sb-Sn, was obtained by ascending development from aq. soln. on strips of asbestos millboard.

3596. SHISHNIASHVILI, M. E. **Adsorption of electrolytes on aluminosilicic gels and new basic salts of aluminum.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* **1950**, 169-77.—*C.A.* 44, 8733*b*.

Gels were prepd. by mixing 0.1 N solns. of $Al(NO_3)_3$ or $AlCl_3$ and Na_2SiO_3, and prolonged electrodialysis. In this process, the chem. compn. of the gel changed progressively; thus, an initial gel Al_2O_3. 2.4 SiO_2 had, at the end of the electrodialysis, the compn. Al_2O_3.1.65 SiO_2. At the same time, the amt. of exchangeable Al decreased constantly, with the result that a highly dialyzed gel contained no exchangeable Al. The acidity which did appear in such highly purified gels under the action of salts, was due to hydrolytic splitting of the adsorbed salt.

3597. STRAZHESKO, D. M. AND GLAZMAN, YU. M. **Relation between the adsorption of coagulator ions and their concentration in solution.** *Dopovidi Akad. Nauk Ukrain. R.S.R.* **1950**, 283-5 (in Ukrainian).—*C.A.* **46**, 318*c*.

The adsorption of $Sr(NO_3)_2$ (0.01 – 0.1 *M*) in coagulation of hydrosols of AgI (10 millimole/liter), HgS, and As_2S_3 (8 millimole/liter), was investigated by tagging with radioactive Sr^{89}. With c = concn. of $Sr(NO_3)_2$ the amts. adsorbed, at the concns. c, $5c$, and $10c$, were: on AgI, 47.6 micromole/g (4.17%), 184.7 (3.47), 315.1 (2.96); on HgS, 16.8 (5.16), 46.8 (2.87), 83.3 (2.56); on As_2S_3 63.9 (12.58), 90.2 (3.55), 118.5 (2.33).

3598. TANANAEV, I. V. AND RUDNEV, N. A. **Physicochemical analysis of systems significant in analytical chemistry. XVIII. Theory of precipitation of barium sulfate from the point of view of turbidimetric analysis.** *Zhur. Anal. Khim.* 5, 82-9 (1950).—*C.A.* **44**, 4815*i*.

The systems studied were $BaSO_4$-C_2H_5OH-H_2O and $BaSO_4$-$BaCl_2$-C_2H_5OH-H_2O. Equiv. quantities of H_2SO_4 and $BaCl_2$ solns. were combined in a mixt. of H_2O and EtOH, the total vol. being 50 ml. Where an excess of $BaCl_2$ was desired it was added simultaneously with the stoichiometric quantity of $BaCl_2$. The alc. in the final mixt. made up 0.50% and the excess $BaCl_2$ was 0-0.3 *M*. The light absorption of the suspension increased sharply with the alc. content and reached a max. at 30% of alc. after which it dropped sharply. The behavior of the maxima on the curves under the influence of excess $BaCl_2$ was observed. The effect of $BaCl_2$ was to augment the effect of EtOH.

3599. TANANAEV, I. V. AND RUDNEV, N. A. **Physicochemical analysis of systems significant in analytical chemistry. XIX. Investigation of the system $BaSO_4$-NaCl-C_2H_5OH-H_2O from the point of view of turbidimetry.** *Zhur. Anal. Khim.* **5**, 281-5 (1950).—*C.A.* **45**, 59*f*.

The solns. studied were prepd. by adding to 12.50 ml of 0.004 M H_2SO_4 a NaCl soln., alc. H_2O, and finally $BaCl_2$ soln. to make the total vol. 50 ml. The quantity of $BaCl_2$ in all solns. was equiv. to the H_2SO_4. The concn. of NaCl was 0-1 M and the alc. content was 0-50% by vol. From the time $BaCl_2$ was added, extinction readings were taken at definite intervals after 0.25-5 min. Time was an important factor in the behavior of this system. By plotting time vs. extinction 4 types of curves were obtained depending on the alc. and NaCl content. NaCl increased somewhat the soly. of $BaSO_4$ while alc. had the opposite effect. It was observed that the form of the ppt. differed depending on the presence of $BaCl_2$ and NaCl.

3600. TIAN, ALBERT. **Chemical inactivity of adsorbed potassium permanganate.** *Compt. rend.* **230**, 442-3 (1950).—*C.A.* **44**, 5245*b*.

If $BaSO_4$ was pptd. in a soln. of $KMnO_4$ the color varied from cyclamen to light rose as the $KMnO_4$ concn. decreased from 0.5 N to 0.005 N. If the reducer remained in aq. soln. several days, the color of the ppt. faded, owing to the reversibility of the adsorption, whereby the H_2O freed the MnO_4^- very slowly. The color did not fade on exposure to the sun or at a temp. of 70°C for weeks, even in linseed oil.

3601. TRUJILLO, R. AND MARTINEZ, J. BELTRAN. **Insoluble hexavanadates. I. Silver hexavanadate.** *Anales real soc. españ. fís. y quím.* **46B**, 639-44 (1950).—*C.A.* **45**, 4595*a*.

The successive formation of $Ag_2H_2V_6O_{17}$ and $Ag_4V_6O_{17}$ from $AgNO_3$ and $H_4V_6O_{17}$ solns. was confirmed conductiometrically. The addn. of $AgNO_3$ to $(NH_4)_4V_6O_{17}$ showed no compd. formation conductometrically. The taking up of about 60 moles of NH_3 per mole of $Ag_4V_6O_{17}$ was probably adsorption.

3602. UZUMASA, YASUMITSU AND OKURA, TAKESHI. **Aging of precipitates. Change of the electrical charge of precipitates in the course of aging.** *J. Chem. Soc. Japan, Pure Chem. Sect.*, **71**, 616-18 (1950).—*C.A.* **45**, 6456*b*.

The existence of the phenomenon that the particle size of ppts. becomes finer at an earlier stage of aging was verified by the observation of the elec. charge on the particles of the ppts. of $BaSO_4$, $CaCO_3$, and $CaC_2O_4.H_2O$.

3603. UZUMASA, YASUMITSU AND OKURA, TAKESHI. **Aging of precipitates. Effect of aging on the adsorbability of precipitate.** *J. Chem. Soc. Japan, Pure Chem. Sect.*, **71**, 587-90 (1950).—*C.A.* **45**, 6456*a*.

The particular phenomenon in which the particle size became finer in the earlier stage of aging was observed with the ppts. of $CaCO_3$ and $Fe(OH)_3$. This phenomenon was verified by the measurement of the adsorption of $[Cu(NH_3)_4]^{++}$ or methylene-blue on the ppt.

3604. Uzumasa, Yasumitsu and Okura, Takeshi. **Aging of barium sulfate precipitate.** *J. Chem. Soc. Japan*, Pure Chem. Sect,, **71**, 259-62 (1950).—*C.A.* **45**, 4526*g*.

The $BaSO_4$ ppt. prepd. by the addn. of $Ba(OH)_2$ to excess H_2SO_4 was filtered with a coarse filter paper of 1.5-μ interstices, and the residue weighed. During the course of aging of $BaSO_4$ ppt. formed under various conditions there was a stage (or in some cases stages) where the particles of the ppt. became much finer.

3605. Uzumasa, Yasumitsu and Okura, Takeshi. **Aging of precipitates. II. Adsorbability of barium sulfate precipitate and change of its apparent volume.** *J. Chem. Soc. Japan*, Pure Chem. Sect., **71**, 314-16 (1950).—*C.A.* **45**, 4999*c*.

The existence of the particular stage where the particle size of $BaSO_4$ ppt. became finer during its aging was verified by the measurement of the adsorption of methylene blue and of Fe^{+++} on the ppt., and by the detn. of the apparent vol. of the ppt. with the centrifuge.

3606. Uzumasa, Yasumitsu and Okura, Takeshi. **Aging of precipitates. III. Aging of calcium oxalate.** *J. Chem. Soc. Japan*, Pure Chem. Sect., **71**, 497-500 (1950).—*C.A.* **45**, 6455*i*.

The particle size became finer in an earlier stage of aging the ppt. of calcium oxalate. The change took place only when there was a certain excess of oxalate ion in the mother liquor, whereas no perceptible change occurred in case an excess of Ca ion existed in the soln.

3607. Vogel, Richard C. and Gibson, George. **Migration of sodium ions through quartz plates in an electric field. I.** *J. Chem. Phys.* **18**, 490-4 (1950).—*C.A.* **44**, 9221*c*.

The only important mechanism of current flow was the migration of Na ions through the quartz plate. The activation energy was from 22 to 25 kcal. and depended upon the potential gradient. The rate of migration of the Na ions was essentially independent of the concn. of the Na ions.

3608. Wadsley, A. D. **A hydrous manganese oxide with exchange properties.** *J. Am. Chem. Soc.* **72**, 1781-4 (1950).—*C.A.* **44**, 6327*i*.

A hydrous Mn oxide of the approx. formula $(Na, Mn)Mn_3O_7.nH_2O$ was prepd. by the oxidation of Mn hydroxide in aq. alk. suspension. The hydrous oxide readily formed metal complexes which were not considered to be true compds. The complexes were formed by the substitution of metal ions for Na ions.

3609. Yamamoto, Takemaro. **Effect of cations on the growth of crystals of barium sulfate from aqueous solutions.** *J. Chem. Soc. Japan*, Pure Chem. Sect., **71**, 56-8 (1950).—*C.A.* **45**, 5001*g*.

The effects of the concn. of solns., the order of mixing, and of foreign cations were studied in the pptn. of $BaSO_4$. The largest crystals were obtained by adding 0.2 ~ 0.5 *N* $(NH_4)_2SO_4$ or H_2SO_4 to 0.02 *N* $BaCl_2$. In the presence of H^+, Cu^{++}, Mg^{++}, Ca^{++}, Zn^{++}, Cd^{++}, Al^{3+}, La^{3+}, Ce^{3+}, ZrO^{++}, Cr^{3+}, Mn^{++}, Fe^{3+}, Co^{++}, Ni^{++}, Th^{4+}, and UO_2^{++}; the faces *c* (001) and *q* (011) developed, the crystal elongating in the direction of *a*- or *b*-axis.

3610. Zabolotskiĭ, T. V. and Nelyubin, V. K. **Change of crystal faces of ammonium nitrate under the influence of various ions.** *Doklady Akad. Nauk S.S.S.R.* **75**, 215-17 (1950).—*C.A.* **46**, 803*b*. Microscopic observation was made of the changes brought about in crystal habit (from needle to isometric forms) by the following ions: K, Na, Ca, Ba, Zn, Cd^{2+}, Pb^{2+}, Fe^{3+}, Cr^{3+} all introduced as nitrates; NH_4 salts of Cl^-, SO_4^{2-}, PO_4^{3-}; salts KCl, $MgSO_4$, $MgCl_2$, in variable concns. The crystn.-impeding effects of adsorption films and anomalous cryst. solns. were discussed, especially for the valency effects.

3611. Abdurashitov, S. A. and Pashaev, B. P. **The diffusion of inorganic salts through porous media that were saturated with water.** *Trudy Inst. Fiz. i Mat., Akad. Nauk Azerbaidzhan. S.S.R., Ser Fiz.* **5**, 54-8 (1951) (in Russian).—*C.A.* **48**, 3104*e*.

The diffusion of 0.02 *N* aq. solns. of KCl, $MgCl_2$, $CaCl_2$, $CaSO_4$, and $K_2CO_3.2H_2O$ through sand was measured according to an electrocond. method. The sand was satd. with water. The measurements were extended as long as 30 days. The cond. curves plotted with respect to time showed a point of inflection for KCl, $MgCl_2$, and $CaCl_2$, but not for $CaSO_4$ and K_2CO_3.

3612. Barve, P. M. and Jambotkar, A. K. **Mutual coagulation of colloidal solutions. Interaction between colloidal antimony sulfide and colloidal ferric hydroxide and the equilibrium dialyzate of colloidal ferric hydroxide.** *J. Indian Chem. Soc.* **28**, 453-8 (1951).—*C.A.* **46**, 6466*c*.

The coagulating power of colloidal $Fe(OH)_3$ was due to two factors: that of the colloidal particles and that of the intermicellar electrolytes. If the latter were removed by dialysis, more $Fe(OH)_3$ was required to ppt, an equal amt. of Sb_2S_3 by mutual coagulation.

3613. Basińska, Halina and Orylska, Krystyna. **Coagulation of silver thiocyanate sol.** *Roczniki Chem.* **25**, 472-80, in English 480-1 (1951).—*C.A.* **46**, 8935*c*.

Coagulation values of AgCNS soln. were detd. by measurements of light absorption. The effect of substances lowering the dielec. const. of the dispersing medium was investigated.

3614. Bernard, René; Davoine, François, and Hirtz, Jean. **Study of thin adsorbed layers by radioactive trace elements.** *Compt. rend.* **232**, 1826-8 (1951).—*C.A.* **46**, 2876*c*.

Tritolyl phosphate contg. radioactive P^{32} was used to measure its adsorption on glass disks. Layers formed at room temp. rapidly reached 12 A. (approx. unimol. layer) and increased in thickness less rapidly for several weeks.

3615. Berne, E. **A new type of ion-exchange column for the separation of radioactive bromine or chlorine.** *Acta Chem. Scand.* 5, 1260-6 (1951) (in English).—*C.A.* 46, 4860*f*.

Small amts. of Br^- were adsorbed from neutral solns. contg. BrO_3^- on an exchanger consisting of AgO adsorbed on diatomaceous earth. The Br^- was eluted with a soln. contg. NaI and Ba^{++} and the eluate passed through the H form of Amberlite IR-120 to remove Ag^+ and Ba^{++}.

3616. Booth, A. H. **Anomalous cocrystallization of radioactive trace quantities of foreign ions with sodium chloride crystals. I. Correlation with crystallographic effects.** *Trans. Faraday Soc.* 47, 633-40 (1951).—*C.A.* 45, 9976*i*.

The formation of tracescale "anomalous mixed crystals" is caused by strong adsorption of the foreign ions on specific crystal planes. Among a group of metal ions, all of which modify the habit of NaCl, Cd and Pb cocrystallize strongly with NaCl from solns. contg. the foreign ions in radioactive trace amts. $PbCl_2$ and $CdCl_2$ strongly inhibit crystn. of NaCl, thicken the crystn. layers and form oriented overgrowths on the (100) face.

3617. Booth, A. H. **Anomalous cocrystallization of radioactive trace quantities of foreign ions with sodium chloride crystals. II. Examination of the criteria distinguishing anomalous mixed crystals from internal-adsorption compounds.** *Trans. Faraday Soc.* 47, 640-5 (1951).—*C.A.* 45, 9977b.

The inclusion of Th B in the crystals could be prevented by the presence of an excess of another adsorbable substance (Cd^{++}) and cubo-octahedral crystals showed, in autoradiographs, a localized distribution of the Th B. Inclusion took place only during active crystal growth; Th B did not migrate into the NaCl crystals during recrystn. unless there was active growth of small crystallites to larger ones.

3618. Burkhard, P. N.; Bacon, L. R., and Wegst, Walter F. **Action of alkaline solutions on glass surfaces.** *Proc. Am. Soc. Brewing Chemists* 1950, 83-100 (1951).—*C.A.* 45, 8730*d*.

The inhibiting action of Na aluminate, Na zincate, Na berylliate, and a no. of tannins was investigated. Various types of beer bottles were used in the study. It was demonstrated that the presence of the aluminate and zincate in alk. soln. decreased corrosion and actually protected glass. A 30°C rise in temp. tripled the corrosive action in the bottle washing range. Na_3PO_4, when employed partially to replace NaOH, increased corrosion.

3619. Charmandarian, M. O. and Andronikova, N. N. **The colloidal solution of ferric hydroxide in the presence of sulfate ions.** *Bull. soc. chim. France* 1951, 327-9.—*C.A.* 46, 319*h*.

$MgCO_3$ was added to solns. of $Fe_2(SO_4)_3$ to prep. colloidal agglomerates. The amt. of $MgCO_3$ required for pptn. and the chem. properties of the ppt. were given.

3620. Dmitrenko, O. I.; Kargin, V. A., and Ryabinina, A. A. **Molecular uptake of silver salts by iron hydroxide.** *Kolloid. Zhur.* 13, 3-10 (1951).—*C.A.* 45, 3688*i*.

Gels obtained by hydrolyzing $FeCl_3$ in H_2O were dialyzed and electrodialyzed for months. The elec. resistance *R* of the gels increased during this treatment, e.g. from 8 (gel *A*) to 135 (gel *B*) and then remained almost const. (*C*); *R* of distd. H_2O was 70 in these units. The uptake by gel *A* was due to Cl^- in it, the uptake by gel *B* to OH^- (which substitutes for Cl^- during dialysis) and to true mol. adsorption, and the uptake by *C* was small because the sample was partly cryst. and the electrolytes were removed from the surface of the micelles. Gels prepd. by hydrolysis of $Fe(NO_3)_3$ behaved similarly.

3621. Fyfe, W. S. **Note on base exchange in New Zealand laumontite and natrolite.** *New Zealand J. Sci. Technol.* 32B, No. 5, 28-9 (1951).—*C.A.* 45, 10436*e*.

The suitability of laumontite and natrolite as cation-exchange materials was discussed.

3622. Gaudin, A. M.; Spedden, H. R., and Corrineau, M. P. **Absorption of silver ion by sphalerite.** *Trans. Am. Inst. Mining Met. Engrs., Tech. Pub.* No. 3142-B (in *Mining Eng.* 3, 780-4) (1951).—*C.A.* 45, 8949*g*.

Sphalerite was crushed, ground, sized, and purified by treating with H_2O_2. After washing, the mineral was formed into columns consisting of 12 to 15 g of sphalerite in a length of 10 cm and a cross-section less than 1 cm. The particles were in the size range of about 48 to 325 mesh. Radioactive Ag^{110} and ordinary $AgNO_3$ formed a test soln. When the concn. of the influent soln. was very low, 10^{-6} moles per liter, all of the Ag was removed by the sphalerite.

3623. Gest, H.; Ballou, N. E.; Abraham, B. M., and Coryell, C. D. **Co-separation of aqueous barium ion with solid lanthanum fluoride.** *Natl. Nuclear Energy Ser.* Div. IV 9, Radiochem. Studies: The Fission Products, Book 1, 145-56 (1951).—*C.A.* 47, 5760*c*.

The co-sepn. of Ba ion with LaF_3 was studied with Ba^{140} as a tracer. The source of Ba activity was neutron-irradiated uranyl nitrate. Data obtained for the co-sepn. with internally formed LaF_3 (ppt. formed in the presence of the foreign ion) of the order of 200 mg/liter was represented by the empirical Freundlich equation $x/m = 0.0135\ c^{0.40}$, where *x* is mg/liter of Ba ion carried down, *c* is mg/liter of Ba ion remaining in soln. and *m* is mg/liter of LaF_3.

3624. Gest, H.; Burgus, W. H., and Davies, T. H. **Co-separation of aqueous fluozirconate ion with solid lanthanum fluoride.** *Natl. Nuclear Energy Ser. Div.* IV 9, *Radiochem. Studies: The Fission Products, Book* 1, 157-69 (1951).—*C.A.* 47, 5760*e*.

Using carrier-free Zr^{95} as a tracer, surface adsorption was primarily responsible for the co-sepn. of Zr as $BaZrF_6$ with both (1) externally formed and (2) internally formed LaF_3. The data were satisfactorily described by the Langmuir adsorption equation, $x/m = k_1c/(1 + k_2c)$, where in (1), $k_1 = 0.05$ and $k_2 = 2.3$ and in (2), $k_1 = 0.053$ and $k_2 = 0.71$. The adsorption was found to be reversible. A surface of 58.3 m^2/g was calcd. for externally formed LaF_3.

3625. GEST, H. AND GLENDENIN, L. E. **Co-separation of aqueous fission products with manganese dioxide.** *Natl. Nuclear Energy Ser.*, Div. IV, **9**, *Radiochem. Studies: The Fission Products*, Book I, 170-5 (1951).—*C.A.* 47, 5839f.

In dil. HNO_3, MnO_2 was effective as a general scavenger for the fission-product elements Nb, Te, Zr, and possibly others. In concns. above 10*M*, Nb, Te, and Mo were specifically removed. The co-sepn. of Nb^{95} with externally formed, freshly pptd. wet MnO_2 in 10*M* HNO_3 was quant. after 30 min. of contact.

3626. GHOSH, B. N.; CHAKRAVARTY, S. N., AND KUNDU, M. L. **Adsorption of ions by hydrated manganese dioxide in relation to its electrical charge and the concentration of the hydrogen ions liberated.** *J. Indian Chem. Soc.* **28**, 319-22 (1951).—*C.A.* **46**, 5928*h*.

The neg. charge of $6.16\ (MnO_2, MnO).43.15H_2O$ prepd. by reaction of $MnSO_4$, $KMnO_4$, and H_2SO_4 was lowered and reversed in the presence of bivalent cations in the order $Ba > Ca > Mg$. The exchange adsorption was detd. in 0.2 *N* to 0.0125 *N* chloride and acetate solns. The adsorption of Cl ion is much less than that of the bivalent cations.

3627. GHOSH, B. N.; CHOWDHURY, R. N. ROY, AND BURMAN, D. P. **Effect of electrolytes on the stability and electrokinetic potential of vanadium pentoxide and chromium hydroxide sols.** *J. Indian Chem. Soc.* **28**, 1-6 (1951).—*C.A.* **45**, 8851*f*.

The electrokinetic potentials of V_2O_5 and pos.-charged Cr hydroxide sol. were measured by the electroendosmotic method, and the coagulation by different electrolytes was measured. Chlorides of Na, K, Mg, Ba, Ca, and Al were used. As the concn. of the electrolyte increased, the electrokinetic potential of the sol decreased. The potential of pos.-charged Cr hydroxide sol and the rate of coagulation were measured in the presence of ferrocyanide, oxalate, sulfate, hydroxide, and benzoate of K.

3628. HENSLEY, JAMES W. **Adsorption of tagged phosphate ions on glass surfaces as related to alkaline attack.** *J. Am. Ceram. Soc.* 34, 188-92 (1951).—*C.A.* **45**, 7320*g*.

Sorption was measured by means of a tracer technique, with radioactive $Na_3PO_4.12H_2O$. Radioautographs were prepd. to show the distribution of sorbed phosphate. Phosphate ions were not sorbed appreciably at room temp. by a clean, fused glass surface, but when the surface layer was removed, as by alk. attack, sorption was rapid. Three types of glasses were tested: "Pittsburgh Noncorrosive" microscope slides, soft-glass weighing bottles, and "Pyrex" beakers. Sorption of phosphate ions on a glass surface was a good indicator of alk. attack but various factors complicate the process.

3629. HOLLIDAY, A. K. AND DAVIES, K. N. **Some properties of colloidal silver bromide.** *Fundamental Mechanisms of Phot. Sensitivity (Butterworths Sci. Pubs., London)* **1951**, 56-60.—*C.A.* 45, 9336*h*.

Electrophoretic-mobility measurements on AgBr sols indicated that the ζ-potential depended primarily on the concn. of Ag or Br ions in the electrolyte. When $AgNO_3$ was used to give high Ag-ion concns., adsorption of nitrate ion appeared to increase with time, reducing the initially high ζ values and rendering the sol unstable. The use of AgF largely prevented this and a fairly stable sol resulted.

3630. JACOBS, G. **Centrifugation potentials and the effect of electrolytes on the ζ-potential of the arsenious sulfide sol.** *Mededel. Koninkl. Vlaam. Acad. Wetenschap., Belg., Klasse Wetenschap.* **13**, No. 7, 3-28 (1951).—*C.A.* 46, 5400*i*.

The sedimentation potential, V, of a sol in a centrifugal field where ω was the angular velocity was proportional to ω^2, as required by theory. The effects of KCL, Na_2SO_4, $K_4Fe(CN)_6$, HCl, $BaCl_2$, $[Co(NH_3)_5Cl]Cl_2$, $[Co(NH_3)_4CO_3]NO_3$, and Na_2S, resp., on the ζ-potential of As_2S_3 sols (4-56 g/liter) were studied. Potentials were somewhat less than those detd. by electrophoresis.

3631. JUNG, L.; STASIW, O., AND TELTOW, J. **Tarnish reaction of sulfur-containing silver bromide crystals with bromine and with silver.** *Z. physik. Chem.* **198**, 186-99 (1951).—*C.A.* 47, 30*d*.

The bleaching of brown AgBr crystals, contg. about 0.1 mol. % of Ag_2S, with Br or Ag obeys the laws of tarnish reactions. Under conditions where the reaction is rapid, it obeys the parabolic law $N_L K_A = (S^2/2t) N_\upsilon$; N_L is the Loschmidt no., K_A Wagner's tarnish const., S thickness of tarnish zone, t elapsed time, N no. of mols. per sp. vol. of reaction products, and υ electron consumption per indicator mol. The value of the tarnish consts. depends on the concn. of $CdBr_2$ used to dil. (in solid soln.) the AgBr.

3632. KANEKAR, C. R. AND SUBRAHMANIAM, K. E. **Optical properties of zirconium hydroxide gels.** *J. Univ. Bombay*, Sect. A, **19**, Pt. 5 (Science, No. 29), 28-34 (1951).—*C.A.* 46, 4886*e*.

$Zr(OH)_4$ gels were prepd. by mixing $Zr(NO_3)_4$ and $NaC_2H_3O_2$ solns. The colloidal particles first became slightly spherical in shape or isotropic in nature, and subsequently gradually increased in size and anisotropy. The addn. of acids did not modify the course of gelation. HCl and HNO_3 addn. inhibited the agglomeration of the particles, whereas H_2SO_4 hastened the agglomeration; the HCl and HNO_3 had a peptizing effect on the particles, while the H_2SO_4 had a coagulating effect.

3633. KAYSER, F.; BLOCH, J. M., AND GOMMERY, G. **The adsorption of molecules of sodium hydroxide, sodium chloride, and sodium citrate by sodium montmorillonite.** *Bull. soc. chim. France* **1951**, 462-5.—*C.A.* **46**, 318*d*.

Montmorillonite previously satd. with Na adsorbed approx. 75 millimoles of NaOH per 100 g of the mineral clay. The NaOH was removed by repeated washing with doubly distd. H_2O. NaCl and Na citrate were not adsorbed by the clay.

3634. KRESTINSKAYA, V. N. AND ABDULLINA, N. G. **Adsorption of alkali metal and alkaline earth metal ions by a colloidal solution of sulfur during its coagulation.** *Kolloid. Zhur.* **13**, 289-97 (1951).—*C.A.* **45**, 9998*e*.

Raffo sols were coagulated by salts, and the amt. *a* of the coagulating cation adsorbed by the ppt. was detd. The coagulating concn. was about 0.01 g equiv./liter for $BaCl_2$ and $CaCl_2$, 0.20 for $MgCl_2$, 0.075 for CsCl and $RbNO_3$, 0.10 for KCl, 0.81 for NaCl, and 5.3 for LiCl. The exchange adsorption seems to have secondary importance in the coagulation of S sols. In acidified S sol, K^+ is strongly adsorbed during coagulation.

3635. KRISHNAMURTI, K, AND KARBELKAR, N. V. **Adsorbed ions as efficient coagulators of sols.** *Science and Culture* **16**, 576 (1951).—*C.A.* 46, 5401*b*.

The coagulating power for an appositely charged sol of Fe^{+++}, Ag^+, and other ions adsorbed in colloidal sols is greater than that of the same ions in soln. The close approach of the double layers of the colloidal particles is responsible for the increase in coagulating power.

3636. KRUMMENERL, T. **Inhibition of grain growth in silver bromide crystals.** *Fundamental Mechanisms of Phot. Sensitivity* (Butterworths Sci Pubs., London) **1951**, 74-77.—*C.A.* 45, 9406*b*.

Adsorption of AgBr by H_2SnO_3 or Al_2O_3 sols caused "attachment inhibition" of grain growth, although the surface of the AgBr was still partially free. The inhibiting substances must be present in relatively high concn. to be effective, and a hydrophilic colloid was necessary for stabilization. Inhibition of grain growth by strongly adsorbed agents which cover the AgBr surface is termed "adsorption inhibition," and relatively small amts. of such agents are effective.

3637. KURBATOV, M. H.; WOOD, G. B., AND KURBATOV, J. D. **Application of the mass law to adsorption of bivalent ions on hydrous ferric oxide.** *J. Chem. Phys.* **19**, 258-9 (1951).—*C.A.* 45, 4113*b*.

The hydrous oxide was treated as an ion exchanger, and factors such as pH and anion concn. related quantitatively to adsorbate and adsorbent quantities by a mass-law expression. Predicted relations were verified by expts. on the adsorption of Sr, Ba, Ra, and Co ions on hydrous Fe_2O_3 from solns. contg. 10^{-9} g-atom of metal per ml.

3638. KURBATOV, M. H.; WOOD, G. B., AND KURBATOV, J. D. **Isothermal adsorption of cobalt from dilute solutions.** *J. Phys. & Colloid Chem.* **55**, 1170-82 (1951).—*C.A.* 46, 803*h*.

Adsorption of Co from very dil. solns. (10^{-5}-10^{-6} *M* or less) on hydrous Fe_2O_3 was measured. The exptl. technique involved the use of Co^{55} and Co^{66} as tracers to det. the amt. of Co removed from the soln. by the adsorbent. The adsorption isotherms indicated a region in which Henry's law held. Decreased quantities of adsorbent and increased salt concn. decreased the fraction of Co adsorbed from a soln. of given concn. Increasing the pH and quantity of adsorbent increased the fraction of Co adsorbed.

3639. LA MER, VICTOR K. AND DINEGAR, ROBERT H. **The limiting degrees of supersaturation of the sparingly soluble sulfates.** *J. Am. Chem. Soc.* **73**, 380-5 (1951).—*C.A.* 45, 4530*a*.

The max. limiting concns. of SO_4^{--} that can coexist in aq. soln. with Ba^{++} and Sr^{++} ions, resp., without producing rapid visible pptn. were investigated for a variety of conditions. To avoid possibility of local inhomogeneities in concn. as a result of the direct mixing of reagents leading to premature nucleation, SO_4^{--} was generated homogeneously by chem. reactions in the presence of the cations. The uncorrected ratio for $BaSO_4$ varied from 55 to 48; when corrected to unit activity coeff., assuming the activity coeff. of $BaSO_4$ behaved like that of $ZnSO_4$ and $CdSO_4$, the ratio assumed a const. value of 21.5. This corrected ratio varied little if at all with ionic strength except on the addn. of specific foreign neutral salts. The ratio decreased with rising temp.

3640. MACKOR, E. L. **The properties of the electrical double layer. II. The zero point of charge of silver iodide in water-acetone mixtures.** *Rec. trav. chim.* **70**, 747-62 (1951).—*C.A.* 46, 6463*d*.

Electrophoretic measurements in a modified microcuvette showed that the concn. of Ag^+ at the zero point of charge of AgI was multiplied 1000 times in going from pure water to 10 mole % acetone. Further addn. of acetone had little effect on χ, but increased the standard thermodynamic potential of Ag^+ and decreased the concn. of Ag^+ at the zero point of charge.

3641. MACKOR, E. L. **The properties of the electrical double layer. IV. The stability of the silver iodide sol in water-acetone mixtures.** *Rec. trav. chim.* **70**, 841-66 (1951).—*C.A.* 46, 6463*f*.

The flocculation of a AgI sol by Na, Ba, and La perchlorates was studied in H_2O-acetone mixts. Up to 30-40 vol. %, acetone stabilized the sol. At high acetone concns. the stability dropped off rapidly.

3642. MATSUMURA, GENTARO. **Preparation of silver colloid.** *J. Am. Chem. Soc.* **73**, 2375 (1951).—*C.A.* 45, 9997*d*.

A gray-pink colloidal soln. of Ag was prepd. by decompg. at 1010°C for 30 min. a mixt. of $AgNO_3$ soln. kneaded with pulverized MgO and treating the product with dil. AcOH to dissolve MgO, filtering, and electrodialyzing.

3643. MIURA, MASAJI AND MATSUO, HIROSHI. **Studies on the coprecipitation of nitrate ion with barium sulfate. I.** *J. Sci. Hiroshima Univ.* Ser. A, **15**, 149-53 (1951).—*C.A.* 47, 6297*f*.

The amts. of NO_3 ion copptd. from 0.005-0.15 *M* solns. of KNO_3 with $BaSO_4$ on addn. of $Ba(OH)_2$ and H_2SO_4 solns. were detd. The results fitted the adsorption isotherm, $x = m[lc/(1+lc)]^n$, where l, m, and n were consts., c was concn. of adsorbate in soln., and x was the amt. adsorbed.

3644. NEMTSOVA, V. V.; RADUSHKEVICH, L. V.; LUK'YANOVICH, V. M., AND CHMUTOV, K. V. **Mechanism of the aging of a vanadium pentoxide sol.** *Doklady Akad. Nauk S.S.S.R.* **77**, 297-9 (1951).—*C.A.* 45, 6013*a*.

Particle size distribution curves were constructed from electron-microscopic measurements of 200-250 particles of V_2O_5 hydrosols prepd. by the action of 10% HCl on NH_4 metavanadate, and allowed to stand for different lengths of time. The growth proceeded essentially over slow oriented coagulation. Crystn. from true soln. played a role in the growth of the particles. However, in a normal sol, the amt. of V_2O_5 in true soln. was small, and the growth must be due mainly to coagulation.

3645. Ôsawa, Toshiyuki. **Purity of precipitate and crystal.** *J. Chem. Soc. Japan, Pure Chem. Sect.*, **72**, 463-5 (1951).—*C.A.* **46**, 1848*e*.

The copptn. mechanism of Fe^{+++} by various oxalates was studied. In BaC_2O_4 the mechanism was mainly the occlusion of the mother liquor in the ppt. and the formation of complex salt between BaC_2O_4 and $Fe_2(C_2O_4)_3$. In Sr, Cd, Cu, Zn, Pb, and Ag oxalates occlusion in the ppt. was the main cause of copptn.

3646. Ôsawa, Toshiyuki. **The purity of precipitates and crystals. VII. Coprecipitation phenomena by various silver salts.** *J. Chem. Soc. Japan, Pure Chem. Sect.*, **72**, 570-3 (1951).—*C.A.* **46**, 5388*i*.

The relation between the solubilities of silver salts and the copptn. of manganous, K, and NO_3 ions was studied, and the results were summarized. The relative amts. of the copptd. manganous ion were in the order: chloride > bromide > iodide.

3647. Pruckner, Franziska; Schulenburg, M. von der, and Schwuttke, G. **Identification of adsorbed substances by reflection spectra.** *Naturwissenschaften* **38**, 45-6 (1951).—*C.A.* **46**, 1869*f*.

Numerous examples are given showing that the reflection spectra obtained by spectroscopy of materials adsorbed chromatographically are very similar to their adsorption spectra in soln. Often the maxima of the extinction curve are shifted to the red and somewhat flatter.

3648. Quintin, Marguerite. **Variations in the oxidation-reduction potential during the precipitation of ferrous and ferric hydroxides.** *Compt. rend.* **232**, 1303-5 (1951).—*C.A.* **45**, 7854*h*.

The effect of pH on the oxidation-reduction potential of an equimol. mixt. of $FeCl_2$ and $FeCl_3$ was studied in the absence of O_2. The soly. product of $Fe(OH)_3$, at pH 2 was 4×10^{-38}. Pptn. of $Fe(OH)_2$ began at pH 5, yielding a soly. product of 1.65×10^{-15}. It was possible that traces of O_2 might be responsible for the fact that the curves of *E vs.* pH did not follow the theoretical path.

3649. Ramsauer, Rembert. **Effects of liquids on the mechanical surface area increase of glass.** *Glastech. Ber.* **24**, 239-47 (1951).—*C.A.* **46**, 801*a*.

The grinding wear of glass by an abrasive depended not only on its hardness, but on the specific adsorption properties and the mol. constitution of the suspension liquid. The changes of the surface energy brought about by the liquid were detd. not only by the Gibbs adsorption isotherm but by the nature of the glass. Expts. were made with glass spheres (a K Pb silicate glass was used) ground during a standard time with a defined abrasive grain size and a const. amt. of liquid, in a porcelain ball-mill. For the adsorption of the liquid on glass, an approximative method was shown by measuring the sedimentation vol. of glass powder from a suspension in the liquid concerned. The polar or nonpolar groups in the mol. constitution of the liquid were sharply characterized by the elementary relation.

3650. Rastogi, M. C. **Distribution of the sparingly soluble salts in periodic structures. II.** *J. Indian Chem. Soc.* **28**, 732-4 (1951).—*C.A.* **46**, 8936*c*.

$Ba_3(PO_4)_2$ forms Liesegang rings sepd. by clear spaces in agar. The concn. of pptn. per g of gel in the rings exceeds greatly that in the clear spaces between. HgI_2 in agar, and $Ag_2S_2O_3$, $Ag_4Fe(CN)_6$, Ag molybdate, and Ag borate in gelatin, however, form bands sepd. by areas of peptized sol.

3651. Reiss, Howard. **The growth of uniform colloidal dispersions.** *J. Chem. Phys.* **19**, 482-7 (1951).—*C.A.* **45**, 9336*e*.

Much interest was recently focused upon the prepn. of monodispersed colloids by use of the "growth-by-diffusion" process. An assembly of competing particles, growing by diffusion, developed the squares of their radii at equal rates. This condition provided a mechanism leading toward uniformity.

3652. Rozen, B. Ya. **Iodine and bromine adsorption on mineral adsorbents from aqueous solutions.** *Doklady Akad. Nauk S.S.S.R.* **81**, 243-5 (1951).—*C.A.* **47**, 21*c*.

A study of the adsorption of I_2 and Br_2 on clays and muds, including a consideration of the effect of the following ions on the adsorptions: K^+, Na^+, Mg^{++}, Ca^{++}, SO_4^{--}, and Cl^-. The adsorption of I_2 and Br_2 from aq. solns. with addn. of 1, 3, 5, and 10% of the salts that affect the adsorption was effected on the following adsorbents: (1) quartz sands, (2) clays, and (3) aged $Al(OH)_3$. There was an increase of the adsorption of I_2 and Br_2 in the presence of the following salts: KCl, NaCl, $MgCl_2$, $CaCl_2$, K_2SO_4, Na_2SO_4, $MgSO_4$, and $CaSO_4$. The silica and the aged $Al(OH)_3$ adsorbents had almost identical adsorption capacities.

3653. Rubia Pacheco, J. de la and Blasco López-Rubio, F. **Turbidometry of barium sulfate.** *Inform. quim. anal.* (Madrid) **5**, 1-6 (1951).—*C.A.* **45**, 10134*e*.

The detn. of Ba^{2+} as $BaSO_4$ obeyed Beer's law, either in neutral solns. or solns. slightly acidic with HCl. The detn. of SO_4^{2-} was equally valid if solid Ba acetate was used as the pptg. reagent in a neutral soln. The results obtained showed that in detg. Ba, the coexistence of $BaSO_4$ with an excess of SO_4^{2-} impeded the turbidifying action of the Cl, while in the case of sulfates, the acetate ions caused the protecting action.

3654. Schweitzer, George K. and Nehls, James. **Precipitate-ion exchange reactions using radiosilver^{111}.** *J. Phys. & Colloid Chem.* **55**, 215-21 (1951).—*C.A.* **45**, 4579*c*.

The rate of exchange between radio-Ag^{111} ions and a Ag-salt ppt. was measured at 40, 50, and 60°C. From the data the activation energy for the movement of Ag ions through the Ag-salt lattice was calcd. The following values in kcal./mol. were obtained with the following salts: AgBr 15.0, AgI 11.8, AgCN 16.0.

3655. Shapiro, D. A. **Relation between the electromotive force of diffusion in pit-holes and the adsorptive properties of the rocks.** *Doklady Akad. Nauk S.S.S.R.* 77, 637-40 (1951).—*C.A.* 46, 10775*i*.

The e.m.f. of diffusion at the boundary of 2 porous rocks with different adsorptive properties, satd. with different concns. of a uni-univalent salt, did not in general obey Nernst's law, as a result of preferential adsorption of anions or cations. The anomaly decreased with decreasing pore size of the rock and with increasing satn. with gas and petroleum.

3656. Shively, R. R. Jr. and Weyl, W. A. **The color change of ferrous hydroxide on oxidation.** *J. Phys. & Colloid Chem.* 55, 512-15 (1951).—*C.A.* 45, 6012*a*.

The oxidation of white $Fe(OH)_2$ to deep-brown $Fe(OH)_3$ went through deep-blue and olive intermediate products which owed their strong light absorption to an exchange of electrons via the outer electron shell of the hydroxide ions. By coprecipitating $Fe(OH)_2$ with other hydroxides the distance over which such an exchange can occur depended on the state of deformation of the hydroxide ions, which was greater for $Cd(OH)_2$ than for $Zn(OH)_2$ and for $Be(OH)_3$ than for $Al(OH)_3$.

3657. Sinitsyn, P. G. **Exchange of Ba^{++} and H^+ ions on permutite.** *Zhur. Fiz. Khim.* 25, 82-6 (1951).—*C.A.* 45, 6006*h*.

The adsorption of Ba ions was studied on a permutite. It took two months to reach adsorption equil. Buffered solns. of pH between 4 and 12 were used. The quantity adsorbed *S* (milliequiv. Ba/100 g dry permutite) depended linearly on pH, in agreement with $S = a + b(\text{pH})$ but 2 straight lines were obtained, intersecting at pH = 8.5 and the slope was larger in the alk. than in the acid range.

3658. Spitsyn, Vikt. I. and Ippolitova, E. A. **Titanium phosphates.** *Zhur. Anal. Khim.* 6, 5-14 (1951).—*C.A.* 45, 4592*i*.

Ti was pptd. from $TiCl_4$ and $TiOSO_4$ solns. with NaH_2PO_4. The compn. approximated closely the formula $2TiO_2.P_2O_5$. For effective pptn. the NaH_2PO_4 soln. should be taken in a 5-10 fold excess, depending on the pH. In mildly acid medium, the ppt. was very stable. At 3*N* with respect to HCl, the ppt. formed with great difficulty, also the P_2O_5 in the ppt. diminished. In alk. medium, the compn. of the ppt. changed because of hydrolysis. Pyrophosphate gave a product that dissolved in excess precipitant. Titanic acid ppts. adsorbed phosphate ions to an extent depending on the degree of dispersion and age of the titanic acid.

3659. Stasiw, O. **Optical properties of silver bromide with additives at low temperatures.** *Z. Physik* 130, 39-50 (1951).—*C.A.* 45, 9366*g*.

The elementary process in the photochem. formation of colloidal Ag in crystals of AgBr with added Ag_2S (~0.01 mole %) was studied. Photochemically active complexes formed between sulfide ions and displaced Ag ions and between sulfide ions and bromide holes. The reaction products from these complexes diffused through the crystal and formed complexes between a displaced Ag ion, a sulfide ion, and a bromide hole which aggregated and formed colloidal Ag.

3660. Težak, Božo. **Methorics of precipitation from concentrated electrolyte solutions. I. Effect of uni-and bivalent cations [in combination with] sulfate components on the peptization of barium sulfate by an excess of barium chloride.** *Arhiv Kem.* 23, 30-43 (1951).—*C.A.* 46, 9937*i*.

Pptd. $BaSO_4$ was digested with successive portions of H_2O and the larger particles centrifuged off after 24 hrs. The turbid supernatant fluid was examd. tyndallometrically. For univalent cations the peptization increased in the order, K, Na, H, Li, whereas for the bivalent cations it was greater than with Li, increasing in the order Zn, Mn, Cd. The pos. charge of adsorbed univalent cations neutralized not only the valence charge of the primary plane, but also neutralized the charges of the SO_4^{--} adsorbed on it. The bivalent and trivalent (Al, La, and Th) ions in sufficient concn. acted similarly. A tendency towards assocn. led to agglomeration of primary into secondary structures.

3661. Aditya, S. **Stannic oxide. Nature of stannic oxide negative sol.** *J. Indian Chem. Soc.* 29, 296-300 (1952).—*C.A.* 47, 3083*e*.

A 0.775% sol of SnO_2 with pH 6.40 was prepd. Addn. of neutral salts liberated H ion in decreasing order: Ba, Ca, Na, K. This was confirmed by titration with the corresponding bases. With the same cation, the decreasing order or adsorption of anion according to the rate of decrease of pH was: oxalate, sulfate, chloride.

3662. Bender, Max and Mouquin, Henry. **Brownian movement and electrical effects.** *J. Phys. Chem.* 56, 272-8 (1952).—*C.A.* 46, 7402*f*.

Elec. effects were assocd. with cell walls and environment of the particle. Brownian movement made in deep cells could not be duplicated in shallow ones. It was noted that with decreasing pH the cell-wall charge decreased faster than the particle charge and became opposite in sign; thus an attraction was created between particle and cell wall. Qual. observations showed that the particle was not attached to the cell wall but was held in position many mol. diams. distant. The ionic type and concn. of the medium were found to affect the Brownian movement.

3663. Benzimra, Andrée and Collet, Luc Henry. **Electrolysis through a semipermeable membrane of copper ferrocyanide.** *Compt. rend.* 234, 434-5 (1952).—*C.A.* 46, 6523*a*.

It was found by electrolysis of 10^{-1} to 10^{-4} *M* solns. of HCl, H_2SO_4, NaCl, KCl, $CuCl_2$, and others, across a semipermeable membrane of Cu ferrocyanide, at a medium voltage (about 12 v.), that the same form of current *vs.* voltage curve was obtained. Precise measurements with a 10^{-2} *M* soln. of $CuCl_2$ and Cu electrodes showed that the membrane did not introduce any e.m.f. into the circuit.

3664. Charmandarian, M. O. and Andronikova, N. N. **The behavior of a colloid in the presense of electrolyte during the process of its formation.** *Bull. soc. chim. France* **1952**, 97-9.—*C.A.* **46**, 6463*b*.

The effects on sol stability of NaCl, Na_2SO_4, $MgCl_2$, and $MgSO_4$ present during the prepn. of $Fe(OH)_3$ colloids was studied. A sharp change in stability was noted at a crit. concn. of the sulfates. The chlorides delayed the coagulation more than did the sulfates.

3665. Charmandarian, M. O. and Andronikova, N. N. **The reciprocal action of sodium chloride and ferric chloride on the colloidal solution of nondialyzed ferric hydroxide.** *Bull. soc. chim. France* **1952**, 95-7.—*C.A.* **46**, 6465*i*.

In sols contg. 8.02 and 20.1 g Fe_2O_3/liter NaCl reduced the stabilizing action of $FeCl_3$. The order of coagulation depended upon the concns. of $FeCl_3$, NaCl, and the colloid itself.

3666. Chatterji, A. C. and Rastogi, M. L. **Adsorption tendency of freshly precipitated, difficultly soluble salts for their ions.** *Z. anorg. u. allgem. Chem.* **268**, 89-97 (1952).—*C.A.* **46**, 6459*g*.

The adsorption of components of the mother liquor by several difficultly sol., freshly pptd. salts was investigated in the light of competing theories of adsorption.

3667. Craig, R. A. and Hartung, E. J. **Membrane permeability. VI. Permeability to mixtures of electrolytes and the effect of concentration.** *Trans. Faraday Soc.* **48**, 964-9 (1952).—*C.A.* **47**, 4692*e*.

The cupric ferrocyanide membrane was less effective in restricting the diffusion of electrolyte at higher concns. The permeability at 25°C to solns. contg. equimolar amts. of KCl and KNO_3 or KCl and NaCl was measured. Measurements of relative penetration rates were obtained by allowing a soln. of the electrolytes to flow on one side of the membrane and detg. the concns. of each electrolyte in the effluent from the other side.

3668. Curti, Renato; Colombo, Umberto, and Clerici, Fortunato. **Chromatography with specific adsorbents.** *Gazz. chim. ital.* **82**, 491-502 (1952).—*C.A.* **47**, 4689*d*.

The base adsorbent was prepd. from Na silicate which had been treated with AcOH and dried under different conditions; the sp adsorbents were prepd. by preliminary treatment (before AcOH treatment) with the org. compds. The dimensions of the granules did not affect the specificity, and only the form of the adsorption curve depended on these dimensions. The ease of elution of the dyes indicated that van der Waals forces were the only bonds between adsorbent and dye.

3669. Davies, K. N. and Holliday, A. K. **Electrophoresis of silver bromide sols. I. Establishment of reproducible electrophoretic mobilities in presence of excess silver ion.** *Trans. Faraday Soc.* **48**, 1061-6 (1952).—*C.A.* **47**, 5214*e*.

When $AgNO_3$ was added to a AgBr sol, variable electrokinetic behavior was observed, and the sol coagulated and darkened in white light. The substitution of AgF for $AgNO_3$ gave well-defined, reproducible electrophoretic mobilities, and a stable and light-insensitive sol. Addn. of $AgNO_3$ subsequent to the extended use of AgF gave equally good results. The important factor in obtaining reproducibility was the avoidance of contamination of the AgBr by material from the contg. vessels.

3670. Davies, K. N. and Holliday, A. K. **Electrophoresis of silver bromide sols. II. Effect of added electrolyte on the electrokinetic ζ-potential.** *Trans. Faraday Soc.* **48**, 1066-73 (1952).—*C.A.* **47**, 5214*g*.

The ζ-potential of AgBr detd. in various electrolytes was compared with the theoretical surface potential derived from the lattice defect distribution in the AgBr crystal. A value of the concn. of lattice defects in unit vol. of crystal was calcd. from the exptl. data and compared with the value obtained from cond. measurements. Nonlattice anions giving insol. compds. with Ag^+ adsorbed strongly at low pAg; other nonlattice anions adsorbed appreciably only when present in high concn. Nonlattice cations appeared to adsorb weakly irrespective of pAg.

3671. Dempster, P. B. and Ritchie, P. D. **Surface of finely ground silica.** *Nature* **169**, No. 4300, 538-9 (1952).—*C.A.* **46**, 8788*a*.

The existence of a highly sol. surface layer on quartz particles was demonstrated. All siliceous dusts examd. possessed a high-soly. layer which blended smoothly into a less sol. core.

3672. Gaudin, A. M.; Spedden, H. R., and Laxen, P. A. **Adsorption of sodium ion on quartz.** *Trans. Am. Inst. Mining Met. Engrs., Tech. Pub.* No. **3276-B** (in *Mining Eng.* 4, 693-6 (1952)).—*C.A.* **46**, 7485*c*.

When a mineral particle is fractured, bonds between the atoms are broken. The unsatisfied forces that appear at the newly formed surface account for the adsorption of ions at the mineral surface. In developing a flotation theory, a study was made of Na ion adsorption from an aq. soln. on quartz. Adsorption of Na increased with concn. of Na ion but less rapidly than in proportion to it. Increasing the concn. of cations other than H or Na decreased somewhat the adsorption of Na ion.

3673. Gilbert, Jacques. **Structure of arsenic sulfide sols.** *Compt. rend.* **234**, 1616-18 (1952).—*C.A.* **46**, 7844*c*.

Sols of As_2S_3 were better conductors and more strongly acid than the original solns. of H_2S and As_2O_3 from which they were formed. The acid strength was 3×10^{-8} *N* for 0.01 *M* As_2S_3, with a variance of 10-20% dependent on the degree of dispersion. The micelles were charged negatively through preferential adsorption of anions, with H ions forming a pos. atm.

3674. Gleditsch, Ellen and Salveson, Aamund. **The exchange of ions between a salt and its saturated solution.** *Bull. soc. chim. France* **1952**, 523-7.—*C.A.* **46**, 10777*d*.

The exchange of ions between $Pb(NO_3)_2$ crystals and satd. solns. of the salt were studied with RaD as the radioactive indicator. If the crystals were made radioactive and placed in their satd.

soln. exchange occurred in a Fruendlich-type isotherm at 20°C; exchange was greatest for the smallest crystals and decreased as the crystals became larger in size.

3675. GYULAI, Z. AND BIELECK, S. **Transition layer between growing crystals and their solution.** *Acta Phys. Acad. Sci. Hung.* 1, 199-207 (1952) (in German).—*C.A.* 47, 1455*a*.

At the surface of contact between the crystal and the soln. there exists a transition layer in which the ions and the H_2O mols. are partly arranged in such a manner as to form the continuation of the crystals. When the equil. in the transition layer is disturbed at one point, the partly arranged ions add themselves on the crystal. Such a disturbance occurs mostly at the points and edges of the crystal. The formation of layers and of steps in crystals can be explained only by the presence of a transition layer.

3676. HAUTOT, A. AND SAUVENIER, H. **Mechanism of desensetizer action. II. Adsorption of desensitizers on grains of silver halide.** *Bull. soc. roy. sci. Liege* 21, 95-101 (1952).—*C.A.* 47, 4230*a*.

Density vs. log. intensity was plotted for emulsions densensitized, then washed for increasing periods at room temp. Initial desensetization by a factor between 10 and 10^3 was changed by prolonged washing to a factor between 2 and 5. Desensitizers were more strongly adsorbed on the most sensitive grains. All desensitizers appeared to trap photoelectrons; in addn. CrO_3 appeared to oxidize the nuclei of the latent image as they formed.

3677. HERSHENSON, H. M. AND ROGERS, L. B. **Errors in volumetric analysis arising from adsorption.** *Anal. Chem.* 24, 219-20 (1952).—*C.A.* 46, 2951*f*.

The error resulting from adsorption of Ag^+ on soft glass was shown to be appreciable even when the solns. were not extremely dil.

3678. HIYAMA, SHIMPEI AND FUKUI, HIROSHI. **A consideration of the hydrating mechanism of calcined gypsum.** *Gypsum* 1, 233-5 (1952) (English summary).—*C.A.* 46, 10575*a*.

Natural gypsum calcined 2.5 hrs at 165°C and aged 18 hrs was hydrated to flakes of gypsum by adding citric or succinic acid (larger flakes with the 1st; the strength rather low in both) and to needles by adding H_3BO_3, NaCl, $ZnSO_4$, $CaCl_2$, $Al_2(SO_4)_3$, Na_2SO_4, $(CO_2Na)_2$, adipic acid, malonic acid, AcONa, or sebacic acid (ranked from the largest needles; the strength high in larger needles). The addn. of org. acids produced generally smaller crystals than that of sulfate needles.

3679. HONIGMANN, B. **Modification of the habit of sodium chloride crystals in saturated solution under the influence of temperature oscillations.** *Z. Elektrochem.* 56, 342-5 (1952).—*C.A.* 46, 10771*f*.

Crystals of NaCl were immersed in satd. soln. in closed vessels contg. excess NaCl in the bottom. The temp. was oscillated over ranges of 0.1, 2, and 5° around 20°C in various expts. The period of the temp. oscillation was 20 min. At the end of the expts., crystals originally cubes (001) exhibited faces 001, 111, 012, (011?). Crystals originally octahedra (111) (from solns. contg. urea) exhibited faces 111, 001, 012, 011. Crystals originally dodecahedra (011) (from solns. contg. glycine) exhibited faces 011, 001, 111, (012?).

3680. HUBBARD, DONALD AND CLEEK, GIVEN W. **Deuterium- and hydrogen-electrode characteristics of lithium-silica glasses.** *J. Research Natl. Bur. Standards* 49, 267-71 (1952) (Research Paper No. 2363).—*C.A.* 47, 5222*h*.

pH and pD response curves as a function of compn. pass through a max. of 59 mv./pH or pD at approx. 82% SiO_2, limited on the low-silica end by poor chem. durability and tendency towards devitrification. On the high-silica end the response drops and hygroscopicity and deuterioscopicity decrease. The glasses showed more swelling in acid-H_2O than in acid-D_2O solns.

3681. HUBBARD, DONALD AND GOLDMAN, RICHARD G. **Heterogeneous equilibria at the glass electrode-solution interface.** *J. Research Natl. Bur. Standards* 48, 428-37 (1952).—*C.A.* 46, 10017*a*.

Aq. acidic solns. leached alkalies from silicate glass and left a silica-rich layer that acted as negatively charged nonmigratabld ions. The migratable ions in the system behaved according to the distribution law and Donnan membrane theory. In the alk. region the rate of soln. of all glasses exceeded the rate of swelling. Glasses contg. over 74% SiO_2 and poor in durability showed high $Ag(NH_3)_2{}^+$ in the surface. If the SiO_2 content was below 74%, soln. and sloughing occurred, and Ag at the interface decreased rapidly to zero.

3682. ILER, R. K. **Polymerization of silicic acid; retarding effect of chromate ion.** *J. Phys. Chem.* 56, 678-9 (1952).—*C.A.* 46, 8943*e*.

The chromate ion retards the gelling of aq. silicic acid in the pH range of 1 to 2. An unstable silico-chromic acid in equil. with free acids is probably formed. Since gel time varies inversely with the square of the concn. of silicic acid, the amt. of silicic acid combined with chromic acid can be calcd.

3683. JACOBS, G. **Centrifugation potentials and the influence of electrolytes on the ζ-potential of the As_2S_3 sol.** *Trans. Faraday Soc.* 48, 355-62 (1952).—*C.A.* 46, 9936h.

The disperse phase moved away from the rotation axis and retains its charge, but the smaller counter ions remained behind. This gave rise to a potential difference between 2 points in the soln. at different distances from the rotation axis. The effect of several electrolytes on the ζ-potential of concd. As_2S_3 sol was detd. There was a strong decrease of the ζ-potential when small amts. of KCl were added.

3684. KERN, RAYMOND. **The effect of the rate of evaporation of aqueous solutions of alkali halides on the faces of crystalline precipitates.** *Compt. rend.* 234, 970-1 (1952).—*C.A.* 46, 9372*h*.

Crystals were obtained by evapn. from a microscope slide of glass or of Pt and observed with a microscope. Rate of evapn. was controlled by (*a*) working at room temp. in free space, in an enclosed chamber, or by desiccants of various drying strengths, (*b*) heating the microscope stage in such a way as to regulate evapn. Salts studied were LiF, NaF, NaCl, KCl, KBr, and KI. Slow evapn. gave only the 100 faces.

3685. Kern, Raymond. **Effect of the rate of evaporation of nonaqueous solutions of alkali halogen salts on crystal faces developed.** *Compt. rend.* 234, 1379-80 (1952).—*C.A.* 46, 9373*a*.

Solns. in MeOH and EtOH, Me_2CO, MeCOPh, and dioxane were studied. In every case slow evapn. produced only cubes, whereas an increased rate produced octahedra. For a given solvent, the crit. rate of evapn. necessary to produce octahedra increased in the order NaCl, KCl, KBr, NH_4I, KI, RbI.

3686. Kern, Raymond. **The effect of the rate of evaporation of solutions of cesium chloride-type alkali halides on the crystal faces obtained.** *Compt. rend*, 234, 1696-7 (1952).—*C.A.* 46, 10761*g*.

When aq. solns. of CsBr, CsCl, or CsI are evapd. slowly, the rhombic dodecahedral form (110) is obtained. At high rates of evapn. the cube form (100) is obtained. The formation of dendrites makes it impossible to det. the forms of NH_4Cl and NH_4Br. For low rates of evapn. (low degrees of supersatn.) planes with low elec. fields, i.e. planes contg. both cations and anions, form the faces, (100) for NaCl-type and (110) for CsCl-type lattices.

3687. Kind, V. V. **New hypothesis of cement hardening.** *Tsement* **18**, No. 2, 4-6 (1952).—*C.A.* 47, 287*a*.

H_2O penetrates the lattice and microcrevices of clinker minerals, and in consequence the latter are ruptured. The fragments are hydrated and disintegrate further. The hydration products go into soln. until they sat. the available H_2O. Hydration continues within the satd. soln. forming hydrated mols. which remain near the seat of the hydration reaction. The hydrated mols. aggregate into larger units (colloids) and forming a gel. The colloids crystallize and recrystallize, gradually the crystals grow together pressing out the H_2O and hardening the gel.

3688. Kubaschewski, Oswald and Krusenstjern, Arvid v. **Porosity of anodized layers.** *Metalloberfläche* A6, No. 7, 97-102 (1952).—*C.A.* 46, 10961*e*.

Macropores in anodized Al can be found by observing the action of $CuSO_4$ or $HgCl_2$ solns. on the base metal through an anodized layer or by testing for the loci of passage of elec. current through the layer. Microporosity is indicated by the increase in weight if $Pb(NO_3)_2$, $CuSO_4$, or $K_2Cr_2O_7$ solns. are absorbed.

3689. Kurbatov, M. H. and Wood, Gwendolyn B. **Rate of adsorption of cobalt ions on hydrous ferric oxide.** *J. Phys. Chem.* **56**, 698-701 (1952).—*C.A.* 46, 8480*e*.

Co 60 was used as a radioactive tracer. The rate of adsorption of Co from soln. by freshly pptd. Fe_2O_3 was 1st order at a concn. of 8.4×10^{-8} g atoms Co per liter. At 2×10^{-6} g atoms Co per liter, the rate was complex, showing two 1st-order curves with 1 hr and 5.8 hrs half lives, resp.

3690. Landsberg, Rolf. **The semipermeability of copper cyanide membrane.** *Z. physik. Chem.* 199, 266-79 (1952).—*C.A.* 46, 8935*i*.

The p.d. between different solns. on two sides of Cu ferrocyanide membranes was measured. Where the two solns. were the same uni-univalent electrolyte with concns. differing by a factor of 10, a p.d. smaller than expected was obtained. This effect increased with increasing abs. concn., and was greater for F than for Na.

3691. Loening, E. E. and Farnell, G. C. **Photographic behavior of the silica/silver-ion system.** *Phot. J.* 92B, 187-94 (1952).—*C.A.* 47, 4231*a*.

The photographic properties of a system produced by adsorption of Ag ions and OH ions on silica were studied. The standard sample consisted of 200 mg silica immersed in 5 ml 0.001 *M* $AgNO_3$ at pH 7.4-7.6. Exposures were normally made at 0°C and were physically developed in a hydroquinone-quinone-citric acid-$AgNO_3$ soln. Adsorption of Ag ions by the silica was accompanied by adsorption of OH ions. The developability of colloidal Ag deposited on glass showed a similar behavior, suggesting that the rapid fading of the latent image resulted from coagulation of colloidal Ag. Systems formed with silica contg. an adsorbed gelatin layer were more sensitive than those without gelatin.

3692. Long, Arthur O. and Willard, John E. **Reactions of ions in aqueous solution with glass. Studies with radioactive tracers.** *Ind. Eng. Chem.* 44, 916-20 (1952).—*C.A.* 46, 5939*d*.

The simultaneous sorption and desorption of Na ions by glass was studied with Na^{24} and Na^{22}. The initial rate of desorption was greater than was the rate of sorption, but both became nearly const. after this initial interval. Effects of leaching of neutron-irradiated glass samples showed that water and 0.1 *N* HNO_3 were almost equally effective and that pretreatment by soaking the glass sample in a foreign-ion soln. did not remove all of the available Na^+.

3693. Lydersen, Dagfin and Gjems, Odd. **Conductometric titration of sulfate.** *Z. anal. Chem.* 137, 189-95 (1952).—*C.A.* 47, 1006*i*.

The conductometric titration of SO_4^{--}, in solns. of the K or NH_4 salt, were shown to be inexact because of adsorption by the $BaSO_4$ ppt. The error depended partly upon the concn, of the titrated soln. but should be taken into consideration in exact work.

3694. Matijević, E. and Težak, B. **Coagulation mechanism of hydrophobic sols (discussion of experimental results with silver halide sols in the nascent state).** *Kolloid-Z.* 125, 1-13 (1952).—*C.A.* 46, 6466*a*.

The effects of opposite ion charge, amt. of ions, and sol concn. on the electrolyte coagulation of the Ag halide sols were established. The applicability of the coagulation method for detg. the complex-forming ions in electrolyte solns. was indicated with $Th(NO_3)_4$ and $Al(NO_3)_3$ solns. The general state of the electrolyte soln. was of utmost importance in coagulation of hydrophobic colloid systems.

3695. MATSUURA, NIRO. **Effects of impurities in the electrolyte on the electrodeposition of zinc. VI. Coprecipitation of antimony with iron hydroxide.** *J. Chem. Soc. Japan,* Pure Chem. Sect. 73, 873-6 (1952).—*C.A.* 47, 6275*c*.

The amt. of Sb copptd. with Fe hydroxide was expressed by Langmuir's adsorption isotherm $x/m = c/-(14.2 + 0.58\ c)$, where x = copptd. Sb, m = pptd. $Fe(OH)_3$, c = concn. of Sb in mg/liter which was in equil. with Sb copptd. Radioactive Sb^{125} was used as tracer.

3696. MILLER, V. B.; NEĬMAN, M. B., AND SAZONOV, L. A. **General method for studying coprecipitation and adsorption with tagged atoms.** *Zhur. Anal. Khim.* 7, 269-80 (1952).—*C.A.* 47, 1541*a*.

In a system contg. Ba and Sr copptn. was studied with the aid of radioactive Ba^{140} and Sr^{89}. Ba was pptd. as $BaCrO_4$ and Sr as $SrSO_4$. The expts. were carried out at different concns. of $BaCl_2$ and $SrCl_2$, and in a wide range of pH. Under specified conditions, H^+ concn. prevented pptn. of $BaCrO_4$. In solns. having a molar Sr:Ba ratio of 5:1, max. copptn. took place at pH 7.5. The max. copptn.-pH relationship found experimentally was in good agreement with the Langmuir adsorption isotherm. Copptn. of Sr was greatly reduced in the presence of 0.01% of gelatin.

3697. NICOL, A. **Action of water on three anhydrous crystalline calcium silicates.** *Bull. soc. chim. France* 1952, 418-21.—*C.A.* 46, 7719*h*.

$CaO.SiO_2$, $2CaO.SiO_2$, and $3CaO.SiO_2$ were prepd. by melting together CaO and SiO_2 in stoichiometric proportions. The finely powdered products were made into a paste with water, covered with a layer of water, and let stand for more than a year in a bell jar at 16-20°. It was found that hydration was accompanied by production of hydrated SiO_2, $Ca(OH)_2$, and $CaCO_3$.

3698. OSAWA, TOSHIYUKI. **Purities of precipitate and crystal. VIII. Relations between coprecipitation and the solubility of carbonates.** *J. Chem. Soc. Japan,* Pure Chem. Sect. 73, 320-3 (1952).—*C.A.* 47, 383*c*.

Copptn. of Mg^{++}, NO_3^-, and UO_2^{++} with the carbonates of Mg, Ni, Mn, Zn, Ca, Ag, Ba, Sr, Pb, Cu, and Cd was studied.

3699. ROBERTSON, W. D. **Precipitation of colloidal ferric oxide by corrosion-inhibitor ions.** *J. Phys. Chem.* 56, 671-2 (1952).—*C.A.* 46, 7403*a*.

The pptn. values with respect to a Fe_2O_3 sol, 1 g/liter, were detd. for the following anions used as corrosion inhibitors: PO_4^{---}, WO_4^{--}, CrO_4^{--}, $Cr_2O_7^{--}$, MoO_4^{--}, SO_4^{--}, OH^-, IO_3^-, NO_2^-, Cl^-, ClO_4^-, ClO_3^-, NO_3^-. The colloidal pptg. power of anions was not a significant factor in the corrosion-inhibition mechanism.

3700. RYDBERG, JAN AND RYDBERG, BRITTA. **Adsorption on glass and polyethylene from solutions of thorium and thorium complexes in tracer concentrations.** *Svensk Kem. Tidskr.* 64, 200-11 (1952) (in English).—*C.A.* 47, 5210*h*.

Radioactive Th^{234} was obtained in $HClO_4$ soln. from $UO_2(NO_3)_2$ solns. by extn. with ether and ion-exchange sepn. Its β-particle emission was used for measurements. The carrier was Th^{232} as $Th(ClO_4)_4$. Polyethylene bottles were treated with HCl; some were coated with Silicone C-25 and baked to 250°. Iena and Pyrex glassware were subjected to a detailed cleaning procedure. The adsorption on polyethylene rose to pH 7 and probably decreased beyond pH 9. The difference was attributed to glass acting as a cation exchanger contg. weak acid groups and polyethylene adsorbing neutral mols.

3701. SCHMID, GERHARD AND JETTER, ALBRECHT. **The preparation of seeds and nuclei for precipitation reactions with ultrasonics.** *Z. Elektrochem.* 56, 760-7 (1952).—*C.A.* 47, 3082*f*.

A $BaSO_4$ pptn. effected in the presence of dil. HCl gave a coarse, polydisperse ppt.; pptn. usually began 6 sec. after mixing. When the ppt. was treated with 175 kc, 6-8 watt/cm² ultrasonics, there was no change. Treatment during pptn. gave a finer, but even more polydisperse, ppt. It was possible to prep. denucleated glass vessels. When a pptn. without irradiation was effected in such a vessel, the ppt. was monodisperse, with all particles of the largest size 17μ, and the pptn. time 15 sec. When a $BaSO_4$ ppt. was mixed with water, irradiated, and filtered, the filtrate contained nuclei, but the residue was unchanged. Addn. of this filtrate to another $BaSO_4$ pptn., without irradiation, produced smaller particles and faster rates.

3702. STENHOUSE, JAMES F. AND ARMSTRONG, W. M. **The aqueous oxidation of pyrite.** *Trans. Can. Inst. Mining Met.* 55 (in *Can. Mining Met. Bull.* No. 477, 49-53) (1952).—*C.A.* 46, 3470*i*.

Pyrite oxidized at a measurable rate at lower temps. in caustic aq. solns. than in air. The aq. oxidation of pyrite in these solns. under O_2 pressure was investigated by measuring the effect of reaction variable on O consumption by the reactions.

3703. STOCK, D. I. **Microspherical aggregation of barium sulfate.** *Nature* 170, 423 (1952).—*C.A.* 47, 2571*d*.

$BaSO_4$ (10 g) shaken mechanically in 50 ml of dry benzene for 24 hrs formed spheres 0.5-1 mm in diam. Violent irregular shaking for 30 min. broke the spheres to yield a flocculate. Spheres reformed after regular mech. shaking. Similar results were obtained in Et_2O but not in dioxane. Basic Pb carbonate did not form spheres.

3704. TEWARI, SWARUP N. **The nature of hydrated chromium oxide. III. Dependence of the oxide character on the adsorption of different amphoteric oxide ions.** *Kolloid-Z.* 129, 140-3 (1952).—*C.A.* 47, 4686*d*.

Adsorption series for hydrated chromium oxides made by addn. of NaOH solns. to $CrCl_3$ solns. were established. Among the cations, Ba was adsorbed less than Ag or Cu. The oxalate ion was adsorbed more than thiosulfate, and chromate and ferrocyanide were the anions adsorbed least. In keeping with the amphoteric nature of $Cr(OH)_3$, the cations were adsorbed most strongly when the oxides were pptd. with an excess of NaOH, and the anions were adsorbed most strongly when the pptn. was brought about with a deficiency of NaOH.

3705. ADLER, I. AND STEIGMAN, J. **The interaction of uranyl ions with $UX_1(Th^{234})$ in acid solution.** *J. Phys. Chem.* **57**, 440-3 (1953).—*C.A.* **47**, 7288*b*.

Studies were made of the rate of adsorption of UX_1 from acid uranyl nitrate solns. by means of a C-coated Geiger-Müller tube. A max. was noted in the adsorption-time curve. The effects of different acids, thicknesses of absorbent coating, and temps. were examd. The max. was due to the opposing processes of adsorption and desorption of the uranyl salts.

3706. ATEN, A. H. W. JR.; STEINBERG, H.; HEYMANN, D., AND FONTIJN, A. **Absence of chromium exchange in solid chromic chromate.** *Rec. trav. chim.* **72**, 94 (1953) (in English).—*C.A.* **47**, 6739*f*.

Chromic sulfate, labelled with Cr^{51}, pptd. at pH 5 with a soln. of chromate to give a solid with Cr^{+++} to CrO_4^{--} in a ratio of almost 2. When the compd. was dissolved and pptd. as $PbCrO_4$, a γ-counter showed less than 1% exchange. Thus, in the course of the treatment, the Cr atoms of Cr^{+++} and of CrO_4^{--} were not equiv. at any stage.

3707. HARMSEN, G. J.; SCHOOTEN, J. VAN, AND OVERBEEK, J. TH. G. **Viscosity and the electroviscous effect of the silver iodide sol. I. Influence of the viscosity gradient and of aging of the sol.** *J. Colloid Sci.* **8**, 64-71 (1953).—*C.A.* 47, 5215d.

A fresh AgI sol, prepd. by mixing solns. of $AgNO_3$ and KI so as to have a slight excess of KI, followed by electrodialysis and electrodecantation, decreased in viscosity with aging, primarily owing to the effect of I^- liberated on aging.

3708. ROCHE, BOUCHETAL DE LA AND PEROT, G. **The ion-exchange power of the insoluble salt of Madrell.** *Bull. soc. chim. France* **1953**, 307-9.—*C.A.* **47**, 6577*d*.

The salt of Madrell was a good exchanger of cations and its exchange power was comparable to the exchange power of com. products. The salt of Madrell may be highly polymerized.

3709. RUDNEV, N. A. **Investigation of coprecipitation of sulfides by use of radioactive indicators.** *Zhur. Anal. Khim.* **8**, 3-10 (1953).—*C.A.* 47, 4698*a*.

Copptn. of sulfides was studied with radioactive Zn^{65}, Co^{60}, and Fe^{59}. The study was made in solns. at various concns. in which the tagged ions were present either in equimol. quantities or in considerably smaller concns. The original salts were chlorides, except Ag which was taken as nitrate and As taken as $NaAsO_2$. The precipitant was H_2S passed through 25 ml of soln. at a rate of 50-60 bubbles/min. at 18-20°. The amt. of Zn pptd. was with HgS 40.2, CuS 11.2, CdS 9.5, Bi_2S_3 3.7, and with SnS_2 3%. The amt. of Co pptd. was with SnS_2 8.1, HgS 5.5, and CdS 3.4%. The amt. of Fe pptd. was with SnS_2 8.9, Sb_2S_3 6.5, CdS 3.2, and As_2S_3 2.8%.

3710. TEŽAK, BOŽO; MATIJEVIC, E.; SCHULZ, K.; MIRNIK, M.; HERAK, J.; VOUK, V. B.; SLUNJSKI, M.; BARIC, S.; KRATOHVIL, J., AND PALMAR, T. **The mechanism of coagulation of lyophobic sols as revealed through investigations of silver halide sols in statu nascendi.** *J. Phys. Chem.* 57, 301-7 (1953).—*C.A.* 47, 6219*i*.

The coagulation values of several neutral electrolytes were detd. for Ag halide sols with various concns. of stabilizing ions. The coagulations were observed tyndallometrically. The following electrolytes were tested: Li, Na, K, Rb, Cs, Ca, uranyl, Al, Th, and strychnine sulfates or nitrates in the case of neg. sols, and $NaNO_3$, SO_4, Cr_2O_7, PO_4, OAc, propionate, butyrate, valerate, and citrate in the case of pos. sols.

3711. VAN HOOK, ANDREW AND REARDON, EDWARD J. **Liesegang rings on metallic bases.** *Nature* **171**, 177(1953).—*C.A.* 47, 4172*f*.

Liesegang rings of Ag_2CrO_4 can be formed on metallic bases.

II-7. Metals With Various Solutions

3712. ROTH, ALBERT. **The structures of electrolytically-prepared aluminum oxide.** *Z. anorg. allgem. Chem.* **244**, 48-56 (1940).—*C.A.* 35, 2762³.

Al sheets, 99.995% pure, were oxidized by a.c. or d.c. in solns. of H_2SO_4 or $H_2C_2O_4$ for various periods of time with various current ds. and at temps. of 22° or 30°C. They were then washed, dried, and the surface film was x-rayed with Co radiation. In each case the product initially obtained was amorphous. When samples of the oxides were heated for 4 hrs at temps. from 600° to 1000°C a change to γ-Al_2O_3 occurred.

3713. BEINERT, H. AND BONHOEFFER, K. F. **Passivity of iron and the Ostwald-Lillie concept of nerve conductance. III. Oscillographic investigations of the cathodic behavior of passive iron and of platinum in nitric acid.** *Z. Elektrochem.* 47, 536-45 (1941).—*C.A.* **36**, 4396².

The general run of the potential curves depended on the kind of Fe used, the concn. of the acid, the temp. and particularly on the HNO_3 content. The results could be explained by the assumption that the unimol. layer of a surface oxide was reduced at the "intermediate potential." For activation it was sufficient that the current reduced a part of this oxide layer. The rest was reduced spontaneously by localized currents.

3714. ERBACHER, OTTO. **Different types of local solubility cells.** *Korrosion u. Metallschutz* 17, 5-13 (1941).—*C.A.* **35**, 7352⁶.

Soly. cells were caused by the presence of areas of different solubilities on the metal surface. The formation of such anodes on Pb and Bi was proved by the use of isotopic radioactive elements as indicators in prepg. radiographs of the metal surfaces.

3715. Likhtman, V. I. and Rebinder, P. A. **Effect of glide-plane orientation in single crystals of tin on their adsorption-promoted deformation.** *Compt. rend. acad. sci. U.R.S.S.* 32, 130-1 (1941) (in English).—*C.A.* 37, 813^2.

The relation of the initial angle of orientation X_0 of the glide plane to the effect of surface-active substances on deformation was measured. The adsorption effect was at max. when λ_0 was approx. 45°C. Plastic deformation was facilitated by adsorption of surface-active substances, which penetrated the microcracks developed along the gliding plane and formed films thereon.

3716. Rebinder, P. A.; Likhtman, V. I., and Maslennikov, V. M. **Deformation of single crystals of metals as facilitated by adsorption of surface-active substances.** *Compt. rend. acad. sci. U.R.S.S.* 32, 125-9 (1941) (in English).—*C.A.* 37, 812^9.

Pure single crystals of Sn and Zn were used. The stresses were applied to the crystals kept in air, a purified nonpolar paraffin, or in the paraffin to which oleic acid was added. The deformation was greatly facilitated by the presence of the surface-active oleic acid. The optimum concentration of the latter was 0.2% of the paraffin oil.

3717. Suito, Eiji. **Thermal analysis of the catalytic action of colloids. III. Effect of acid and base on the catalytic decomposition of hydrogen peroxide by colloidal platinum.** *Rev. Phys. Chem. Japan* 15, 155-70 (1941) (in English).—*C.A.* 45, 937*f*.

The catalytic decompn. of H_2O_2 by Pt sol was unchanged in type (1st-order reaction) when 0.00001-0.1 *M* H_2SO_4 or 0.00001 *M* KOH was added either to H_2O_2 (series *A*) or to Pt sol (series *B*) before mixing, but deviated to the 2-nd order reaction when 0.0001-0.1 *M* KOH was similary added. The effect of the ions adsorbed on the solid surface of the colloidal particles was discussed.

3718. Brdička, Rudolf. **The adsorption of reduced methylene blue on the dropping-mercury electrode.** *Z. Elektrochem.* 48, 278-88 (1942).—*C.A.* 37, 5661^3.

Polarographic reduction of methylene blue produced a complex wave between pH 4.92 and 9.24. A small anomalous wave, which was independent of concn., preceded the main wave obtained at concns. above 10^4M. The anomalous wave was considered due to the adsorption of undissocd. leucomethylene blue which reached a limit when the surface of the Hg drop was covered. The following values were calcd.: the max. no. of adsorbed mols. = 10^{14} mols./cm^2; their vol. = 0.606 l./mole; and their adsorption energy = 11.2 kg.-cal./mole.

3719. Brdička, R. **The polarographic behavior of riboflavin. II. The adsorption of the reduction products and their oscillographic investigation.** *Z. Elektrochem.* 48, 686-93 (1942).—*C.A.* 37, 5661^5.

The anomalous wave appearing before the main reduction of riboflavin was considred due to the reduction products in the light of results obtained with methylene blue. Detailed analysis of the current-voltage curves with due consideration of semiquinone formation seemed to indicate that only the leuco form of riboflavin was adsorbable. The kinetics of the adsorption phenomenon were studied with a cathode-ray oscillograph. At certain applied voltages, the current-time curves thus obtained showed 2 delayed maxima, due to the sep. adsorption of the semiquinone and leuco forms of riboflavin.

3720. Hampel, J. **Reactions of solid substances. CXXV. Course of the sintering process in copper powder as followed by its adsorption capacity for dissolved dyestuffs.** *Z. Elektrochem.* 48, 82-4 (1942).—*C.A.* 37, 295^4.

The Cu powder was prepared and heated in H_2. An alc. soln. of Congo red and aq. solns. of eosin, methylene blue and rhodamine were studied. The adsorption curves of these dyestuff solutions were very similar and showed maximum adsorption at 200°C.

3721. Müller, Otto H. **Oxidation-reduction potentials measured with the dropping-mercury electrode. IV. Polarographic study of α-hydroxyphenazine:** *J. Biol. Chem.* 145, 425-41 (1942).—*C.A.* 37, 836^5.

The polarographic wave decreased with an increase in the dropping time of the Hg electrode. It was, therefore, impossible to show the existence of this tautomer with a stationary electrode. This represented the first real difference between potentiometric and polarographic data pertaining to reversible org. systems.

3722. Vavruch, Ivan. **Application of polarography and conductometry to the evaluation of refined sugars.** *Z. Zuckerind. Böhmen Mähren* 66, 43-50 (1942).—*C.A.* 38, 5099^5.

Polarographic and cond. measurements were made upon 64 samples of refined sugar produced from massecuites of varying purity, and the limits within which the ratio between the mg molasses and the ash content of the white sugar may vary were detd. A simple factor was established from the exptl. results.

3723. Vavruch, Ivan. **Electrolytic adsorption coefficients of refined sugar and molasses.** *Z. Zuckerind. Böhmen Mähren* 66, 35-40 (1942).—*C.A.* 38, 6585^9.

The suppression of the 0 max. was detd. and the electrolytic adsorption coeffs. were calcd. for aq. solns. of refined sugar and molasses. Molasses suppressed the 0 max. approx. 1000 times as much as refined sugar. The electrolytic adsorption coeff. of refined sugar was about the same as HCOOH, while molasses was near acid fuchsin.

3724. Wüstefeld, A. **Adsorption properties and plasticity of phosophate surface layers on ingot steel.** *Kolloid-Z.* 101, 82-7 (1942).—*C.A.* 38, 5446^5.

The inter-relations between phosphate layer, lubricant and the shaping of ingot Fe were investigated. Surprisingly, phosphate layer was essentially harder than the Fe. A distinct layer, difficultly sol. in fat solvents, was deposited on phosphate layer soaked for 15 hrs in various 2% soap solns. The soap soln, functioned as a lubricant through the adsorption of soap on phosphate layer. The adsorption layer was independent of the thickness of phosphate layer. Phosphate layer made drawing easier chiefly through its adsorptive powers for lubricants and its high plasticity.

3725. Bonhoeffer, K. F. **The theory of periodic chemical reactions in excitable systems.** *Ber. Verhandl. sachs. Akad. Wiss. Leipzig, Math-phys. Klasse*· **95**, 57-70 (1943).—*C.A.*39, 1801^{4}.
For the math. treatment of a periodic reaction, such as the polarization of an Fe wire in HNO_3, the characteristic variables for the state of the system were the degree of excitation x and the refractivity y. The change of state was then: $dx/dt = f(s,y)$ and $dy/dt = g(x,y)$. The variation of dx/dt as a function of x when $y = 0$ was discussed.

3726. Ghosh, Bholanath. **Spreading of liquids on mercury surface.** *J. Indian Chem. Soc.* **20**, No. 10, 349-54 (1943).—*C.A.* **38**, 3181^{5}.
The spreading of water, contg. traces of HCl, H_2SO_4, HNO_3, H_3PO_4, NaCl, KCl, RbCl, CsCl, and colloidal graphite soln. irradiated by x-rays, on a Hg surface was studied. The number of H^+ or alkali ions necessary to produce a film of unit area was evaluated.

3727. Haller, Robert. **The explanation of dyeing processes.** *Kolloid-Z.* **105**, 147-9 (1943); *Chem. Zentr.* **1947**, **I**, 18-19.—*C.A.* **41**, 6051e.
From the varying results of expts. on the coloring of films of Al_2O_3 produced anodically on sheet Al and the Al_2O_3 used for chromatographic adsorption analysis with org. dyes (as alizarin, Ponceau G, methylene blue, brilliant green), it was concluded that the color effect on eloxated Al was a function of the particular degree of dispersion of the Al_2O_3 grains deposited on the metal.

3728. Harms, H. **A method for the determination of the absolute number of molecules adsorbed from binary mixtures on defined metal surfaces.** *Kolloid-Z.* **103**, 202-10 (1943).—*C.A.* **38**, 3528^{7}.
The change in concn. occurring in the liquid mixt. upon adsorption was detd. The effective metal surface was found by using Hg spheres leaving a capillary under pressure, whose size distribution was detd. Back transport of adsorbed mols. was prevented by means of an air space. The method was applied between -45° to 83°C to aq. and alc. solns. of naphthol yellow.

3729. Stackelberg, M. V., and Schutz, H. **Quantitative estimation of surface-active substances by polarographic adsorption analysis.** *Kolloid-Z.* **105**, 20-6 (1943) —*C.A.* **38**, 5163^{3}.
The max. of a polarogram can be suppressed by surface-active substances which were adsorbed at the Hg surface. Examples were soaps, gelatin and dyes. The degree of accuracy of adsorption analysis by polarographic methods was brought within 2% by standardization with solns. under the same conditions as used for analysis.

3730. Vavruch, Ivan. **Effects of sulfites on the height of the polarographic 0 maximum.** *Z. Zuckerind. Bohmen Mahren* **66**, 161-3 (1943).—*C.A.* **38**, 5100^{8}.
Sulfites did not have a noticeable effect on the 0 max. of a normal wt sucrose soln. in 0.002 *N* K_2SO_4 until their concn. was 3 times as high as that normally found in com. refined sugar. The suppression of the 0 max. in some refined sugars was caused mainly by surface-active substances which occurred in small quantities in every refined sugar.

3731. Vavruch, Ivan. **The effects of the medium on the height of the polarographic oxygen maximum of the refined sugar.** *Z. Zuckerind. Bohmen Mahren* **67**, 61-71 (1943).—*C.A.* **41**, 7145*c*.
Alkalies present in concns. up to 4 x 10^{-3} N in 1 N sugar solns. produced no polarographically detectable changes when the soln. was heated to 70°C. Polarographically inferior sugars readily underwent decompn. when heated to 140°C (15 min. to 5 hrs) either as solid or in soln. The increased formation of capillary-active substances at the higher temp. reduced the 0 max. The 0 max. was increased after only 24 hrs in a vacuum, since volatile substances, which account for the characteristic odor, escaped.

3732. Devaux, Henri. **Crystallization of substances from solutions spread on mercury.** *Compt. rend.* **219**, 565-7 (1944).—*C.A.* **40**, 1371^{6}.
The crystn. of salts such as $CuSO_4$, $ZnSO_4$, $MgSO_4$, Na_2SO_4, iron sulfate, etc., from films of solns. only several mols deep was described. Two zones were observed within the film: a section of very finely developed crystals within which new nuclei formed and grew continuously, and a zone, immediately at the base of these crystals, which was entirely free of crystals and undoubtedly only unimol. The sepn. was very sharp. The segregation was ascribed to adsorptive forces at the Hg surface.

3733. Erbacher, Otto. **Is the adsorption of cations on metal surfaces primary or secondary?** *Z. Elektrochem.* **50**, 9-11 (1944).—*C.A.* **38**, 6155^{9}.
A review of the author's earlier expts. led to the conclusion that the adsorption of cations was primary.

3734. Fischer, Hellmut. **Primary or secondary adsorption of ions from water solutions on metal surfaces.** *Z. Elektrochem.* **50**, 11-13 (1944).—*C.A.* **38**, 6155^{9}.
Electrolysis inhibitors, whether cations or anions, underwent primary adsorption, which was defined as adsorption on the active centers of the metal surface.

3735. Pavelka, Fritz. **Protective film on aluminum. IV. Some experiments on the adsorption of chloride ions on the protective film on aluminum and its effect.** *Kolloid-Z.* **109**; 145-9 (1944).—*C.A.* **41**, 5002*b*.
Behavior in the elec. oxidation was explained by noting the time required for the attainment of certain c.d. or the slope of the oxidation curve in certain regions. Observation of the behavior during the electrolytic formation of a protective film on Al afforded a very sensitive means of detecting the presence of Cl^-.

3736. Van Rysselberghe, Pierre and Alkire, George J. **Polarographic reduction of carbon dioxide.** *J. Am. Chem. Soc.* 66, 1801 (1944).—*C.A.* 39, 28^3.

Study of CO_2 in 0.1 *M* Me_4NCl showed that CO_2 exhibited well-defined reduction waves with a half-wave potential of -2.24 ± 0.01 v. The slope dE/du varied between 0.359 and 0.614 v. (E = cathodic potential, u = ratio of the current to the diffusion current.)

3737. Williams, Kenneth T. and Johnson, Clarence M. **Determination of soluble pectin and pectic acid by electrodeposition.** *Ind. Eng. Chem., Anal. Ed.* 16, 23-5 (1944).—*C.A.* 38, 700^4.

Since the sol. pectinous materials were negatively charged colloids, it was possible to deposit them on the anode of a suitable electrolytic system. The outfit consisted of a Hg-filled side arm and Pt wire to serve as cathode and a disk of 45-mesh Pt gauze as anode. To a low-ash soln. contg. 5-50 mg of pectin, add 58 ml of water and 42 ml of 95% EtOH. With the electrolytic vessel in ice water apply 5-20 milliamps. directly from a 220-v. circuit. At the end of 5 hrs withdraw the anode, wash in EtOH and weigh.

3738. Benedicks, Carl and Rubens, Gerhard. **The effect of liquids on the strength of glass and hardened steel.** *Jernkontorets Ann.* **129**, 37-106 (1945).—*C.A.* 41, 3030*d*.

Certain tensile tests showed a quicker break with wet specimens than in parallel dry tests. These tests definitely showed that the presence of a liquid might have a strong effect on the tensile strength. A theory was presented explaining the effect of a liquid on the strength of a material, according to which the liquid contained in a crack on the surface of the material had two effects. At the outer end of the crack the liquid caused a decrease in the strength, at the deeper sections it had a strengthening effect. At the wider part the liquid might decrease the cohesive force, at the narrow part it might produce a "gluing" effect.

3739. Cassie, A. B. D., and Baxter, S. **The water repellency of fabrics and a new water repellency test.** *Textile Institute* 36, 1945.

3740. Mokrushin, S. G. **Formation of monomicellar films of colloidal hydroxides of metals on the surface of hydrosols.** *Compt. rend. acad. sci. U.R.S.S.* 47, 110-12; *Doklady Akad. Nauk S.S.S.R.* 47, 113-15 (1945).—*C.A.* 40, 4276^3.

It was possible to study the formation and to est. the thickness of films in the colloidal hydroxides of Fe, Al, and Cr. When a polished Cr plate was immersed in a soln. of colloidal $Fe(OH)_3$, the surface film adhered to the plate by its dry (hydrophobic) surface; when the plate was withdrawn, the surface film became attached by its lower (hydrophilic) surface. The layer adhering by its hydrophilic surface could be washed off by distd. water. The first layer could be dried on the plate, and the process repeated. With $Fe(OH)_3$, the surface film reached 37.3A, after 12-14 days.

3741. Morlock, Robert. **The spreading of liquids on metals as a function of their surface condition.** *Comm. tech. états et propriétés surface métaux, Journées états surface.* Oct. 1945, 219-22.—*C.A.* **42**, 3640*e*.

The spreading of a liquid on a mechanically polished metallic surface was similar to that on an amorphous surface like glass. If the cryst. structure was reëstablished, no spreading took place, either for polar or nonpolar liquids, if no capillary forces were involved.

3742. Müller, Otto H. **Oxidation-reduction potentials measured with the dropping-Hg electrode. V. Anomalous polarographic waves in dilute solutions of certain dyes.** *Trans. Electrochem. Soc.* 87, 22 pp. (1945).—*C.A.* 39, 2934^2.

In the polarographic analysis of many dyes representing reversible oxidation-reduction systems, in addn. to the "regular" wave with a half-wave potential equal to the E'_0 of the system. a small wave, the anomalous wave, was found at a more pos. potential. The sepn. of these waves varied with different *dyes* and was largest in the *thiazines;* it decreased under a variety of conditions in a similar way as anomalies (deviations from Beer's law) found in spectroscopic studies of such dyes, and thus suggested a common cause. The results were discussed in connection with the selective adsorption of the leuco form of the dyes.

3743. Taylor, Cyril S.; Tucker, C. M., and Edwards, Junius D. **Anodic coatings with crystalline structure on aluminum.** *Trans. Electrochem. Soc.* **88**, 8 pp (preprint) (1945).—*C.A.* 39, 5184^9.

An x-ray diffraction pattern corresponding to that of γ alumina was obtained when the formation potential was above about 100 v. The formation of a cryst. coating did not seem to be a characteristic of the electrolyte, for cryst. coatings were obtained with a variety of electrolytes.

3744. Chakravarti, B. and Ghosh, S. **Preparation of silver sol. by the reduction of organic salts of silver. I.** *Proc. Natl. Acad. Sci. India* **15A**, 82-5 (1946).—*C.A.* 44, 3769*g*.

Ag sol was prepd. by suspending Ag citrate (from $AgNO_3$ and Na citrate, washed free of electrolyte) in cond. H_2O and reducing it with H_2. The sols obeyed Beer's law on diln. for the absorption in the visible spectrum. Although sols were easily formed by reduction of Ag salts of multivalent anions (tartrate and citrate), they were not obtained from HCOOAg or AcOAg.

3745. Deryagin, B. and Smolinanskiĭ, M. **A tribometric method of measuring adsorption on a solid-solution interface. Applications to the study of the lubricating action of adsorbed layers.** *Compt. rend. acad. sci. U.R.S.S.* **54**, 137-40 (1946) (in English).—*C.A.* 41, 2625*h*.

The surface-active substances (stearic acid, palmitic acid, myristic acid, caproic acid, octyl alc., and cetyl alc.) were deposited in a thin film of paraffin oil from a benzene soln. upon a smooth plate. The coeff. of friction of the surface of the plate was then measured by means of a slider supported by three steel needles. The detd. coeff. of friction was a measure of the quantity of active agent adsorbed on the plate. The data were found to fall on continuous curves representing the Langmuir isotherm.

3746. Khristov, St. G. **Mechanism of overvoltage at the active hydrogen electrode.** *Annuaire univ. Sofia, Faculté phys.-mat.* 43, *Livre* 2, 63-73 (1946-1947).—*C.A.* 43, 8284*h*.

The overvoltage was due to the adsorption of protons on the electrode; this created a potential barrier through which succeeding protons must approach the electrode. Quantum-mech. treatment of overvoltage at the active H electrode resulted in a general theory for both H-and metal electrode overvoltage.

3747. Kruykova, T. A. **Effect of the adsorption of surface-active substances on the movement of drops during the flow of mercury from a dropping electrode.** *J. Phys. Chem. (U.S.S.R.)* **20**, 1179-86 (1946) (in Russian); *Acta Physicochim U.R.S.S.* **22**, 381-91 (1947) (in English).—*C.A.* **41**, 3004*e*, 6823*f*.

Addn. of surface-active compds. (amyl alc., phenol, methylene blue, K oleate) to 0.001 *N* $PbCl_2$ + satd. KCl lowered the first part of the polarographic wave and often simulated an addnl. wave. Similar effects were shown by starch, gelatine, agar, and saponin in various electrolytes. In the growing drop the Hg surface moved up. This caused concn. of adsorbed surface-active substances near the upper part of the drop (i.e., its base). Consequently, the upper part had a lower surfacd tension than the lower part, and this difference in surface tensions worked against the rising of the surface.

3748. Morize, Pierre and Lacombe, Paul. **Study of the oxidation of aluminum by air, at ordinary temperature, by measuring the potential.** *Compt. rend.* **222**, 658-9 (1946).—*C.A.* 40, 5983^2.

Refined Al (99.99%) was freed of its oxide coating by electrolytic means, with a bath contg. 2 cc. Ac_2O to 1 cc. $HClO_4$ (sp. gr. 1.61) (contact with air or water was avoided). The metal was then immersed in acetone and finally washed in abs. alc. When placed in a 3% NaCl soln. (air-free) the Al so prepd. gave an e.m.f. of -1.20 v. referred to a satd. calomel electrode, whereas mechanically polished Al gave -0.74 v., both at room temp.

3749. Soda, Norimune and Okamoto, Shoji. **Effect of temperature on boundary friction.** *Oyo Butsuri (Applied Phys.)* **15**, No. 3-4, 9-13 (1946).—*C.A.* 41, 5293*c*.

In the static friction, controlled by the mol. arrangement between the 2 surfaces in contact, a loss of mol. orientation at the transition temp. reflected immediately on the friction. In the dynamic friction, concerned with many unorderly mols. covering orderly mol. layers, a breakdown in the mol. arrangement at the transition temp. did not directly affect the friction.

3750. Thiesse, Xavier and Belon, Suzanne. **Wetting power and the activation energy of adsorption upon a dropping-mercury cathode.** *Compt. rend.* **223**, 794-6 (1946).—*C.A.* 41, 4021*g*.

The height of the maximums due to O-adsorption obtained on the polarogram showed that the variation of O desorption as a function of *c*, the concn. of surface-active agent, was represented by $1-(\Delta H/H_0) = e^{-Kc}$. H_0 was the height of the max. for O-adsorption in a soln. of aerated H_2O contg. 50 mg NaCl/liter, ΔH was equal to $H-H_0$, where H is the height of the max. for concn. *c*, and *K*, the adsorption const. for each compd., was the vol. of soln. contg. 1 g of wetting agent and for which $\Delta H/H_0 = 1 - 1/e$.

3751. Van Rysselberghe, Pierre. **Polarographic reduction of carbon dioxide. II. Polymerization and adsorption at the dropping-mercury cathode.** *J. Am. Chem. Soc.* 68, 2047-9 (1946).—*C.A.* **41**, 35*g*.

In general, polarographic reduction waves follow equations of the type $E = E_{1/2} + (RT/\alpha F) \ln[i/(i_d - i)]$ where E = abs. value of the cathode potential, $E_{1/2}$ = abs. value of the half-wave potential, R = molar gas const., T = abs. temp., F = 1 faraday, i = reduction current, i_d = limiting diffusion current, α is a small integer representing the no. of electrons. A theory was based upon the sharing of 2 H^+ and 2 electrons by more than 1 mol. of the reducible substance, and the establishment of an adsorption equil. of the reduction product between the dropping-Hg cathode and the soln.

3752. Bigelow, W. C.; Glass, E., and Zisman, W. A. **Oleophobic monolayers. II. Temperature effects and energy of adsorption.** *J. Colloid Sci.* 2, 563-91 (1947).—*C.A.* 42, 2490*i*.

The temp. was detd. at which the oleophobic property (produced by films deposited on Pt from a soln. of the polar compd.) disappeared. When cetane was used as the solvent, the temp. increased with the concn. of polar compd. in soln. but reached a max. at 0.5% concn. for octadecanol, stearic acid, and octadecylamine. The max. temps. for these 3 compds. were 41°, 73°, and 104°C. For films deposited from bicyclohexyl solns. on Pt, the max. value of the temp. was 60°C higher for any given compd. than the max. value for cetane solns.

3753. Bowden, F. P. and Grew, K. E. W. **An experimental determination of the capacity of the double layer.** *Discussions Faraday Soc.* No. **1**, 91-4 (1947).—*C.A.* 42, 8667*f*.

The capacity at the interface between Hg and aq. soln. of H_2SO_4 was detd. by measurement of the velocity of the charge at the interface with very small c.d. The value (20 microfarads/cm^2) was considerably higher than the values previously obtained by the same method, but was in good agreement with the values obtained in the electrocapillary method and in expanding surface method. Over the limited range of potential the 3 methods agreed in giving values for the capacity of 20-21 microfarads/cm^2.

3754. BRDICKA, R. **Measurements of quantities concerning the adsorption of certain reducible compounds of their reduction products at the dropping-mercury electrode.** *Collection Czechoslov. Chem. Communs.* 12, 522-40 (1947).—*C.A.* 42, 5355*d*.

If one of the oxidation-reduction forms should be absorbed on the Hg drops, the free energy change which occurred would shift the polarographic wave to more neg. potentials if only the oxidized form was adsorbed. At low concns. of the oxidation-reduction system the Hg drops would be unsatd. and a single wave would appear. Above a certain concn. 2 waves would follow the normal wave at more neg. values if the oxidized form only was adsorbed (e.g., phenosafranine), or precede the normal wave at more pos. potentials if the reduced form only was adsorbed (e.g. methylene blue and lactoflavin).

3755. CHAMIÉ, C. AND HAÏSSINSKY, M. **Deposit of polonium on mercury.** *J. chim. phys.* 44, 197-8 (1947).—*C.A.* 42, 5300*c*.

From a study of the effects of pH and time of contact and of agitation it was concluded that Po in soln. as ions but not in the colloidal state was adsorbed by metallic Hg. A distribution equil. was not involved, because Po adsorbed on Hg was not readily released at either low or high pH.

3756. CHANDA, BIMAL. **Quantitative studies on the anodic oxidation of aluminum.** *Trans. Indian Inst. Chem. Engrs.* 1, 67-71 (1947-48).—*C.A.* 44, 8264*h*.

Oxide coatings were formed on sheets of 99.4% Al foil by electrolysis. Increasing the electrolyte concn. from 10 to 20% H_2SO_4 had little effect on thickness of oxide film, but increased the amt. of Al dissolved in the electrolyte. Raising temp. from 85° to 105°F resulted in marked increase in Al dissolved and in the formation of a more porous and lighter film which was unsuitable for dyeing. Tests were made with Brilliant Croceine 9B. The optimum dipping time was 5-10 min. The amt. of dye absorbed was not affected by dye concn. but was almost linear with oxidation time (thickness of oxide film).

3757. COTTON, PIERCE. **The spreading of fatty acids on vaporized metallic films.** *Compt. rend.* 22, 1005-7 (1947).—*C.A.* 43, 4923*h*.

Drops of oleic and pelargonic acids were found to spread on a Ag surface vaporized on a glass or quartz carrier, provided the metal film thickness was less than 1 $m\mu$ for oleic and 2 $m\mu$ for pelargonic acid.

3758. GRUZ, T. ERDE AND VARGA, E. **The effect of nonelectrolytes on the electrode potentials of amalgams and on the amalgamated metals.** *Hung. Acta Chim.* 1, No..2, 18-27 (1947).—*C.A.* 42, 8676*g*.

The potentials of resting and dropping amalgams of Bi, Pb, Cd, Tl, and Zn were detd. in solns. of various isoamyl alc., benzyl alc., o-toluidine, o-cresol, p-cresol, butyric acid, and valeric acid. To make the solns. elec. conductors, Na_2SO_4 was added and both solns. and app. were carefully freed of O_2. The potentials were detd. partly by the adsorption of ions and neutral dipole mols. on the liquid side of the boundary between metal and soln., partly by adsorption of metal ions on the amalgam side of the double layer.

3759. HERR, W. **The behavior of ions of more and less noble metals on metallic surfaces and the determination of absolute values of ion adsorption by means of radioactive indicators.** *Angew. Chem.* A59, 155-7 (1947).—*C.A.* 42, 1120*h*.

The size of a metallic surface could be found from measurements of the electrochem. exchange between metal atoms and more noble ions. Theoretical considerations and data for the adsorption of Pb ions from acid soln. of various concns., with ThB as indicator, were presented.

3760. KOLOTYRKIN, YA. AND BUNE, N. **Hydrogen overvoltage on lead electrode and the static potential of lead dissolving in sulfuric acid.** *J. Phys. Chem.* (U.S.S.R.) 21, 581-7 (1947) (in Russian).—*C.A.* 41, 6821*b*.

The H-overvoltage was detd. in dil. H_2SO_4, O_2 being carefully excluded. At low current densities, the Pb was covered with adsorbed O_2. The processes of soln. and deposition of Pb did not affect the overvoltage-current relationship.

3761. LIKHTMAN, V. I.; REBINDER, P. A., AND YANOVA, L. P. **The effect of the rate of deformation and the temperature on the magnitude of the adsorptive reduction in the strength of single crystals of tin and lead.** *Doklady Akad. Nauk, S.S.S.R.* 56, 827-30 (1947); *Chem. Zentr.* 1948, II, 471-2.—*C.A.* 44, 8189*h*.

Cylindrical single crystals of very pure Sn and Pb were prepd. By the use of special app. the rate at which the crystals were drawn was varied from 0.05 to 1000% per min. The crystals were drawn in air, in petroleum oil, and in the latter with the optimum addn. (about 0.2%) of the following surface-active substances: oleic acid, palmitic acid, and cetyl alc. Measurements were made at 20° and 100°C. The max. adsorption effect for Sn at 20° was at a rate of 5% elongation per min. At 100°C, the max. effect was observed at 240% per min.

3762. LUKOVTSEV, P. D. **Theory of the hydrogen overvoltage.** *J. Phys. Chem.* (U.S.S.R.) 21, 589-98 (1947) (in Russian).—*C.A.* 41, 6821*d*.

Equations for overvoltage were derived by assuming that the desorption of H occurred simultaneously by two processes (combination of 2 adsorbed H atoms and reaction of an absorbed H with H+) and that the probability of each process depended on the inhomogeneity of the solid surface.

3763. MOKRUSHIN, S. G. **Surface layer of colloidal solutions and the size of colloidal particles.** *Trans. Faraday Soc.* 43, 1-2 (1947).—*C.A.* 41, 4994*e*.

The spontaneous formation of very thin, invisible surface films has been found to result from surface or two-dimensional coagulation in a positively charged hydrosol. The film thickness of colloidal $Fe(OH)_3$ was about 3-4 $m\mu$. The micelles of $Fe(OH)_3$ were of a plate-like shape.

3764. Ríus, A. and Knecht, J. A. **Electrochemical passivity of lead.** *Anales fís. y. quím. (Madrid)* **43,** 367-88 (1947).—*C.A.* **41,** 6797*a*.

Pb was rendered passive by treatment with various reagents and the passivity did not disappear on treatment with solns. of $Ba(NO_3)_2$, Na_2CO_3, Na_2SO_3, $NaHSO_3$, hydroquinone, pyrogallic acid, or H_2SO_4. Passivity was destroyed rapidly by $Na_2S_2O_6$, H_2O_2 in acid medium, $K_3Fe(CN)_6$ in alk. medium, H_2CrO_4, $HMnO_4$, NH_4CAc, $(NH_4)_2SO_4$. The film causing passivity contained pores readily penetrated by metallic Hg.

3765. Stout, H. P. **The electrodeposition of hydrogen on palladium.** *Discussions Faraday Soc.* No. **1,** 107-14 (1947).—*C.A.* **42,** 8668*i*.

The electrodeposition and electro-soln. of H_2 at Pd electrodes in aq. solns. of H_2SO_4 were irreversible processes. The linear *V* vs. log *i* relation was due to a rate-detg. process in the formation of gaseous H_2. The max. quantity of H_2 taken up by Pd electrolytically corresponded to a ratio of 0.65 atom of H to 1 atom of Pd, in agreement with the view that H_2 dissolved ionized, its electrons going to fill up the vacant *d* states of the Pd, which numbered about 0.6 per atom.

3766. Stout, H. P. **The energy of activation in the electrodeposition of oxygen.** *Discussions Faraday Soc.* No. **1,** 246-7 (1947).—*C.A.* **42,** 8668*c*.

Published work on the electrodeposition of O_2 at a Pt electrode showed that the reaction in acid and alk. solns. proceeded differently, whereupon it was to be expected that the energy of activation in the 2 cases was different. The energy of activation for deposition on Pt from 0.2 *N* H_2SO_4 was 18.7 kcal. at the reversible potential of 0.9 v. against a satd. calomel electrode at a temp. of 35°C.

3767. Tverdovskiĭ, I. P. and Frumkin, A. N. **Relation between the wetting of mercury and the nature of the solvent.** *J. Phys. Chem. (U.S.S.R.)* **21,** 819-24 (1947) (in Russian).—*C.A.* **42,** 2160*b*.

N_2 bubbles (0.15-0.4 mm diam.) were placed on, or pressed against, a Hg surface in 0.3 *N* NH_4NO_3 solns. in alc.-H_2O mixts., the Hg polarized cathodically, and the interfacial tension σ_{12} at the Hg-soln. boundary and contact angle θ (through the soln.) were detd. as functions of the applied voltage V. In H_2O θ passed through a max. (about 100°C) at the V of the electrocapillary max. N_2 was sepd. from Hg by a film of the soln. which was thick enough to have properties of the bulk phase.

3768. Uhlig, H. H. **Passivity in chromium-iron alloys: adsorbed iron films on chromium.** *Am. Inst. Mining Met. Engrs., Inst. Metals Div., Metals Technol.* **14,** No. 6, *Tech. Pub. No.* **2243,** 10 pp. (1947).—*C.A.* **41,** 7186*d*.

Fe brought into contact with Cr was passive at the interface. This was demonstrated by electroplating or evapg. Fe on a Cr surface and immersing in 3 N HNO_3. A residual film of Fe always remained on the Cr surface. Fe apparently was adsorbed on the surface of Cr in a manner similar to adsorption of alkali metals on W, previously studied in the field of electron emission. The chem. properties of Fe so adsorbed were changed and the Fe behaved as a passive metal.

3769. Vorisková, M. **Adsorption effect on the polarographic curves of pyocyanine.** *Collection Czechoslov. Chem. Communs.* **12,** 607-19 (1947) (in Eng.).—*C.A.* **42,** 5354*i*.

The polarographic reduction of pyocyanine (α-hydroxy-methylphenazine) was investigated over the pH range 0-12. At higher concns. above 10^{-4} M two waves of unequal height appeared, the first being always higher by a value that was independent of the concn. In alk. solns. up to a pH of 10 an extra wave appeared at more pos. potentials the height of which was likewise independent of the concn. of α-hydroxy-methylphenazine. These anomalies were due to the adsorption of undissocd. mols. of dihydropyocyanine.

3770. Bon, Francois. **Adsorption on the surface of mercury in contact with electrolytic solutions.** *Ann. phys.* [12], **3,** 680-724 (1948).—*C.A.* **44,** 6748*i*.

The effect was studied by measuring the surface tension (γ) by the drop-wt method, keeping the Hg-drop cathode as function of concn. (*c*) at several const. applied voltages (E). The γ vs. log *c* iso-voltage plots were characterized by a network of similar curves. If O_2 was eliminated from the solns., the ion concn. in the epiphase was const. in each portion of the iso-voltage curves. Similar three-sloped curves have been found for solns. of KCl, $CaCl_2$, $BaCl_2$, NH_4Cl, Li_2SO_4, AcOH, $(COOH)_2$, and NaOH.

3771. Bonhoeffer, K. F.; Brauer, Elfriede, and Langhammer, Günter. **II. Cathodic polarization of iron in nitric acid.** *Z. Elektrochem.* **52,** 29-37 (1948).—*C.A.* **43,** 7792*a*.

The potentials of passive Fe wires (0.01-0.92% C) in HNO_3 (d. = 1.4) contg. urea bore no simple relation to their C contents. Below a certain c.d., the rheobase, cathodic polarization did not activate Fe in concd. HNO_3, but lowered the potential somewhat. A c.d. equal to the rheobase activated in about 0.1 sec, and the potential went through characteristic changes. In a few tenths of a sec the Fe again became passive, and its potential rose even above the original value. This after-potential was assocd. with a dullness of the surface, which brightened as the potential dropped to its normal passive value.

3772. Bonhoeffer, K. F.; Haase, Vera, and Langhammer, Günter. **III. The refractory state of newly passive iron in concentrated nitric acid.** *Z. Elektrochem.* **52,** 60-7 (1948).—*C.A.* **43,** 7792*d*.

Fe that has just become passive again after cathodic activation is in a refractory state as regards reactivation. Detn. of the threshold or the rheobase gives a quant. measure of this state. Its decay with time parallels that of the after-potential. Both it and the after-potential are due to a relatively thick film of Fe oxide impregnated with HNO_2.

3773. BONHOEFFER, K. F. AND LANGHAMMER, G. **IV. Theory of the cathodic polarization of iron in nitric acid.** *Z. Elektrochem.* 52, 67-72 (1948).—*C.A.* 43, 7792*f*.

The variables chosen were: *x*, the degree of activity, or excitation, measured by the potential; and *y*, the degree of refractivity, measured by the threshold. Trajectories in the *x*, *y*-plane were constructed and shown to account qualitatively for the threshold, the rheobase, accommodation, periodicity, and various details of the refractory state.

3774. BONHOEFFER, K. F. AND GERISCHER, HEINZ. **V. Anodic behavior of copper in hydrochloric acid.** *Z. Elektrochem.* 52, 149-60 (1948).—*C.A.* 43, 7792*e*.

On a Cu anode in HCl at certain c.d. a surface film formed and dissolved periodically. This behavior was studied in detail. At a sufficient c.d. a white layer of CuCl formed on the anode, starting at the edges. As soon as the anode was covered, a dark coloration swept over it from the edges inward. This was Cu_2O, formed because of depletion of H ions in the pores of the CuCl layer. With its formation the anode potential drop increased sharply by as much as 16 v. The self-accelerating formation and dissolving of Cu_2O were essential to the periodicity.

3775. BRENNER, ABNER; RIDDELL, GRACE, AND SEEGMILLER, ROBERT. **Chromated protein films for the protection of metals.** *J. Electrochem. Soc.* 93, No. 3, 55-62 (1948).—*C.A.* 42, 2911*d*.

Steel, Zn, Al, and brass were protected from corrosion by the use of chromated protein films. Either casein, albumin, or gelatin was applied to the metal surface by dipping. The film was impregnated with chromate, which acted as an inhibitor of corrosion and hardened the film, by adding the salt to the protein soln. or by a sep. immersion.

3776. DEVAUX, HENRI. **The use of thin films on mercury for the determination of the positions of the attractive poles of molecules and of the role of these poles in various physical properties of matter.** *Compt. rend.* 226, 1649-51 (1948).—*C.A.* 42, 6208*f*.

Thin films of aq. $CuSO_4$ spread very evenly on a Hg surface proved there was a strong attraction between $CuSO_4$ and Hg. Since the soly. of $CuSO_4$ in water was greatly reduced when present in a thin film on such a substrate, it was concluded that the hydrophilic pole was blocked by the union with Hg.

3777. ERBACHER, OTTO; HERR, WILFRID, AND WIEDEMANN, MALENE. **Metal-ion adsorption on metal surfaces.** *Z. Naturforsch.* 3a, 637-45 (1948).—*C.A.* 43, 5254*f*.

The adsorption of Pb^{++}, Bi^{3+}, and Th^{4+} ions on Au, Ag, Ni, and Hg was detd. in solns. of 0.1 *N* HNO_3, HCl, and H_2SO_4. Curves for Hg deviated from the isotherms of solid metals by showing less adsorption. The effect of solvent, salt soly., normal potential corresponding to the ion, ion charge as well as hydration of the ion, and of adsorbed metal on the adsorption process was discussed with Freundlich adsorption isotherms.

3778. GUITTON, L. **Conditions for passivation of stainless steels and its practical application.** *Metal Treatment* 15, 3-13 (1948).—*C.A.* 42, 4508*d*.

It has been found necessary to subject the surfaces to sensitization by uniform acid corrosion before the actual passivation. The sensitizing soln. which had been found to give the best results was a mixt. of HNO_3 10% by vol. and NaF 2% by wt employed below 60 °C. Sensitization accelerated passivation in an oxidizing medium and considerably increased its stability. Passivation of 18-8 steel corresponded to the adsorption of O_2 on the surface of the metal.

3779. GUITTON, LOUIS. **The passivity of stainless steels and the phenomena of adsorption.** *Compt. rend.* 226, 805-7 (1948).—*C.A.* 42, 7139*g*.

18/10 Cr/Ni and Cr/Mn steels were rendered passive in 10% HNO_3. A preliminary sensitization with HF-HNO_3 increased the passivity considerably and eliminated the sharp drop in potential which otherwise occurred during the first 10 min. Samples rendered passive after sensitization resisted the action of H_2SO_4. Unsensitized specimens showed a preliminary unstable passivity, brief activity, and finally a permanent stable passivity. The passivity was ascribed to adsorption of O_2.

3780. HAISSINSKY, M. **Relations between exchange phenomena and electrochemical phenomena.** *J. chim. phys.* 45, 224-31 (1948).—*C.A.* 43, 6891*b*.

There was apparently no correlation of the initial rate of exchange between tagged metals and solns. of their salts and the electrochem. potential of the metals. It was postulated that the exchange reaction $M = M^{n+}$ was very rapid, practically reversible, and independent of the nature of the metal or of the state of the surface.

3781. HAISSINSKY, M.; COTTIN, M., AND VARJABEDIAN, B. **Exchange between metals and their ions in solution. I. Preliminary experiments.** *J. chim. phys.* 45, 212-23 (1948).—*C.A.* 43, 6890*f*.

Expts. with tagged atoms indicated that the dependence on time was $\log x = a \log t + \log b$, where *x* was the quantity of metal exchanged in g atoms and *a* and *b* were consts. The anion strongly affected the rate of exchange. With Pb the exchange decreased in the order chloride, nitrate, acetate for 0.0001 M solns., but in 0.1 *N* solns. acetate exchanged faster than nitrate. With Bi chloride solns. exchanged faster than did nitrate solns.; the chloride solns. exchanged faster than sulfate up to 2 min., but for longer times the order was inverted. For Cu, the exchange of acetate, sulfate, and nitrate solns. was about the same; the bromide was 100 times as fast; and the chloride was still faster initially but then diminished. For Mn the rate of exchange was too slow to permit conclusions except that sulfate solns. exchanged slightly more rapidly than did the nitrate solns.

3782. HICKLING, A. AND TAYLOR, D. **Anodic behavior of metals. V. Copper.** *Trans. Faraday Soc.* 44, 262-8 (1948).—*C.A.* 43, 47*a*.

The initial build-up of anodic polarization at a Cu anode, detd. by using the cathode-ray oscillograph, was in 2 stages in NaOH solns.: (a) charging of a double layer, and (b) formation of an oxide film upon the anode. Cu_2O was initially formed but it was almost at once oxidized to CuO. The thickness of the film when O_2 evolution first commenced was some 4 mols. in 0.1 *N* NaOH. With Pt, Au, and Ni the oxide film was formed before the O_2 evolution potential was reached was about 1 mol. thick.

3783. KAPPANNA, A. N. AND JOSHI, K. M. **The reaction between mercury and nitric acid. A kinetic study.** *J. Indian Chem. Soc.* **25**, 547-54 (1948).—*C.A.* **43**, 7305*g*.

When Hg was added to HNO_3, kept continously stirred, in the range of concns. of 4 *N* to 7 *N*, the soln. of the metal started after an interval of time (period of passivity). The period of passivity was greater in dil. solns. than in concd. solns. for a given rate of stirring. At the same concn. the period of passivity was greater in more rapidly stirred solns. At 22°C, when the concn. of HNO_2 was approx. 0.0012 *N*, soln. of the Hg began. HNO_3 contg. 0.0012 *N* HNO_2 initially had no period of passivity.

3784. KEILIN, BERTRAM. **Adsorption at the dropping-mercury electrode.** *J. Am. Chem. Soc.* **70**, 1984 (1948).—*C.A.* **42**, 7642*e*.

Increasing concns. of horse albumin decreased the diffusion current of the polarogram shown by the dye *p*-hydroxyphenylazobenzenearsonic acid to an asymptotic value of 25% of the true value. A const. protein concn. gave const. reduction in current independent of dye concn.

3785. KOSHURNIKOV, G. S. **Adsorbed layers as a passivating factor.** *Zhur. Obshchei Khim.* **18**, 388-97 (1948).—*C.A.* **43**, 28*b*.

Adsorption from aq. solns. (10 ml) of pure PhOH, BuOH, and $BuCO_2H$ on powders of pure Fe, Al_2O_3, and tech. Fe_2O_3 (1 g) were detd. in 30 min. runs. The adsorbed layers of PhOH on Fe resisted energetic washing with H_2O and lowered the rate of soln. of Fe in 1% H_2SO_4, e.g., vol. of H_2 evolved after 5, 15, and 40 min., without PhOH 3.28, 10.78, and 31.12, with adsorbed PhOH 1.99, 8.95, and 28.62. Strong passivating effects were obtained if a d.c. was passed during the adsorption, and the adsorbed film was subsequently condensed with urotropine. Similar effects were also obtained by preliminary electrolytic treatment prior to adsorption.

3786. MAXTED, E. B. **Detoxication of catalyst poisons. VI. Use of a revivable filter column.** *J. Chem. Soc.* **1948**, 1091-3.—*C.A.* **43**, 1536*e*.

Spent Pt catalyst can be detoxicated by treatment with dil. aq. Na molybdate. By filtering tech. benzene through a column of treated catalyst thiophene was removed by adsorption. Upon exhaustion, the catalyst was revived *in situ* by brief hydrogenation followed by a Na molybdate treatment. In the detoxication process adsorbed thiophene was converted first to thiophane.

3787. PCHELIN, V. A. **The surface properties of proteins.** *Soveshchanie po Belka Akad. Nauk S.S.S.R. (5-ya Konferents. Vysokomolekulyar. Soedineniyam)* **1948**, 83-93. —*C.A.* **43**, 2842*b*.

The surface layer of 0.5% egg albumin was obtained by slowly replacing the soln. below the surface layer with flowing pure H_2O. The surface layer was then deposited on a Cr plate and its thickness detd. by comparing reflection from it with reflection from a standard plate on which varying thicknesses of albumin had been deposited. The layer was adsorbed on surfaces from soln., avoiding uptake from the surface of the soln., the thickness was 4 monolayers on Cr and 2 on glass.

3788. POTAU, M. **Phenomena related to the adsorption of salts by mercury.** *Anales real soc. espan. fis y. quim.* **44A**, 445-56 (1948).—*C.A.* **43**, 4922*e*.

When a crystal of an alkali halide was immersed in Hg covered with H_2O, the crystal dissolved much more rapidly at the interface than in the bulk H_2O phase. This was probably due to the intense adsorption of the salt at the Hg-H_2O surface. The effect was not observed with crystals of tartaric acid. Small NaCl crystals placed on a Hg-H_2O interface dissolved in less than half the time required to dissolve crystals of the same dimensions on a glass-H_2O interface.

3789. RAMARAO, G. **Passivity of magnesium.** *J. Indian Chem. Soc.* **25**, 243-4 (1948).—*C.A.* **43**, 2076*e*.

Mg exhibited passivity when exposed to air in the presence of ultraviolet radiations. The extent of passivity was measured by the displacement of Cu from a soln. of $CuSO_4$. The moisture carried by the air, under the influence of ultraviolet rays, produced an oxide film that passivated the Mg surface. The same current of air in the dark swept off partly any film and slightly activated the surface.

3790. SANDELL, E. B. **Colorimetric determination of traces of gold.** *Anal. Chem.* **20**, 253-6 (1948).—*C.A.* **42**, 3695*h*.

Traces of Au could be isolated by pptn. with $SnCl_2$ with Te as collector and detd. colorimetrically or photometrically with 5-(*p*-diethylaminobenzylidene) rhodanine as reagent.

3791. TOURKY, A. RIAD AND EL-WAKKAD, S. E. S. **Studies on some metal electrodes. I. Oxide-film formation on copper, and the evaluation of the standard electrode potential of the metal.** *J. Chem. Soc.* **1948**, 740-9.—*C.A.* **42**, 8092*c*.

The standard electrode potential of Cu was evaluated by varying the pH of the soln. and by removing oxide initially present by reduction with H_2 or subjecting the Cu electrode to high vacuum at elevated temp. By comparing the results obtained in and out of contact with air in buffers initially free from Cu ions, a set of conditions could be chosen leading to the evaluation of the true standard electrode potential. The Cu electrodes were prepd. by electrodeposition on Pt plates, 1 x 1 cm.

3792. Vyskočil, A. **The protection of iron by means of metal layers.** *Chemie* (Prague) **4**, 184 (1948).—*C.A.* **46**, 2469*g*.

The protection achieved by the layer depends on whether the protective layer acts as cathode (Sn, Cu, Ni) or as an anode (Zn, Al) with respect to the Fe. In order to achieve protection the protective layer must be continuous.

3793. Zuev, Yu. S. **Determination of the adhesion forces between particles in the sediments of suspensions.** *Kolloid. Zhur.* **10**, 281-8 (1948).—*C.A.* **43**, 7777*d*.

Suspensions of Zn in C_6H_6 were studied. The yield stress increased linearly with the depth of sediment. Some surface-active substances ("Aerosol OT," oxidized petrolatum, oleic acid, and raw linseed oil) accentuated the increase in dispersity observed on shaking the suspension; some other substances (octyl and cetyl alc. and isoamyl stearate) were less active.

3794. Bockris, J. O'M. and Conway, B. E. **Studies in hydrogen overpotential. Effect of catalytic poisons at platinzed platinum and nickel.** *Trans. Faraday Soc.* **45**, 989-99 (1949).—*C.A.* **44**, 3813*i*.

The effect of As_2O_3 in HCl on H-overvoltage at platinzed Pt electrodes and that of traces of As_2O_3, CO, CS_2, KCN, and $PtCl_4$ on the rate of H_2 evolution at a Ni cathode was detd. A limiting current of about 3 x 10^{-3} amp./cm^2 in *N* aq. HCl occurred at 0.1 *M* in As_2O_3. The variation of H-overvoltage with time at const. c.d. was considerable, erratic, and of long duration in the presence of traces of impurities, but was considerably reduced by pre-electrolysis. Impurities of 10^{-10} mole/liter affected the rate of H_2 evolution reaction on Ni cathodes.

3795. Bowden, E. P. and Moore, A. C. **Physical and chemical adsorption of long-chain compounds on metals.** *Research* (London) **2**, 585-6 (1949).—*C.A.* **44**, 3766*c*.

Pure metal foils were made artificially radioactive and dipped in a C_6H_6 soln. of the long-chain compd. If the film were held by phys. forces only, it could be desorbed unchanged. If, however, chem. reaction had taken place, the film on removal would bring radioactive metal with it. Octadeyl alc. was adsorbed on surfaces of Zn, Cd, Cu, Pt, and Au and then removed. In no case was any reaction observed; the adsorption was entirely phys. However, with Zn, Cd, and Cu the film reacted with the metal. When Et stearate was used, there was no reaction with Au or Pt, but with Zn, Cd, and Cu slight reaction was observed.

3796. Brummage, K. G. **Structure of stearic acid films on copper.** *Nature* **164**, 244-5 (1949).—*C.A.* **44**, 6695*g*.

Cu stearate was present after a Cu surface was covered with stearic acid. The same pattern was obtained with other fatty acids.

3797. Buinov, N. N.; Demenev, N. V.; Shur, A.S., and Fedorova, G. G. **The structure of metallic films obtained on the surface of aqueous solutions of metal salts by action of reducing gasses. I. The structure of platinum films.** *Kolloid. Zhur.* **11**, 289-98 (1949).—*C.A.* **44**, 901*h*.

Pt films (prepd. on H_2O by passing H_2 over the surface of Pt salt solns.) were transferred on collodion films, and examd. in an electron microscope. The films started as sep. crystals smaller than the limit of the electron microscope (30 A.) and later combined to aggregates (0.5-1μ) which had no definite shape, but showed preferred angles of 90° and 120°. The aggregates not only lay in the surface but formed also under the surface. When the av. thickness of the film was less than 120 A., the aggregates formed branched chains.

3798. Burgers, W. G. **Crystal growth in the solid state (recrystallization).** *Physica* **15**, 92-106 (1949) (in English).—*C.A.* **44**, 398*f*.

The crystn. of metal grains in a solid matrix was contrasted with crystn. from soln. or vapor phases; the first situation did not usually lead to growth of crystals with geometrical faces. As example, Al growing in a quasi-isotropic fine-grained sheet gave almost circular grains. Counting of these grains and measurement of their diams. gave the dependence of rate of nucleation and rate of growth on temp., degree of deformation, and time of heating. The final crystals were formed from nuclei already present in the cold-worked metal, not from nuclei spontaneously formed during annealing.

3799. Chamie, C. and Filcakova, H. **The adsorption of polonium by mercury in different solutions.** *J. chim. phys.* **46**, 174-5 (1949).—*C.A.* **43**, 7791*a*.

The chloride, oxychloride, nitrate, and acetate of Po in combination with the solvents HCl, CH_3-COOH, acetone, MeCOEt, $CH_3COCH_2COCH_3$, alc., and NH_4OH were placed in contact with Hg, and the deposition of Po was measured. A deposition was found in all cases of true solns., but none in the case of colloidal suspensions. The Po formed an amalgam that diffused into the Hg.

3800. Chaudron, Georges; Lacombe, Paul, and Youssov, Georges. **A new determination in the absence of oxygen of the solution potential of electrolytically polished aluminum.** *Compt. rend.* **229**, 201-3 (1949).—*C.A.* **43**, 8912*d*.

Since the prior detn. of the potential of electrolytically polished Al, -1.20 v., was much lower than the theoret. -1.95 v., the measurement was repeated with an app. in which the prepn., purification, and potential detn. could be made without exposure to O_2. A value of -1.60 v. in 3% NaCl soln. was obtained by this procedure.

3801. Coffin, C. C. and Tingley, I. I. **The exchange of silver ions between aqueous solutions and surfaces of metallic silver.** *J. Chem. Phys.* **17**, 502-3 (1949).—*C.A.* **43**, 7791*b*.

The exchange of Ag ions between solns. of $AgNO_3$ and surfaces of metallic Ag was studied with a radioactive isotope (Ag^{110}, half-life 225 days). On the basis of measured areas, etched and polished surfaces of annealed Ag foil exchanged with 0.1 *N* $AgNO_3$ solns. to depths of about 10 and 100 at. layers, resp. Cryst. surfaces appeared to retain their entire activity which, however, was so low (10-20 counts above background) that the exptl. results were highly uncertain. Cryst. Ag by itself showed little tendency to exchange with ions in soln. but received a deposit of metal when it was mixed with noncryst. Ag.

3802. Finks, A. J. and Petito, N. J. **Penetration of sintered metals by solution of surface-active agents.** *Anal. Chem.* **21**, 1101-2 (1949).—*C.A.* **43**, 8791*d*.

"Seepage values" were detd. by passage of aq. solns. of wetting agents through a series of 5 stainless steel filtering crucibles with progressively smaller pore sizes for the sintered filtering element, these sizes being 65, 35, 20, 10, and 5 microns, resp. The most effective wetting and penetrating agents gave lowest values.

3803. Grahame, David C. **Measurement of the capacity of the electrical double layer at a mercury electrode.** *J. Am. Chem. Soc.* **71**, 2975-8 (1949).—*C.A.* **44**, 54*a*.

A small drop of Hg was surrounded by a large Pt gauze sphere and the capacity of the system (Hg soln. - Pt) was sensibly that of the double layer in contact with the Hg. Improvements were made in the detn. of the d.c. potential and in timing the fall of the drop, from which its size and area were detd. The differential capacity in a 0.1 *N* soln. of KCl was detd. at 25°C over a range of 0-1.90 v. relative to the *N* calomel electrode.

3804. Greenhill, E. B. **Adsorption of long-chain polar compounds from solution on metal surfaces.** *Trans. Faraday Soc.* **45**, 625-31 (1949).—*C.A.* **43**, 8789*h*.

The compds. used were stearic acid, Et stearate, and octadecyl alc. The isotherms showed satn. of the surface occurred at very low concn. with stearic acid, whereas alc. and esters required much higher concn. Although the initial rate was very rapid, final equil. may not be reached for many hours. The adsorption process appeared to be the same for thoroughly cleaned and reduced powders as for oxide-coated powders. With the clean powders, however, the adsorption increased in some cases owing to an increase in the surface area brought about by the reduction and degassing procedure at 200°-250°C.

3805. Greenhill, E. B. **Lubrication of metal surfaces by mono- and multi-molecular layers.** *Trans. Faraday Soc.* **45**, 631-5 (1949).—*C.A.* **43**, 9424*c*.

Lubricating layers of stearic acid, Et stearate, octadecyl alc., and the stearates of Cu and Ag were deposited on a flat metal surface and the friction between this surface and a clean slider of the same metal was detd. Where a metal could be lubricated by a soln. of one of these compds. in paraffin oil, 1 or 3 deposited layers sufficed; where a paraffin soln. did not provide lubrication, more than 3 layers were necessary.

3806. Hackerman, Norman and Schmidt, Harold R. **The adsorption of organic corrosion inhibitors on iron and steel surfaces.** *J. Phys. & Colloid Chem.* **53**, 629-38 (1949).—*C.A.* **43**, 6559*g*.

The films formed by org. corrosion inhibitors on steel and Fe surfaces were studied by electron diffraction. Depending on the conditions, both oriented and unoriented surface films were formed. Naphthenic acid, cyclohexylamine, cyclohexanone, cetyl alc., and stearic acid were used as film formers on steel surfaces. Treatment of the films with hydrocarbon solvents showed that the intensity of adsorption on the metal surface was a property of the specific substances employed.

3807. Hackerman, Norman and Schmidt, Harold R. **The role of adsorption from solution in corrosion inhibitor action.** *Corrosion* **5**, 237-43 (1949).—*C.A.* **43**, 6559*i*.

Adsorption isotherms were run at 40°C for stearic acid, stearyl alc., succinimide, dibutylthiourea, and p-amino-biphenyl, two methods being used. (1) A C_6H_6 soln. of the inhibitor was shaken with a weighed amt. of powd. steel, and aliquot portions of the C_6H_6 soln. were analyzed for the inhibitor. (2) A glass column was packed with steel powder, and jacketed for temp. control. Inhibitor solns. could be flowed through the column under any desired condition, and a corrosive soln. could also be used to det. the extent of desorption. Of the substances studied, only the stearic acid gave measurable results. Part of the stearic acid was desorbed by C_6H_6, but not all.

3808. Hickling, A. and Wilson, W. H. **Increase of oxygen overpotential at a platinum anode by reducing agents.** *Nature* **164**, 673 (1949).—*C.A.* **44**, 3815*a*.

The presence of low concns. of certain reducing agents, which normally function as depolarizers, brought about very substantial increases in the potential at which O_2 was evolved at a Pt anode. The phenomenon was studied by polarizing a clean Pt-wire anode in an inert electrolyte until the potential became substantially steady, and a quantity of the oxidizable substance added. The elevations of anode potentials were observed after 2 min. with a variety of addn. agents.

3809. Kamienski, B. **Potentiometric chromatography. III. Preparation and testing of the electrometric adsorption element.** *Bull. intern. acad. polon. sci., Classe sci. math. et nat.*, Ser. A, **1949**, 157-60 (in English).—*C.A.* **45**, 8377*c*.

The Hg drop making contact with a Pt electrode was kept in position by a glass filter so that the Hg did not break contact with the Pt when the app. was tilted. Pure silicic acid for coating the other Pt electrode was prepd. The app. exhibited large potential changes when exposed to bright sunlight, AcOH, NH_3, or CO_2 vapors.

3810. Kamienski, B. **Potentiometric chromatography. IV. Electrometric selective adsorption. The antimony electrode.** *Bull. intern. acad. polon. sci., Classe sci. math. et. nat.*, **Ser. A, 1949**, 171-82.—*C.A.* **45**, 8377*e*.

It was possible to use the elec. adsorption element as a very sensitive device for detecting very dil. solns. of acids and bases flowing out of the adsorption tube. A microelectrode of Sb was constructed and similar results were obtained as with the micro quinhydrone electrode. Potential changes were observed when different substances passed the adsorption tube. Tswett's classical chromatography of leaf was investigated with the method of potentiometric chromatography. When the element was filled with Zn, Cd, Sn, Bi, or other metals, cations could be checked qualitatively by their effect on the potential of the metal.

3811. Koshurnikov, G. S. **Adsorptive passivation of iron with protein layers.** *Zhur. Priklad. Khim.* **22**, 698-702 (1949).—*C.A.* **43**, 8246*c*.

Best passivation towards 10% H_2SO_4 was obtained by 15-min. immersion in a soln. contg. gelatin 0.2, concd. HNO_3 7.5, PhOH 0.25, $K_2Cr_2O_7$ 0.5 g, in 20 ml H_2O, with subsequent rinsing and wiping off the excess. The protective action consisted in the formation of a gelatin-nitrophenolic film on the HNO_3-etched iron surface. The films were even more resistant to other acids, HCl and AcOH, but provided no protection against salt solns.

3812. Koshurnikov, G. S. **Passivation of iron by adsorptive-lacquer coatings.** *Zhur. Priklad. Khim.* (J. Applied Chem.) **22**, 809-11 (1949).—*C.A.* **44**, 851*b*.

The passivating effect of adsorbed layers of PhOH-HCHO, PhOH-urotropine, $NO_2C_6H_4OH$-gelatin, phosphate-casein, against 10% H_2SO_4, was strongly increased by addnl. coating with a film of Bakelite with subsequent polymerization. On an Fe surface without adsorbed layer, the Bakelite film was completely detached after exposure to 10% H_2SO_4 for 18-21 hrs, whereas a film formed on an adsorptively protected surface still adhered to the metal after exposure for 128 hrs.

3813. Kryukova, T. A. and Frumkin, A.N. **Retardation of tangential movements of the surface of mercury drops by butyl alcohol solutions.** *Zhur. Fiz. Khim.* **23**, 819-27 (1949).—*C.A.* **43**, 8911*e*.

Hg was dropped from a glass capillary (radius 0.006 cm) into 3 N KCl + 0.003 N $HgCl_2$ at the rate (v) of 1 drop in 0.6 or 2.2 sec. It was cathodically polarized. When the tangential movement of the drop surface was stopped by addn. of gelatin, the current became 2.2 and 4.0. When BuOH was added instead of gelatin, the current was reduced; minima of this current were observed in 0.03 M BuOH and at about -0.7 v. At e.m.f. less than -0.4 v. and above -1.4 v. the effect of BuOH was very small. If the adsorption process were the slowest part of the reaction, the retardation, would have been independent of v; this gave the lower limit for the rate of the adsorption process.

3814. Kuz'min, L. L. and Poroikove, V. A. **Overvoltage of hydrogen on porous iron.** *Zhur. Priklad. khim.* (J. Applied Chem.) **22**, 572-7 (1949).—*C.A.* **44**, 52*d*.

Cathode potentials of pressed, electrolytic, or reduced Fe powder 3.6 x 1.2 x 0.3 cm tablets were measured, at 20 ± 0.2°C, in a 15% KOH soln. in a stream of H_2, against a satd. calomel electrode, at 7 c.d. from 0.5 to 10.0 amp/dm. The tablets were made with 20% (of the wt of the Fe powder) of a 4% soln. of rubber in gasoline; the nature of the binder had no significant influence. Increase of the pressure (from 1000 to 2000 kg/cm^2) at const. temp. (950°C) and time (2 hrs) raised E in all cases, most markedly with the finest reduced Fe powder; this corresponded to a reduction of the porosity from 51 to 36%. Variations of the temp. of pressing, between 600 and 950°C, had no significant effect on E at low c.d. Best results, i.e., lowest overvoltages, were obtained, for electrolytic Fe powder, at pressing temp. 700-800°C, and for the finer reduced powder, at 600°C.

3815. Leidheiser, Henry, Jr. and Meelheim, Richard **The influence of crystal face in the catalytic deposition of cobalt on a single crystal of copper.** *J. Am. Chem. Soc.* **71**, 1122-4 (1949). —*C.A.* **43**, 6063*b*.

Electrolytically polished monocryst. spheres of Cu were immersed in HCOOK solns. of a Co salt at 180-250°C and Co was catalytically deposited on the surface. The relative catalytic activities of the crystal faces of Cu in order of decreasing activity were: (210), (310), (321), and (320); (311) and (211); (100); (331) and (221); (110); and (111). The results were correlated with the spacing between Cu atoms and the spacing between O atoms in the formate mol.

3816. Loshkarev, M.; Krivtsov, A., and Kryukova, A. **A new type of chemical polarization. II. Experimental proof of existence and study of the properties of adsorption layers.** *Zhur. Fiz. Khim.* **23**, 221-31 (1949).—*C.A.* **43**, 5316*b*.

The differential capacity of electrodes in 0.5 N Na_2SO_4 satd. with p-naphthol, thymol, and Ph_2NH was detd. It had a max. for Ag, Cu, Hg, Sn, Bi, and Pb electrodes at the potentials E_3 -1.19, -1.19, -1.20, -1.24, -1.30, and -1.35, v. relative to satd. Hg_2Cl_2 electrode; thus, the potentials at which desorption occurred varied much less than the potentials (E_0) of the zero charge of various metals. Adsorbed films were removed by desorption rather than by reduction, except for PhCOMe and alizarin oil which were both reduced and desorbed.

3817. Loshkarev, M. and Kryukova, A. **A new type of chemical polarization. I. Cathodic deposition of metals on mercury in the presence of additions.** *Zhur. Fiz. Khim.* **23**, 209-20 (1949). —*C.A.* **43**, 5315*i*.

When the voltage applied to a cell Hg | Hg_2Cl_2, satd. KCl | 0.05 N metal sulfate + N H_2SO_4 | dropping-Hg cathode increased, the current strength increased, remained const., and then rapidly increased again. The permeability of adsorbed films of surface-active substances increased when the at. wt of the penetrating ion increased and its charge (hence, the intensity of electrostatic field) decreased.

3818. Machu, W. **Kinetics of the destruction and of the formation of covering layers on metallic surfaces, particularly of phosphate coatings.** *Osterr. Chem.-Ztg.* **50**, 148-57 (1949).—*C.A.* **43**, 9014*h*.

During corrosion the cathodic layers were destroyed under growth of the anodic areas and decrease of the corrosion rate. The rate *k* for iron in 1 *N* Na_2SO_4 soln. = 0.0028, for iron coated with Mn phosphate, and treated with K_2CrO_4, in 3% NaCl soln. *k* = 0.000017 (without K_2CrO_4, *k* = 0.000044) for iron coated with Zn phosphate, in air *k* = 0.000002 - 0.000006. Protective phosphate coatings were formed by deposition at cathodic areas.

3819. MEDALIA, A. I., AND KOLTHOFF, I. M. **Redox recipes. I. Reaction between ferrous iron and peroxides. General considerations.** *J. Polymer. Sci.* **1**, 377-98 (1949).—*C.A.* 43, 8829*c*.

A mechanism with Fe^{++} and OH perhydroxyl radicals as intermediates was presented, which accounted for the exptl. observations in the ferric-Fe^{+++} -catalyzed decompn. of H_2O_2. The reaction between H_2O_2 and Fe^{++} induced the reaction between H_2O_2 and various org. compds.; this induced reaction was a chain reaction that was initiated by the active intermediates (ferryl Fe or OH radical) formed in the primary reaction.

3820. MOSES, SAUL. **The nature of adhesion.** *Ind. Eng. Chem.* **41**, 2338-42 (1949).—*C.A.* **44**, 903*d*.

Data were given on the adhesion of polystyrene deposited from acetone or benzene, Me methacrylate polymer deposited from acetone and MeCOEt, and copolymer of vinyl acetate and vinyl chloride deposited from acetone systems to Al alloy. The adhesion depended on the presence of a fluid or mobile state at or near the film-metal interface.

3821. PALACIOS, JULIO AND VIGNON, MARIA TERESA. **Electrode potentials resulting from adsorption.** *Anales real. soc. espan. fis. y quim.* **45A**, 125-44 (1949).—*C.A.* 44, 9276*i*.

In the cell [Cu/$CuSO_4$ (aq.)/Pt] the current flowed unceasingly and the Pt electrodes became coated with Cu to the extent of about 1 mg/cm^2. Similar phenomena occurred in the cell Zn/$ZnSO_4$ (aq.)/Hg. The potentials of Pt and C electrodes in solns. of $CuSO_4$ and $CuCl_2$ and of Pt, Ag, Fe, and Cu in solns. of $ZnSO_4$ and $ZnCl_2$ were measured. The e.m.f. resulted from the tendency of the electrode to incorporate cations from the soln. into their own crystal lattices.

3822. PATRIE, J. **The mechanism of electrolytic oxidation and the formation of layers of aluminum oxide.** *Rev. aluminum* 26, 397-403 (1949). 27, 3-7 (1950).—*C.A.* 44, 4805*d*.

An Al anode in a d-c circuit was polarized by an anodic oxide film (about 0.1 μ thick) formed as result of the discharge of OH ions on the electrode. The growth of this film was dependent on the superposition of 2 opposing phenomena in the electrode: (1) some OH ions passed through the barrier and deposit on the metallic anode oxidizing the Al, (2) there was an inverse ionization phenomenon depending on the dissolving power of the bath on the Al and the oxidation conditions. These factors det. the thickness of the film formed.

3823. PAULI, WOLFGANG. **The color and constitution of colloidal gold.** *Helv. Chim. Acta* **32**, 795-810 (1949) (in German).—*C.A.* 43, 6885*g*.

Au sols were composed of chloro and bromo as well as chlorohydroxo mixed complexes, not of elementary Au. The color change, red to blue, was due to coagulation of these ions. The coagulation was a 3-step process. To account for the color of colloidal Au a mutual action between colorless ionic surface complexes and the Au particle nuclei was necessary.

3824. PRYOR, M. J. AND EVANS, U. R. **Passivity of metals. X. The mechanism of direct solution of ferric oxide.** *J. Chem. Soc.* **1949**, 3330-6.—*C.A.* 44, 4842*b*.

α-Ferric oxide dissolved comparatively rapidly in HF or concd. HCl, which readily formed sol. complexes with ferric ions. In dil. soln. of HCl, H_2SO_4, which did not easily form these complexes, the rate of soln. fell off with time, and the resulting solns. contained Fe^{++}. The fact that the soln. was the same in dil. solns. of HCl, H_2SO_4, and $HClO_4$ of equiv. concns., and was not influenced by addnl. Cl^-, suggested that the important step in the reaction was the combination of adsorbed H^+ with O ions belonging to the oxide lattice.

3825. RIES, HERMAN, E. JR.; JOHNSON, MARVIN F.L., AND MELIK, JOHN S. **Adsorption-desorption isotherm studies of catalysts. III. Nitrogen and stearic acid adsorption by supported catalysts and their components.** *J. Phys. & Colloid Chem.* **53**, 638-61 (1949).—*C.A.* **43**, 6897*g*.

Unreduced supported Co catalysts were investigated by the low-temp. adsorption of N_2 (B.E.T.) and the adsorption of stearic acid (in benzene soln.). Both the supporting materials proper and the supports coated with Co compds. were studied to det. the effect of support structure on the structure of the supported catalyst. An unsupported catalyst, mostly $CoCO_3$ and the same substance supported on diatomaceous earth, TiO_2 (anatase), silica gel, and Al_2O_3 were investigated.

3826. SHAFRIN, ELAINE G. AND ZISMAN, W.A. **Hydrophobic monolayers adsorbed from aqueous solutions.** *J. Colloid Sci.* 4, 571-90 (1949).—*C.A.* **44**, 2325*h*.

Hydrophobic monolayers were formed on Pt by adsorption of n-alkyl primary amines from aq. solns. The contact angle of the soln. from which the monolayer was formed at the treated Pt surface was measured at room temp. as a function of soln. concn. and pH for the C_4, C_8, C_{12}, C_{14}, and C_{16} amines. The angle varied from 0° to 90°, increasing in general with conc. and reaching a max. at a pH near 10 for the short-chain amines (through C_{12}). The max. appeared at acid conditions for hexadecylamine. The highest contact angle observed with the individual amines increased with chain length, from 52° for C_4 to 89° for C_{16}.

3827. TÖDT, FRITZ. **Effect of local galvanic couples in oxide coatings of metals.** *Arch. Metallkunde* 3, 273-8 (1949).—*C.A.* **44**, 960*c*.

Local electrolytic effects at metal surfaces were either due to the presence of a nobler metal or to oxide films. This action could be measured on the basis of increased rate of soln. with aeration or directly by reading the potential between the aerated metal surface (Fe, Cu, Pt) and a less noble electrode.

3828. Tödt, Fritz. **Electrochemical behavior and rate of formation of oxide films on metal surfaces, especially iron.** *Metalloberfläche* 3, A170-3 (1949).—*C.A.* 44, 2869*h*.

Metals covered with a thin oxide layer formed a galvanic element with Cd in a strong salt soln. until the oxide was reduced. Hence, the total no. of coulombs produced was an indication of the amt. of oxide present. Exposure of Fe for 5 min. in air gave an oxide film of about 200 A.

3829. Veselovskiĭ, V. I. **Photoelectrochemical processes on iron in the presence of hydrogen peroxide.** *Zhur. Fiz. Khim.* **23**, 1095-1105 (1949).—*C.A.* 44, 929*c*.

Cathodically polarized or scraped Fe was not light-sensitive in *N* NaOH. Fe coated with an oxide film (about 100 A thick) by anodic polarization or by heating in air became (in *N* NaOH) less noble on illumination with wave lengths shorter than 460 mμ. In darkness the current I_o between this electrode and a Ag/Ag_2O electrode was very small as long as the polarization voltage V was less than 0.3 v. and rapidly increases with V at greater anodic polarization of Fe. In light, the current I_1 was noticeable at $V = -0.3$ v., increased with V linearly until O_2 evolution starts (at +0.3 v.) and increased more rapidly with V at V more than 0.3 v.

3830. Yoneda, Yukio. **Fundamental research on anodic reaction. II. Activation energy of anodic oxygen-producing reaction on some electrode materials in 0.1 *N* sodium hydroxide.** *Bull. Chem. Soc.* (Japan) 22, 266-73 (1949) (in English).—*C.A.* 45, 4582*a*.

The mechanism of an electrode reaction could be detd. from the activation energy which was independent of the surface area. By using Pt, magnetite, and natural graphite anodes in aq. 0.1 *N* NaOH (carbonate- and chloride-free) and stirring with O_2 the resp. activation energies of the O-producing reactions for the temp. range 25-65 °C were detd. From the overvoltage on Pt, measured potentiometrically 30 min. after closing the circuit, an activation energy of 15.9 ± 2.0 kcal. and α of 0.353 ± 0.017 were calcd.; from the oscillographically measured overvoltage a calcd. activation energy of 13.8 ± 0.6 kcal. and α of 0.488 ± 0.008 resulted. For the magnetite the activation energy was 26.2 ± 3.2 kcal. and α 2.24 ± 0.23.

3831. Audubert, R. and Bonnemay, M. **Overvoltage and adsorption.** *J. chim. phys.* 47, 204-7 (1950).—*C.A.* 45, 7895*h*.

The discharge of H ions on a platinized Pt electrode could take place either directly or through the intermediary of an adsorption process. Exptl. results were best explained with both concepts; at low overvoltages, the adsorption process predominated.

3832. Bryan, J. M. **Action of boiling distilled water on aluminum.** *J. Soc. Chem. Ind.* (London) 69, 169-73 (1950).—*C.A.* 44, 10647*a*.

Protective films on Al were believed to be α-$Al_2O_3.H_2O$ (bohmite). Following an initial rapid reaction between O_2-free boiling distd. water and high-purity Al, the film acquired a limiting thickness of about 2.5×10^{-4} cm (48-hr immersion). H_2 was evolved until the film had acquired its limiting thickness. Oxygen gas had almost no effect on the rate or extent of film formation. High-purity Al (99.9930%) was attacked more vigorously by boiling water and formed thicker films than less pure Al (99.25-99.83%) or alloys of Al with Mn or Mg.

3833. Cook, G. B. and Hudswell, F. **The preparation of thin layers of uranium oxide.** *J. Sci. Instruments* 27, 230-1 (1950).—*C.A.* 44, 10424*d*.

The layers were prepd. on Pt or stainless steel foil. The area to be covered was defined by painting the perimeter with nitrocellulose lacquer. Uranyl acetate dissolved in pyridine was then painted on the foil and was ignited after drying. The thickness of deposit could be detd. by direct weighing.

3834. Dekker, A. J. and Geel, W. Ch. van. **The rectifying properties of the system aluminum-alumina-electrolyte under alternating current.** *Phillips Research Repts.* 5, 303-14 (1950).—*C.A.* 45, 2795*f*.

For an Al_2O_3 film 0.35 microns thick the conduction current (Al neg.) was given by $(i_c) \approx 2 \times 10^{-7} V^2$. The leakage current (Al pos.) was given by $(i_i) \approx 2 \times 10^{-11} V^2$, where (i) was in amp./cm^2 and V was in volts. The system had high capacitance because of the thinness of the oxide film. The structure of the oxide film was not stable, but depended upon the direction of the applied potential. When the Al was pos. the film became stable.

3835. Erbacher, Otto. **The electrostatic hinderance of ion adsorption on metal surfaces.** *Z. Elektrochem.* 54, 369-74 (1950).—*C.A.* 45, 3682*d*.

In the case of ion adsorption on metal surfaces, the Ostwald (Freundlich) isotherm could not be interpreted as the summation of Langmuir isotherms belonging to different active centers, but was conditioned by the electrostatic interaction of the adsorbed ions.

3836. Erdey-Grúz, Tibor. **Oscillographic analysis. The possibilities of a surface investigating method.** *Magyar Kém. Folyóirat* 56, 83-7 (1950).—*C.A.* 45, 3260*d*.

The polarization capacity of a metallic surface depended on the condition of this surface and on the changes occurring thereon. The correlation of the polarization capacity with the changes in potential served as a basis for detg. the conditions of the metallic surface and its changes, even when the surface area was unknown. Examples showed the suitability of the oscillographic method for the study of surface processes of metals.

3837. Fensham, P. J. **Self diffusion in polycrystalline tin.** *Australian J. Sci. Research* 3A, 105-8 (1950).—*C.A.* 45, 411*f*.

The rate of vol. diffusion in polycrystals of tin was in general agreement with the measurements of self-diffusion rates in different crystallographic directions within single crystals. The rate of diffusion along the grain boundaries was generally considerably higher than that of vol. diffusion, except along boundaries between twins or crystals of similar orientation.

3838. FENSHAM, P. J. **Self diffusion in tin crystals.** *Australian J. Sci. Research* **3A**, 91-104 (1950).—*C.A.* 45, 411*d*.

The rate of self diffusion in single crystals of white tin of various orientations was measured by use of the radioactive isotope Sn^{113}. Diffusion was anisotropic, the ratio of the coeffs. parallel and perpendicular, resp., to the tetragonal (*c*) axis being approx. 2 at 180° and 3 at 223°. The anisotropy was discussed in terms of the vacancy mechanism of diffusion.

3839. HAASE, L. W. **Corrosion behavior in very dilute aqueous solutions. IV. Corrosion on copper.** *Werkstoffe u. Korrosion* 1, 390-3 (1950).—*C.A.* 45, 1486*i*.

In dil. aq. solns., Cu had a closely defined dissolving power, which depended only slightly on the state of the Cu, but which caused and limited the formation of inhibiting films within an extended range. Under suitable conditions, a carbonaceous film, which formed on the Cu in water, could be protective, while with water contg. impurities, a local cell action could cause attack on the Cu.

3840. HACKERMAN, NORMAN AND GLENN, E. E., JR. **Orientation of a polyfunctional organic molecule at a steel surface.** *J. Phys. & Colloid Chem.* 54, 497-505 (1950).—*C.A.* 44, 6229*b*.

Electron diffraction patterns of SAE 1020 and evapd. Fe surfaces after adsorption and desorption of alkylpyrrolidinedione (Tretolite Co. K115, mol. wt. 350) at concns. of 0.0001, 0.001, 0.01, 0.1, and 1.0% in Skelly-solve B (hexane, 2-methylpentane and 3-methylpentane mixt) showed firm adsorption in an oriented 2-dimensional layer from the 2 dil. solns. The alkylpyrrolidinedione mol. with the cyclic portion having 3 adjacent polar groups could cover the surface from a 0.0001% soln. if the cyclic portion was flat and from a 0.01% soln. if the cyclic portion was vertical.

3841. HAISSINSKY, M. AND PAPPAS, A. **Isotopic exchange between selenium and its ions in aqueous solutions.** *J. chim. phys.* 47, 506-13 (1950).—*C.A.* 44, 9777*a*.

Tracer expts. with radioactive Se showed that Se atoms from the amorphous solid exchanged rapidly with those in a HCl soln. 0.1 *M* with respect to SeO_2, provided the normality of the acid was 5.5 or greater. The rate of exchange increased with increase in acid strength, reaching a value of 40% in 1 hr, when the HCl was 10 *N*. Measurements at 1°, 16°, and 33°C indicated a temp. coeff. for the exchange corresponding to an energy of activation of 6 kcals. per mole.

3842. KATZ, W. **Velocity of solution of copper in various salt solutions and the mechanism of copper corrosion.** *Werkstoffe u. Korrosion* 1, 393-9 (1950).—*C.A.* 45, 1487*a*.

By means of polarization curves and corrosion current measurements, the Cu corrosion was distinguished as a cathodically regulated process. The thickness of the H atom film on the Cu surface was measured in different salt solns. It decreased with increasing Cu content of the solns., in a manner variable with the different anions. In chloride solns. the thickness of the layer decreased from 36 to a fraction of a layer, and was here the thinnest; for Na acetate the decrease was lowest with a greater layer thickness.

3843. LAITINEN, H. A. AND ONSTOTT, E. I. **Adsorption and reduction of tetrachloroplatinate (II) ion at the dropping-mercury electrode.** *J. Am. Chem. Soc.* 72, 4565-70 (1950).—*C.A.* 45, 4579*f*.

$PtCl_4^{--}$ ion must be adsorbed on the dropping-Hg electrode to be reduced at potentials more pos. than about 1 volt (*vs.* standard calomel electrode). The desorption process did not appear to be reversible, although the desorption half-wave potential was independent of the $PtCl_4^{--}$ ion concn. Added adsorbents shifted the desorption half-wave potential to more pos. values.

3844. LOSHKAREV, M. A. AND GRECHUKHINA, T. N. **Adsorption chemical polarization and cathodic deposition of alloys from noncomplex electrolytes.** *Zhur. Fiz. Khim.* 24, 1502-10 (1950).—*C.A.* 45, 5537*e*.

The electrodeposition of Pb, Cu, Sn-Pb, Cu-Pb, and Cu-Sn was studied. The exptl. technique and the deposition of Sn were described. The work showed the effect of org. agents (phenol, naphthol, aromatic amines) and colloids (gelatin) on the cathodic deposition of metals and alloys from aq. electrolytes without formation of cationic complexes. It was found in all cases that gelatin increased the polarization and improved the quality of the deposit.

3845. LOSHKAREV, M. A. AND KRYUKOVA, A. A. **Changes of polarographic waves under the action of adsorption processes on mercury.** *Doklady Akad. Nauk. S.S.S.R.* 72, 919-22 (1950).—*C.A.* 44, 9827*d*.

Inhibition of the electrode process, as distinct from the mere effect of suppression of surface motion of the Hg, was proper only to a limited no. of surface-active substs., those which formed the closest-packed adsorbed films. Most effective in that respect were homologs of PhOH (xylenols, carvacrol, *m*-cresol, thymol), ethers of PhOH (phenetole, eugenole, anethole), 1 and 2-naphthols, the camphane group (camphor, borneol), secondary and tertiary aromatic amines (diphenylamine, tribenzylamine, diethylaniline), aromatic alcs. ($PhCH_2OH$), methol, etc.

3846. MIGNOLET, J. C. P. **Studies in contact potentials. II. Vibrating cells for the vibrating condenser method.** *Discussions Faraday Soc.* 8, 326-331 (1950).

Cells were described for measuring surface potentials of films adsorbed on evaporated metal deposits. Essentially they were electrically-driven, hollow tuning forks. The accuracy was ±1 or 2mV on individual contact potential measurements and ±10 or 20mV on surface potential determinations.

3847. PATRICK, WALTER A. AND LITTLER, CLARENCE L. **Method of measuring the absolute potential of aqueous half-cells.** *J. Phys. & Coll. Chem.* 54, 1016-27 (1950).—*C.A.* 45, 479*g*.

The abs. potential of a calomel half-cell had been measured. A freshly prepd. electrode was dipped into a soln. contg. a reactive ion and also an identical stationary electrode. A transient current owing to formation of a Helmholtz double layer at the fresh electrode was observed and measured with a cathode ray oscilloscope. Changes in the concn. of the reactive ion led to a change in, and finally, a reversal of the transient current, at which point the p.d. between the electrode and the soln. must be zero.

3848. PATRICK, WALTER A. AND WAGNER, HERMAN B. **Mechanism of oxygen reduction at an iron cathode.** *Corrosion* 6, 34-8 (1950).—*C.A.* 44, 2391*e*.

Expts. were reported with Fe-Hg cells, and a description of the procedure and diagrams of the app. were given. Data on current, c.d., % absorption on cathodic soln., and percent yield of H_2O_2 indicated that the greatest yields of H_2O_2 were obtained in alk. solns. with small c.ds. Possibly H_2O_2 was also formed in acidic solns., but it was more quickly reduced further to the OH ion which reacted to form H_2O.

3849. PRYOR, M. J. AND EVANS, U. R. **The reductive solution of ferric oxide in acid. I. The reductive solution of oxide films present on iron. II. Reductive solution of powdered ferric oxide.** *J. Chem. Soc.* **1950**, 1259-74.—*C.A.* 45, 489*h*.

The soln. in dil. acid of films formed by heat-treatment of Fe was not direct soln. as Fe (III) ions; it was reductive soln. as Fe (II) ions. Thin films dissolved quickly and regularly by uniform cathodic action on the surface; thicker films, slowly and irregularly because of preferential reaction around discontinuities. The rate and the current efficiency of reductive soln. of α-ferric oxide powders diminished with an increase in the temp. of the previous ignition of the oxide, with an increase in the time of reduction, and with an increase in pH of the electrolyte. Results with HCl, H_2SO_4, and $HClO_4$ were practically identical.

3850. STRAZHESKO, D. M. AND TARTAKOVS'KA, B. E. **Electrostatic adsorption of ions in nonaqueous solutions.** *Dopovidi Akad. Nauk Ukraïn. R.S.R.* **1950**, 109-12 (in Ukrainian).—*C.A.* **46**, 324*e*.

Hydrogen and oxygen (air) electrode potentials of platinized Pt were measured in 0.01 *N* solns. of HCl and NaOH in MeOH + H_2O and EtOH + H_2O mixts. of different compns. and in the pure alcs. The reversible H potential varied very little with addn. of the alcs. to H_2O. In contrast, the pos. potential of the irreversible air electrode was strongly lowered in the presence of alcs., particularly EtOH. The org. substance decreased strongly the electrostatic adsorption of anions.

3851. SUTRA, GENEVIÉVE. **Hydrogen overvoltage.** *Compt. rend.* **230**, 644-5 (1950).—*C.A.* 44, 5728*g*.

The irreversible deposition of H_2 was considered to occur according to the following mechanism: Adsorption of protons on the surface of the cathode occurred until a certain concn. was reached and the surface became satd. The liberation of H_2 began at this point. There existed a fixed ratio, K, between the free and adsorbed protons, which varied with the affinity of the metal for protons.

3852. SUTRA, GENEVIÈVE. **Hydrogen overvoltage.** *Compt. rend.* **230**, 749-50 (1950).—*C.A.* 44, 5728*i*.

The relation between the overvoltage and the work required to ext. the electrons was compared for a no. of unpolished metal surfaces, and no correlation existed. (Pt, Au, Ag, Ni, Mo, Sn, graphite, Ta, Hg.) The work function (x) was const. at 5 v. The heat of adsorption was shown to be somewhat variable with the overvoltage.

3853. SUTRA, GENEVIÉVE. **Hydrogen overvoltage in the course of electrolysis.** *Compt. rend.* **230**, 842-4 (1950).—*C.A.* 44, 5729*a*.

The slow liberation of H_2 at the cathode was considered a reversible process. It was shown that the overvoltage was independent of the H ion concn. of the electrolyte, and had the form $n = C \log 1/s$, where s was the soly. of protons in the cathode. The soly. of H in Co, Ni, Cu at 600-1000°K. followed the relation $\ln s = a - b/T$.

3854. TÖDT, FRITZ. **The current output of galvanic cells caused by transfer of oxygen as a measure of the oxidation and initial corrosion of metals.** *Werkstoffe u. Korrosion* **1**, 49-51 (1950).—*C.A.* 44, 4806*a*.

Studies were made on the amt. of O_2 produced at a Pt electrode, and an attempt was made to explain the initial corrosion of metals on the basis of a galvanic cell reaction. The metal surface was charged with amts. of O_2 lying between 10^{-9} and 10^{-12} g equivs./cm^2.

3855. TÖDT, FRITZ. **The formation and the electrochemical decomposition of the oxide layer on metals.** *Z. Elektrochem.* **54**, 485-94 (1950).—*C.A.* 46, 7905*g*.

Expts. were carried out to show that measurements of current intensity in a cell with a Pt cathode and an unpolarizable anode allowed the detn., with great accuracy (down to 10^{-12} mol./cc.), of the amt. of O_2 absorbed at the cathode in the form of oxide layers. The cathode depolarization by O_2 was detd. quant., and the corresponding quantity of electricity allowed the calcn. of the amt. of O_2 absorbed by the metal cathode and the detn. of the thickness of the oxide film. At the same time, the method could be used for detn. of the amt. of dissolved O_2 with a precision superior to any chem. method and without taking samples of the soln.

3856. TÖDT, FRITZ. **The reaction of atmospheric oxygen dissolved in water on metal surfaces.** *Chem.-Ztg.* 74, 254-6 (1950).—*C.A.* 46, 8546*b*.

Except in the cases of Cr and Al, on which an O or oxide coating served to protect from attack, a simple electrochem. model with the oxide layer as cathode and the ground metal as anode served for the theoretical explanation of O corrosion of metals. Two independent methods of expt. led to this conclusion. The elec. output of a Pt, Cu, or Ni cathode was found to depend on the quantity of electrochemically effective O or oxide at the surface. An oxide layer on a Pt surface yielding as little as 10^{-7} coulomb/cm^2 could be measured. Also, an O-content of 3 parts per billion could be measured.

3857. Wakkad, S. E. S. El and Hickling, A. **Anodic behavior of metals. VI. Cobalt.** *Trans. Faraday Soc.* **46**, 820-4 (1950).—*C.A.* **45**, 2796*b*.

The initial build-up of anodic polarization at a Co anode was detd. with the cathode-ray oscillograph. In alk. solns., CoO was first formed but this was further oxidized to Co_2O_3 when the surface was only partly covered with the lower oxide. In hot concd. alkali solns. continuous soln. of CoO to give CoO_2^{--} ions may occur. In the passivation of a Co anode the Co_2O_3 formed a protective layer, essentially 1 mol. thick, which was further oxidized to CoO_2 before O evolution commenced.

3858. Wakkad, S. E. S. El and Wakkad, Mrs. S. E. S. El. **Oxide film formation on the surface of metals in aqueous solutions and evaluation of their standard potentials. II. Mercury electrode.** *J. Phys. & Colloid. Chem.* **54**, 1371-83 (1950).—*C.A.* **46**, 7911*a*.

The behavior of the Hg electrode in solns. varying from pH 0 to pH 14 and initially free from Hg^{++} was studied. The true thermodynamic potential (e_{25}) of a standard Hg electrode out of contact with air was 0.7971 v. and 0.7988 v. in the presence of air.

3859. Weiser, Harry B. and Merrifield, Paul. **The concept of critical zeta potential for hydrophobic sols.** *J. Phys. & Colloid Chem.* **54**, 990-8 (1950).—*C.A.* **45**, 419*i*.

Moving—boundary expts. on Au and Se sols showed that the ζ-potential as computed by the Helmholtz-Smoluchowski equation was the crit. stabilizing factor for monodisperse lyophobic colloids.

3860. Wickert, Kurt. **The significance of the activity of metal surfaces in electrochemical reactions.** *Metalloberfläche* **4**, A181-6 (1950).—*C.A.* **45**, 2795*h*.

A reaction with metal surfaces was possible in the presence of electron receptors only, since the metal always acted as electron donor. Free electron transfered between metal and electron acceptor was necessary for electrochem. reactions. It was found that in this case also, the surface prepn. was very important for Evans elements with low electrolytic resistance. Passive surfaces did not lose metal cathodically, and metals whose activity surpassed a certain value lost more weight cathodically than anodically. The Evans principle should be corrected to allow for this activity.

3861. Wickert, Kurt; Böhnert, E., and Pilz, H. **The solubility of iron in hydrochloric acid in the first second.** *Werkstoffe u. Korrosion* **1**, 106-7 (1950).—*C.A.* **44**, 5683*i*.

In test of the soly. of Armco Fe in HCl, both with and without an inhibitor, $(CH_2)_6N_4$ was used as the inhibitor in concns. up to 0.75%. The action of the inhibitor was effective only in later sec, if an active surface was present. On polished surfaces there was no great difference in the action of HCl during the first sec, with or without inhibitor. The inhibitor appeared to form a film on the metal surface; the time required for this film formation was an important factor in decreasing soly.

3862. Wolstenholme, G. A. and Schulman, J. H. **Metal-monolayer interactions in aqueous systems. II. Adsorption of long-chain compounds from aqueous solution onto evaporated metal films.** *Trans. Faraday Soc.* **46**, 488-97 (1950).—*C.A.* **44**, 9773*f*.

Evapd. films of Cu and Ag with hydrophilic surfaces were immersed in aq. solns. of surface-active long-chain compds. and the contact angles detd. Na dodecyl sulfate was adsorbed on the surface of Cu films that were exposed to O_2, and the rate of increase of the contact angle depended on the temp. and on the concn. of long-chain ions in soln. Sol. fatty acids formed adsorbed monolayers on Cu surfaces that had been exposed to air, but not to O_2 alone and not on Ag surfaces that had been exposed to O_2 or air. Adsorption on evapd. metal films was extremely sensitive to impurities in air, possibly CO_2 and S-contg. compds.

3863. Bateman, J. B. and Harris, Margaret W. **Measurement of properties of thin films on chromium by the reflection of polarized light.** *Ann. N.Y. Acad. Sci.* **53**, 1064-81 (1951).—*C.A.* **46**, 4876*d*.

Results were presented of polarization measurements on aliphatic acid layers transferred to Cr by Blodgett's method. Glass slides coated with Cr were examd. in a polarizing assembly suitable for the measurement of elliptically polarized light. The desired no. of paired aliphatic acid monolayers was then transferred to the slide, and the polarimetric measurements repeated.

3864. Bowden, F. P. and Moore, A. C. **Physical and chemical adsorption of long-chain compounds on radioactive metals.** *Trans. Faraday Soc.* **47**, 900-8 (1951).—*C.A.* **46**, 2372*c*.

A metal foil about 0.001 cm thick and a few cm^2 in area was used as the adsorbing surface. It was irradiated with neutrons and washed until no further radioactivity was extd. The adsorption of a long-chain fatty acid, alc., or ester on Pt and Au was phys. On Zn, Cd, or Cu the adsorption could be followed by chem. reaction. The metal soap formed was physically attached to the surface and in the presence of solns. of the adsorbate a relatively thick film of soap may be formed adjacent to the metal surface.

3865. Brumbaugh, Robert J. **Corrosion resistance of zirconium-effect of oxygen, nitrogen, carbon, and hafnium.** *Ind. Eng. Chem.* **43**, 2878-80 (1951).—*C.A.* **46**, 6070*e*.

Corrosion tests were carried out with Zr and Ti contg. small amts. of impurities at 35°C, in quiescent solns. of NaOH, NH_4OH, H_2SO_4, HNO_3 of various concns. Standard grade Zr (2.5% Hf) was less resistant than low-Hf Zr. Corrosion resistance of Zr was slightly superior to that of Ti in most media and quite superior in dil. H_2SO_4 and in both dil. and concd. HCl. Addn. of small amts. of O_2, N_2, and C resulted in a slight decrease in corrosion resistance of low-Hf alloy with the effect being most pronounced in concd. HCl. N_2 alloys of Zr were less resistant than either carbon or oxygen alloys.

3866. Cook, E. L. and Hackerman, Norman. **Adsorption of polar organic compounds on steel.** *J. Phys. & Colloid Chem.* 55, 549-57 (1951).—*C.A.* 45, 5590*c*.

Adsorption from a benzene soln. of higher-mol. aliphatic acids, amine alcs., and esters on SAE 1020 steel powder (specific surface area of 0.10 m^2/g) exhibited irreversible and reversible adsorption. Total adsorption and irreversible adsorption were in the following decreasing order: acids, amines, alcs., esters. The total adsorption was a function of mol. wt and polar group, and exceeded the calcd. amt. necessary for a complete close packed monolayer by 20-70%. The extent of the irreversible adsorption was independent of the above factors and yielded incomplete surface coverage.

3867. Daniel, S. G. **Adsorption on metal surfaces of long-chain polar compounds from hydrocarbon solutions.** *Trans. Faraday Soc.* 47, 1345-59 (1951).—*C.A.* 46, 6459*d*.

The adsorption of the alc. and ester was 90% or more complete in 3 min. for all metals examd. Pt, Au, Ag, Ni, Fe, Cr, Sn, and Al gave time-adsorption curves similar to those obtained with the alc. and ester. The adsorption of the acids on Cu, Pb, Zn, and Cd increased continually with time. When reaction between adsorbate and the metal surface occurred, it was the phys. properties of the reaction products, the metal soaps, that detd. the observed behavior.

3868. Evans, U. R. and Davies, D. E. **The pitting of zinc by distilled water and dilute solutions.** *J. Chem. Soc.* **1951**, 2604-14.

The pitting occurred as a result of electrolytic effects. A necessary condition for pitting: small anodic areas shall be surrounded by anodic and large cathodic areas. The ratio of effective cathodic area to anodic area determined the intensity of attack, which explained the sharp pitting produced by distilled water. For concentrated solutions, the total corrosion was greater, but the attack less intense. The corrosion products were oriented zinc oxide, some beta-hydroxide, and negatively charged collodial particles.

3869. Frumkin, A. N.; Iofa, Z. A., and Bagotskiĭ, V. S. **Reply to N. I. Kobozev.** *Zhur. Fiz. Khim.* **25**, 1117-31 (1951).—*C.A.* 46, 6527*g*.

From the theoretical standpoint, desorption of at. H was ruled out because, at a c.d. of 0.1 $amp./cm^2$ with $\eta = 1.3$ v., a calcn. showed that the surface coverage θ was $1.8.10^{-11}$; then the velocity of desorption was $0.8.10^{-13}$ $mol./cm^2$ sec, which corresponded to $0.8.10^{-8}$ $amp./cm^2$. Rough calcns. showed that electrochem. desorption, $H_a + H_3O^+ + e \rightarrow H_2 + H_2O$; or recombination, $2H_a \rightarrow H_2$, are much more rapid processes than $H_a \rightarrow H$.

3870. Gerischer, Heinz. **Alternating-current polarization of electrodes with a potential-determining step for equilibrium potential.** *Z. physik. Chem.* **198**, 286-313 (1951).—*C.A.* 46, 4934*c*.

The electrode was considered as a double-layer condenser with a parallel kinetic polarization resistance. The latter could be divided into a contribution arising from the discharge process and another from transport and reaction processes of substances participating directly in the discharge process. Specific cases treated were: pure diffusion, diffusion accompanied by a homogeneous reaction, and diffusion accompanied by a heterogeneous reaction, such as adsorption.

3871. Grahame, David C. **The role of the cation in the electrical double layer.** *J. Electrochem. Soc.* **98**, 353-50 (1951).—*C.A.* 45, 10101*b*.

The differential capacities of 0.1 *N* solns. of the chlorides of Li, Na, K, Rb, Cs, H, NH_4, Mg, Ca, Sr, Ba, Mn, Co, Ni, Al, La, and Pr against a Hg surface were measured at various potentials at 1000 cycles per sec. The data showed that the nature of the cation made only a very small difference in the differential capacity of the elec. double layer.

3872. Grubitsch, Heribert. **The measurement of oxide films on platinum.** *Werkstoffe u. Korrosion* 2, 85-9 (1951).—*C.A.* 45, 7453*i*.

The O-covering of the Pt surface was proportional to the abs. surface, not to the active surface. It was indicated that the proportionality assumed by Tödt between the O-covering or current strength and the disconnect-time of a Pt electrode in an O-contg. electrolyte was in error.

3873. Grubitsch, Heribert and Väyrynen, Hilkka. **The solution rate of iron in 0.1 *N* hydrochloric acid in the first seconds.** *Werkstoffe u. Korrosion* 2, 362-5 (1951).—*C.A.* 46, 2889*b*.

The increased soln. rate in 0.1 *N* HCl in the first few sec. was due to the presence of an oxide coating in the case of polished test specimens. Tests on specimens free of oxide (reduced in H_2) showed an increase in the initial soln. rate in both aq. and ethereal HCl.

3874. Hickling, A. and Wilson, W. H. **The anodic decomposition of hydrogen peroxide.** *J. Electrochem. Soc.* **98**, 425-33 (1951).—*C.A.* 46, 43*h*.

By using anodes of Pt, platinized Pt, Ni, Au, and graphite, H_2O_2 was decompd. anodically under all conditions except at very high c. ds. The process postulated for decompn. in alk. solns. was $HO_2^- = H^+ + O_2 + 2e^-$. This reaction took place rapidly and was diffusion controlled, beginning at low anodic potentials. The process was independent of the electrode material. In neutral or acid solns. however, the processes proceeded at potentials about 10 times higher than in alk. solns.

3875. Johnston, R. J. and Ubbelohde, A. R. **A wedge effect at amalgam-electrolyte surfaces.** *Proc. Roy. Soc.* (London) **A206**, 275-86 (1951).—*C.A.* 47, 3727*g*.

When amalgams were formed by discharge of Li^+, Na^+, K^+, Ca^{2+}, Ba^{2+}, Mg^{2+}, NH_4^+ at a Hg cathode in a glass vessel, at a min. potential characteristic of each, a wedge of electrolyte penetrated between the amalgam and the glass. This effect was not observed with Ag^+, Zn^{2+}, Cd^{2+}, or H^+. There was a very strong adsorption of discharged metal atoms at the interface. A theoretical calcn. showed that a large drop in γ was assocd. with large metal atom polarizability.

3876. KAHAN, GEO. J. **Hydrophobic films on solid surfaces.** *J. Colloid Sci.* 6, 571-5 (1951).—*C.A.* 46, 2876*g*.

Hydrophobic films were formed on Pt by immersion in 0.1% aq. K stearate of pH = 9.5 and various aq. long-chain quaternary ammonium halides over the pH range 1.5-11.0. In contrast hydrophobic films could be formed on glass only with the quaternary ammonium compds. The formation of hydrophobic films on Pt by either cationic or anionic agents is prevented by pretreating the Pt with $SnCl_2$ or Na metasilicate solns.

3877. KAPPANNA, A. N. AND DEORAS, BHANU RAMCHANDRA. **Anodic oxidation of formate ion.** *J. Indian Chem. Soc.* **28**, 287-94 (1951).—*C.A.* **46**, 6521*i*.

At low c.d., CO_2 was the only gaseous product in the anodic oxidation of formate ion at 30°C, with HCOONa and HCOOH solns. and a Pt anode. Above 12.5 ma./cm^2 O_2 evolution started while at 50 ma./cm^2, CO and H_2 were obtained.

3878. LOSHKAREV, M. A. AND KRYUKOVA, A. **Change in polarographic waves under the influence of adsorptive processes on mercury.** *Zhur. Anal. Khim.* 6, 166-77 (1951).—*C.A.* 45, 8919*e*.

The effects studied were those of gelatin, xylidine, benzyl alc., camphor, carvacrol, methyl blue, β-naphthol, menthol, and tribenzylamine. Formation of adsorbed layers changed both the shape and the position of polarographic waves of Cu, Cd, Cr, and Sn in H_2SO_4. This was caused by hampering surface movement of the Hg as well as by blocking electrode processes.

3879. MACGILLAVRY, D.; SINGER, J. J. JR., AND ROSENBAUM, J. H. **Metal-solution potentials of nickel in foreign-ion solutions.** *J. Chem. Phys.* **19**, 1195-2202 (1951).—*C.A.* **46**, 1370*e*.

Ni showed stationary potentials in KOH and phosphate buffer solns. when O_2 was excluded. The stable potentials were reversible with respect to a change of pH. Ni was unable to displace H_2 from 0.1 M H_3PO_4 soln.; Ni dissolved only on admission of air.

3880. MACKOR, E. L. **The properties of the electrical double layer. I. Thermodynamics of the double layer on silver iodide and mercury.** *Rec. trav. chim.* **70**, 663-74 (1951) (in English).—*C.A.* **46**, 6463*c*.

A comparison of thermodynamically derived equations for various parameters of the double layer on AgI and on the polarized Hg electrode emphasized the similarities of these double layers and led to a better understanding of the AgI system.

3881. MACKOR, E. L. **The properties of the electrical double layer. III. The capacity of the double layer on mercury and on silver iodide.** *Rec. trav. chim.* **70** 763-83 (1951).—*C.A.* 46, 6463*e*.

Data on the capacity of the Hg electrode in NaF solns. were interpreted by the use of the double layer. The adsorptions of $AgClO_4$ and of NaI on AgI from H_2O, acetone, and 25 vol. % acetone, resp., were detd. electrometrically. Analogies with the Hg electrode were used to calc. the capacities of the mol. condenser on AgI in these solns.

3882. MIZUGUCHI, JUN. **Surface action of a lead peroxide electrode in electrolytic oxidation. III.** *J. Electrochem. Soc. Japan* 19, 380-3 (1951).—*C.A.* 46, 4931*c*.

Some org. compds. such as glucose, formalin, gluconic acid, oxalic acid, and formic acid were electrolyzed in a 5% H_2SO_4 soln. with Pt and Pb-PbO_2 anodes, resp., and the oxidation products were estd. In spite of the fact that the O-overvoltage of a PbO_2 anode was nearly equal to or lower than that of Pt, the oxidation power of a PbO_2 anode was much higher than that of Pt.

3883. UNO, SHŌHEI AND ICHIJI, NAOJI. **The freezing of gold, platinum, and arsenious sulfide sols. I.** *J. Chem. Soc. Japan*, Pure Chem. Sect., 72, 588-90 (1951).—*C.A.* 46, 5400*h*.

The coagulation of the sols of Au, Pt, and As_2S_3 resulting from freezing-thawing was studied. Urea showed protective action for the sols against the action of freezing-thawing.

3884. UNO, SHŌHEI AND ICHIJI, NAOJI. **The freezing of gold, platinum and arsenious sulfide sols. II. Protective action of hydrophilic colloids against the coagulation caused by freezing.** *J. Chem. Soc. Japan, Pure Chem. Sect.*, 72, 607-10 (1951).—*C.A.* 46, 5932*e*.

Freezing Au no. was defined as the wt in mg of the colloid added to 10 ml of sol. that prevented the color change of the colloid with freezing. For the sake of differentiation, Zsigmondy's Au no. was denominated as NaCl-thawing Au no. Both values were detd. for hydrophilic sols of gelatin, casein, agar, gummi arabic, egg white, sodium oleate, potato starch, dextrin, sol. starch, and sodium alginate, against the sols of Au, Pt, and As_2S_3.

3885. UNO, SHŌHEI; ICHIJI, NAOJI, AND KOBAYASHI, AKIO. **The freezing of gold, platinum and arsenious sulfide sols. III. Protective action of alcohols, sugars, and urea against the coagulation caused by freezing. IV. Factors that determine the freezing gold numbers of alcohols, sugars, or urea, and the possibility of concentration of sols by freezing.** *J. Chem. Soc. Japan, Pure Chem. Sect.* 72, 877-80; 880-2 (1951). —*C.A.* 46, 6465*g*.

The coagulation of Au, Pt, or As_2S_3 sols on thawing was prevented by the presence of alcs., sugars, or urea. The protecting action of alcs. from MeOH to raffinose was studied. The protecting action of alcs., sugars, or urea changed with the modes of freezing and the properties of sols.

3886. VETTER, KLAUS J. **The condition of passive iron, particularly in nitric acid.** *Z. Elektrochem.* 55, 274-80 (1951).—*C.A.* 45, 9948*g*.

The slight corrosion of passive Fe was detd. and found to be independent of the potential of the Fe. The addn. of Cl^- increased the corrosion. A.C. measurements gave similar values for the capacity of the double layer (55 microfarads/cm^2) in concd. HNO_3 as with Pt.

3887. ANTROPOV, L. I. **The nature of cathodic reactions.** *Zhur. Fiz. Khim.* **26**, 1688-93 (1952).—*C.A.* 47, 4767*c*.

The usual cathodes belong to 2 groups. In one group (Pt, Pd, Ni, and Co) the rate of H_2 evolution was limited by the rate of recombination of H atoms. The H-overvoltage was independent of pH, and the concn. *c* of H atoms in the cathode surface was greater than corresponds to equil. The electrolytic H was markedly absorbed, and unsatd. org. compds. were cathodically hydrogenated (by the H adsorbed on the cathode) while polar groups were reduced with difficulty. In a second group (Hg, Zn, Pb, and Mg) the rate of H evolution was limited by the rate of discharge of H^+.

3888. Baker, Hayward R.; Shafrin, Elaine G., and Zisman, Wm. A. **The adsorption of hydrophobic monolayers of carboxylic acids.** *J. Phys. Chem.* **56**, 405-12 (1952).—*C.A.* **46**, 7399*d*.

An adsorption technique was extended to the study of monolayers physically adsorbed on Pt from aq. solns. of varying concns. of various mono- and dicarboxylic acids. The conditions for max adsorption lie between pH 4 and 6. Both the shape of the contact angle-pH curves and the positions of the points of inflection agreed well with the theoretical results previously predicted.

3889. Benesch, Ruth E. and Benesch, Reinhold. **The role of adsorption in the reduction of organic mercury compounds at the dropping-mercury electrode.** *J. Phys. Chem.* **56**, 648-53 (1952).—*C.A.* **46**, 9450*i*.

It was shown that the product resulting from the addn. of one electron to certain org. Hg compds. was adsorbed at the dropping-Hg electrode. The no. of mols. adsorbed per unit area was detd. by several methods with good agreement. Expts. were made with PhHgOH showing that the wavelike irregularity on the 1st wave was caused by the adsorption of reduction products on the Hg surface. The height of the prewave had no significant temp. coeff. between 0° and 63°C; this again confirmed the adsorption phenomena.

3890. Berwick, I. D. G. and Evans, U. R. **The cause of the chemical resistance of stainless steel.** *J. Appl. Chem. (London)* **2**, 576-90 (1952).—*C.A.* **47**, 1562*i*.

Austenitic steels were studied electrochem. The theory that the passivity of stainless steels was due to a physically adsorbed layer of O_2 was tested. Below a certain concn. of O_2 stainless steel never became passive; above this concn., the reciprocal of the time needed was a linear function of the O_2 added. This indicated that an oxide film was formed according to the logarithmic law. A trace of O_2 was needed to prevent attack on stainless steel by dil. acid, and passivity sometimes broke down in plants at inaccessible corners where renewal of O_2 was insufficient.

3891. Bockris, J. O'M. and Azzam, A. M. **Kinetics of the hydrogen-evolution reaction at high current densities.**
Trans. Faraday Soc. **48**, 145-60 (1952).—*C.A.* **46**, 8543*a*.

H_2 evolution as a function of electrode potential was detd. up to c.d. > 100 amp./cm^2. The overpotential was detd. on Hg, W, Ag, Ni, Pt, and Pd electrodes in 5 *N* HCl at c.ds. from 10^{-3} to about 100 amp./cm^2. Combination of at. H was not the rate-detg. process at c.ds. above those of the order of 10 amp./cm^2 on any metal. On Hg electrodes the path was slow discharge followed by rapid electrochem. desorption; that on Ni was slow discharge followed by the at. combination desorption.

3892. Bockris, J. O'M. and Pentland, N. **Mechanism of hydrogen evolution at copper cathodes in aqueous solutions.** *Trans. Faraday Soc.* **48**, 833-9 (1952).—*C.A.* **47**, 3725*f*.

Purified solns. of 0.0001 - 0.1 *N* HCl and 0.005 - 0.15 *N* NaOH were used from 10° to 40°C over a c.d. range of $10^{-8} - 10^{-2}$ amp./cm.^{2} In alk. soln., discharge from Na^+ was negligible under exptl. conditions. The desorption step was catalytic combination of H atoms at low c.d.; at higher c.d. desorption by the electrochem. step may become important.

3893. Bonnemay, M. **The poisoning of hydrogen electrodes.** *J. chim. phys.* **49**, No. 7-8, 142-6 (1952).—*C.A.* **47**, 980*i*.

Platinized Pt electrodes were poisoned by acting as anodes in an electrolysis of HCl, under conditions evolving Cl_2. The effect of poisoning conditions on the current-overpotential curves when the electrodes were used as H electrodes was studied. Temp. of poisoning and of measurement had no effect. The same quantity of electricity did not give the same degree of poisoning, since this also increased with the poisoning potential. The mechanism of poisoning may be due to the occupation of adsorption sites on the Pt by Cl, so that the discharge of H could only occur without adsorption.

3894. Bonnemay, Maurice; Makram, Helmy, and Royon, Jean. **The diffusion of ions across metallic coatings.** *Compt. rend.* **235**, 955-7 (1952).—*C.A.* **47**, 4175*d*.

The porosity of electrodeposited metal coatings was examd. by 2 methods. The potential of a Cu electrode plated with Cr and immersed in 2 *N* $CuSO_4$ was detd. as a function of time and Cr thickness. In the other method Cu was activated by neutron irradiation, plated with Cr, immersed in a $CuSO_4$ soln. and the increase of Rd-Cu in soln. detd.

3895. Carmo, Anta, Maria do and Cottin, Maurice. **Isotopic exchange between silver metal and its ions in solution.** *Compt. rend.* **234**, 1686-8 (1952).—*C.A.* **46**, 10778*b*.

Ag^{110} was placed in a 0.2 *M* soln. of $AgNO_3$ for a no. of hrs at 100-150°C. The phases were then sepd., and the soln. was analyzed for Ag^{110}. The amt. of exchange increased with the quantity of metal originally present, the temp., and the time of contact.

3896. Danon, J. and Haïssinsky, M. **Electrodeposition from very dilute solutions and heterogeneity of the electrode surface.** *J. chim. phys.* **49**, C123-30 (1952).—*C.A.* **46**, 4934*i*.

The crit. potential for the cathodic deposition of Bi on Au (previously polarized) varied with the concn. according to Nernst's law of electrochemistry down to about 3×10^{-16} *N*. Without previous polarization the deposition at this concn. was characterized by an undervoltage. The distribution of Bi between a nitrate soln. of Bi^{+++} (10^{-12} to 8×10^{-7} *N*) and a Ag electrode at potentials equidistant from the crit. potential followed 2

Freundlich isotherms, one of which had an exponent less than 1 at very low concn. and the other an exponent larger than 1.

3897. EVANS, U. R. AND BERWICK, I. D. G. **Passivity of metals. XI. Anodic behavior of iron oxide films.** *J. Chem. Soc.* **1952**, 3432-7.—*C.A.* 47, 1555*e*.

The visible oxide film on Fe was immediately auto-reduced by dil. H_2SO_4; anodic polarization preserved the film and O_2 was evolved. During anodic treatment, the film acquired a charge of excess O in its outer layers; this must be removed from the whole surface before localized reduction of the ferric oxide could start.

3898. FRUMKIN, A. N. **Adsorption of organic substances and electrode processes.** *Doklady Akad. Nauk S.S.S.R.* **85**, 373-6 (1952).—*C.A.* **46**, 10956*i*.

Adsorption of org. substances on electrodes was classified: (1) The electrode process, in the absence of an adsorbed layer, was detd. by the rate of the reaction not by the supply of the reactant, e.g. the discharge of H^+ ions. (2) The reaction in the absence of an adsorbed layer was fast enough for the chem. polarization to be negligible in comparison with the concn. polarization. (3) The adsorbed layer could, by inhibiting the tangential motion, affect the current intensity without altering significantly the rate of the reaction itself. (4) The adsorbed layer opposed the penetration of the reaction particles to the electrode.

3899. GRAHAME, D. C.; POTH, M. A., AND CUMMINGS, J. I. **The differential capacity of the electrical double layer The role of the anion.** *J. Am. Chem. Soc.* **74**, 4422-5 (1952).—*C.A.* 47, 28*b*.

There was a strong correlation between the shape of the capacity curves and the soly. of the corresponding Hg(I) salts. Anion pairs which exhibited the same general soly. relations (NO_3^- ClO_4^-, CO_3^{--}, OH^-) also showed similar capacity curves. The results were used to calc. the surface charge d. of the elec. double layer.

3900. GREGORY, J. N.; HILL, J. F., AND MOORBATH, S. **Diffusion of thoron in solids. III. Diffusion and recoil in multimolecular films of barium stearate by emanating-power measurements.** *Trans. Faraday Soc.* **48**, 643-51 (1952).—*C.A.* **47**, 977*c*.

Films of Ba stearate on Pt slides, contg. 1 or 2 layers of equil. Rd-Th, Th X, were investigated as a function of temp. and thickness of the layer. The multilayer thickness at which the recoil fraction of the emanating power diminished to zero was a direct measurement of the recoil range of Th from Th X.

3901. HILLSON, P. J. **Adsorption and hydrogen over-voltage.** *J. chim. phys.* **49**, C88-96; *Trans. Faraday Soc.* **48**, 462-73 (1952).—*C.A.* **46**, 4933*i*.

The strength with which surface-active agents were adsorbed on metallic electrodes on which H_2 was being evolved was studied by the effect which they had upon overvoltage and the capacity of the electrodes. The adsorbates studied were hexyl alc., caproic acid, hexylamine hydrochloride, and *p*-toluenesulfonic acid. The electrode metals were Ni, W, Ag, Ta, and Au. The metals differed considerably in their behaviors toward the adsorbed materials. These differences were correlated with the energy of adsorption of H_2 and O_2 on the metals.

3902. IOFA, Z. A.; LYAKHOVETSKAYA, E. I., AND SHORIFOV, K. **Influence of halide ions on the adsorption of organic cations on the surface of iron.** *Doklady Akad. Nauk S.S.S.R.* **84**, 543-6 (1952).—*C.A.* **46**, 9378*c*.

At small polarizations, $[(iso\text{-}Am)_4N]_2SO_4$ in pure 1 *N* H_2SO_4 had almost no effect on either the cathodic or the anodic polarization of pure Fe; at higher polarization, with increasing adsorption of the org. compd., the overvoltage of H discharge increased. On addn. of 1 *N* HCl, the surface charge of the Fe became more neg., the $(iso\text{-}Am)_4N^+$ ions were more easily adsorbed and, as a consequence, the cathodic and anodic reactions were considerably slowed down. This point of view was borne out by direct detns. of the adsorption of $(PhCH_2)_3N$ in 1 *N* H_2SO_4 on Fe powder prepd. by decompn. of $Fe(CO)_5$ and reduced in H_2 at 350-400°C. The surface area of the Fe powder was at least 0.4×10^4 cm^2/g.

3903. ITO, GORŌ. **Effects of surface conditions of aluminum on its corrosion.** *Repts. Sci. Research Inst.* (Japan) **28**, 220-4 (1952).—*C.A.* 47, 4271*e*.

Com. pure Al plates 1 mm thick (annealed 30 min. at 400°C) were polished with emery paper or electrolytically, and the p.d. between each treated Al plate and a 1 *N* standard colomel cell in 3% NaCl detd. The various increases observed of the p.d. with time (sec) after different treatments were attributed to the presence or formation of Al_2O_3 surface films, between which (through fissures) and the metal surface some polarization seemed to have occurred.

3904. KOBOZEV, N. I. **The adsorption theory of hydrogen overvoltage. I. Overvoltage and the energy of the bond Me—H. II. Desorption of hydrogen from polarized cathodes.** *Zhur. Fiz. Khim.* 26, 112-34; 438-50 (1952).—*C.A.* 47, 4766h.

H_2 taken up by cathodes such as Hg (high overvoltage) left these chiefly by emission of H atoms from metal hydrides. Chem. recombination of H atoms was probably only when the degree of coverage of the metal surface by H atoms was great.

3905. KOVALENKO, P. N. AND BAGDASAROV, K. N. **Electrode polarization in the electrolysis of copper in the oxalate buffer solution.** *Zhur. Fiz. Khim.* 26, 605-10 (1952).—*C.A.* 47, 3722*f*.

The polarization *E* during cathodic deposition of Cu on a Pt grid was different from that on dropping Hg. The large *E* on Pt must have been due to retarded crystn. of Cu. The stability consts. of $[Cu(C_2O_4)_2]^{2-}$ and $[Cu(C_2O_4)_3]^{3-}$ were approx. 8×10^{-8} and 12×10^{-10}.

3906. LOSHKAREV, M. A. AND KRYUKOVA, A. A. **Effect of adsorbed films on the discharge of univalent metals on mercury.** *Zhur. Fiz. Khim.* **26**, 731-6 (1952).—*C.A.* 47, 3722*i*.

$(PhCH_2)_3N$ and $(Bu_4N)_2SO_4$ 0.005 *M*) greatly lowered the limiting current of Tl^+ (from 0.05 *N* Tl_2SO_4 + 6 *N* H_2SO_4) and Ag^+ (from 0.025 *N* Ag_2SO_4 + 6 *N* H_2SO_4) at 25°C and −15°C; at −15°C also, camphor slightly lowered the current. $PhNH_2$ (0.5 *M*) also retarded discharge of Ag^+ on dropping Hg.

3907. LOVELAND, J. WEST AND ELVING, PHILIP J. **Application of the cathode-ray oscilloscope to polarographic phenomena. I. Differential capacity of the electrical double layer.** *J. Phys. Chem.* 56, 250-5 (1952).—*C.A.* 46, 7904b.
The change in capacity effects were shown for the adsorption and desorption of octyl alcohol in 0.5 *M* Na_2SO_4 soln. at a dropping-Hg electrode.

3908. LOVELAND, J. WEST AND ELVING, PHILIP J. **Application of the cathode-ray oscilloscope to polarographic phenomena. III. Potentials of adsorption-desorption capacity peaks and surface charge density relationships exhibited by alcohols at aqueous saline solution-mercury interfaces.** *J. Phys. Chem.* 56, 935-41 (1952).—*C.A.* 47, 2058*b*.
Differential capacity oscillograms for the satd. solns. of octyl and heptyl alcs. showed 4 capacity peaks on each of the cathodic and anodic sweeps rather than the expected 2 peaks, indicating double-film formation. A satd. soln. of amyl alc. gave only 2 adsorption-desorption capacity peaks in each trace, indicating the formation of a mono-film layer. The lower the mol. wt of the alc., the greater was the potential span between capacity peaks for the satd. solns. Adsorption processes depended directly on the surface charge existing at the Hg surface.

3909. LOVELAND, J. WEST AND ELVING, PHILIP J. **Application of the cathode-ray oscilloscope to polarographic phenomena. IV. Peak and minimum capacities of adsorption-desorption processes exhibited by alcohols at aqueous saline solution-mercury interfaces.** *J. Phys. Chem.* 56, 941-5 (1952).—*C.A.* 47, 2058*d*.
The capacities of the adsorption and desorption peaks assocd. with film formation for satd. and supersatd. solns. of amyl, hexyl, heptyl, and octyl alcs. were measured from differential capacity oscillograms. The adsorption-desorption processes taking place at low applied neg. potentials gave rise to capacities about twice as great as those at more neg. potentials. Desorption processes were found generally to give higher capacities than adsorption processes, especially with alcs. of higher mol. wt.

3910. LOVELAND, J. WEST AND ELVING, PHILIP J. **Application of the cathode-ray oscilloscope to polarographic phenomena. V. Influence of frequency, concentration, and structure of alcohols on film formation at aqueous saline solution-mercury interfaces.** *J. Phys. Chem.* 56, 945-8 (1952).—*C.A.* 47, 2058*f*.
The resistance of an alc. film layer at the potential of the most neg. capacity peak varied inversely with the square of the voltage-sweep frequency. The variation of peak capacities with voltage-sweep rates provided a procedure for detg. relative rates of adsorption and desorption of film layers at a Hg-aq. soln. interface. The potential differences between the capacity peaks for the 8 isomeric amyl alcs. decreased, going from the tertiary to the secondary to the primary alcs.

3911. MACNEVIN, WM. M. AND LEVITSKY, MICHAEL. **Reproducible platinized platinum electrodes for anodic polarography.** *Anal. Chem.* 24, 973-5 (1952).—*C.A.* 46, 8539*d*.
A Pt microelectrode coated with electrolytically deposited Pt gave appreciably more current in anodic polarography than did one of uncoated Pt. Reproducible currents were obtained with successively prepd. electrodes when prepd. by a specified procedure. Pt black had much greater current response than a bright deposit (obtained from spectroscopically pure chloroplatinic acid). Salts of Zn, Ni, Cd, and Fe had no marked effect while those of Pb, Hg^{2+}, and Cu were especially effective in producing Pt black.

3912. MAŠEK, JIŘÍ. **Polarographic reduction of inorganic anions containing oxygen. II. Mechanism of discontinuity.** *Chem. Listy* 46, 385-9 (1952).—*C.A.* 46, 10959*b*,
A mechanism of discontinuous reduction of O-contg. inorg. anions, was checked by oscillographic curves expressing the dependence of the current on time. At a certain distance from the electrode, adsorption of multivalent cations led to the formation of a max. inhomogeneity of the elec. field into which deformed anions were drawn because of interference in reduction.

3913. MATYÁŠ, MILOŠ. **Adsorption of some aliphatic alcohols on the dropping-mercury electrode.** *Chem. Listy* 46, 65-8 (1952).—*C.A.* 46, 10957*f*.
MeOH and EtOH were not adsorbed on the dropping-Hg electrode; they shifted the half-wave potentials of Cd and Pb to pos. values and decreased their diffusion currents. BuOH, iso-BuOH, AmOH, iso-AmOH, and octanol were adsorbed on the electrode; they did not affect the diffusion currents and shifted the half-wave potentials of bivalent metals (Cd and Pb) to more neg. values.

3914. MELIK-GAĬKAZYAN, V. I. **The kinetics of adsorption of surface-active substances on the mercury electrode.** *Zhur. Fiz. Khim.* 26, 560-80 (1952).—*C.A.* 47, 5817*d*.
The double layer was established in less than 1 microsec. Data of capacitance and resistance in electrolyte solns. contg. various alcs. (Bu, amyl, hexyl, octyl) showed that the slow step of the adsorption of these org. mols. was their diffusion to the electrode surface. A slow adsorption step was clearly ruled out.

3915. MELIK-GAĬKAZYAN, V. I. **Formation of multilayers at the mercury-solution interface and its effect on the differential capacity of the double layer.** *Zhur. Fiz. Khim.* 26, 1184-90 (1952).—*C.A.* 47, 5817*f*.
The effect was studied by measurements of differential capacity of the double layer. In solns. (CsCl, KCl, LiCl, HCl, $AlCl_3$, $BaCl_2$, $MgCl_2$ and KCl + $La_2(SO_4)_3$) addn. of octyl alc. in concns. not less than 1/2 that corresponding to satn. (10^{-3} *M*)

was accompanied by multilayer formation at potentials near the null potential of the Hg electrode.

3916. MERKER, R. L. AND ZISMAN, W. A. **Competitive adsorption from solution between hydrophobic and hydrophilic molecules and ions.** *J. Phys. Chem.* 56, 399-404 (1952).—*C.A.* 46, 7399*b*.

Studies of the adsorption of water-sol. amines and their ions in aq. soln. of various pH values showed that hydrophobic films on Pt were primarily due to the pickup of free amine in the more alk. regions of the pH scale. In the less alk. regions hydrophobicity was due to the adsorption of amine ion. Similarly, in the case of water-sol. carboxylic acids, the hydrophobic films in the more acid regions were due to undissocd. acid mols.

3917. NESTEROVA, V. I. AND FRUMKIN, A. N. **The platinum electrode. IX. Adsorption of oxygen by platinized platinum at its contact with molecular oxygen and at anodic polarization.** *Zhur. Fiz. Khim.* 26, 1178-83 (1952).—*C.A.* 47, 3727*d*.

A platinized Pt sheet was satd. with H_2 in a soln. which was removed. The wet sheet was kept in O_2 for t days and then immersed in N H_2SO_4, after which it was cathodically polarized. The change in potential ϕ of the electrode with the amt. of electricity supplied was slow in 2 potential regions (0.9-0.8 and 0.3-0.1v., resp., relative to N H_2 electrode) and rapid at other ϕ. When dry sheets of platinized Pt were kept in O_2 at a high temp. for 1 hr, the uptake of O_2 increased to 200°C; the smaller uptake at 300°C was not, and the negligible uptake at 400°C was assocd. with a decrease in electrode surface; this decrease was due to recrystn. rather than to dissoln. of Pt. The adsorbed amt. of O_2 was less than a monolayer.

3918. OBRUCHEVA, A. D. **The platinum electrode. X. Study of the adsorption of oxygen by smooth platinum by the electrochemical method.** *Zhur. Fiz. Khim.* 26, 1448-57 (1952).—*C.A.* 47, 4766*e*.

A Pt wire was anodically polarized in N H_2SO_4 for several hrs and then cathodically polarized; the potential of this cathode first decreased, then remained almost stationary and then decreased again. The ratio of the equiv. of O_2 taken up during anodic to H_2 taken up during cathodic polarization was 0.1 for heavily platinized Pt contg. 0.06 g Pt black on 1 cm^2, 0.23 for 0.001 g/cm^2, and 0.55 for smooth Pt. Both O_2 and H_2 penetrated into smooth Pt and only slowly reappeared on the surface.

3919. PALACIOS, J. AND BAPTISTA, A. **The adsorption of cations by metals demonstrated with radioactive tracers.** *Compt. rend.* 234, 1676-7 (1952).—*C.A.* 46, 10775*f*.

Pieces of metals were placed in 0.27 M $ZnSO_4$ solns. rich in Zn^{65} tracer. Analysis of the metals after immersion from 14 to 45 hrs indicated that Ag adsorbed the most Zn, and in decreasing order, Fe, Cu, Au, Pt, and Pd. Autoradiographs of Al foil in the $ZnSO_4$ soln. showed that the Zn adsorbed was isolated in a no. of small domains over the surface of the foil.

3920. PERMITINA, N. G. AND SHLYGIN, A. I. **Relation between adsorptive and catalytic stages in the hydrogenation process in the presence of a liquid phase.** *Zhur. Fiz. Khim.* 26, 956-9 (1952).—*C.A.* 47, 3677*f*.

A platinized-Pt electrode was immersed in 0.1 N H_2SO_4 or KOH and satd. with H_2; then EtMeC(OH)C⋮CH was added, and the vessel was shaken for an hr. The hydrogenation was a zero-order reaction, and its rate was in H_2SO_4 3 times as great as in KOH.

3921. PERRY, E. J. AND WINKLER, C. A. **The reaction between silver and triphenylmethyl chloride.** *Can. J. Chem.* 30, 235-44 (1952).—*C.A.* 46, 6914*a*.

Initially, the reaction in toluene was very fast and in accordance with a logarithmic growth law both at 65.4° and 44.9°C; at 44.9°, however, long before the crit. film thickness of 1.6×10^{-6} cm was reached, there occurred a very sudden decrease in the rate of reaction at a well defined and quite reproducible film thickness of 80A. In MeCN the over-all rate was considerably faster than in toluene and the crit. film thickness occured at a temp. about 40°C below that in toluene.

3922. PICCARDI, GIORGIO AND FERRONI, ENZO. **The action of water on copper.** *Ann. chim.* (Rome) 42, 607-9 (1952).—*C.A.* 47, 3082*d*.

Not only did multidistd. water dissolve Cu, but the reaction depended on the phys. state of the Cu in the soln. When multidistd. water was brought briefly in contact with a well-scoured capsule of Cu, and then used to prep. colloidal Au, the soln. turned the characteristic ruby red; this showed that some Cu was present in ionic form.

3923. POUND, GUY M. AND LAMER, VICTOR K. **Kinetics of crystalline-nucleus formation in supercooled liquid tin.** *J. Am. Chem. Soc.* 74, 2323-32 (1952).—*C.A.* 46, 8480*f*.

Oxide-coated droplets of molten Sn of a narrow size range were supercooled at 120°C below their m.p. of 232°C. The droplets were of the order of magnitude of 5 μ in diam., and the specimens each consisted of several g of about 10^{10} of these droplets. Rate of nucleation of crystals in the supercooled liquid droplets was measured dilatometrically as a function of temp. and droplet size. The solidification rate increased rapidly with decrease in temp. and increased in droplet size.

3924. RANDLES, J. E. B. **Kinetics of rapid electrode reactions. II. Rate constants and activation energies of electrode reactions.** *Trans. Faraday Soc.* 48, 828-32 (1952).—*C.A.* 47, 3723*i*.

The rate const. of the oxidation-reduction reaction at an inert electrode was defined in terms of the magnitude of the exchange current at the electrode when it was in equil. with equal concns. of the reduced and oxidized components. The energy of activation calcd. from the temp. dependence of this rate const. was shown to correspond to that potential of the electrode which made the energy barrier of the reaction sym.

3925. Randles, J. E. B. and Somerton, K. W. **Kinetics of rapid electrode reactions. IV. Metal-ion-exchange reaction at amalgam electrodes.** *Trans. Faraday Soc.* **48**, 951-5 (1952).—*C.A.* 47, 6280*b*.

The rate consts. k and heats of activation ΔH were investigated for the dil. metal amalgam and aq. metal ion reactions: Tl^+, Cd^{2+}, Pb^{2+} in M KNO_3; Zn^{2+} in either M KNO_3, KCl, KBr, KCNS, KI; Cu^{2+} in M KNO_3; $CuEn_2^{2+}$in En-HClEn; $Cu(NH_3)_2^+$ in NH_4Cl-NH_3; Bi^{3+} in M $HClO_4$ or HCl; Na^+, K^+, Cs^+ in M NMe_4OH. A dil. amalgam dropping electrode was used to obtain a reproducible and uniform electrode surface.

3926. Schiessl, S. v. **Thickness of oil films on metallic surfaces.** *Kolloid-Z.* **129**, 84-91 (1952).—*C.A.* 47, 5761*f*.

An interferometric method was described to det. the thickness as a function of time, when vertical sepn. of 2 plates under a given force took place. From hydrodynamics an equation was derived contg. the initial distance h_0. Agreement between theory and expt. was good for various oils of different chem. constitution.

3927. Shafrin, Elaine G. and Zisman, Wm. A. **The spreading of liquids on low-energy surfaces. IV. Monolayer coatings on platinum.** *J. Colloid Sci.* **7**, 166-77 (1952).—*C.A.* 46, 7399*i*.

Contact-angle measurements were made on oleophobic, hydrophobic films formed by immersing freshly flamed Pt surfaces in $C_{16}H_{34}$ solns. of $C_{18}H_{37}NH_2$. A linear relation was found between cos θ and the surface tension of homologous series of liquids. The free surface energy of the coated Pt was probably not much more than 28.5 ergs./cm². Glass coated with long-chain amine had similar, but not identical, spreading behavior.

3928. Simnad, Massoud T. **Radioisotopes in the study of metal surface reactions in solutions.** *Symposium on Properties of Metallic Surfaces* (Inst. Metals, London) **1952**, 23-58.—*C.A.* 47, 2610*d*.

The chief characteristics of radioisotopes, their advantages and limitations in tracer work, and the effect of radiation on matter were discussed. The passivating action of chromates was studied with the aid of tagged chromate ions in soln. Self diffusion and isotopic exchange in surface films and aq. solns. were discussed in view of their important part in governing the behavior of metals in soln.

3929. Sutra, Geneviève. **Hydrogen overvoltage.** *J. Chim. phys.* **49**, C66-9 (1952).—*C.A.* 46, 4934*e*.

A new mechanism of H overvoltage was presented in which H^+ was adsorbed on the surface of the cathode and the proton penetrated inside the cathode. When the metal was satd., evolution of gaseous H occurred

3930. Tödt, Fritz. **The measurement of the cathodic reduction of oxygen by appropriate model elements.** *Z. Elektrochem.* **56**, 165-9 (1952).—*C.A.* 46, 8540*e*.

The capacity of O microelements with cathodes of Pt or Au and Cd anodes was measured in 1% NaCl soln. of pH 8-8.5 with c.ds. of 6 and 1.5×10^{-8} amp./cm², resp. Films of less than a monoat. layer at a given depolarization current did not change much to a higher resistance in the outer circuit.

3931. Tödt, Fritz; Kahan, S., and Schwarz, W. **Influence of the diffusion layer on the electrochemical determination of oxygen and the oxide layers of metals.** *Z. Elektrochem.* **56**, 19-23 (1952).—*C.A.* 46, 9451*f*.

The quantity of current in coulombs/cm² betwee an aerated Pt cathode and an Al anode sepd. by a diaphragm was measured and the drop in c.d. with time recorded and plotted. A 0.1% NaCl soln. brought to a pH of 8-9 with 0.01 N NaOH was the electrolyte. Measurements were made in an O_2-rich and an O_2-poor soln., both with and without stirring.

3932. Trivedi, A. K. M. and Patani, M. J. **Hydration of colloidal arsenic sulfide.** *J. Indian Chem. Soc.* **29**, 747-50 (1952).—*C.A.* 47, 5216*g*.

When As_2S_3 was coagulated by a low concn. of NaCl, the coagulum was hydrated, but most of the stabilizing ion appeared in the supernatant liquid, and the coagulum was irreversible.

3933. Vetter, Klaus J. **The active state and the spontaneous repassivation of current-activated iron in nitric acid.** *Z. Elektrochem.* **56**, 106-15 (1952).—*C.A.* 46, 7850*i*.

Exptl. results obtained previously by an oscillographic method on the activation of Fe in HNO_3 by passage of current, and the subsequent spontaneous repassivation, were discussed.

3934. Vetter, Klaus J. and Booss, Hans Jürgen. **The protective layer on freshly passivated iron and its relationship to the refractoriness of this iron.** *Z. Elektrochem.* **56**, 16-19 (1952).—*C.A.* 46, 9042*g*.

The Fe content and reducing properties of the black protective coating on passive Fe showed it to be Fe_3C, left behind by the soln. of Fe. It dissolved slowly in HNO_3, reaching a value of 3-25 γ Fe/cm² per 5 min. after 30 min. with the formation of Fe^{3+}, CO_2, and HNO_2 which was detd. from the HNO_3/HNO_2 oxidation-reduction potential on Pt. The layer did not cause the passivity; the slowly falling refractoriness was caused by the steady formation of HNO_2.

3935. Wicke, E. and Weblus, B. **Capacity of polarization, adsorption, and overvoltage on platinum.** *Z. Elektrochem.* **56**, 169-76 (1952).—*C.A.* 46, 8540*f*.

The capacity of polarization measured with a.c. gave a figure for the adsorption of H_2 at the electrode. Its dependence upon the compn. of the electrolyte was investigated with N HCl, N NaCl + 0.1 N HCl, and N $AlCl_3$ + 0.1 N HCl. No influence of the additive cation was observed. The results showed that the slow discharge of the H ions at the surface of the Pt cathode was responsible for the overvoltage.

3936. Yanagisawa, Masaaki. **Surface diffusion and electro-surface diffusion of mercury on tin foils.** *Ôyô Butsuri* (J. Applied Phys.) **21**, 18-20 (1952).—*C.A.* 46, 10779*a*.

The rate of growth of amalgam layer on Sn foils, etched and nonetched with dil. HCl, was measured at 12-95°C. The activation energies of the surface diffusion of Hg were calcd. as 5180 cal and 3540 cal for etched and nonetched surface, resp.

3937. BERG. T. G. OWE. **Passivity of iron.** *Z. Metallkunde* **44**, 82 (1953).—*C.A.* 47, 5334*f*.
The behavior of a metal in the activation region influenced its passivity. Measurements of soln. rate of Cu and Fe in HNO_3 with and without agitation were mentioned.

3938. BONHOEFFER, KARL FRIEDRICH. **Passivity of iron.** *Z. Metallkunde* **44**, 77-81 (1953).—*C.A.* 47, 5334*e*.
Anodic treatment with H_2SO_4 with varying c.ds. yields min. passivation, depending on agitation. True passivation c.ds. and potential were detd. One must distinguish the true passivating c.d. (17 amp./cm^2 in $1N$ H_2SO_4) from the 1 min. passivation maintaining c.d. of 7 amp./sq. cm. which was the equiv. c.d. for the corrosion of passive Fe in this acid. HNO_2 was furnished by the initial Fe going into soln. The presence of differing amts. of HNO_2 was responsible for the differences in behavior of aged or freshly passivated Fe.

3939. BRYSON, ALEXANDER AND LOWY, S. LENZER. **Separation of zinc and cadmium by the use of activated copper.** *Analyst* **78**, 299-303 (1953).—*C.A.* 47, 6891*c*.
Cu powder was prepd. from CuO by heating in H_2. Cool and grind in a mortar. To a soln. contg. not over 0.5 g of Cd + Zn add Na_2CO_3 till a permanent ppt. formed, add KCN in an amt. 10 times the wt of Cu + Cd, 10 g of K Na tartrate, and dil, to 100 ml. Heat nearly to boiling, and add Cu powder in small portions. Continue until added Cu remained red for several min. In this way Cd was pptd. and Zn stayed in soln.

3940. HACKERMAN, NORMAN AND POWERS, R. A. **Surface reactions of chromium in dilute $Cr^{51}O_4^{--}$ solutions.** *J. Phys. Chem.* **57**, 139-42 (1953).—*C.A.* 47, 7288*e*.
The adsorption of chromate, dichromate, and hydrogen chromate ions on a Cr surface was detd. as a function of ion concn. and pH. The anions were tagged with radiochromium-51. Max. adsorption corresponded to a monolayer. Hydroxyl, sulfate, and chloride ions reduced adsorption. Adsorbed anion could be removed only by boiling in concd. HNO_3.

3941. KIKUCHI, MINORU AND KANEKO, NORIMASA. **Metal coloring by electrodeposition of a thin film. I.** *J. Electrochem. Soc. Japan* **21**, 17-20 (1953).—*C.A.* 47, 6796*g*
When a soln. composed of Cu tartrate (0.1-0.2*M*) and NaOH (1-2*M*) was electrolyzed with a C anode and Cu (or brass, Au, or Pt) cathode at 25° the cathode plate was colored by a coating of a thin film on the surface of the plate.

3942. TÖDT, F. AND MEYER, W. **Potentials on platinized platinum with cathodic charging with special consideration of the reversible hydrogen electrode.** *Z. Elektrochem.* 57, 29-33 (1953).—*C.A.* 47, 6279*f*.
By using platinized Pt as cathode totally immersed in electrolyte (dil. HCl, NaOH, or buffers), a const, potential was reached in a few min. With increasing c.d. the potential became more neg., because of increasing alky. around the cathode. The no. of coulombs necessary for removing O adsorbed by exposure of the electrode to air was detd. The surface became nearly satd. in 5 min. and completely so in 1 hr. A platinized Pt surface took up 100 times as much O_2 as bright Pt.

3943. WAHLIN, H. B. AND NAUMANN, VIRGIL O. **The transmission of hydrogen through palladium by electrolysis.** *J. Appl. Phys.* **24**, 42-4 (1953).—*C.A.* 47, 3726*a*.
Whenever a metal was made the cathode in a dil. H_2SO_4 bath, the transmission of H_2 could be observed by means of its reaction with atm. O_2. A more detailed study of the transmission through Pd showed that the area of the surface at which the H_2 left was the principal controlling factor.

II-8. Ionic Exchange, Principally in Columns

3944. BHATNAGAR, S. S.; KAPUR, A. N., AND BHATNAGAR, MAHENDRA SARUP. **Adsorptive properties of synthetic resins. III.** *J. Indian Chem. Soc.* **16**, 261-8 (1939).—*C.A.* 34, 301^2.
Adsorption of acids by acid-catalyzed phenol-formaldehyde resin or by acid-catalyzed resorcinol-formaldehyde resin increased in the order: HCOOH, CH_3COOH, butyric acid. With NH_3-catalyzed phenol-formaldehyde resin, NH_3-catalyzed resorcinol-formaldehyde resin, or *m*-phenylenediamine-formaldehyde resin, the above order was reversed. Refluxing (NH_3-catalyzed resorcinol-formaldehyde resin) with HCl did not change the order of adsorption of acids from that of the untreated resin.

3945. SAMUELSON, OLOF. **Use of base-exchanging substances in analytical chemistry. II.** *Svensk. Kem. Tid.* **51**, 195-206 (1939).—*C.A.* 34, 1271^2.
With the aid of 3.2 g of the organolite (a sulfonic acid) it was possible to remove all Al^{+++} from a soln. contg. a little more than 2 milliequiv. of $Al_2(SO_4)_3$, and H^+ ions replaced the Al^{+++} in the soln. The H^+ equiv. to the SO_4^{--} could then be titrated with NaOH to a methyl red end point. The organolite could be regenerated by washing with 200 ml of 2 N HCl followed by pure water. With about 5 g of organolite which was satd. with NH_4^+ ions, it was possible completely to remove a little over 2 milliequiv. of K^+, and the anions were left in the filtrate.

3946. COHN, WALDO E. **The anion-exchange separation of ribonucleotides.** *J. Am. Chem. Soc.* **72**, 1471-8 (1940).—*C.A.* 44, 5954*a*.
The nucleotides of ribonucleic acid were sepd. from each other and from the corresponding free bases and ribosides by successive elution from strong base anion exchangers with weak acids and buffers of controlled pH and anion concn. The expts. utilized principally 200-400 mesh Dowex-1,

a strong base anion exchanger; Dowex 2 and Amberlite IRA-400 were also employed with similar results.

3947. SAMUELSON, OLOF. **Base-exchanging substances in analytical chemistry. IV.** *Svensk. Kem. Tid.* **52**, 241-7 (1940).—*C.A.* **35**, 1340⁷.

Known $FeCl_3$ and $Al_2(SO_4)_3$ were added to $CaHPO_4$ in *N* HCl. These solns. were passed through a layer of H-satd. sulfonic acid organolite. The Fe and Al were completely held back, quantitatively sepg. them from HPO_4^{--}. The Fe and Al were then washed out of the organolite with dil. HCl. The recoveries were very good. Minerals contg. Ca, Fe, Al and P were analyzed with this sepn.

3948. SCHWARTZ, M. C.; EDWARDS, W. R., JR., AND BOUDREAUX, GRACE. **Removal of chlorides and sulfates by synthetic resins.** *Ind. Eng. Chem.* **32**, 1462-66 (1940).

A synthetic organic resin was prepared from *m*-phenylenediamine, fromaldehyde, and HCl. A variety of aq. solns. containing either Cl^- or SO_4^{--} were treated and the effect of the various factors detd. in removing the solutes. The process appeared to be one in which whole mols. were removed, and ion exchange was of very minor proportions if it occurred at all.

3949. ELVING, PHILLIP J.; DANZIG, MEYER H., AND BACHMAN, G. BRYANT. **Synthetic resins and base-exchange phenomena.** *Proc. Indiana Acad. Sci.* **51**, 136-45 (1941) (Pub. 1942).—*C.A.* **37**, 198⁴.

A review of the general field.

3950. KOT, A. A. **Causes of a decrease in the exchange capacity of glauconite.** *Teplosilovoe Khoz.* **1941**, No. 1, 31-3.—*C.A.* **37**, 4507⁸.

As a result of insufficient utilization of a water-purification plant the glauconite was coated with $Al(OH)_3$ and org. substances. Washing with 0.5% NaOH restored the exchange capacity.

3951. PROKHOROV, F. G. AND YANKOVSKIĬ, K. A. **Experimental studies and the results of a year's operation of the first H cation-exchange plant.** *Teplosilovoe Khoz.* **1941**, No. 3, 8-12.—*C.A.* **37**, 6779⁴.

The industrial H cation-exchange plant for the softening of water with a total hardness of 12-14° and a carbonate hardness of 11-13° (chloride content 7 mg/liter) was equipped with filters having a bituminol lining 4-5 mm thick as a protection against corrosion. After a year's operation the outer layers of this coating had run off as a result of the filters standing unused for long periods at a relatively high temp. (in summer up to 35-50°C). Sulfurated lignite was used as a softening agent. It was shown to be a good H and Na ion-exchange material and as satisfactory as glauconite.

3952. PROKHOROV, F. G. AND YANKOVSKIĬ, K. A. **Results and six months' operating experience with the hydrogen-cation exchange installation at the Dulevo factory.** *Izvest. Vsesoyuz. Teplotekh. Inst. im. Feliksa Dserzhinskogo* **14**, No. 1, 3-9 (1941).—*C.A.* **38**, 3401⁵.

The cation-exchange material was prepd. by treating lignite with 18-20% oleum. Washing with H_2O removed the excess acid, dust and coal particles less than 0.2 mm. Under the same conditions, the filter resistance was less, the softening action practically the same, and the exchange capacity 2.5-3 times as great as with a glauconite filter. Best results were obtained by regeneration with a mixt. of NaCl and HCl.

3953. SAMUELSON, OLOF. **The dynamic equilibrium in filters of ion-exchanging substances.** *Svensk. Kem. Tid.* **53**, 422-34 (1941).—*C.A.* **38**, 3889⁷.

An equation contg. an empirical const. was derived; it agreed well with the exptl. results. The thickness of the filter layer, the velocity of filtration and the concn. of the soln. were varied in expts. with a sulfonic acid organolite derived from a synthetic resin. A considerable sepn. of the cations of a soln. could be achieved by filtering through an organolite filter.

3954. SAMUELSON, OLOF. **Use of base-exchange material in analytical chemistry.** *Svensk. Kem. Tid.* **54**, 124-34 (1942).—*C.A.* **38**, 2896⁶.

A sulfonic acid organolite was used of which the com. product was powd. and treated with 25% HCl to remove Fe. The detn. of SO_4^{--} in solns. contg. Na, K, Ca, Al, Fe or Cr was explained after passage through a filter of organolite satd. with H_2. Phosphate analyses could be carried out by this method. Various metal ions could be sepd. after preliminary formation of complexes, e.g., Fe and Al with HPO_3.

3955. WIESENBERGER, E. **Organic base exchange in microchemical analysis.** *Mikrochemie ver. Mikrochim. Acta* **30**, 176-80 (1942).—*C.A.* **37**, 4654⁹.

Artificial resins (such as Wofatit-K) should stand in water overnight to make them swell. Place them in 7% HCl soln. for about 30 min. and wash with water until no more acid can be detected with methyl red in the washings. Samples of 5-7 mg of KCl, $NaClO_3$, K_2SO_4, KNO_3, $FeSO_4.(NH_4)_2SO_4.6H_2O$, $ZnSO_4.7H_2O$, $NiSO_4.7H_2O$, $MgSO_4.7H_2O$, and $CuSO_4.5H_2O$ were analyzed. The salt and moist Wofatit were stirred and filtered through a tube with fritted glass filter at the bottom into a quartz flask. Wash with gentle suction and about 20 ml of water added in 1-ml portions. The filtrate would contain H^+ equiv. to the displaced cations and also equiv. to the anions present.

3956. WILBRANDT, W. **Kinetics of ion exchange through selectively permeable membranes.** *Arch. ges. Physiol. (Pflügers)* **246**, 274-90 (1942).—*C.A.* **38**, 4850⁴.

Ion exchange depended not only upon the concn. product of the ions but also upon electrostatic conditions. The dependence of the rate of exchange and of the two gradients upon ionic concn. and mobility was derived for varying ratios of the two ionic mobilities. For very large values of this ratio the potential reached, at the membrane, a value equal to the Donnan potential. If the valence nos. of the ions were different, the above three quantities become a function of the valence ratio.

3957. DOLIQUE, R. AND MACABET, L. **Some natural and synthetic zeolites. I. Preliminary determinations: physical tests and chemical analyses.** *Bull. soc. chim.* **10**, 72-9 (1943).—*C.A.* **38**, 2542[8].

A standard method was sought for comparing the power of exchange of Na ⇄ Ca by some natural and synthetic zeolites. The phys. tests were: granulometric analysis, true and apparent d., resistance to crushing, dehydration, rehydration, and porosity. Most of the samples corresponded to the known zeolite formula $n\mathrm{SiO_2.Al_2O_3.Na_2O}.x\mathrm{OH}$, the Al being substituted in some by Fe, and Na by Ca.

3958. DOLIQUE, R. AND MACABET, L. **Some natural and synthetic zeolites. II. Exchange sodium ⇄ calcium by the so-called constant-volume method.** *Bull. soc. chim.* **10**, 80-8 (1943).—*C.A.* **38**, 2543[3].

The exchange $Z.\mathrm{Na_2} + \mathrm{CaCl_2} \rightleftarrows Z.\mathrm{Ca} + 2\mathrm{NaCl}$ (Z = silico-aluminic block) was studied. A const.-vol. method was used in which Na-zeolite was reacted with a known vol. of 0.1 *N* or 0.01 *N* $\mathrm{CaCl_2}$ soln., detg. at regular intervals the Ca remaining in soln. The operation was continued until equil. The velocity of decalcification was $dx/dt = K_0 - K_2x + Kx^2 - K'x^3$, and the four coeffs. K_0, K_1, K and K' were calcd. from the exptl. data. The exchange was affected more by the porosity than by the hardness, and, in general, the velocity of exchange decreased with increasing porosity.

3959. DOLIQUE, R. AND MACABET, L. **Some natural and synthetic zeolites. III. Exchange sodium ⇄ calcium by the variable-volume method.** *Bull. soc. chim.* **10**, 88-98 (1943).—*C.A.* **38**, 2543[7].

A known $\mathrm{CaCl_2}$ soln. was passed over a known wt of zeolite. The liquid was collected at the outlet of the app. until Ca began to pass. The total vol. of soln. purified was noted. The zeolite was washed with distd. H_2O and a concd. NaCl soln. circulated to restore its exchangeable Ca ions. The same decalcification was repeated, but the flow was continued until the Ca content of the soln. was the same at the inlet as at the outlet. The vol. passed through was noted. A graph showing the Ca contents of the solns. leaving the app. as ordinates and the vols. passed through at const. velocity as abscissas allowed easy detection of a good and poor zeolite.

3960. GOEHRING, MARGOT AND DARGE, ILSE. **Determination of sulfate in the presence of interfering cations.** *Z. anal. Chem.* **125**, 180-4 (1943).—*C.A.* **37**, 3016[3].

Ca, Fe and Cr interfered with the formation of pure $\mathrm{BaSO_4}$. If, however, the soln. was first filtered through a synthetic resin (e.g., Wolfatit) the interfering ions were removed and in the filtrate the sulfate could be pptd. with $\mathrm{Ba^{++}}$ successfully.

3961. KEMMER, F. AND THOMPSON, J. **Acid-regenerated zeolites.** *Power Plant Eng.* 47, No. 6, 82-5 (1943).—*C.A.* **37**, 5527[8].

The exchange capacity and various acidities of carbonaceous zeolites were described. Tables showing exchange capacity made it possible, knowing the original raw water, to predict precisely the exchange values and characteristics.

3962. NILLSON, NILS. **Organic ion-exchangers and their use.** *Tek. Tid.* 73, K91-8 (1943).—*C.A.* **39**, 3970[1].

A brief review of the production, testing, and field of use of artificial resins having base-exchange properties.

3963. RUSSELL, R. G. AND PEARCE, D. W. **Fractionation of the rare earths by zeolite action.** *J. Am. Chem. Soc.* **65**, 595-600 (1943).—*C.A.* **37**, 3363[4].

No cation was encountered of which the valence or the size was so large that it was unable to enter into base-exchange reactions. Fractional sepns. within the rare earth group were obtained by means of zeolite action when concd. solns., contg. sufficient ions to exceed the capacity of the exchange material, were used. The rare earth ions of decreasing (crystal) ionic radius were held more firmly in the zeolite lattice, while the larger ions were held less firmly. By regeneration of the base-exchange material the rare earth ions could also be removed in a fractional manner, the largest (most loosely held) ions being removed first.

3964. SAMUELSON, OLOF. **Fractionation of sulfite waste liquor.** *Svensk Papperstidn.* 46, 583-6 (1943) (German and English summaries).—*C.A.* **38**, 2487[6].

The adsorption of the acids of sulfite waste liquor was studied by the use of an org. cation exchanger (organolite) with an artificial resin base. When a no. of pure acids of low mol. wt were compared, it was found that the amt. of acid held by the exchanger increased as the mol. wt of the acids decreased. If the acids liberated from sulfite waste liquor were passed through a filter of such an organolite which was satd. with $\mathrm{HO^-}$, the greater part of the lignosulfonic acid would pass through it. The acids adsorbed had a low MeO and S content and consisted largely of carboxylic acids.

3965. TRAUTZ, MAX AND NIENHAUS, HEINRICH. **Exchange capacities, vapor-pressure isotherms and heats of wetting of some technical $\mathrm{H^+}$ exchangers.** *J. prakt. Chem.* **162**, 181-217 (1943).—*C.A.* **38**, 2544[1].

An exchanger was defined as a solid colloidal absorbent of large surface area which in contact with solns. rapidly established the following equil.: $SA + LB = SB + LA$, where S was the adsorbent, L the soln., and A and B were ion types. The general mode of investigation of exchangers was outlined and then applied specifically to 3 exchangers: $\mathrm{H^+}$ Dusarite, $\mathrm{H^+}$B200, and $\mathrm{H^+}$C200. Photomicrographs showed that the particles ranged from 0.4 to 0.9 mm in size, and consisted of charcoal and some other gleaming brittle granules. True d. (s) of the samples were detd. in a H_2O-filled pycnometer.

3966. WALTON, H. F. **Equilibria in a carbonaceous cation exchanger.** *J. Phys. Chem.* 47, 371-82 (1943).—*C.A.* **37**, 5298[9].

Partition relations were studied for H, Na, K, Ca and Ba ions between H_2O and Zeo-Karb, a $\mathrm{H_2SO_4}$-treated coal. For any pair of cations, the distribution of the ions could be explained by assuming the exchanger to consist of 2 or more solid acids of different dissocn. const. The greatest deviation from the law of mass action was in the case of Ca and H ions.

3967. FRIZZELL, LAURENCE D. **Quantitative separations with an exchange adsorber.** *Ind. Eng. Chem., Anal. Ed.* **16**, 615-16 (1944).—*C.A.* **39**, 35^7.

"Zeo-Karb" was efficient in sepg. cations from anions in solns. of $FeCl_3$, $CuSO_4$, $Na_2C_2O_4$, $NH_4H_2PO_4$ and $Ca(BO_2)_2$. For a quant. sepn. the total ion concn. should have been low and the pH about 4. The procedure applied to 0.1 *N* solns. of $K_2Cr_2O_7$, $KBrO_3$ and KIO_3 resulted in a reduction of the cations. The I^- in 0.1 *N* KI was oxidized to free I_2.

3968. GUSTAVSON, K. H. **Determination by means of organolites of complex formation in basic chromium (III) salts.** *Svensk Kem. Tid.* **56**, 14-23 (1944).—*C.A.* **39**, 4557^8.

The aq. soln., contg. up to 0.1 milliequiv. of Cr per cc., was filtered through a cation-binding organolite ("Wofatit KS and K" and "Wofatit M") to remove the complex cations; the complex anions were removed analogously and the uncharged complexes were left in the soln. The bound complexes could be eluted with 10% NaCl soln., or preferably with 3-6 *N* HCl, and analyzed. The 1st filtrate contained H^+ equiv. to the adsorbed cations. In the 2nd filtrate the complexly bound acid residues and Cr were detd.

3969. KLEMENT, ROBERT. **Separation of orthophosphoric acid by means of the ion-exchange resins. I. Wofatit.** *Z. anal. Chem.* **127**, 2-5 (1944).—*C.A.* **39**, 475^6.

Wofatit M was useful for removing H_3PO_4 from solns. contg. no trivalent cation. Wofatit KS was valuable in removing H_3PO_4 from solns., but allowing all other ions to pass through. The H_3PO_4 could be removed from the resin by washing the column with HCl.

3970. MAGISTAD, O. C.; FIREMAN, MILTON, AND MABRY, BETTY. **Comparison of base-exchange equations founded on the law of mass action.** *Soil Sci.* **57**, 371-9 (1944).—*C.A.* **38**, 6457^6.

Suspensions of Ca-satd. Fallbrook sandy loam in in equil. with solns. contg. NaCl or NH_4Cl were studied with regard to the accuracy of fit of the observed data with that obtained by the application of various base-exchange equations founded on the law of mass action. The effect of Na percentage of soln., of varying vol. and diln., of varying amt. of soil, of soln. concn. and diln., and of temp. were reported.

3971. MUELLER, EDWARD R. **Resinous ion exchange applications.** *Paper Trade J.* **119**, No. 12, 30-3 (1944).—*C.A.* **38**, 6443^9.

A brief comparison of the ion-exchange action of zeolites and of resins, with a brief discussion of the applications of the latter.

3972. NACHOD, F. C. AND SUSSMAN, SIDNEY. **Removal of electrolytes from solutions by ion exchange.** *J. Chem. Education* **21**, 56-8 (1944).—*C.A.* **38**, 1936^2.

The chemistry of the demineralization process by means of cation and anion exchangers was reviewed.

3973. NACHOD, F. C. AND WOOD, W. **The reaction velocity of ion exchange.** *J. Am. Chem. Soc.* **66**, 1380-4 (1944).—*C.A.* **38**, 5130^7.

The reaction rate was detd. by following the rate with which ions from soln. were removed by the solid ion exchanger, or conversely, the rate with which exchangeable ions were released from the exchange material into the soln. The reactions were second-order bimol. reactions; the values could be calcd. by using concns. instead of activities. The rate of anion exchange or acid absorption was very much slower than the rate of the cation-exchange reactions; this suggested a different reaction mechanism for this class of exchangers.

3974. NELSON, RAYMOND AND WALTON, HAROLD F. **Cation exchange at high pH.** *J. Phys. Chem.* **48**, 406-10 (1944).—*C.A.* **39**, 1001^8.

Measurements were made on the uptake of K ions by Zeo-Karb from solns. of pH 3.8 to 12.5. As with Ca, almost linear increase of uptake with pH was found. It indicated that Zeo-Karb contained weak acidic groups with dissocn. const. of the order of 10^{-13}. Measurements on the uptake of Ni, Cu and Zn from ammoniacal salt solns. indicated that Cu was absorbed principally as $Cu(NH_3)_2^{++}$, Ni as $Ni(NH_3)_4^{++}$ and Zn as a complex or complexes of intermediate compn

3975. RYZNAR, JOHN W. **Preparation and purification of hydrous oxide sols. by ion exchangers.** *Ind. Eng. Chem.* **36**, 821-3 (1944).—*C.A.* **38**, 5711^6.

Inorg. anion exchangers were metallic oxides, whereas the org. were synthetic resins of the *m*-phenylenediamine-CH_2O type as well as other resins of amine-aldehyde condensation type. A substantially electrolyte-free silicic acid sol. was prepd. by passing a Na silicate soln. through an acid-regenerated cation-exchange material. When anion exchangers were utilized, metals forming insol. hydrous oxides could be used to form the corresponding oxide sols. A sol. formed outside of the exchange bed could be purified by passing through an acid-regenerated cation- and then through an alkali-regenerated anion-exchange bed.

3976. SAMUELSON, OLOF. **Investigations of complex salt solutions with the use of organic ion exchangers. I.** *Svensk Kem. Tid.* **56**, 277-81 (1944).—*C.A.* **40**, 3358^6.

The combination of Na hexametaphosphate with Fe^{+++} was carried out with varying amts. of suitably prepd. 0.1 *N* $NaPO_3$, which were mixed with 1 cc. of 0.1 mol. of $FeNH_4(SO_4)_2$ soln., and the mixt. was passed through a column of tech. synthetic-resin sulfonic acid ion exchanger 12 mm in diam. and 200 mm high. The "cation soln." obtained was heated for 30 min. almost to boiling temp. and the Fe then detd. When the $NaPO_3$ soln. was replaced by NaCl soln., the Fe was adsorbed quantitatively.

3977. SHOEMAKER, M. J. **Dealkalizing by a two-zone hydrogen zeolite system.** *Proc. Ann. Water Conf., Eng. Soc. Western Penna.* **5**, 1-9 (1944).—*C.A.* **39**, 5374^9.

A water of uniform alky. was obtained from 2 H-zeolite exchangers operated in series. Only the first exchanger was regenerated with acid. The second unit served as a H-ion accumulator, taking up acid liberated by the first unit during the first part of its cycle, and completing dealkalization when the first unit was partially exhausted.

3978. THOMAS, HENRY C. **Heterogeneous ion exchange in a flowing system.** *J. Am. Chem. Soc.* **66**, 1664-6 (1944).—*C.A.* **38**, 6177[9].

A math. description was given of the performance of a cation-exchange column for the case in which the rate of the exchange was detd. by a second-order law. The effect of the reverse reaction was included without approximation.

3979. BOUTSERIN-GALLAND, ANDREE (MME.). **Phenomena of ion exchange and simultaneous adsorption by free humic acid or humic acid associated with an inorganic support.** *Bull. soc. chim.* **12**, 116-20 (1945).—*C.A.* **40**, 7457[5].

The ion-exchange powers of 2 widely different lignite samples and of humic acid prepd. from one of them were compared by treatment with $CaCl_2$ solns. The removal of impurities, so that samples with very low ash were obtained, often resulted in greatly enhanced ion-exchange properties. A method of prepg. very pure humic acid from lignite was described.

3980. BURTON, D. AND LEE, G. **Determination of the acid and salt content of vegetable-tanning extracts and liquors-the error caused by excessive dilution.** *J. Intern. Soc. Leather Trades Chem.* **29**, 204-9 (1945).—*C.A.* **40**, 2332[9]

Total salt could be detd. by measuring increase in acidity after passing the soln. through a base-removing resin. The analytical soln. (filtered) was used. Tests with 15 g quebracho-formaldehyde resin and with Zeocarb H1 (0.5 to 1 mm diam.) showed that not over one milliequiv. of salt in 200 ml could be passed through the resin before regeneration.

3981. CARSON, J. F., JR. AND MACLAY, W. D. **1,4-Anhydro-DL-xylitol.** *J. Am. Chem. Soc.* **67**, 1808-10 (1945).—*C.A.* **40**, 64[7].

Xylitol (80 g) and 0.8 g $PhSO_3H$ were heated at 155-60°C in N_2 for 45 min., the dark viscous liquid in 400 ml H_2O passed through Amberlite IR-4 to remove the $PhSO_3H$, and the 61 g of the dry sirup distd. at 0.01 mm in a short-path still. The yield of 1,4-anhydro-DL-xylitol, *m* 37-8°C, n_D^{25} 1.4977, d_4^{25} 1.354 (the sirup crystd. after standing 1 yr) was 65%.

3982. DAVIS, LANNES E. **Theories of base-exchange equilibriums.** *Soil Sci.* **59**, 379-95 (1945).—*C.A.* **39**, 5159[6].

The Donnan equil. between colloidal suspensions contg. salts of 2 cations and filtrates obtained from such suspensions was discussed. On theoretical grounds, mass-action-law equations for the Donnan equil. should have yielded equil. values that were const. solely when the variables were activities. The Donnan systems involved true equilibriums between 2 phases, the prepn. of which involved a base exchange.

3983. DAVIS, LANNES E. **Kinetic theory of ionic exchange for ions of unequal charge.** *J. Phys. Chem.* **49**, 473-9 (1945).—*C.A.* **40**, 2370[9].

The oscillation vol. theory of Jenny was discussed and extended to the case of ions of unequal charge, and a simple approx. equation was derived. The oscillation vol. theory implied that ionic exchange was a complex ionic redistribution in the colloidal suspension.

3984. HOLMES, E. LEIGHTON. **Some properties of organic ion-exchanger materials.** *J. Soc. Dyers Colourists* **61**, 39-40 (1945).—*C.A.* **39**, 2168[1].

Cation-exchangers could be regarded as either insol. salts or acids: in either case the H or metallic portion of the complex mol. was mobile and replaceable. The anion-exchangers could be regarded as insol. bases, and their basicity was entirely dependent upon the presence of basic N groupings. Developments in anion-exchangers had centered around the prepn. of resins of increased basic strength. Materials, other than synthetic resins, put forward as anion-exchangers comprised insol. dyestuffs, proteins, and dry metallic oxido gels.

3985. KOZAK, R. AND WALTON, H. F. **Separation of metal ions by cation exchange.** *J. Phys. Chem.* **49**, 471-2 (1945).—*C.A.* **40**, 2371[2].

An attempt was made to sep. Cu and Ni, Cd and Zn, and Ag and Cu ions by cation exchange. Zeo-Karb (a sulfonated coal) did not give quant. sepn., but it was improved by increasing the length of the column from 2 to 6 ft. The method was deemed less practical than chem. sepn.

3986. NACHOD, F. C. AND WOOD, W. **The reaction velocity of ion exchange. II.** *J. Am. Chem. Soc.* **68**, 629-31 (1945).—*C.A.* **39**, 2245[1]

If the cation was kept const. and the anion varied in a series of H^+-ion exchange expts., the rate of approach of equil. exchange was the same, but the values obtained with salts of weak acids were very much larger as contrasted with strong acid salts. The cation-exchange capacity increased as a function of the charge of the cation; however, the univalent ions exchanged with faster rate than the bivalent ions. The variation of rate consts. among the cations was generally what would be expected from their respective diffusion rates. Diffusion alone was not the rate-detg. factor but other effects, such as ionic size, charge, and steric availability of the exchange position in the exchanger played a decided role.

3987. RUNNEBERG, GÖRAN AND SAMUELSON, OLOF. **Ion-exchange substances in analytical chemistry. VII. Determining alkalies in the presence of phosphate ions.** *Svensk Kem. Tid.* **57**, 91-5 (1945).—*C.A.* **40**, 2416[8].

The exchange material was ground to pass 0.5 mm diam. and layered in 14 mm diam. and 100 to 150 mm depth, then satd. with H^+ ions by passing HCl through it. The method was tested with solns. of 0.1 *N* Na^+, K^+, Li^+, and 0.4 *N* $HPO_4^=$. After one of these solns. had percolated through the column, the filter layer was treated with 55 cc. 5 *N* HCl and 100 or more cc. distd. H_2O. The recovery of alkalies was very good.

3988. RUNNEBERG, GÖRAN. **Ion-exchange substances in analytical chemistry. VIII. Determining potassium in the presence of sulfates.** *Svensk Kem. Tid.* **57**, 114-7 (1945).—*C.A.* **40**, 2416[9].

Solns. containing K which could not be readily analyzed for K_2O on account of the presence of

SO_4^{--}, were sepd. by the org. ion exchanger. The samples were passed through 120 mm layers of org. ion exchanger to remove the K_2O. Then the column was washed with 100 cc. 5 *N* HCl and 100 cc. distd. H_2O, the resulting KCl soln. was evapd. to dryness, dried at 130°C, dissolved in H_2O and titrated with stand. $AgNO_3$ soln.

3989. Runneberg, Göran and Samuelson, Olof. **Ion-exchange substances in analytical chemistry. X. Determination of alkali in the presence of chromate, molybdate, tungstate, phosphomolybdate, phosphotungstate, and silicotungstate.** *Svensk Kem. Tid.* **57**, 250-4 (1945).—*C.A.* **40**, 2417^6

Na^+, and K^+ salts of these anions could not be sepd. and detd. by the H^+ satd. org. ion exchanger. The solns. were then satd. with NH_4^+ ions and passed through the column. NH_4OH was passed through until it came through alk. and then the column was washed with H_2O. The above anions passed through the exchanger layer completely free of all Na and K ions and the Na^+ and K^+ were recovered by treating the exchanger with 5 *N* HCl.

3990. Samuelson, Olof. **Ion-exchange substances in analytical chemistry. IX. Experiments with solutions containing nitrates and perchlorates.** *Svensk Kem. Tid.* **57**, 158-68 (1945).—*C.A.* **40**, 2417^2.

Salts of HPO_4^{--}, NO_2^-, ClO_4^- and Li^+, Na^+, K^+, NH_4^+, Mg^{++}, Ca^{++}, Sr^{++}, Ba^{++}, Zn^{++}, Mn^{++}, Co^{++}, Ni^{++}, Al^{+++}, Fe^{+++}, Cr^{+++} were passed through the org. ion exchanger. In general, 0.5 g of the sample was dissolved in 50 cc.H_2O and passed through a 130 mm layer of the exchanger followed by 200 cc. distd. H_2O. The anion was calcd. from the titration. 50 cc. 5 *N* HCl was then put through the column, followed by 100 cc. H_2O. Acid and water were evapd. to dryness, and the residue dried and weighed; it was taken up in 50 cc. H_2O passed through a H^+ satd. cation exchanger, washed as before and treated with HCl in the same way and titrated to give the cation. The results were within 0.4% of the truth. CN complex compds. $K_3Fe(CN)_6$, $K_4Fe(CN)_6$, $K_3Cr(CN)_6$, $K_3Co(CN)_6$, $K_4Mo(CN)_8 2H_2O$, $K_4W(CN)_8 \cdot 2H_2O$ were also investigated.

3991. Samuelson, Olof. **Determination of the total lime content of sulfite cooking acid (tower or raw acid).** *Svensk Papperstidn.* **48**, 55-6 (1945).—*C.A.* **39**, 3157^7.

A method was described for detg. the total CaO content in sulfite cooking acid. The SO_2 was first replaced by HCl. The free acid in the resulting soln. was titrated with NaOH. The metal cations were then exchanged against H ions, and the acids thus liberated were again titrated with the 2 titrations. The analysis might have been carried out in 20 to 30 min., and the error was less than 0.5%.

3992. Sussman, Sidney and Mindler, Albert B. **Ion exchange. Old process finds new uses.** *Chem. Industries* **56**, 789-95 (1945).—*C.A.* **39**, 2833^5.

3993. Sussman, Sidney; Nachod, Frederick C., and Wood, Wm. **Metal recovery by anion exchange.** *Ind. Eng. Chem.* **37**, 618-24 (1945).—*C.A.* **39**, 3502^9.

The metals studied comprised exchange and recovery of Cr, V, Mo, Fe, Pt, Pd, and Au. Expts. comprised both dynamic (tube) and static (equil.) types. Cr recovery was studied most extensively. The chromate removal by the chloride and sulfate salts of the anion exchanger was about the same, i.e., 3.09 and 3.05 milliequiv. per g of exchanger resin. Recovery of the Cr with alk. regenerants, such as NH_4OH, averaged 80-90%.

3994. Applezweig, Norman. **Semimicro ion-exchange column.** *Ind. Eng. Chem., Anal. Ed.* **18**, 82 (1946).—*C.A.* **40**, 1066^9.

The column was a 9-mm condenser tube carrying a 3-way stopcock and an overflow tube.

3995. Bauman, W. C. **Improved synthetic ion-exchange resin.** *Ind. Eng. Chem.* **38**, 46-50 (1946).—*C.A.* **40**, 971^9.

An improved nuclear sulfonic-type resin formed by condensing *o*- and *p*-phenolsulfonic acids with CH_2O was produced. Its exchange capacity (32,000 grains $CaCO_3$ per ft^3) was higher than previously known cation-exchange materials in both sodium and acid cycles. The resin was stable and without color throw over a wide range of pH up to 100°C and showed excellent stability to rapid changes in salt concn.

3996. Bishop, John A. **Covalent adsorption on base-exchange resins. I. Adsorption of monobasic acids.** *J. Phys. Chem.* **50**, 6-12 (1946).—*C.A.* **40**, 2711^3.

The adsorption on Amberlite IR-3 of AcOH, $CH_2ClCOOH$, $CHCl_2COOH$, HCl, $(COOH)_2$, and tartaric acid was studied. The adsorption might have been correlated by regarding the process as one of salt formation. In concd. solns. direct adsorption of unionized mols. may have produced greater adsorption than was predicted from the equation and the ionization consts. of the acids.

3997. Eastmond, E. John. **Spectrographic determination of calcium in microbiological culture media.** *J. Opt. Soc. Am.* **36**, 57-60 (1946).—*C.A.* **40**, 1556^5.

The chief problem was to prep. standards. This was solved by removal of Ca from the actual medium by use of a cation-exchange column of Amberlite IR-100 operated in a K cycle.

3998. Fedorova, G. V. **Use of sulfocoal [sulfonated coal] for analytical purposes.** *Izvest. VTI (Vseoyuz. Teplotekh. Inst. im. Feliksa Dzerzhinskogo)* **15**, No. 2, 28-9 (1946).—*C.A.* **40**, 5509^6.

A base-exchange reaction was used to det. Cl^- and $SO_4^=$ in natural and feed waters using sulfonated, ash-free coal (30-40 g) in a buret over a layer of quartz.

3999. Gapon, E. N. **Ion exchange between solid and liquid phases. III.** *J. Phys. Chem. (U.S.S.R.)* **20**, 297-302 (1946).—*C.A.* **40**, 5616^6.

It was assumed that the surface charge of an adsorbent was detd. by the potential and capacity of the elec. double layer and that this potential was detd. only by the activity of the alkali (for cation adsorption) or acid (for anion adsorption) whereas the capacity depended on the activity of all electrolytes in the soln.

4000. Gustavson, K. H. **Investigation of complex formation in chromium salts by means of organolites (a preliminary summary).** *J. Intern. Soc. Leather Trades Chem.* **30**, 264-79 (1946).—*C.A.* **41**, 877*c*.

Wofatit KS (1g) treated with excess 67% acid Cr sulfate (free from neutral salts) absorbed 0.158 g Cr_2O_3. By treatment of Wofatit KS with excess NaCl its cationic exchange power was detd. to be 2.01 mg equiv. per g. The calcd. equiv. wt of Cr fixed was 79, corresponding to one pos. charge per atom Cr or $Cr_2(OH)_2SO_4^{++}$. Acid-treated organolites were prefered to Na organolites except when the Cr complex was acid-sensitive, e.g., sulfito-chromates. NaCl did not displace Cr completely from the organolite but HCl did.

4001. Gustavson, K. H. **Investigation of complex formation in chromic salts by the organolite method. IV. The formation of hydroxochlorochromic chlorides.** *Svensk Kem. Tid.* **58**, 274-6 (1946).—*C.A.* **41**, 7790*i*.

A 66% acid $CrCl_3$ free from neutral NaCl was prepd. from pure hydrous Cr_2O_3 and HCl. A part of this was aged 4 weeks, then treated with given amts. NaCl, warmed to 98°C for 5 min., and aged 4 weeks. These solns. were passed through columns of Wofatit KS. The samples to which no NaCl was added had 330 milliequiv./liter Cr and 218 Cl and the one having 2 *M* NaCl contained 330 and 2200 milliequiv./liter, resp.

4002. Jaag, Ed. **Research with base-exchange material.** *Textil-Rundschau* **1**, 99-105 (1946).—*C.A.* **41**, 6003*b*.

The exchange capacity of base-exchange materials was detd. The quantity of water softened was taken as a measure of the exchange capacity of the material under test. Graphs reported showed that the hardness increased very rapidly as soon as it was no longer 0. Tests were run on a no. of com. materials, including natural and artificial zeolites, artificial resins, and materials having an activated-C-base. The values used were a mean of those obtained after the 3rd and 4th regenerations. In general, the artifical resin materials showed very good exchange capacity and the artificial zeolites good capacity, while the materials having an activated charcoal base were intermediate between these two.

4003. Kaganov, I. N. **Ion exchangers.** *Sakharnaya Prom.* **19**, No. 3, 20-1 (1946).—*C.A.* **41**, 2825*b*.

The prepn. and functioning of natural and synthetic, org. and inorg., base and acid exchangers were reviewed briefly.

4004. Lindner, R. **Separation of rare earths by radiometric adsorption analysis.** *Naturwissenschaften* **33**, 369-70 (1946).—*C.A.* **43**, 6101*b*.

La could be readily sepd. from Pr; in a mixt. of equal parts, 49% of the La was recovered in pure form. La, being more basic, was adsorbed least. Elements from Ce to Sm showed some irregularities. Ce could readily be sepd. from La and Pr. The differences in adsorption of Pr, Nd, and element 61 were very little. Sm showed unusual adsorption, stronger even than Y. Element 61 was easily sepd. from Sm.

4005. Myers, Robert J. **Synthetic-resin ion exchangers.** *Advances in Colloid Science* **I**, 317-51 (1946).

This review was divided as follows: (1) Types of ion-exchange resins; (2) nature of exchange by synthetic resins; (3) methods of examination of synthetic-resin ion exchangers; (4) chemical properties in static systems; (5) chemical properties in dynamic systems; (6) applications of synthetic-resin ion exchangers.

4006. Ryznar, John W. **A new method of preparation and purification of some hydrous oxide sols.** *Colloid Chemistry* **6**, 1113-17 (1946).—*C.A.* **40**, 2595^2.

Pure and stable silica sols. could be obtained by passing Na silicate through an acid-regenerated exchange bed. Ferric hydroxide sol. could be freed from Cl^- by passage through an alkali-regenerated anion exchanger. Combinations of cation and anion exchangers were also used.

4007. Samuelson, Olof. **Investigations of complex salt solutions with the use of organic exchangers. III. Investigations of bivalent zinc, nickel, cobalt and copper chloride solutions.** *Iva* **17**, 17-22 (1946).—*C.A.* **40**, 6360^9

Expts. were carried out with a synthetic-resin sulfonic acid ion exchanger on *N* solns. of Ca, Zn, Ni, Co, and Cu chlorides. In no case was Cl^- adsorbed. After equil. was reached the exchanger was washed with distd. water until free of Cl^-, treated with 5 *N* HCl, the soln. evapd., and the residue fumed with H_2SO_4. The residue from this treatment was dissolved in H_2O, and sulfate detd. by the ion-exchanger method, with titration with 0.1 *N* NaOH. The exchange capacity was the same for all ions investigated. Conclusions on the effect of different types of complexes on the adsorption of chlorides could be drawn only if the complexes were very stable.

4008. Samuelson, Olof. **The use of ion-exchange materials in analytical chemistry. XI.** *Iva* 17, 5-9 (1946).—*C.A.* 40, 5657^9.

The detn. of various anions by an ion-exchange method was studied by percolating solns. of bromides, iodides, chlorates, bromates, and iodates through a layer of an org. H^+ exchanger. BrO_3^- and IO_3^- were reduced, but it was possible to exchange the cation for H^+ in the other cases. The concn. of the anions could be detd. by titration of the H^+ with NaOH. Cr^{+++} salts could be sepd. even in hot solns.

4009. Samuelson, Olof. **The use of ion-exchange substances in analytical chemistry. XII. Cadmium salts.** *Svensk Kem. Tid.* **58**, 247-51 (1946).—*C.A.* **41**, 1571*h*.

Cd^{++} was quantitatively sepd. from the anions Cl, Br, I, NO_3 ClO_4 AcO, C_2O_4, SO_4, and HPO_4 by passing neutral solns. through a 160-mm layer of H^+ satd. Wofatit KS in 0.2-0.4-mm granules. The rate of filtration was more significant than the concn. of Cd^{++} A satisfactory technique consisted of drawing a 50-cc. soln., neutralized to methyl red, through the filter layer in about 10 min.

4010. Sillén, Lars Gunnar and Ekedahl, Erik. **Filtration through a sorbent layer. II. Experiments with an ion exchanger; theory, apparatus, and preliminary results.** *Arkiv. Kemi, Mineral. Geol.* **A22**, No. 16, 12 pp. (1946).—*C.A.* 41, 4682*d*.

The actual performance of a cation exchanger was compared with that predicted from theoretical considerations. The system investigated was: $Ag^+(soln.) + H^+(adsorbed) \rightleftarrows Ag^+(adsorbed) + H^+(soln.)$. The thoroughly washed sorbent (a sulfonated org. material) in a glass filter funnel was first brought to equil. with HNO_3 of the desired concn. Then $AgNO_3$ soln. was passed through the exchanger at a measured const. rate. The e.m.f. (E_c) of a pair of Ag-AgI electrodes, one immersed in the influent soln., the other in the effluent soln., was detd. as a measure of the ratio a_o/a of the concns. of Ag^+ in influent soln. and effluent soln.

4011. Tiger, H. L.; Sussman, S.; Lane, M., and Calise, V. J. **Desalting sea water—a practical chemical method.** *Ind. Eng. Chem.* **38**, 1130-7 (1946).—*C.A.* 41, 237*f*.

Desalting briquets contained Ag zeolite and Ag_2O which removed Na, Ca, Mg, and Cl. Sulfate reduction, where required, was accomplished with $Ba(OH)_2 8H_2O$. The briquets also contained activated charcoal to remove taste (arising from the plasticizer in the Vinylite resin desalting bag), stearic acid to act as an internal lubricant for the briquetting process, and bentonite clay to disrupt the briquet when in contact with sea water. Six briquets, packed with Vinylite desalting bag which included a filter, occupied the space of 0.7 pint of H_2O, and produced 6 pints of drinkable H_2O.

4012. Walton, H. F. **Ion exchange.** *J. Chem. Education* **23**, 454-8 (1946).—*C.A.* 40, 6904^7.

Ion-exchange phenomena were described, together with various applications and lecture demonstrations.

4013. Ackermann, A. **Measurement of the efficiency of ion exchangers.** *Bull. soc. chim. France* **1947**, 619-25.—*C.A.* 42, 2490*g*.

A 0.01 *N* chloride soln. was passed at 10-10.5 cc./min. through 20 g of a sulfated carbon exchanger (27.4 cc. in a tube 3.9 $cm^2 \times 81$ mm high) and the cation exchanged for H. The amt. of soln. passed to the break point (when cation appeared in filtrate) was 134, 130, 124, 87, 78, and 91 cc./g of exchanger for Ba, Ca, Mg, K, Na, and NH_4, resp.

4014. Ayres, John A. **Purification of zirconium by ion-exchange columns.** *J. Am. Chem. Soc.* **69**, 2879-81 (1947).—*C.A.* 42, 1522*c*.

The cation exchanger was Amberlite IR-100 and the anion exchanger Amerlite IR-4. When solns. contg. 10 g $ZrO(NO_3)_2$ were poured through the H-form of Amberlite IR-100 (5-6 ml/min.) 98% of the Zr remained in the effluent. With the Na-form of the resin, 99% of the Zr passed through. The capacity of the resin for Zr was 0.00084 mole/100 cc. of resin. $Fe(NO_3)_3.9H_2O$ (2 g) in 200 ml of the Zr stock soln. was passed through the column. Essentially all the Zr passed through; about 98% of the iron was absorbed. A similar expt. was carried out for mixt. of Ti and Zr. Essentially all the Zr passed through whereas about 5/6 of the Ti was absorbed. Be was completely removed by the ion-exchange resin.

4015. Barzakovskiĭ, V. P. **Ion exchange on solid organic substances.** *Prirsoda* **36**, No. 5, 47-51 (1947).—*C.A.* 42, 1679*e*.

4016. Bauman, W. C. and Eichhorn, J. **Fundamental properties of a synthetic cation-exchange resin.** *J. Am. Chem. Soc.* **69**, 2830-6 (1947).—*C.A.* **42**, 1366*h*.

The analysis of Dowex 50 in the sodium form was C 26.8, H 7.0, S 8.9, Na 6, O (by difference) 51.3, and H_2O 41.4%. Glass electrode titration with 2 *N* NaOH showed 4.92 milliequivs. of exchangeable-H per g of oven-dried H resin. This accounted for 8.4% S, the other 0.5% presumably being present as sulfone cross links. The constitution of each spherical particle appeared to be that of a homogeneous gel, consisting of a basic hydrocarbon cross-linked skeleton which limited the linear motion of the SO_3^- anions.

4017. Bhatnagar, M. S. **Studies on organic adsorbents. II. Adsorption of acids and alkalies by resorcinol-formaldehyde resins.** *J. Sci. Ind. Research (India)* **6B**, No. 12, 185-8 (1947).—*C.A.* 44, 3332*g*.

The increase in adsorption of a homologous series of fatty acids in aq. solns. was proportional to the length of the hydrocarbon chain. The adsorption was true adsorption, and was decreased by the substitution of polar groups. The amt. of HCOOH adsorbed was twice that of $(COOH)_2$, and 3 times that of aconitic acid. In hydroxy- and nitroaromatic acids the adsorption increased with the increase in the value of group moments in the order: $COOH > Cl > OH > NO_2$; with substituted acids the order was $o < m < p$.

4018. Boyd, G. E; Schubert, J., and Adamson, A. W. **The exchange adsorption of ions from aqueous solutions by organic zeolites. I. Ion-exchange equilibria.** *J. Am. Chem. Soc.* **69**, 2818-29 (1947).—*C.A.* 42, 1780*g*.

In the simple case of the simultaneous competitive adsorption of two singly charged cations, A^+ and B^+, by an org. zeolite, by analogy with the Langmuir adsorption mechanism the equation for the adsorption of A^+ could be written: $(X/m)_{A^+} = kb_1 C_{A^+}/(1 + b_1C_{A^+} + b_2C_{B^+})$, where $(X/m)_{A^+}$ was the amt. of A^+ ion adsorbed per unit wt of adsorbent, C_{A^+} and C_{B^+} are the respective equil. concns. (activities) of A^+ and B^+ in soln., k, b_1, and b_2 were consts. In very small initial concns. of A^+, the complete adsorption of A^+ would not desorb enough B^+ to cause a detectable change in C_{B^+}. Hence, a $C_{A^+}/(X/m)_{A^+}$, C_{A^+} plot should have been linear. This was checked experimentally.

4019. Boyd, G. E.; Adamson, A. W., and Myers, L. S., Jr. **The exchange adsorption of ions from aqueous solutions by organic zeolites. II. Kinetics.** *J. Am. Chem. Soc.* **69**, 2836-48 (1947).—*C.A.* 42, 1781*g*.

In terms of the base-exchange reaction $A^+ + BR = AR + B^+$, where A^+ and B^+ were the exchanging monovalent cations. The over-all transport of mass was: (1) diffusion of A^+ through the soln. to the adsorbent particles; (2) diffusion of A^+ through the adsorbent particles; (3) chem. exchange between A^+ and BR at the exchanging positions in the interior of the particles; (4) diffusion of the displaced cation B^+ out of the interior of the exchanger; and (5) diffusion of the displaced cation B^+ through the soln. away from the adsorbent particles.

4020. BOYD, G. E.; MYERS, L. S., JR., AND ADAMSON, A. W. **The exchange adsorption of ions from aqueous solutions by organic zeolites. III. Performance of deep adsorbent beds under non-equilibrium conditions.** *J. Am. Chem. Soc.* **69**, 2849-59 (1947).—*C.A.* **42**, 1782*c*.

The exptl. work was done with Amberlite IR-1 as adsorbent. An exptl. method for the continuous recording of the concn. history of the effluent from a deep bed was developed with radio-isotope equipment and techniques. The concn. histories in various alkali metal exchange expts. had the same form as the curves predicted by theory over a wide range of relative concn. Good agreement was found between the values of the distribution coeff. A dependence of desorption rate of flow and on macrocomponent-ion concn. was indicated, and it was shown that it was possible to apply the transfer theory procedure to column desorption data.

4021. DJURFELDT, RALPH; HANSEN, JENNY, AND SAMUELSON, OLOF. **Ion-exchange substances in analytical chemistry. XIII. Acetates and oxalates.** *Svensk Kem. Tid.* **59**, 13-18 (1947).—*C.A.* **41**, 3009*b*.

Acetate and oxalate solns. were percolated through a layer of an org. cation exchanger. The following cations were quantitatively withheld when assocd. with the anions, CH_3COO^- and $C_2O_4^{--}$: Li, Na, K, NH_4, Mg, Ca, Ba, Sr, Zn, Mn, Co, Ni, Cd, and Cu. Fe, Al, and Pb were given in the CH_3COO^- list, but omitted under $C_2O_4^{--}$. Even small amts. of $C_2O_4^{--}$ afforded ample complex formation to vitiate this percolation as a quantitative method for Fe and Al. Al and Be were withheld 100%, but the Fe was exchanged completely only when 2 milliequivs. were not dild. to more than 500 cc. and this freshly made up.

4022. EIDINOFF, MAXWELL LEIGH. **Method for extending study of metal ion-cation exchanger isotope fractionation.** *J. Chem. Phys.* **15**, 527 (1947).—*C.A.* **41**, 6142*h*.

Isotope fractionation in cation-cation exchanger equil. could be studied more readily by the addn. of 5-50 microcuries of radioisotopes to the element. Some excellent pairs were $Be^{7,9}$, $Be^{9,10}$, $Na^{22,23}$, $Na^{23,24}$, $K^{39,41,42}$, $Ca^{40,41,45}$.

4023. EKEDAHL, ERIK AND SILLEN, LARS GUNNAR. **Filtration through a sorbent layer. III. Sorption experiments with an ion exchanger.** *Arkiv. Kemi, Mineral., Geol.* **25A**, No. 4, 26 pp (1947) (in English).—*C.A.* **42**, 7112*a*.

The reaction studied was the replacement of H^+ by Ag^+ with a com. sulfonic acid base cation exchanger. Results were automatically recorded.

4024. HARRIS, DARWIN H. AND TOMPKINS, EDWARD R. **Ion exchange as a separation method. II. Separations of several rare earths of the cerium group (lanthanum, cerium, praseodymium, and neodymium).** *J. Am. Chem. Soc.* **69**, 2792-2800 (1947).—*C.A.* **42**, 1835*g*.

Expts. with mixts. of Y and Ce showed that Dowex 50 was much superior to the Amberlite resins IR-1 and IR-100 for the sepn. of rare earths by the citrate-elution technique. With Dowex 50 it was possible to get essentially complete sepns. between several rare earths of the Ce group in a single adsorption-elution cycle. Pr was sepd. in trace and in bulk amts. from Ce. Ce was sepd. from La.

4025. HELRICH, KENNETH AND RIEMAN, WILLIAM III. **Determination of phosphorus in phosphate rock. Separation from cations by ion-exchange resin.** *Anal. Chem.* **19**, 651-2 (1947).—*C.A.* **41**, 6836*g*.

Phosphate rock digested with hot 12 *N* HCl gave a soln. contg. Ca^{+2}, H_3PO_4, and HCl. If the soln. was evapd. to dryness and baked at 100°C for an hr, any H_2SiO_3 would be dehydrated and probably some HF lost. If the residue was taken up in dil. HCl and filtered and then run through a column of ion-exchange resin, the Ca^{+2} and other cations would be deposited on the resin and the final effluent would contain merely HCl and H_3PO_4. The titration to pH 4.6 served to convert all HCl to NaCl and the H_3PO_4 to NaH_2PO_4. Subsequent titration to pH 9.0 converted the $H_2PO_4^-$ to HPO_4^{-2}.

4026. JOHNSON, WARREN C.; QUILL, LAURENCE L., AND DANIELS, FARRINGTON. **Rare earths separation developed on Manhattan Project.** *Chem. Eng. News* **25**, 2494 (1947).—*C.A.* **41**, 7305*b*.

The methods for sepg. the rare earths by adsorption on Amberlite resins were outlined chronologically. Credit for certain developments was assigned to individuals and groups.

4027. KETELLE, B. H. AND BOYD, G. E. **The exchange adsorption of ions from aqueous solutions by organic zeolites. IV. The separation of yttrium-group rare earths.** *J. Am. Chem. Soc.* **69**, 2800-12 (1947).—*C.A.* **42**, 1782*h*.

Radioisotopes were used, and the sepn. was followed by means of a counting cell. Various theoretical factors involved in the studies were surveyed. Studies were made under various conditions of temp. and pH with Amberlite IR-1 or Dowex-50 as the ion-exchange resin and the citrate elution technique. The fractionation of the heavy rare earths could be made so complete that the method was established as a promising procedure for the quant. analysis of rare earths for cationic impurities. A sample of Er_2O_3, previously exhaustively purified, in which all other rare earths were reported absent by spectrographic analysis, was shown to contain 10 p.p.m. of Tm by irradiation of the Er_2O_3 with neutrons and subsequent chromatographic sepn.

4028. KUNIN, ROBERT AND MYERS, ROBERT J. **Rates of anion exchange in ion-exchange resins.** *J. Phys. & Colloid Chem.* **51**, 1111-30 (1947).—*C.A.* **42**, 21*f*.

The rate-detg. step for the anion exchange was the rate of diffusion of the ions through the gel structure. The rate was shown to follow the parabolic diffusion law and to depend on the degree of satn. of the exchange resin as well as the concn. of ions. Furthermore, the energy of activation of the exchange reaction with HCl was 6600 cal, in good agreement with the activation energy for the diffusion of HCl in water. The effect of a neutral salt (NaCl) on the reaction rate of HCl was also in agreement with the diffusion theory.

4029. Kunin, Robert and Myers, Robert J. **The anion-exchange equilibria in an anion-exchange resin.** *J. Am. Chem. Soc.* **69**, 2874-8 (1947).—*C.A.* **42**, 3237c.

For the acid-adsorption cycle, the titration curves for the neutralization of HCl, H_2SO_4, HNO_3, H_3PO_4, $HC_2H_3O_2$, $H_2C_2O_4$, citric acid, HCOOH, benzoic acid, and salicylic acid by the hydroxyl form of Amberlite IR4B in water and in neutral salt solns. were detd. For the regeneration cycle, the titration curves were obtained for the reaction between the chloride and sulfate forms of the resin and solns. of NaOH, Na_2CO_3, $NaHCO_3$, and NH_4OH. Evidence was obtained that indicated that all 3 types of processes were true anion-exchange reactions.

4030. Lur'e, Yu Yu. **Organic exchange masses-organolites. Their use in analytical chemistry.** *Zavodskaya Lab.* **13**, 532-9 (1947).—*C.A.* **42**, 4484g.

Details were given for the prepn. of sulforesorcinol cationite, sulfophenol cationite, and methylated *m*-phenylenediamine resin. Ordinary peat was used as a cationite and was found to absorb about 11% by wt of Pb^{+2} from the effluent waters of Pb dressing plant.

4031. Lur'e, Yu Yu and Filippova, N. A. **Use of organolites in analytical chemistry. I.** *Zavodskaya Lab.* **13**, 539-47 (1947).—*C.A.* **42**, 4484h.

A dil. soln. of Ni, Co, and Cu salts could be enriched by means of cationites by about 40 times or more. The loss of metal in the total cycle of absorption and regeneration amounted to 1-2%. It was possible to use cationites for quant. sepn. of amphoteric metals from anions and nonamphoteric cations by absorbing them with cationite and then extg. with alkali solns. It was possible to sep. Sb, Mo, W, Zn, and Al from all the elements which formed basic hydroxides (Fe, Cu) and from As which remained with the other anions as an arsenite ion.

4032. Marinsky, J. A.; Glendenin, L. E., and Coryell, C. D. **The chemical identification of radioisotopes of neodymium and element 61.** *J. Am. Chem. Soc.* **69**, 2781-5 (1947).—*C.A.* **42**, 1811g.

A sample which contained essentially the Pr group (Pr, Nd, and 61) with very little Ce, Sm, Eu, and Y was isolated with about 15 mg of La carrier from a rare earth fission-product elution fraction. The rare earth activities were adsorbed on an Amerlite IR-1 column and eluted with a 5% soln. of NH_4 citrate at pH 2.75. Fractions of the eluate were collected. Four β-peaks and one γ-peak were found, the γ-peak being assocd. with the third β-peak. The first peak was identified as due to traces of 57-day Y^{61}. Considerable quantities of 61^{147} could be prepd. as the result of the industrial application of nuclear power.

4033. Mayer, Stanley W. and Tompkins, Edward R. **Ion exchange as a separation method. IV. A theoretical analysis of the column separation process.** *J. Am. Chem. Soc.* **69**, 2866-74 (1947).—*C.A.* **42**, 3237f.

A simple theoretical analysis of the ion-exchange column sepn. process based on the analogy of the ion-exchange sepn. column to the fractional-distn. or extn. column was developed for the case in which the distribution coeff. of the solute between the solid and liquid phases remained const. throughout the column. The theory was also applied to detn. of the purities of the rare earths sepd. by this process.

4034. Monroe, Watson H. **Rapid oxidation of glauconite in glauconitic sand.** *Bull. Am. Assoc. Petroleum Geol.* **31**, 1509-11 (1947).—*C.A.* **42**, 845f.

Samples of glauconite from greensand deposits of N.J. retained their characteristic green color and hardness after several years in storage. Glauconite from the Upper Cretaceos Eutaw formation of the Gulf Coastal Plain was softer and upon exposure to weathering oxidized rapidly to limonite.

4035. Oda, Ryohei and Shimizu, Hiroshi. **Studies on ion-exchange synthetic resins. I. Fundamental studies on the removal of salt from sea water. II. Optimum amount of resin and practical capacity.** *Chem. High Polymers* (Japan) 4, 135-8 (1947).—*C.A.* **45**, 2705i.

Fundamental studies were carried out with 0.5-0.6 *N* NaCl and HCl. Resin prepd. from natural rubber and H_2SO_4 was used as a cation exchanger A, and *m*-phenylenediamine-HCHO resin was used as an anion exchanger B. The optimum quantity corresponding to 25 cc. of sea-water was greater than 7 g for A and 5-6 g for B. Continuous shaking for 4 hrs was desirable.

4036. Oda, Ryohei; Shimizu, Hiroshi, and Nakayama, Yorhiro. **Mechanism of ionic exchange adsorption in ion-exchanging synthetic resins.** *Repts. Chem. Research Inst. Kyoto Univ.* **16**, 41 (1947).—*C.A.* **45**, 7813i.

Natural rubber was resinified with H_2SO_4 and then sulfonated with fuming H_2SO_4 to a cation-exchanging resin, which was allowed to adsorb statically, by exchange, various cations from 0.1 *N* solns. of their chlorides. In terms of the amt. adsorbed (millieq./g resin), the univalent cations ranked from the smallest as Li, Na, K, and NH_4 (1.21, 1.31, 1.38, and 1.40, resp.); the bivalent cations as Ni, Cd, Mg, Ca, and Ba (1.33, 1.38, 1.42, 1.47, and 1.56, resp.).

4037. Oda, Ryohei; Shimizu, Hiroshi, and Nakayama, Yoshiro. **Preparation of a few ion-exchange synthetic resins.** *Repts. Inst. Chem. Research, Kyoto Univ.* **16**, 43-5 (1947).—*C.A.* **45**, 9199g.

Catalyzed with H_2SO_4, resorcinoldiglycolic acid and HCH were condensed into a hard ion-exchange resin. The product from 2 g resorcinoldiglycolic acid, 2.3 formalin, and 2 cc. 88% H_2SO_4 heated 7 hrs without adding H_2O in a H_2O bath was the best; this showed in 0.5 *N* HCl the exchange value 7.2 with 0.5 *N* NaOH, and 4.1 millimol./g with 0.5 *N* NaCl.

4038. PENISTON, QUINTIN P.; FELICETTA, VINCENT F., AND MCCARTHY, JOSEPH L. **Sulfite waste liquor analysis. Determination of sulfate by a conductometric titration method.** *Anal. Chem.* **19**, 332-4 (1947).—*C.A.* **41**, 4308*c*.

10 ml of waste liquor were passed through an ion-exchange column contg. Amberlite IR-100 to replace Ca^{+2} or Mg^{+2} with Na^{+}. Water was added to 100 ml + 5 ml of 5% HCHO and the soln. was dild. to 300 ml with 75% iso-PrOH. At room temp. the SO_4^{-2} was titrated with standard $BaCl_2$ conductometrically. A slight excess of reagent was added as shown by the elec. resistance and the SO_4^{-2} content calcd. from an elec. cond. graph.

4039. PROKHOROV, F. G. AND KORNEYEVA, M. G. **Organic cation-exchangers.** *Izvest. VTI* **16**, No. 6, 1-6 (1947); *Chem. Zentr.* **1948**, **I**, 1046.—*C.A.* **44**, 8021*d*.

The manuf., compn., and properties of Wofatite P, C, D, K, and KS, Seocarb, Amberlite IR-100, and the Russian Sulfocoals (brown or mineral coal treated with oleum contg. 20% SO_3) were reported. Wofatite P showed the greatest resistance to hot, alk. waters. The Sulfo-coals were satisfactory in acid media.

4040. PROKHOROV, F. G. AND YANKOVSKII, K. A. **Dynamic activity of cationites towards cations.** *Zavodskaya Lab.* **13**, 656-9 (1947).—*C.A.* **43**, 3268*d*.

Solns. of chlorides (nitrates in the case of Ag and Pb), $\sim 3.6 \times 10^{-3}$ *N*, were filtered through a 0.5 m column of a typical cation exchanger (40 g, grain size 0.60-0.75 mm, dry vol. 60 ml, wet vol. 83 ml) in a 1.5-cm-diam. tube, at a linear rate of 10 m/hr, and the amt. of filtrate collected until 1st appearance of the cation filtered was detd. The activity of the exchanger (g equiv./m^2) until 1st appearance of the given cation in the filtrate was found to be: Li 66.5, Na 93.5, K 168.0, NH_4 133.5, Cs 144.0, Ag 188.5, Be 158.5, Mg 189.0, Ca 201.0, Cu 201.0, Sr 189.0, Cd 176.5, Ba 208.0, Pb 236.5, Mn 169.0, Ni 189.0, Co 183.0.

4041. RICHES, J. P. R. **Preliminary experiments on the use of synthetic resins in the estimation of trace elements.** *Chemistry & Industry* **1947**, 656-8.—*C.A.* **42**, 837*i*.

4042. SPEDDING, F. H.; VOIGHT, A. F.; GLADROW, E. M., AND SLEIGHT, N. R. **The separation of rare earths by ion exchange. I. Cerium and yttrium.** *J. Am. Chem. Soc.* **69**, 2777-81 (1947).—*C.A.* **42**, 1520*d*.

The sepn. of macro quantities of rare earths of spectrographic purity by adsorption on Amberlite-type resins and subsequent elution with such agents as citric acid-ammonium citrate soln. at controlled pH depended on the fact that the rare earths formed complexes with citrate ions. If the pH was suitably adjusted, competition was set up for the rare earth ions between the citrate complexes and the active centers of the resin. Since the equil. consts. for the rare earth citrate complexes varied slightly among the different rare earths, their rates of travel down the column differed sufficiently to lead to their sepn. The resin used was Amberlite IR-1. The effect of various factors including the concn. of the eluant, the pH of the element, the ratio Ce/Y in the starting sample, and the length of columns were established by which Ce and Y, of spectrographic purity, could be sepd. in macro quantities.

4043. SPEDDING, F. H.; VOIGT, A. F.; GLADROW, E. M.; SLEIGHT, N. R.; POWELL, J. E.; WRIGHT, J. M.; BUTLER, T. A., AND FIGARD, P. **The separation of rare earths by ion exchange. II. Neodymium and praseodymium.** *J. Am. Chem. Soc.* **69**, 2786-92 (1947).—*C.A.* **42**, 1520*g*.

Optimum conditions for the sepn. by means of 5% citrate solns. were: pH = 2.55, sample wt 0.25 to 0.50 g (as oxide) per cm^2 of resin bed, flow rate 1.5-3.0 cm/min. Column diam. did not appreciably affect sepn. In a test expt., a column 64 mm in diam. with a bed 175 cm long was used. The sample was 0.25 g/cm^2 and analyzed 51.7% Pr. The flow rate was 1.5 cm/min. and the pH was 2.55. The break-through came at 184.1, which, at this flow rate, was approx. 2.5 days after the start of the elution. 22% of the Nd was obtained of spectroscopic purity, and more than 50% of the original Nd was eluted with a purity > 98% Nd.

4044. SPEDDING, F. H.; FULMER, E. I.; BUTLER, T. A.; GLADROW, E. M.; GOBUSH, M.; PORTER, P. E.; POWELL, J. E., AND WRIGHT, J. M. **The separation of rare earths by ion exchange. III. Pilot plant scale separations.** *J. Am Chem. Soc.* **69**, 2812-18 (1947).—*C.A.* **42**, 1521*a*.

Detailed procedures were outlined for the pilot-plant scale sepn. of the rare earths using Amberlite IR-100 and 0.5% citric acid-ammonium citrate solns. as eluant. Twenty-four columns 4 in. in diam. and with resin bed 8 ft long were used. The pH of the eluant was 3.9, and 0.1% phenol was used to prevent mold growth. Large samples of rare earths of high purity were obtained by these procedures.

4045. THEIS, EDWIN AND THORSTENSEN, T. C. **Studies relative to cationic chromium complexes through the use of cationic exchange resins.** *J. Intern Soc. Leather Trades Chem.* **31**, 137-43 (1947).—*C.A.* **41**, 4942*f*.

The effect of addn. of Na_2SO_4, HCOONa, and $Na_2C_2O_4$ to 33% basic Cr sulfate liquor was studied. The stock liquor, free from neutral sulfate, was prepd. by SO_2 reduction of CrO_3 and adjustment of basicity with $Ba(OH)_2$. Twenty-five ml of soln. contg. 1% Cr was treated with 100 g wet "Ionac Resin C-200" for 15 min., drained, and washed. Cationic Cr, and accompanying complexly bound anions, were detd. by difference from analysis of the filtrate and washings, and also by eluting the absorbed Cr compd. with 20% HCl. The salt-free liquor contained 90% of total Cr as cations. Addn. of 0.2 to 6 moles $Na_2C_2O_4$ caused rapid decrease in percentage of cationic Cr to 15% at max. $Na_2C_2O_4$. All cationic bound sulfate was displaced in the presence of more than 2 moles $Na_2C_2O_4$. Oxalate acidity of the cationic Cr complex increased to 47% at max. $Na_2C_2O_4$.

4046. THOMAS, G. GARROD AND DAVIES, C. W. **Ion-exchange resins as catalysts.** *Nature* **159**, 372 (1947).—*C.A.* **41**, 3995*i*.

Ion-exchange resins, in the H form, offered several advantages as acid catalysts. Amberlite

IR-100, a synthetic resin which had one equiv. sulfonic acid group in 500 g resin, was used as catalyst for ester hydrolysis. This resin was more efficient than HCl by factors of 1.7 for MeOAc, 2.3 for EtOAc, and 9.8 for BuOAc.

4047. Thompson, R. B. and Roberts, E. J. **Design and operation of ion-exchange installations.** *Chem. Eng. Progress* **1**, No. 3, *Trans. Am. Inst. Chem. Engrs.* **43**, 97-102 (1947).—*C.A.* **41**, 2284*g*.

Lab. studies were discussed dealing with factors of design, net capacities, effective strength of exhaustion solns., effective anion removal, acid efficiency, capacities of anion exchangers, anion exchangers, and the factors of design in com. size units.

4048. Tiselius, A.; Drake, B., and Hagdahl, L. **Group separation of amino acids by adsorption analysis.** *Experientia* **3**, 21-6 (1947) (in English).—*C.A.* **41**, 4407*i*.

Amino acid mixts. were divided into four groups. The soln. (50 mg of mixed amino acids in 10 ml 5% HOAc) was forced through 3 filters in series contg. (1) charcoal, (2) Wofatit C, and (3) Wofatit KS, resp., and washed with 50 ml 5% HOAc. The No. 1 filter contained the aromatic amino acids. About 1 liter 20% HOAc was passed through filters No. 2 and 3. Filter No. 2 was eluted with 500 ml *N* HCl and the eluate was evapd. to give the basic amino acids. Filter No. 3 was eluted with 750 ml *N* HCl, the eluate was evapd., and the residue, which contained acidic and neutral amino acids, was dissolved in 10 ml H_2O and poured through filter No. 4 contg. Amberlite IR-4. The neutral amino acids were removed by washing with 100 ml H_2O. The acidic amino acids were eluted with 250 ml *N* HCl.

4049. Tompkins, Edward R.; Khym, Joseph X., and Cohn, Waldo E. **Ion exchange as a separation method. I. The separation of fission-produced radioisotopes, including individual rare earths, by complexing elution from Amberlite resin.** *J. Am. Chem. Soc.* **69**, 2769-77 (1947).—*C.A.* **42**, 1834*h*.

The ion-exchanger used was Amberlite IR-1. When an aq. soln. contg. cation M^{+n} was brought into contact with the resin, M^{+n} in the soln. exchanged with those cations originally held in the resin by its free acid groups: $n\mathrm{RH} + \mathrm{M}^{+n} \rightleftarrows \mathrm{R}_n\mathrm{M} + n\mathrm{H}^+$. The final equil. concns. of M^{+n} and H^+ depended principally upon the activities of the two cations and upon the respective affinities of each for the resin. The effective concn. of an ion might have been lowered by complex formation, and thus any cation might have been effectively replaced from its resin compd. by a relatively dil. soln. of a second cation contg. a compd. which would complex the other cation.

4050. Tompkins, Edward R. and Mayer, Stanley W. **Ion exchange as a separation method. III. Equilibrium studies of the reactions of rare earth complexes with synthetic ion-exchange resins.** *J. Am. Chem. Soc.* **69**, 2859-65 (1947).—*C.A.* **42**, 1835*h*.

The exchange consts. for several rare earths, equilibrated with the NH_4^+ compd. of Dowex 50 resin, varied. A study of the citrate complexes showed that the one in which three H_2Cit^- ions were combined with a rare earth ion was responsible for the relatively large sepn. factors between these elements. A preliminary, comparative study of the effectiveness of several exchangers (Dowex 50, Dowex 30, Duolite C, and Amberlite IR-1) and complexing agents (citric acid, tartaric acid, lactic acid, sulfosalicylic acid, ethyl acetoacetate, acetylacetone, oxalic acid, citric acid in 50% EtOH) was made. When Dowex 50 was used in the column, the concn. of the rare earth ions in the soln. could not exceed 3×10^{-4} *M* without adversely affecting the sepn. With Amberlite IR-1, this concn. should have been below 10^{-6}*M*. The pH of the citrate soln. should not have been greater than 3.2

4051. Tsuda, Kyôsuke. **Ion-exchange resins.** *Kagaku no Ryôike* (J. Japan. Chem.) **1**, 2-7 (1947).—*C.A.* **44**, 3180*e*.

In Japan prevailing practical applications were in obtaining pure water for pharmaceutical uses, for storage batteries, in purifying glucose, in removing catalyst Ni from sorbitol to be used in manufg. ascorbic acid, in removing salts from sea water, etc.

4052. Austerweil, G. **The determination of the efficiency of ion-exchangers.** *Bull Soc. Chim. France* **1948**, 948-52.—*C.A.* **43**, 1881*d*.

The exchangers were a large monomeric mol. of quinone-imine complex resembling aniline black, an amino polystyrene, a trimethanolmelamine-formaldehyde resin polymerized with the aid of an amino group attached to a heterocyclic compd., and a synthetic resin of a metaphenylene diamine-formaldehyde base polymerized with the aid of an amino group as above but attached to an aromatic cyclic compd. Exchangers in which the amino group did not take part in the polymerization hydrolyzed less than the others, but their capacity was not so great.

4053. Austerweil, Geza. **Method for evaluating the efficacy of anion exchangers.** *Compt. rend.* **226**, 799-801 (1948).—*C.A.* **42**, 7133*c*.

The amt. of Cl^- fixed by a given amt. of exchanger from HCl solns. of pH values 0, 1, 2, and 3 was meas. The characteristic const. of the material K was derived from the formula $1 + (m - m')/m = K^{\mathrm{pH}}$, where m was the quantity of chloride taken up at satn. from a soln. of known strength. Melamine formaldehyde resin and aminostyrene polymer were tested to show K values 1.214 and 1.174, resp.

4054. Baroni, Alessandro. **Possibilities and uses of ion-exchange resins.** *Materie plastiche* **14**, 15-16 (1948); *Materie plastiche* **10**, 31 (1944).—*C.A.* **42**, 5589*e*.

4055. Bergman, M. **Simple and fast method for determination of permanent hardness in water.** *Can. Chem. Process Inds.* **32**, 1125 (1948).—*C.A.* **43**, 1886*d*.

Ion exchange resins (Amberlite IR-100H and IR-4B) were rinsed with distd. water and 40 g of each was placed in two 1-liter bottles. Tap water (300 ml) was added to the bottle contg. Amberlite IR 100H, the contents well agitated and the bottle left standing 1 min. The soln. was decanted through a filter and 25 ml of filtrate meas. into an Erlenmeyer flask and the balance poured into the bottle contg. Amberlite IR-4B; the soln. was well shaken and left standing 1.5 min. The soln. was decanted through a filter into the first bottle and left standing 1 min. From the decanted soln. a 25 ml sample was added to the 25-ml sample previously put into the Erlenmeyer flask. The combined sample was titrated with 0.02 *N* NaOH by using methyl orange.

4056. Cohn, Waldo E. and Kohn, Harold W. **Ion-exchange separation of the alkali metals.** *J. Am. Chem. Soc.* **70**, 1986 (1948).—*C.A.* **42**, 6234*f*.

Dowex-50 resin was used to sep. a neutron-activated mixt. of 1.0 mg Na, 10 mg, K, 8 mg Rb, and 13 mg Cs as their chlorides. Elution was begun with 0.15 *N* HCl at a flow rate of approx. 0.3 ml per min. Various fractions were collected and analyzed radiometrically for Na^{24}, K^{42}, Rb^{86}, and Cs^{134}

4057. Cohn, Waldo E.; Parker, George W., and Tompkins, Edward R. **Ion exchangers to separate, concentrate, and purify small amounts of ions.** *Nucleonics* **3**, No. 5, 22-33 (1948).—*C.A.* **43**, 4129*c*.

Results showed that 100-1000 millicuries of major fission species could be sepd. by ion exchange with radiochem. purities of 95-98% and assocd. with less than 1-5 mg of total solids. The original solns. contained 100 times this amt.

4058. Consden, R.; Gordon, A. H., and Martin, A. J. P. **Separation of acidic amino acids by means of a synthetic anion-exchange resin.** *Biochem. J.* **42**, 443-7 (1948).—*C.A.* **42**, 6542*d*.

The glutamic and aspartic acids in a wool hydrolyzate were sepd. at pH 2.5 using Amberlite IR4. Likewise, optically active cystic acid was isolated by this procedure from Cl_2-treated wool.

4059. Cristy, Geo. A. and Lembcke, Richard E. **Purification of formalin by ion-exchange treatment.** *Chem. Eng. Progress* **44**, 417-20 (1948).—*C.A.* **42**, 4803*a*.

Ion-exchange treatment was found to be a practical method for removing formic acid and dissolved metals from formalin. Development of the process was described including lab., pilot-plant, and com. operations.

4060. Frush, H. L. and Isbell, H. S. **Amides of glucuronic, galacturonic, and mannuronic acids.** *J. Research Natl. Bur. Standards* **41**, 6, 609-13 (1948).

The preparation of uronic acids was described. An aq. soln. of the 1-amino uronamide was treated with an acid or a suitable cation exchange resin that replaced the glycosylamino group by a hydroxyl. Free amides-stable, crystalline substances were formed that should have proven useful representatives of a new class of carbohydrate derivatives.

4061. Gapon, E. N. and Gapon, T. B. **Chromatographic ion-exchange adsorption. I. Theory of ion-exchange chromatograms.** *Zhur. Fiz. Khim.* **22**, 859-69 (1948).—*C.A.* **42**, 8572*a*.

Equations were derived for ion exchange during filtration of solns. of mixts. of uni-univalent electrolytes through an ion exchanger contg. mobile univalent ions.

4062. Gapon, E. N. and Gapon, T. B. **Chromatographic ion-exchange adsorption. II. Description of ion-exchange chromatograms.** *Zhur. Fiz. Khim.* **22**, 979-90 (1948).—*C.A.* **43**, 465*a*.

The kinetics of the exchange adsorption of 2 and 3 ions and the formation of chromatograms were discussed.

4063. Gapon, E. N. and Gapon, T. B. **Dynamics of ion exchange.** *J. Applied Chem.* **21**, 937-47 (1948).—*C.A.* **44**, 9210*f*.

Consideration of an exchange column subdivided into layers, with the electrolyte soln. passed through in portions, showed that the increase of the adsorbed mole fraction of an ion was detd. by its initial mole fractions in the adsorbed state and in soln., the ion exchange const., and the ratio of the abs. amt. of exchanged ions in soln. and in the solid adsorbent.

4064. Gregor, Harry P. **A general thermodynamic theory of ion-exchange processes.** *J. Am. Chem. Soc.* **70**, 1293 (1948).—*C.A.* **42**, 6201*a*.

The sp. vol. of a strong (sulfonic) acid resin meas. in water with various cations in the exchange position was: $H^+ = 1.283$; $Na^+ = 1.665$; $K^+ = 1.434$; $Cs^+ = 1.388$; $Mg^{++} = 1.665$; $Ca^{++} = 1.585$; $Ba^{++} = 1.453$; $Ag^+ = 1.283$ cc./g. When an alkali metal resin was equilibrated with soln. of the same ion, the sp. vol. decreased with increasing concn. and usually became less than the vol. of the next heavier member of the group equilibrated with pure water.

4065. Gregor, Harry P. and Bregman, J. I. **Characterization of ion-exchange resins. I. Acidity and number of constituent cation-exchange groups.** *J. Am. Chem. Soc.* **70**, 2370-3 (1948).—*C.A.* **42**, 9008*h*.

Investigations of the resinous ion-exchange process were possible only on an empirical level without a knowledge of the physicochem. properties of the resins themselves. In order to det. the nos. and kinds of exchange groups making up a resin, 2 techniques were developed. The first was a direct titration of the resin with base in the presence of neutral electrolyte; the second involved addn. of the salt of a weak acid to the resin and detn. of the extent of reaction by back-titration of the buffer. The rate of diffusion of the exchanging ion to a strong acid group was greater than for a weak acid group. A true cation-exchange resin was defined as a solid phase contg. dissociable cations which would exchange for any other cation independently of the nature of the anion of the exchanging cation in soln. A base adsorbent was a solid phase contg. dissociable cations which would exchange for any other cation only when weak acid anions or hydroxyl ions were the anions of the exchanging cation in soln.

4066. Hamada, Hiroshi. **The equilibrium of exchange reaction by ion-exchange resins. I.** *Kagaku no Ryoike* **2**, 83-4 (1948).—*C.A.* **44**, 2820*c*.

An equation was developed in the exchange reaction $RA + B^+ = RB + A^+$ when the mutual action among ions at exchangeable sites was ignored, liquid phase was taken as gas phase, and electrostatic energy predominant in exchange reaction was included in the exchange heat. In such ideal case, the exchange reaction proceeded according to the law of mass action, though it was a heterogeneous system.

4067. Hems, B. A.; Page, J. E., and Waller, J. G. **The use of ion-exchange resins for separation of basic amino acids.** *J. Soc. Chem. Ind.* **67**, 77-80 (1948).—*C.A.* 42, 5485*c*.

An improved method for sepg. arginine, histidine, and lysine, from protein hydrolyzates was reported. Three anion exchange resins, De-Acidite B, De-Acidite C, and Asmit were examd. Of these De-Acidite C had the greatest capacity for removing HCl from aq. solns. and was used for removing mineral acid from hydrolyzates of the proteins. Four cation exchange resins, Zeo Karb HI, Zeo Karb 215, Zeo Karb 216 and Durasit H, were tested. The third, a carboxylic acid resin, offered special advantages. The second a sulfonic acid resin, had the greatest capacity for individual amino acids and was most extensively used. The large vol. of eluents provided the principal objection to the technique. Elution of adsorbed acids by shaking the resin mechanically with eluates required even greater vols. than the column procedure.

4068. Heymann, E. and O'Donnell, I. J. **Anion-exchange resins. "Acid adsorption" or "anion exchange"?** *J. Colloid Sci.* **3**, 479-81 (1948).—*C.A.* **43**, 335*b*.

Reaction of the acid HA with exchange resins of the polyamine type may have involved (1) anion exchange (RNH_3^+ with adsorbed OH^- yielded RNH_3^+ with adsorbed A^-) or (2) acid adsorption (RNH_2 yielded RNH_3^+ with adsorbed A^-). An unambiguous choice between these possibilities was difficult to perform in aq. systems because H_3O^+ was always present as a proton carrier. Expts. in nonaq. systems would have been more satisfactory.

4069. Juda, Walter and Carron, Morris. **Equilibrium and velocity of the sodium-hydrogen exchange on carbonaceous exchangers in contact with chloride solutions.** *J. Am. Chem. Soc.* **70**, 3295-3310 (1948).—*C.A.* 43, 2848*b*.

The equil. and velocity of the Na-H exchange on 4 com. carbonaceous exchangers in contact with Cl-ion solns. were accounted for by relations identical in form, resp., with a mass-action equation and a 2nd-order rate equation of simultaneous opposing reactions. The concn. equil. consts. $K_{H/Na}$, were const. within 20% over a concn. range of 0.001-1*N*.

4070. Klement, Robert and Dmytruk, Rudolf. **Separation of oxalic and tartaric acids by means of resin exchange (Wofatite).** *Z. anal. Chem.* **128**, 109-10 (1948).—*C.A.* 42, 5805*b*.

The removal of H_3PO_4 by means of resin had already been described. The same treatment would also serve to remove oxalate and tartrate ions presence of which complicated the usual procedure of qual. analysis.

4071. Klement, Robert and Dmytruk, Rudolf. **Separation of phosphoric acid by means of the ion-exchange resin, Wofatite. II.** *Z. anal. Chem.* **128**, 106-9 (1948).—*C.A.* 42, 5799*h*.

To det. Na in the presence of phosphate, it was necessary to remove the latter. Wofatite M proved satisfactory for removing PO_4^{-3} provided the plumped resin in a glass tube was allowed to remain in contact with 100 ml of 5 *N* HCl for 10 min. and then, after the acid had been allowed to drain slowly, washed with water, then with 35 ml of satd. NaCl soln., and finally with water again.

4072. Klyachko, V. A. **Use of ion-exchange resins for analytical purposes.** *Zavodskaya Lab.* **14**, 1257-9 (1948).—*C.A.* 44, 10571*h*.

Complete ion exchange for H did not take place on filtration of dil. salt solns. through the resin columns. Each individual substance had to be examd. in this connection with due precautions as to effects of hydrolysis or counter-ion effects.

4073. Krishnamoorthy, C.; Davis, Lannes E., and Overstreet, R. **Ionic exchange equations derived from statistical thermodynamics.** *Science* **108**, 439-40 (1948).—*C.A.* **43**, 464*g*.

An equation for the equil. distribution of ions between the adsorbent and the soln. was derived by using statistical methods. It was assumed that the partition function was independent of the ionic distribution or that the energy of mixing was zero. This was probably true for completely dissocd. ions but not apparently for H ions and perhaps other ions. A satisfactory equil. const. averaging 367 ±14 was obtained for the distribution of La and Cs ions with the synthetic resin IR-100.

4074. Lister, B. A. and Smith, M. L. **The fractionation of cerium (III) and neodymium mixtures on an ion-exchange column.** *J. Chem. Soc.* **1948**, 1272-5.—*C.A.* **43**, 6535*e*.

Eleven 1.1-m columns in series (1 cm diam.) were packed with Zeokarb H. I. P. The columns were filled with water and 1 *M* or 0.25 *M* Ce Nd nitrate soln. was started through the first column at a rate of 1.4 ml/min. When the percolate contained Ce-Nd, the initial reservoir was changed back to water and flow was continued as long as Ce-Nd was washed out. The first and last fractions showed an increase in Nd concn. the last due to diln. of the soln. with the following water. The sepn. was better with the dil. soln.

4075. Lur'e, Yu. Yu. and Filippova, N. A. **Use of organolites in analytical chemistry.** *Zavodskaya Lab.* **14**, 159-72 (1948).—*C.A.* **42**, 8696*b*.

Cation-exchange expts. were conducted with phenolic cationite (Wofatit P). The following sepns. could be made: (1) Zn and Al from Fe by selective extn. with NaOH from the NH_4^+-satd. cationite. (2) Sb and Sn from As by passing the soln. through H^+-satd. cationite to adsorb Sb and Sn only and then extg. with dil. HCl. (3) Bi from Cu or Pb by passing the soln. through K^+-satd. cationite to adsorb both then extg. Bi with 1% KI soln. (acidified with H_2SO_4 to give 0.1 *N* concn.) and detg. colorimetrically. (4) Bi from Sb as thiocyanates by means of cationite provided the thiocyanate concn. was exactly 6%.

4076. Malquori, Alberto and DeAngelis, Giorgio. **Ammonium-ion exchangers.** *Ann. Chim. applicata* **38**, 469-81 (1948).—*C.A.* **44**, 4166*h*.

A general study of ion exchangers including zeolites, permutites, Wofatit, bentonite, and synthetic resin exchangers.

4077. Oda, Ryohei; Shimizu, Hiroshi, and Nakayama, Yoshio. **Ion-exchange synthetic resins. IV.. Preparation of resins by condensation of Phenoxyacetates with formaldehyde. V. Hydrogen-calcium exchange with phenoxyacetate-formaldehyde resin. VI. Sodium-calcium exchange. VII. Regeneration conditions after sodium-calcium exchange.** *Chem. High Polymers* (Japan) 5, 21-2; 22-4; 24-5; 26-7 (1948).—*C.A.* 46, 1185*a*.

H_2SO_4 was the catalyst. No condensation took place with NaOH. A hard, brown resin was obtained with 98% H_2SO_4 at 140-50 °C. The H-Ca exchange capacity of this resin (RCOOH type) was low. Na-Ca exchange took place easily with 0.5 *N* NaOH. Ca-Na exchange was carried out by passing 0.5 *N* NaCl through the resin after Na-Ca exchange.

4078. Oda, Ryohei and Shimizu, Hiroshi. **Ion-exchange synthetic resins. VIII. Reasons for the decrease of the break-through capacity after repeated sodium-calcium exchange. IX. Quantitative consideration on the decrease of break-through capacity after repeated sodium-calcium exchange. X. Practical break-through capacity of sodium-calcium exchange of phenoxyacetate-formaldehyde resin.** *Chem. High Polymers* (Japan) 5, 86-7; 87-9; 89-91 (1948).—*C.A.* 46, 1185*a*.

The decrease of the break-through capacity after repeated Na-Ca exchange under const. regeneration conditions was noted. The practical-break-through capacity was 1.2 milliequiv./g when 0.5 *N* NaCl (500% of the theoretical amt.) was used as the regenerating soln.

4079. Oda, Ryohei; Shimizu, Hiroshi, and Nakayama, Yoshio. **Ion-exchange synthetic resins. XIII. Characteristics of several cation-exchange resins.** *Chem. High Polymers* 5, 115-16 (1948).—*C.A.* 46, 1185*g*.

For Na-Ca exchange RCOOH > RSO_3H, and for its regeneration RSO_3H > RCOOH; for H-Ca exchange RSO_3H > RCOOH, and for its regeneration RCOOH > RSO_3H. KH-1 had the highest exchange capacity and break-through capacities.

4080. Reid, Allen F. **Multistage ion-exchange system for the fractionation of solute. Radium-barium fractionation.** *Ind. Eng. Chem.* 40, 76-8 (1948).—*C.A.* 42, 4004*f*.

Selective absorption of a portion of the ions in a through-going soln. by an exchange cell and regeneration by the acidified output soln. of a previous cell comprised a repetitive cycle for the continuous sepn. of the fractions. Application of the method to a pilot plant for the concn. of Ra-Ba mixts. was discussed.

4081. Schubert, Jack. **The use of ion exchangers for the determination of physical-chemical properties of substances, particularly radiotracers, in solution. I. Theoretical.** *J. Phys. & Colloid Chem.* 52, No. 2, 340-50 (1948).—*C.A.* 42, 5300*i*.

The possibilities were pointed out of using ion exchangers with radiotracers for (a) the detn. of dissocn. consts. of complex ions, (b) the rapid detection and evaluation of the relative complex-forming properties of org. salts, (c) detns. of the activity coeff. of tracer substances in the presence of large concns. of a foreign electrolyte, (d) the detection and study of radiocolloids, (e) the detection of the state of a radio-element in soln., and (f) the detn. of the charge and relative basicity of a cationic radio-element.

4082. Schubert, Jack and Richter, J. W. **II. The dissociation constants of strontium citrate and strontium tartrate.** *J. Phys. & Colloid Chem.* 52, No. 2 350-7 (1948)—*C.A.* 42, 5301*a*.

The ion-exchange method was used at 25 °C and pH 7 to det. the dissocn. consts. of Sr citrate and tartrate. The total concn. of radio-Sr (53-day Sr 89) was approx. 10^{-11} mole per liter; the ionic strength of the solns. was furnished by NH_4 salts. The pK_c for Sr citrate was 2.81 when the NH_4-ion concn. was 0.16_5 per liter; under the same conditions pK_c for tartrate was 1.69. As the pH increased from 5 to 8, the amt. of radio-Sr adsorbed by the cation exchanger (Amberlite IR-1) increased steadily and markedly.

4083. Schubert, Jack and Richter, John W. **Cation-exchange studies on the barium citrate complex and related equilibria.** *J. Am. Chem. Soc.* 70, 4259-60 (1948).—*C.A.* 44, 5193*f*.

The ion-exchange method was used to measure the dissocn. consts. (K_c) of the Ba citrate complex ion $(BaCit)^-$ and the exchange consts. for equil. between Ba^{140} or Sr^{89} ions and the cation-exchange resin Amberlite IR-1. At pH 7.2 and concn. of NH_4^+ of 0.16_5M, K_c was 0.005 at 25 °C and about 0.008 at 37 °C; at 25 °C and 1.05 *M* $NH_4^+ K_c$ was 0.017. The corresponding values of K_c for $(SrCit)^-$ were 0.0015, 0.002, and 0.0066. Although Ba was much less strongly bound by citrate than was Sr, its affinity for the exchanger was slightly greater.

4084. Simirnov, A. S. and Peremyslova, E. S. **Sorption of acids on anionites.** *Doklady Akad. Nauk. S.S.S.R.* 62, 787-9 (1948).—*C.A.* 43, 1238*b*.

The sorption consisted in actual exchange of the anion of the acid for the OH of the amino-resin, rather than in an addn. of the acid mol. The sorption of org. acids was detd. in the filtration of 0.016 *N* solns. of the acids, flowing at a linear rate of 3m/hr through 10 g of the anionite resin in a column 180 mm high, until 1st appearance of the acid in the filtrate. The amts. adsorbed, $PrCO_2H$ 1.14, AcOH 1.33, HCO_2H 2.18, CH_2ClCO_2H 2.65, CCl_3CO_2H 2.65, CCl_3CO_2H 2.78 milli-equiv./g did not obey Traube's rule according to which adsorption should rise with the mol. wt.

4085. Spedding, F. H.; Fulmer, E. I.; Ayers, Buell; Butler, T. A.; Powell, Jack E.; Tevebaugh, A. D., and Thompson, Robert. **Improved ion-exchange method for separating rare earths in macro quantities.** *J. Am. Chem. Soc.* 70, 1671-2 (1948).—*C.A.* 42, 6260*d*.

Sepn. of the rare earths in large amts. was markedly increased by eluting with 0.1% citric acid soln. in the pH range 5.0-5.5. The pH of the soln. which came from the Amberlite IR-100 column varied with the rare earth that was being eluted and differed by approx. 0.005 pH unit for adjacent elements. From 1:1 mixts. of Nd and Pr or Nd and Sa, 60 to 90% of each element could be obtained spectrophotometrically pure.

4086. STREET, KENNETH JR. AND SEABORG, G. T. **The ion-exchange separation of zirconium and hafnium.** *J. Am. Chem. Soc.* **70**, 4268-9 (1948).—*C.A.* **43**, 4169*b*.

By the HCl elution of the oxy-chlorides, prepd. from a mixt. of Zr and Hf oxides contg. 30% HfO_2, adsorbed on a cation-exchange resin (Dowex 50), a 66% yield of approx. 99.9% HfO_2 was obtained. The process was adaptable to gram quantities.

4087. THOMPSON, JOSEPH AND MCGARVEY, FRANCIS X. **Factors governing the performance of anion exchangers.** *Chem. Inds.* **63**, 55-6 (1948).—*C.A.* **42**, 7907*c*.

The rate of acid removal and the total exchange capacity of resin anion exchanger Amberlite IR-4B increased with valence of acid anion. Regenerants could be rated in order of efficiency: $NaOH > NH_4OH > Na_2CO_3 > NaHCO_3$. A minimum bed depth of 20 in. was required. Optimum flow rate was 3 gal per ft^3 per min. A min. flow should have been maintained to prevent ion bleeding.

4088. TOLLIDAY, J. D.; THOMPSON, G. W. H., AND FORMAN, G. **The use of ion-exchange resins for the determination of cations.** *J. Soc. Leather Trades' Chemists* **32**, 291-308 (1948)—*C.A.* **42**, 9218*d*.

Comparative studies were made with quebracho-HCHO resin, Amberlite IR 100, Ionac C 200 and Zeo-Karb 215, all in the H cycle: both the batch and the column methods were used. Adsorption isotherms by the batch method were obtained for benzoic, gallic, acetic, formic, tartaric, and lactic acids on Amberlite IR 100 at 20°. Equil. was reached in 60 min. Adsorption of benzoic acid was very marked, that of gallic acid considerably lower; adsorptions of the aliphatic acids were still lower but appreciable. The Freundlich equation was applicable in all cases. The Na^+ break-through point for Amberlite IR 100 was well below the total cation-adsorbing capacity of the resin. The useful exchange capacity of quebracho-HCHO resin was much lower than those of Amberlite IR 100, Ionac C 200, and Zeo-Karb 215.

4089. TOMPKINS, EDWARD R. **Separation of radium from barium by the use of an ion-exchange column procedure.** *J. Am. Chem. Soc.* **70**, 3520-2 (1948).—*C.A.* **43**, 2090*d*.

By the use of a high-capacity cation-exchange resin (Dowex 50), the Ra in a soln. contg. 20 γ Ra, 20 mg Ba, and 20 mg Sr, including Ba and Sr tracers, was essentially completely sepd. from Ba and Sr. The compn. of each fraction of the effluent was detd. from the α, β, and γ-ray activity and Al absorption and decay curves of radioactivity.

4090. USTRENKO, YU I. AND DATSENKO, O. V. **Determination of calcium and magnesium in iron ore by ion adsorbents.** *Zavodskaya Lab.* **14**, 1323-7 (1948).—*C.A.* **43**, 4176*e*.

The method was based on adsorption of Ca and Mg by ion-exchange resin (Wofatite R), while Fe and Al remained in soln. as complex-ions. 0.5 g of sample was dissolved in 15 ml of concd. HCl, the soln. was evapd. to sirup and then dild. to 30 ml with 6 *N* HCl, the result was filtered and evapd. to 2-3 ml, whereupon it was dild. with water to 30 ml and treated with a ml of 20% tartaric acid, and the soln. was passed through the adsorbent column (prepd. with 5 treatments of concd. HCl at 70-80°C and washed with water) at 5 ml per min., washing the column with water 3-4 times, and eluting with 2.5 *N* HCl. Ca and Mg were detd. as usual in the eluate. Checks within 0.05-0.1% were obtained.

4091. WIKLANDER, LAMBERT AND GIESEKING, J. E. **Exchangeability of adsorbed cations as influenced by the degree of saturation and the nature of the complementary ions with special reference to trace concentrations.** *Soil Sci.* **66**, 377-84 (1948).—*C.A.* **43**, 3687*c*.

Amberlite IR-1 and radioactive K, Ba, Na, and Sr were used. With increasing K content the exchangeability of K decreased when Na was the complementary ion. In the same way the exchangeability of Sr decreased with falling Sr content when combined with Na, but increased when combined with Ba. For both K and Sr, the percentage replacement approached a limit at very low degrees of satn. The exchangeability of an ion approached a certain limit when the concn. of the ion grew infinitesimally low.

4092. ADAMSON, A. W. AND GROSSMAN, JACK J. **A kinetic mechanism for ion-exchange.** *J. Chem. Phys.* **17**, 1002-3 (1949).—*C.A.* **44**, 2324*h*.

The kinetics of the zeolitic ion exchange of univalent ions in dil. soln. was explained by diffusion of the ions through a bounding liquid film.

4093. AUSTERWEIL, G. **Ion exchange and its applications.** *Nueva ind. quim. (Madrid)* **4**, 271-86 (1949).—*C.A.* **44**, 6203*c*.

A review with emphasis on industrial applications.

4094. BARRER, R. M. **Ion exchange in crystals.** *Bull soc. chim. France* **1949**, D71-83.—*C.A.* **43**, 4534*g*.

A math. discussion and review with 31 references.

4095. BARRER, R. M. **Separations with zeolitic materials.** *Discussions Faraday Soc.* **1949**, No. 7, 135-41.—*C.A.* **45**, 18*h*.

Most natural cryst. zeolites fell into 3 classes of mol. sieve sorbent, each capable of sepg. mixts. by selective occlusion if there were sufficient differences in shape and dimensions between the mols. in the mixt. The mols. removed by occlusion must always be comparatively small. A diversity of modified mol.-sieve sorbents could be produced by cation exchange and by burning out interstitial NH_4^+.

4096. BARRER, R. M. **Transient flow of gases in sorbents providing uniform capillary networks of molecular dimensions.** *Trans. Faraday Soc.* **45**, 358-73 (1949).—*C.A.* **43**, 6488*h*.

Base-exchange reactions made available a series of mordenite crystals enriched in Li^+, Na^+, K^+, NH_4^+, Ca^{++}, and Ba^{++}. The dehydrated crystals provided uniform capillary networks of mol. dimensions for the present investigation. Heterogeneous equil. and flow transients involving gas-sorbent systems were detd. by using the volumetric method in a double sorption system. The zeolites were outgassed for periods of 4-5 hrs at 300-340°C before use, and between runs. Both pos. and neg. temp. coeff. in the relative sorption velocities were observed, the former predominating. Both kinds of temp. coeff. were explained in terms of the diffusion theory developed, and true energies of activation, E, for interstitial diffusion were obtained.

4097. Benin, G. S. and Shnaĭder, E. E. **Evaluation of anion exchangers.** *Sakharnaya Prom.* **23**, No. 6, 23-6 (1949).—*C.A.* **43**, 9296*f*.
The use of 0.1 *N* AcOH was advisable in detn. of the capacity for the absorption of anions. For a complete evaluation it was suggested to use some standard soln. contg. N and coloring matters.

4098. Bjorling, Carl O. **Adsorption analysis of salts of organic acids. A preliminary report.** *Farm. Revy* **48**, 281-5 (1949).—*C.A.* **43**, 5703*c*.
A soln. of salt was filtered through a column of Amberlite IR-100, eluted with water, and titrated. The method gave satisfactory results with Na tartrate, citrate, lactate, and sulfosalicylate, Ca lactate, gluconate, and glycerophosphate, Novalgin, and Na menadiol sulfate.

4099. Calise, V. J. and Lane, Marvin. **Silica removal by a practical ion-exchange process-performance of a commercial installation.** *Ind. Eng. Chem.* **41**, 2554-63 (1949).—*C.A.* **44**, 2149*f*.
Standard cation- and anion-exchange units were followed by a decarbonator and a strongly basic anion exchanger which removed silicic acid. When NaOH was used to regenerate the standard anion-exchange unit, SiO_2 and CO_2 were retained in the early stages of each run and were given up in later stages. With Na_2CO_3 regeneration, SiO_2 was not retained but there was some CO_2 retention. SiO_2 was reduced from 15 parts per million in the raw water to 0-0.5 part per million in the effluent of the SiO_2-removal unit.

4100. Cohn, Waldo E. **The separation of purine and pyrimidine bases and of nucleotides by ion exchange.** *Science* **109**, 377-78 (1949)- *J. Am. Chem. Soc.* **71**, 6, 2275-76 (1949).—*C.A.* **43**, 5440*c*.
Three of the five naturally-occurring bases (cytosine, guanine, and adenine) existed as cations in soln. of pH < 4, had different affinities for cation exchangers, and hence may be eluted successively with HCl or NaCl. The non-ionized bases, thymine and uracil, may be separated by anion exchangers. The nucleotides of yeast nucleic acid (uridylic, cytidylic, guanylic, and adenylic acid) exhibited a weaker exchanger-to-ion bond, and weak acids appeared to be the most practical eluting agents for these materials.

4101. Davies, C. W. **Fractionation of weak electrolyte mixtures by ion-exchange resins.** *Biochem. J.* **45**, 38-41 (1949).—*C.A.* **44**, 1303*f*.
The theoretical basis for the sepn. of weak electrolytes was discussed.

4102. Devlin, Jas. A.; McNabb, Wallace M., and Hazel, Fred. **Preparation of vanadium pentoxide sols by ion exchange.** *J. Franklin Inst.* **248**, 251-3 (1949).—*C.A.* **43**, 8840*a*.
Amberlite IR-100H and Dowex-50 were conditioned by 3 Na-H cycles and used in the H-form. Weighed amts. of NH_4VO_3 were mixed with weighed amts. of the resin, and the mixt. was stirred, filtered, and the sol. analyzed to det. V present as V_2O_5 and as NH_4VO_3. Dowex was more stable in the presence of vanadate, but showed some reducing action after several days.

4103. Duncan, J. F. and Lister, B. A. J. **Ion-exchange studies. I. The sodium-hydrogen system.** *J. Chem. Soc.* **1949**, 3285-96; *Quart. Revs.* (London) **2**, 307-48 (1948).—*C.A.* **44**, 9770*i*; **43**, 3264*d*.
Dowex 50 and Amberlite IR-100H were studied by batch equil., by satn. of a column of exchanger, and by the elution rear boundary obtained when Na ions were exchanged in the column with acid. Solns. of NaCl contg. radioactive Na^{24} were used in conjunction with a Geiger-Müller counter; HCl was the acid used. If a diffuse rear boundary was not produced, calcns. were made on the diffuse front boundary method. Column behavior of Dowex 50 followed the law of mass action, but the Amberlite IR-100H with a pH of 4 or greater showed a small amt. of nonequiv. exchange. Flow rates were maintained at less than 4×10^{-3} cm/sec.

4104. Duncan, J. F. and Lister, B. A. J. **Ion-exchange studies. II. The determination of thermodynamic equilibrium constants.** *Discussions Faraday Soc.* **1949**, No. 7, 104-14.—*C.A.* **45**, 19*i*.
Batch equil. methods and column methods for the Ba-H and La-NH_4 exchange systems were used to evaluate the activities of ions in an exchanger. Radiochem. tracer methods were applied in this crit. examn. of the postulates used by different authors for this type of detn. The mass product varied by about 50%, rising to a max. at an equiv. fraction of about 1/3 for the multivalent ion in the exchanger. The activities in the exchanger may have been incorrectly evaluated because of the effect of some secondary process, such as adsorption soln. of the ions in the exchanger, or swelling of the resin.

4105. Egner, Hans; Eriksson, Erik, and Emanuelsson, Arne. **Composition of atmospheric precipitation. I. Sampling technique. Use of ion-exchange resins.** *Kgl. Lantbruks-Hogskol. Ann.* **16**, 593-602 (1949).—*C.A.* **44**, 385*c*.
Collection app. was made of a glass funnel surrounded by thin stainless steel spikes to discourage birds, and with a filter and an ion-exchange column before the collection reservoir. Prolonged contact of the rain with solids was prevented and the ions to be detd. were caught in the ion exchanger, so that the water could be discarded after it was measd.

4106. Erler, Karl. **Alkalimetric determination of neutral salts of strong acids by means of ion-exchanger Wofatit KS.** *Z. anal. chem.* **129**, 209-12 (1949).—*C.A.* **44**, 73*b*.
A wet column was prepd. with 15-20 g Wofatit KS and allowed to swell for 24 hrs. Then 50 ml of 5 *N* HCl were added and allowed to run through, the column being kept covered always with liquid. It was washed with water until free from Cl. Then concd. NaCl was run through the column, and the column was washed, activated once more with HCl, and washed again. The column could serve for as many as 20-30 analyses.

4107. Furushiro, Kosuke. **Ion-exchange resins.** *J. Soc. Org. Synthetic Chem. Japan* 7, 21-7 (1949).—*C.A.* **44**, 4605*e*.
Anion and cation exchange resins named Diaion K and A, resp., were synthesized. The 1st was condensed from $C_6H_4(OH)SO_3H$ and HCHO into the form

RSO_3Na which was capable of adsorbing anions to 1.9-2.0 mg/g resin below pH 7 (when the SO_3 alone was active) and 3-3.5 times as much above pH 7 (when the PhOH radical also became active). The 2nd was derived from an aromatic amine into the form RNH_2–HCl which was capable of absorbing cations to 0.2-2.0 mg/g resin (equiv. wt of active NH_2 radical).

4108. Grigorvo, O. N. and Tarshis, A. I. **The reactions of ion exchange involving poorly soluble precipitates.** *Kolloid. Zhur.* **11**, 390-4 (1949).—*C.A.* **44**, 2820*a*.

Four ion exchangers were satd. with 0.1 *N* $AgNO_3$, washed until the wash water contained no Ag^+, immersed in 0.1 *N* $BaCl_2$, washed, immersed in 0.1 N $AgNO_3$, etc. The amt. of Ba^{++} and Cl^- taken up from $BaCl_2$, and of Ag^+ taken up from $AgNO_3$, did not change from cycle to cycle. These reactions, in which both ions of the added salt were immobilized (as, e.g., BaM_2 and AgCl, M being the anion of the exchanger) were reversible cation-exchange reactions. A zeolite took up 94-96 milliequiv. Ba^{++}, Cl^-, and Ag^+ per 100 g, a glauconite 9-11 milliequiv., "Wofatit PN" 45-49 milliequiv., and "Sulfocarbon" 32-34 milliequiv.

4109. Gupta, S. L. **Maximum exchange capacities of ion-exchange resins from their titration curves.** *Science and Culture* **14**, 337 (1949).—*C.A.* **43**, 5885*e*.

Potentiometric titration of cation- and anion-exchange resins with NaOH and HCl resp. gave titration curves with inflection points corresponding to the theoretically calcd. capacities. The resins were finely divided and dispersed in H_2O, after dialysis, for the titrations.

4110. Gupta, S. L. **Neutralization curves of ion exchangers.** *Science and Culture* **14**, 539 (1949).—*C.A.* **43**, 8237*c*.

The neutralization curve of a cation exchanger contg. only one type of active group could be expressed by an equation of the type $a = c(1-y) + (k_w/x) + [cyk_a/(k_a+x)] - \{xc(1-y)/[cyk_a/(k_a+x)) + (k_w/x)]\} - x$, where a was the concn. of added base, c was the initial concn. of active groups in the H form, y was the fraction of the total active groups in the soln. phase, k_w was the ion product of water, and x the H-ion concn. The same equation applied to anion exchangers.

4111. Hale, D. K. and Reichenberg, D. **Equilibrium and rate studies of cation-exchange with monofunctional resins.** *Discussions Faraday Soc.* **1949**, No. 7, 79-90.—*C.A.* **45**, 19*c*.

A sulfonated cross-linked polystyrene bead polymer, and a carboxylic-type exchange resin were prepd. Both resins were converted to the H-form, and the H-Na exchange was studied. The exchange-equil. results showed that the amt. of Na^+ taken up by the resins depended on the ratio $[Na^+]/[H^+]$ and not on the $[Na^+]$ and $[H^+]$ separately. The cross-linked polymethacrylic acid behaved as a monofunctional weak acid; the sulfonated cross-linked polystyrene behaved as a monofunctional strong acid. At low concn. of Na^+ in soln. the rate-detg. mechanism was the diffusion of ions through a thin layer of liquid surrounding the resin particle.

4112. Haskell, Vernon C. and Hammett, Louis P. **Rates and temperature coefficients in the hydrolysis of some aliphatic esters with a cation-exchange resin as the catalyst.** *J. Am. Chem. Soc.* **71**, 1284-8 (1949).—*C.A.* **43**, 6064*h*.

Sulfonated coal and two synthetic cation-exchange resins were used. The kinetics of the hydrolysis of methyl acetate, ethyl acetate, ethyl butyrate, ethyl caproate in 70% acetone were studied. The major factor detg. these effects was the loss in internal entropy of the ester when it was fixed on the resins in the transition state.

4113. Heymann, E. and O'Donnell, I. J. **Physicochemical investigation of a cation-exchange resin. I. Resin equilibria.** *J. Colloid Sci.* 4, 395-404 (1949).—*C.A.* **43**, 7785*e*.

The equil. between the sulfonic acid resin Amberlite IR-100 and aq. solns. of various salts were studied by detg. the amt. of acid liberated from the resin as a function of the normality of the salt solns. For salts of strong acids, this approached a limiting value at high normalities that was nearly the same for all salts. The limiting value for salts of weak acids increased with decreasing acid dissocn. const.

4114. Heymann, E. and O'Donnell, I. J. **Physicochemical investigation of a cation-exchange resin. II. Resin conductance.** *J. Colloid Sci.* 4, 405-16 (1949).—*C.A.* **43**, 7785*f*.

The cond. of a plug of swollen Amberlite IR-100 resin contg. various bound cations was detd. in a specially-designed cell. The H resin was a fairly good conductor. Replacement of H with alkali metal ions reduced the cond. by a factor of 6-12, and Ag or multivalent cations reduced the cond. much more. The order of the cond. values for these cations was Mg > Ca > Ag > Ba ≫ La > Th.

4115. Honda, Masatake. **Ion-exchange resins in analytical chemistry. III. Selective adsorbability of anion-exchange resin.** *J. Chem. Soc. Japan, Pure Chem. Sect.* **70**, 101-3 (1949).—*C.A.* **45**, 4169*h*.

Mixts. of 0.033 *N* H_2SO_4, HCl, and H_3PO_4 were passed through a column of anion exchanger. After equil. was reached, the resin was washed with alkali, and the quantities of desorbed acids were measd. The adsorption occurred in the above order from the top of the column, and the ratio of the quantities adsorbed was 50:1:0.03, resp.

4116. Honda, Masatake. **Ion-exchange resins in analytical chemistry. IV. Removal of iron from silicate solutions.** *J. Chem. Soc. Japan, Pure Chem. Sect.* **70**, 103-4 (1949).—*C.A.* **45**, 4169*i*.

Removal of Fe by cation exchangers was applied to Se detn. in steel. Since silicic acid was not adsorbed by anion exchangers, its mixt. with H_3PO_4 could be sepd. by the resin.

4117. Honda, Masatake. **Ion-exchange resins in analytical chemistry. V. Some characteristics of cation exchangers.** *J. Chem. Soc. Japan, Pure Chem. Sect.* **70**, 163-5 (1949).—*C.A.* **45**, 4169*i*.

A cation-exchange resin was prepd. from pure *p*-$HOC_6H_4SO_3H$. About 2/3 of the SO_3H groups were lost during the condensation and 1/3 remained as active groups in the resin formed. The partition ratios of $[Co(NH_3)_6]^{+++}$, $[Co(NH_3)_5Cl]^{++}$, or $[Co(NH_3)_4(NO_2)_2]^+$ to H^+ were 200, 60, and 6 resp., at a concn. of 0.1 *N*.

4118. HONDA, MASATAKE. **Ion-exchange resins in analytical chemistry. VI. Observation of the adsorption band of ion exchangers by Congo red.** *J. Chem. Soc. Japan, Pure Chem. Sect.* **70**, 165-6 (1949).—*C.A.* **45**, 4170*b*.

When a filter paper or cotton fiber dyed with Congo red was placed in a column of cation exchanger, the color was blue in the zone contg. free acid resin and red in the zone which had been exchanged by metals, such as Na. This color change could be used to det. the location of the adsorption layer.

4119. HUFFMAN, E. H. AND LILLY, R. C. **The anion-exchange separation of zirconium and hafnium.** *J. Am. Chem. Soc.* **71**, 4147 (1949).—*C.A.* **44**, 9843*i*.

Adsorption of Zr and Hf as neg. fluo ions on 200-325-mesh Amberlite IRA-400 followed by elution with a mixt. of 0.2 *M* HCl and 0.1 *M* HF at the rate of 6 cc./hr gave excellent sepn. of the 2 elements.

4120. IDLER, DAVID R. **Use of pH indicators with ion-exchange resins.** *J. Am. Chem. Soc.* **71**, 3854 (1949).—*C.A.* **44**, 380*h*.

pH indicators furnished a means of detecting acids adsorbed on a strong base type resin (Amberlite I.R.A. 400). An illustration was the use of phenolphthalein and aspartic acid.

4121. KAKIHANA, HIDETAKE. **Inorganic and analytical chemistry using ion-exchange resin. I. Vanadium-ion exchange in cation-exchange resin column.** *Bull. Chem. Soc. Japan* **22**, 242-7 (1949) (in English).—*C.A.* **45**, 4595*b*.

Tests were carried out with standard V solns. of concn. range 0.6-600.0 γ per cc. and pH range 1-12. The extent of exchange was found for completely regenerated resin, obtained in 1-3 *N* HCl, Na resin, ammonium resin, and resin with OH and sulfonic groups both satd. with Na ions. V at any pH was completely exchanged by the first resin. The extent decreased with pH increase until, at pH 5 and above, V passed quantitatively through the column.

4122. KAYAS, GEORGES. **Separation of sodium and potassium by organic ion exchangers.** *Compt. rend.* **228**, 1002-3 (1949).—*C.A.* **43**, 5698*i*.

The column of Amberlite IR-100 was constructed of thin glass, surrounded by a bronze jacket pierced by a longitudinal slit through which the radioactivity of the column could be followed. The Na in the sample was tagged with Na^{22} formed by irradiating Mg with deuterons in a cyclotron. The Na and K were initially localized in the top 2 cm of the column and were sepd. by development with 0.1 *N* HClO. This eluant was chosen because of the difference in soly. of its Na and K salts. The Na was completely removed and K appeared in the eluent.

4123. KAYAS, GEORGES. **An interesting application of ion exchange in inorganic chemistry.** *Bull. soc. chim. France* **1949**, 883-4.—*C.A.* **44**, 3332*i*.

A soln. of Na_2SO_4 was adsorbed on a column of Amberlite IR-100 and eluted with HCl soln. to obtain an equiv. amt. of NaCl.

4124. KLEMENT, ROBERT. **Application of resin exchangers to the preparation of free acids and their salts.** *Z. anorg. Chem.* **260**, 267-72 (1949).—*C.A.* **44**, 2882*d*.

The prepn. of free acids (HCNS, $H_2PO_3NH_2$, and $H_5P_3O_{10}$) by passing an aq. soln. of the corresponding alkali salt through a column contg. the resin-exchange Wofatit KS was described. The method could be used for the prepn. of other free acids, which in turn could be used for the prepn. of salts that were otherwise difficult to prep.

4125. KORTSCHAK, HUGO P.; GILL, ROBERT F., JR., AND PAYNE, JOHN H. **Regeneration of a cation-exchange resin.** *Ind. Eng. Chem.* **41**, 1406-9 (1949).—*C.A.* **43**, 6872*f*.

Dowex 30 in Na and Ca form was regenerated by HCl and H_2SO_4 solns. HCl was as efficient as H_2SO_4 for regenerating the Na form; the HCl was more efficient than the H_2SO_4 in regenerating the Ca form owing to subsequent exhaustion by the $CaSO_4$ formed. Variation of the concn. of H_2SO_4 had little effect on total capacity for the Na cycle, but the more dil. acid resulted in better max. removal of the Na in the exhaustion phase.

4126. KRAUS, KURT A. AND MOORE, GEORGE E. **Separation of zirconium and hafnium with anion-exchange resins.** *J. Am. Chem. Soc.* **71**, 3263 (1949).—*C.A.* **44**, 8195*f*.

Zr(IV) and Hf(IV) could be sepd. by anion exchange, but the sepn. was not optimum. Partial sepn. at room temp. was achieved by using a 107-cm column of 200-30-mesh Dowex-1 and a mixt. of 0.5 *M* HF-1.0 *M* HCl as eluent. The sepn. was followed by using tracers.

4127. KRAUS, KURT A. AND MOORE, GEORGE E. **Separation of columbium and tantalum with anion-exchange resins.** *J. Am. Chem. Soc.* **71**, 3855 (1949).—*C.A.* **44**, 9843*g*.

The sepn. of Cb and Ta in a 9 *M* HCl-0.05 *M* HF soln. in a 12.5-cm column by means of Dowex-1 was very efficient. Cb eluted relatively rapidly in a sharp, well-shaped band, and the Ta very much more slowly in a somewhat diffuse band with a sharp front edge.

4128. KRESSMAN, T. R. E. AND KITCHENER, J. A. **Cation exchange with a synthetic phenolsulfonate resin. I. Equilibria with univalent cations.** *J. Chem. Soc.* **1949**, 1190-1201.—*C.A.* **43**, 8792*b*.

Cation exchange was studied on a resin prepd. as a cross-linked condensation product of formaldehyde with phenol and Na phenolsulfonate; 96% of the sulfonate groups were free for exchange. The equil. consts. for Li^+, H^+, Na^+, K^+, Rb^+, and Cs^+ were a function of the hydrated ion size expressed as the a° parameter of the Debye-Hückel relation. The equil. were independent of concn. and largely of the anion. The heat of exchange of the K^+-H^+ system was 1.95 kcal/g-mol. and the free energy of the exchange, 0.54 kcal/g-mol.

4129. Kressman, T. R. E. and Kitchener, J. A. **Cation exchange with a synthetic phenolsulfonate resin. II. Equilibria with multivalent cations.** *J. Chem. Soc.* **1949**, 1201-8.—*C.A.* **43**, 8792*d*.

The studies were continued with an NH_4^+ resin and salts of 12 bivalent cations, Al^{3+}, Th^{4+}, and Zr^{4+}. The law of mass action applied to these equil. when concns. were used, rather than activities. Neutralization of all of the sulfonate groups with an equiv. no. of these cations indicated that such multivalent cations were not closely assocd. with their valency no. of sulfonate groups.

4130. Kressman, T. R. E. and Kitchener, J. A. **Cation exchange with a synthetic phenolsulfonate resin. III. Equilibria with large organic cations.** *J. Chem. Soc.* **1949**, 1208-10.—*C.A.* **43**, 8792*e*.

The affinity of quaternary NH_4 salts and the quininium ion increased with increasing size of the ion. The rate of exchange decreased with increasing ionic size. Satn. capacity of the resin for these ions was the same as that of the resin for the inorg. ions previously studied.

4131. Kressman, T. R. E. and Kitchener, J. A. **Cation exchange with a synthetic phenolsulfonate resin. IV. A note on equilibria in presence of nonaqueous solvents.** *J. Chem. Soc.* **1949**, 1211-13.—*C.A.* **43**, 8792*f*.

Univalent cation exchange was studied in mixts. of water and nonaq. solvents. These equil. obeyed the law of mass action when concns. might have been due to the effect of the solvent on the Debye radius values. $MnSO_4$ in aq. EtOH showed a marked incomplete dissocn. compared to water.

4132. Kressman, T. R. E. and Kitchener, J. A. **Cation exchange with a synthetic phenolsulfonate resin. V. Kinetics.** *Discussions Faraday Soc.* **1949**, No. 7, 90-104.—*C.A.* **45**, 19*f*.

Zeo-Karb 215 in the NH_4^+ form was used as the resin in exchange studies involving simple inorg. and substituted quaternary ammonium salts. Exchange velocities, interruption tests, the effect of agitation, and derived kinetic equations were used to det. the mechanisms involved. The data showed that the simple cations in exchange with NH_4^+ obeyed the bounding Nernst film mechanism whereas the substituted quaternary ammonium ions were in general identified with particle diffusion. Measurements on the temp. coeff. of the reactions showed that as long as the cation was small compared with the pores of the resin the energy of activation for diffusion was approx. 5 kcal/mole as was the case for free diffusion in water.

4133. Kunin, Robert and Barry, Ruth E. **Carboxylic, weak-acid type, cation-exchange resin.** *Ind. Eng. Chem.* **41**, 1269-72 (1949).—*C.A.* **43**, 6489*g*.

The exchange characteristics of a uni-functional carboxylic-type cation-exchange resin, Amberlite IRC-50, were given. This type was superior to the sulfonic acid types in equil. involving exchange with H^+ The resin would soften H_2O efficiently in the presence of a large excess of Na^+, but the equil. was such that regeneration with brine was inefficient.

4134. Kunin, Robert and McGarvey, Francis X. **Equilibrium and column behavior of exchange resins. Strong-base anion-exchange resin.** *Ind. Eng. Chem.* **41**, 1265-8, (1949).—*C.A.* **43**, 6489*f*.

The exchange characteristics of a strong-base anion-exchange resin, Amberlite IRA-400, were presented. At low-concn., the order of decreasing exchangeability for the various anions was citrate > sulfate = oxalate > iodide > nitrate > chromate > bromide > thiocyanate > chloride > formate > hydroxyl > fluoride > acetate. Reverse deionization, i.e., a system in which the anion exchanger preceded the cation exchanger, might have been used.

4135. Kunin, Robert and Myers, Robert J. **Exchange equilibria in anion-exchange resins; porous exchangers.** *Discussions Faraday Soc.* **1949**, No. 7, 79-90.—*C.A.* **45**, 19*b*.

Porous modifications of conventional anion-exchange resins of the strong-base and weak-base types were prepd. and examd. for their exchange and phys. characteristics. Decreasing the degree of cross-linking decreased the ion selectivity and increased the ability to adsorb large anions.

4136. Lur'e, Yu. Yu. and Filippova, N. A. **Use of ion-exchange resins in analytical chemistry. IV.** *Zavodskaya Lab.* **15**, 771-9 (1949).—*C.A.* **44**, 475*i*.

Phenol or resorcinol type sulfonated resins removed Ni^{++} and Cu^{++} from solns. of alloys contg. S, if the pH was held at 6 for Ni and 5.5 for Cu; this was best done by adding NH_4OH to a dild. soln. of the sample in HNO_3.

4137. Mariani, Eugenio. **Kinetics of saponification of ethyl acetate by ion-exchanging resins.** *Ann. Chim. applicata* **39**, 717-26 (1949).—*C.A.* **45**, 10016*h*.

Air-dried Amberlite IR-100 (1 g) was agitated with 25 ml of a 0.2 *N* soln. of EtOAc in H_2O or in H_2O-acetone mixts. at different temps., and the velocity of hydrolysis detd. as a function of time (20-50 min.). In H_2O the hydrolysis was more rapid than with an equiv. amt. of HCl. The resin in an aq. soln. of not more than 35% of acetone was also more effective than HCl.

4138. Mills, G. F. and Dickinson, B. N. **Oxygen removal from water by ammine-exchange resins.** *Ind. Eng. Chem.* **41**, 2842-4 (1949).—*C.A.* **44**, 2149*c*.

Anion-exchange resins were treated with Cu^{++}or Ag^+ soln., washed and reduced with 0.5 *N* $Na_2S_2O_4$ Dissolved O_2 was removed from water passed through the reduced resin to a level of less than 0.1 p.p.m. In the lab. expts. 0.24-0.33 of O_2 was removed per mole of Cu and 0.16-0.22 mole of O_2 was removed per mole of Ag to the break-through point.

4139. Oda, Ryohei and Shimizu, Hiroshi. **Ion-exchange synthetic resins. XXII. Exchangeability of inorganic cations. XXIII. Hydration energy of ions and exchangeability.** *Chem. High Polymers* **6**, 346-50, 350-5 (1949).—*C.A.* **46**, 1186*f*.

The cation exchangeability of RSO_3H-type resins was measd. with 0.1 *N* solns. of Li, K, Na, NH_4, Mg, Ca, Ni, Cd, and Ba salts. The relative exchangeability agreed with the lyotropic series.

The hydration energy of ions was calcd. according to the theory of Bernal and Fowler and compared with exchangeability.

4140. REICHELT, H. **Comparative investigations on ion exchange.** *Chem. Tech.* **1**, 28-31 (1949).—*C.A.* **44**, 775*g*.

Expts. were made on H_2O of about 3° carbonate and 8° total hardness, the exchange material being in a vertical glass tube 200 mm diam. with 900 mm depth of material, the direction of flow being reversible. Upward flow gave best results by keeping the exchanger loose and free from slime. The expts. were run until the exit H_2O fell to about 0.15° hardness at which point the material was regenerated.

4141. RICHARDSON, R. W. **Diffusion in ion-exchange media.** *Nature* **164**, 916-17 (1949).—*C.A.* **44**, 2324*i*.

Direct cotton dyes of the aromatic azo Na sulfonate type, in acid form, were selectively adsorbed from soln. by the anion-exchange resin "De-Acidite B." Equil. adsorption of 6 dyes were inversely proportional to mol. size (10 to 30 A.) The resin was thought to contain a network of pores, 10 to 20 A. in diam., which could not be penetrated by larger mols.

4142. ROBINSON, DAVID A. AND MILLS, G. F. **Adsorption of fatty acids from solvents. Duolite A-2 anion-exchange resin.** *Ind. Eng. Chem.* **41**, 2221-4 (1949).—*C.A.* **44**, 5*f*.

The adsorption on Duolite A-2, anion-exchange resin, of a homologous series of carboxylic straight-chain acids increased from acetone, water, and Shell solvent in the order named. The bearing of the results on the mechanism of acid adsorption on anion-exchange resins was discussed.

4143. SPEDDING, FRANK H. **Large-scale separation of rare-earth salts and the preparation of the pure metals.** *Discussions Faraday Soc.* **1949**, No. 7, 214-31.—*C.A.* **45**. 88*h*.

The rare earths could be sepd. by ion-exchange processes with Amberlite IR-100 resin and buffered citrate eluant. The sepn. improved with increase in column length, decrease in pH of eluant, decrease from 5% to 0.5% citrate concn., and decrease of resin particle size. The vol. of eluate increased with decrease in pH and concn. of eluant, increase in column length, and increase in temp. The sepn. of elements of low at. no. was much better than for elements of high at. no. Mold growth in the citrate solns. was temporarily stopped by the addn. of 0.1% phenol.

4144. TOMPKINS, EDWARD R. **Application of ion exchange to the separation of substances in low concentrations.** *Discussions Faraday Soc.* **1949**, No. 7, 232-7.—*C.A.* **45**, 18*g*.

The factors that affected the sepn. of solutes, column efficiency, and the shape of elution curves were enumerated and discussed.

4145. TOMPKINS, EDWARD R.; HARRIS, D. H., AND KHYM, J. X. **The effect of a number of column variables.** *J. Am. Chem. Soc.* **71**, 2504-10 (1949).—*C.A.* **44**, 4798*d*.

The effect of column area, column length and flow rate on the efficiency of an ion-exchange column for applications of vol. reduction and sepn. of fission products was studied for Y and Ce and Y^{91} and $Ce^{141, 144}$ tracers. For max. vol. reduction, the ion-exchange column should have been in the H-form initially and elution of the rare earths should have been made with citrate soln. at a pH of 3.3-3.5. For optimum sepn., it was preferable to elute the mixt. of rare earths from a column in the NH_4 form with citrate at a lower pH.

4146. TOPP, N. E. AND PEPPER, K. W. **Properties of ion-exchange resins in relation to their structure. I. Titration curves.** *J. Chem. Soc.* **1949**, 3299-303.—*C.A.* **44**, 5181*h*.

Synthetic ion-exchange resins were prepd. and titrated with HCl and KOH or NaOH and also in the presence of added NaCl or KCl. The resins were: sulfolated cross-linked polystyrene, cross-linked polymethacrylic acid, phenol-formaldehyde, resorcinol-formaldehyde, sulfonated phenol-formaldehyde, sulfited phenol-formaldehyde, resorcinal-benzaldehydedisulfonic acid-formaldehyde, and resorcylic acid-formaldehyde. If the resin was a strong acid, the exchange capacity was dependent upon the $[Na^+]/[H^+]$ ratio; if the resin was a weak acid, the exchange depended on the pH.

4147. USATENKO, YU. I. AND DATSENKO, O. V. **Determination of phosphorus in phosphorus-copper and ferrophosphorus by the use of cation-exchange agent.** *Zavodskaya Lab.* **15**, 145-7 (1949).—*C.A.* 43, 5336*g*.

The method was based on the fact that Cu, Fe, and other cations were adsorbed by the ion exchange agent (Wofatit R), while P remained in soln. as H_3PO_4 which was detd. volumetrically.

4148. USATENKO, YU. I. AND DATSENKO, O. V. **Determination of molybdenum in ferromolybdenum with the aid of cation exchange.** *Zavodskaya Lab.* **15**, 779-81 (1949).—*C.A.* 44, 478*e*.

0.1 g of sample were dissolved in 10 ml of 5 *N* HNO_3, and 10 ml of concd. HCl. The soln. was evapd. to dryness, taken up in 15 ml of concd. HCl, and dild. to 100 ml. The soln. was passed through a cation-exchange resin at 5 ml/min. It was thereupon washed with H_2O, then with 5% NaOH, and the filtrate was analyzed, after acidification with HCl, for Mo.

4149. WREATH, A. R. AND ZICKEFOOSE, E. J. **Chemical estimation of tetraethyl pyrophosphate.** *Anal. Chem.* **21**, 808-10 (1949).—*C.A.* 43, 8976*g*.

The $(C_2H_5)_4P_2O_7$ in tech. hexaethyl tetraphosphate was detd. by adding 1-2.5 g weighed sample to 50 ml 25% aq. acetone, mixing, letting stand 15 min. at 23-7°C to hydrolyze Et on Amberlite IR-4B, diluting sample and washings to 250 ml with H_2O, pipetting 100 ml aliquot, adding 50 ml 0.10 *N* NaOH, mixing, and back titrating after 30 min. with 0.1 *N* HCl to pH 6 [formation of $Na(C_2H_5)_2PO_4$] with a glass electrode.

4150. YANG, J. T. AND HAISSINSKY, MOISE. **Chromatographic separation of actinium from lanthanum.** *Bull. soc. chim. France* **1949**, 546-7.—*C.A.* 43, 8792*g*.

Mixts. of La, tagged with La^{140}, and mesothorium $2(Ac^{228})$ nitrates, in ratios from $1:10^{-8}$ to $1:10^{-9}$, were passed into a column of Amberlite IR-100 ion-exchange resin 48 cm long and 1 cm in diam. The column was eluted with ammonium citrate solns. of various concns. and pH values, and the effluent was analyzed radiochemically. La was more strongly adsorbed than Ac. Very good sepn. was obtained with pH between 4.5 and 5.5 and citrate concn. below 1%.

4151. Yorston, F. H. **Studies on sulfite waste liquor. I. The action of anion exchangers. III The extraction of sugars.** *Pulp Paper Mag. Can.* **50**, No. 12, 108-11 (1949).—*C.A.* **44**, 4247*g*.

Sulfite waste liquor was deashed with cation-exchange resin Amberlite IR-120 The deashed liquor was passed through columns contg. Amberlite IR-4B and IRA-400. The resins reduced dissolved solids to 70-80%, acidity to 40%, total C to 80-90%, and methoxyl to about 95% of original values. Sugars were recovered by satg. the exchanger with CO_2. Recovery amounted to 60-70%.

4152. Zhukov, I. I. and Brodskaya, N. I. **Connection between exchange capacity and electrokinetic potential.** *Kolloid. Zhur.* **11**, 322-7 (1949).—*C.A.* **44**, 904*a*.

Ion-exchange resins were kept for 2 days in mixts. of 0.01 *N* $BaCl_2$ and $Ba(OH)_2$ or of 0.01 *N* KCl and 0.01 *N* HCl; then the concn. of Ba^{++} or Cl^- and the pH of the supernatant soln. were detd. The rates of electrophoresis of suspended resins in this soln. were measd. Resins prepd. by sulfonation of resin, Wofatit PN, glauconite, and a zeolite adsorbed Ba^{++} more the higher the pH of the resulting soln.; at pH 10.6, 1 g of resin (two samples), Wofatit PN, glauconite, and zeolite took up 6.8, 2.5, 1.9, 0.33, and 0.74 milliequiv. Ba^{++}, resp. The electrokinetic potential was more neg. the higher the pH.

4153. Argersinger, W. J. Jr; Davidson, A. W., and Bonner, Oscar D. **Thermodynamics and ion-exchange phenomena.** *Trans. Kansas Acad. Sci.* **53**, 404-10 (1950).—*C.A.* **45**, 422*h*.

The Na-H exchange equil. on Dowex-50 was investigated. When the activities of the electrolytes in soln. were known and the assumption was made that the resin phase behaved as an ideal solid soln., the apparent equil. const. could be computed. The true equil. const. was obtained by combining the law of chem. equil. with the Gibbs-Duhem equation

4154. Atteberry, R. W. and Boyd, G. E. **Separation of seventh group anions by ion-exchange chromatography.** *J. Am. Chem. Soc.* **72**, 4805-6 (1950).—*C.A.* **45**, 2368*i*.

The halides F, Cl, Br, and I were adsorbed on Dowex-2 and then eluted with *M* $NaNO_3$ at pH 10.4 to sep. the halides. A little I was found in the F fraction. MnO_4^- reacted with the resin. ReO_4^- was eluted with 0.1 *M* $(NH_4)_2SO_4$ and NH_4SCN at pH 8.3-8.5 whereas the elution of TcO_4^- required *M* eluant. The resulting Tc was over 99% pure.

4155. Austerweil, G. V. **Outline of a few fundamental notions governing the exchange of ions.** *Bull. soc. chim. France* **1950**, 1120-5.—*C.A.* **45**, 7407*e*.

A soln. of $CaCl_2$ was run through a column of Na zeolite. The data were discussed and interpreted to show that the characteristics of an ion exchanger were the capacity, the coeff. of exchange, and the activity of the resin. The nature of the exchange was one of adsorption followed by chem. reaction.

4156. Baker, Louis C. W.; Loev, Bernard, and McCutcheon, Thomas P. **Hydrogen-cycle cation exchange for heteropoly acids and salts.** *J. Am. Chem. Soc.* **72**, 2374-7 (1950).—*C.A.* **46**, 6538*c*.

A soln. of $(NH_4)_6H_6[P_2O_2(Mo_2O_7)_9].7H_2O$ passed through a sulfonic acid-type cation-exchange resin showed no evidence of reduction. Similar treatment of $(NH_4)_3H_6[Cr(MoO_4)_6].4H_2O$ gave a pink soln. of the free acid, which on evapn. yielded the green acid. $(NH_4)_3H_5[Co(OH)(MoO_4)_5].3H_2O$ was stable in the solid state but slowly decompd. in soln. Passed through the resin, the soln. had the original color (pH 1.7) and was free of NH_4 ion. A soln. of $13(NH_4)_20.2P_2O_5.8V_2O_5.34WO_3.86H_2O$ passed through the column gave a stable acid soln. (pH 1.6), which on evapn. gave very sol. red-orange solid acid.

4157. Barrer, R. M. **Ion-exchange and ion-sieve processes in crystalline zeolites.** *J. Chem. Soc.* **1950**, 2342-50.—*C.A.* **45**, 417*e*.

Chabazite, $(Ca, Na_2)O.Al_2O_3.4SiO_2.6H_2O$, and analcite, $Na_2O.Al_2O_3.4SiO_2.2H_2O$, were compared by ion-exchange methods. Samples of the crystals of the chabazite were ground before studied, and the analcite was grown hydrothermally: ion-exchange methods used were percolation, hydrothermal exchange, fusion exchange, and vapor phase exchange. Analcite exchanged Na^+ readily for a no. of ions, but exhibited slight exchange for Li^+, Cs^+, Mg^{++} Ca^{++}, or Ba^{++}. A complete ion-sieve effect occurred between Rb^+ (radius 1.48 A.) where exchange took place and Cs^+ (radius 1.65 A.) where no exchange took place. Chabazite exchanged freely with all of the above ions except Mg^{++}

4158. Barrer, R. M. and Riley, D. W. **Influence of ion exchange upon intracrystalline sorption.** *Trans. Faraday Soc.* **46**, 853-61 (1950).—*C.A.* **45**, 4494*e*.

Kr, A, Ne, and He were adsorbed over a series of temps. and pressures in chabazites rich in the ions $(Ca^{++} + Na^+)$, Ba^{++}, Li^+, and NH_4^+. Isosteric heats of sorption showed an inhomogeneity among sorption sites, but among ion-exchange chabazites this inhomogeneity was not marked. Polarization energies in the intense fields adjacent to any cation could account for the very marked effect of ion exchange on the affinity between a nonpolar gas and its intracryst. environment.

4159. Basolo, F. and Steninger, D. H. **Preparation of hydroxoaquabis-(ethylenediamine)-cobalt (III) and hydroxoamminebis-(ethylenediamine)-cobalt (III) salts.** *J. Am. Chem. Soc.* **72**, 5748 (1950).

By means of a strong base anion exchange resin, the replacement by hydroxide ions of chloro, bromo, and iodo ligands coordinated to cobalt (III) in the "Werner-Type" complex was simplified and made more efficient. The resin was used to remove and bind ionic chloride as the hydrochloride. The strongly basic complex hydroxide which formed displaced the coordinated chloro groups, which were in turn removed by the resin. The final product, hydroxo hydroxide was obtained in almost theoretical yield.

4160. BEUKENKAMP, JOHN AND RIEMAN, WM. III. **Determination of sodium and potassium, employing ion-exchange separation.** *Anal. Chem.* **22**, 582-5 (1950).—*C.A.* **44**, 5760*e*.

Na, K, and Mg, held in a column of colloidal Dowex 50, were eluted in the order given by 0.7 *N* HCl, and were easily detd. in the elautes. Effects of elution variables were discussed and exptl. data confirming the theory were given.

4161. BISHOP, JOHN A. **Covalent adsorption on base-exchange resins. II. Adsorption from buffer solutions of straight-chain acids.** *J. Phys. & Colloid Chem.* **54**, 697-702 (1950).—*C.A.* **44**, 8195*h*.

The equation, $\log X = k \log a_{H^+} a_{A^-} + \text{const.}$, where $X =$ adsorption in millimoles of acid per g of resin, was studied using Amberlite IR-400 A.G. and acids and buffer solns. Results predicted by this equation were obtained experimentally for HCl, CH_3COOH, and $CH_2ClCOOH$, and all points for a single acid fell on the same curve, both for the acid solns. and for the buffer solns. Adsorption was attributed to direct reaction as well as to reaction with the displaced OH ions.

4162. BOYD, G. E.; ADAMSON, A. W., AND MYERS, L. S. JR. **Ion charge and exchange rates with ion-exchange polymers.** *J. Am. Chem. Soc.* **72**, 4807-8 (1950).—*C.A.* **45**, 2286*c*.

The equil. exchange rates for uni-, bi-, and trivalent cations on Amberlite IR-1 in dil. HCl diminished rapidly as ionic charge increased. Na^{24}, U^{233}, and Ce^{144} exchanged by film diffusion from 0.001 *N*, 0.003 *N*, and 0.1 *N* HCl, resp., whereas they exchanged by particle diffusion from 0.1 *N*, 0.3 *N*, and 0.5 *N* HCl, resp. Diffusion through the exchange polymer was slower than in aq. soln. and depended only on the nature and compn. of the exchanger, the temp., the ionic strength of the external soln., and the charge of the diffusing ion.

4163. BRAITHWAITE, D. G.; D'AMICO, J. S., AND THOMPSON, M. T. **Effect of chlorine on cation-exchange resins.** *Ind. Eng. Chem.* **42**, 312-15 (1950).—*C.A.* **44**, 3637*b*.

The effects of Cl_2 water were studied at different concns. and pH on regenerated and exhausted cation exchangers. Sulfonated coal and sulfonated phenol-formaldehyde exchangers all eventually disintegrated. Sulfonated styrene-di-vinylbenzene polymers were not attacked by Cl_2.

4164. CASSEL, MARTHE. **Donnan equilibrium and ionic distribution between solutions of electrolytes and sulfonated resins.** *Compt. rend.* **230**, 2286-8 (1950).—*C.A.* **44**, 10417*f*.

The ionic distribution between electrolytic solns. and ion-exchange resins followed the Donnan equil. equations in dil. concns. For concd. solns., the diminution of the amt. of the exchange followed a variation in the ratio of the activity coeffs. of the cations in the external soln. and followed a new distribution represented in a satisfactory manner by an equation of the Freundlich type. Electrolytes studied were KCl, CsCl, NaCl, and NH_4Cl.

4165. CLEAVER, CHARLES S. AND CASSIDY, HAROLD G. **Chromatographic adsorption of amino acids on organic exchange-resins. II.** *J. Am. Chem. Soc.* **72**, 1147-52 (1950).—*C.A.* **45**, 2287*b*.

The countercurrent response of a representative synthetic org. anion-exchange resin (IR-4) toward a typical acidic amino acid (glutamic acid) was studied. The effect of the type of resin, pH of soln., and foreign anion contamination on the response were given in curves. The adsorption varied with the pH as well as with the foreign-anion concn.

4166. COHN, WALDO E. **The anion-exchange separation of ribonucleotides.** *J. Am. Chem. Soc.* **72**, 4, 1471-1478 (1950).

The nucleotides of ribonucleic acid were separated from each other and from the corresponding bases and ribosides by successive elution from strong base anion exchangers with weak acids and buffers of controlled pH and anion concentration. The order of elution at several levels of pH was eastablished for cytidylic, adenylic, guanylic, and uridylic acids.

4167. COSGROVE, J. D. AND STRICKLAND, J. D. H. **Cation-exchange resins. The applicability of the mass-action law to the exchange of univalent ions.** *J. Chem. Soc.* **1950**, 1845-53.—*C.A.* **45**, 1404*i*.

An exptl. test was made of the validity of the mass-action law as applied to the exchange of K, H, and NH_4 ions on phenol-formaldehyde and sulfonated cross-linked polystyrene-type resins. The approx. expression $K' \quad [X_r\ (1-X_r)][(1-X_s)/X_s]$ was calcd. from detns. of the adsorption isotherms and tested for constancy with varying X_{Mr} and X_{Ms}. X_r and X_s were the mole fractions of M^+ on the resin and in soln., resp. Three exptl. techniques were described for obtaining the adsorption data, and plots of K' vs. X_{Mr} and X_{Ms} were given for the exchange of K and H, K and NH_4, and H and NH_4 ions.

4168. D'AMICO, J. S. AND THOMPSON, M. T. **Effect of Chlorine on cation-exchange resins.** *Ind. Eng. Chem.* **42**, 312-15 (1950).—*C.A.* **44**, 3637*b*.

The effects of Cl_2 water were studied at different concns. and pH on regenerated and exhausted cation exchangers. Sulfonated coal and sulfonated phenol-form-aldehyde exchangers all eventually disintegrated. The Cl_2 attacked the methylene bond of the latter to give sol. sulfonic acids of low mol. wt. Sulfonated styrene-divinylbenzene polymers were not attacked by Cl_2.

4169. DAVIES, C. W.; HUGHES, R. B., AND PARTRIDGE, S. M. **Amino acid separations by use of a strong-base resin.** *J. Chem. Soc.* **1950**, 2285-7.—*C.A.* **45**, 207*a*.

Details were given of the sepn. of leucine and glutamic acid or methionine on Dowex 2. Clear-cut separations of two neutral amino acids, leucine and methionine, were obtained. A mixture of glutamic acid and leucine was also separated efficiently.

4170. Davies, C. W. and Nancollas, G. H. **Preparation of carbonate-free sodium hydroxide.** *Nature* **165**, 4189, 237 (1950).

CO_3-free alkali was prepared by passing a solution of NaOH through column containing a strongly basic anion exchange resin in its chloride form.

4171. Davis, Lannes E. **Ionic exchange and statistical thermodynamics. I. Equilibria in simple exchange systems.** *J. Colloid Sci.* **5**, 71-9 (1950).—*C.A.* 44, 6242*c*.

The conditions for ionic exchange equil. were derived from classical thermodynamics and the appropriate ion-exchange terms from statistical thermodynamics.

4172. Davis, Lannes E. **Ionic exchange and statistical thermodynamics. II. Equilibria in irregular systems.** *J. Colloid Sci.* **5**, 107-13 (1950).—*C.A.* 44, 6242*c*.

Irregular ion-exchange systems (i.e., those that did not conform in exptl. behavior to predictions based on a statistically-treated model) were recognized. The internal partition function was markedly affected by strong bond forces. There was a mixt. of 2 "regular" systems having significantly different values for the equil. exchange const.

4173. Davydov, A. T. and Levitskiĭ, I. Ya. **Dependence of the amount of adsorbed cation on the weight of the adsorbent.** *Zhur. Obshcheĭ, Khim. (J. Gen. Chem.)* **20**, 1776-9 (1950); *J. Gen. Chem. U.S.S.R.* **20**, 1837-40 (1950) (Engl. translation).—*C.A.* **45**, 417*d*; **46**, 4883*a*.

The exchange-adsorption isotherm equation of Gapon called for a linear relation between $y = g/a$ and $x = (a/vm)^{1/m}/[C_0 - a/vn]^{1/n}$, where g = wt of adsorbent, a = amt. adsorbed, v = vol. of soln./g adsorbent, C_o = initial concn., m and n = valencies of the ions exchanged. The validity of this relation was confirmed by exptl. data for the exchange of $Ca^{++} + Na^+$, $Ca^{++} + K^+$, $Sr^{++} + Na^+$, $Sr^{++} + K^+$, $Ba^{++} + Na^+$, and $Ba^{++} + K^+$ on glauconite.

4174. Deuel, H.; Solms, J., and Anyas-Weisz, L. **The behavior of soluble polyelectrolytes toward ion exchangers.** *Helv. Chim. Acta* **33**, 2171-8 (1950) (in German).—*C.A.* **45**, 2286*e*.

High-polymer electrolytes such as polygalacturonic acid, polymanuronic acid, and polymetaphosphoric acid were adsorbed by Amberlite IR-4B, in contrast to their low-mol. fragments, which were absorbed like normal ions. Percolation through ion-exchange resins sepd. the low-mol. ions from the high-mol. ions.

4175. Dickel, Gerhard. **New possibilities for the separation of isotopes by means of ion exchangers.** *Z. Elektrochem.* **54**, 353-7 (1950).—*C.A.* **45**, 6885*a*.

The theoretical fundamentals were given for the practically feasible combination of 2 methods of ion exchange, the continuously working residue method and the true countercurrent method. Equations were derived for isotope sepn.

4176. Djourfeldt, Ralph and Samuelson, Olof. **Utilization of ion exchangers in analytical chemistry. XV.** *Acta Chem. Scand.* 4, 165-84 (1950).—*C.A.* 44, 6759*f*.

The effect of the particle size was shown, and an optimal size was recommended. Ion exchange was quant. even for rather acid solns. Conditions for regeneration of the ion exchange column with HCl were studied.

4177. Douglas, D. M.; Elliott, G. A.; Ellis, W. R., and Lee, R. H. **Some attempts to concentrate the K^{40} isotope.** *Proc. Conf. Applications Isotopes Sci. Research, Univ. Melbourne* **1950**, 125-36 (1951).—*C.A.* **45**, 9315*g*.

Cation-exchange expts. utilizing a natural green-sand and a com. zeolite were described. Details were also given of a study utilizing the countercurrent ionic migration method. Neg. results were reported for both procedures.

4178. Ekedahl, E.; Högfeldt, E., and Sillén, L. **Theory of sorption columns.** *Nature*, **166**, 722-723 (1950).

An approach to the calculation of sorption fronts which may be applied to ion exchange methods was developed. A measure of the approach to equilibrium conditions was expressed as a standard function; the function was then used to estimate boundary formation.

4179. Ekedahl, Erik; Högfeldt, Erik, and Sillen, Lars G. **Kinetics and equilibria of ion exchange.** *Nature* **166**, 723-4 (1950).—*C.A.* **45**, 3682*h*.

The apparent equil. const. as a function of the Ag fraction in an ion exchanger was calcd. from results of elution expts. in which a H-ion soln. was percolated at rates from 1 to 70 ml per min. through an ion exchanger satd. with Ag.

4180. Erler, Karl. **Use of exchange resins in analytical chemistry. II. Behavior of Wofatit F toward weak, organic acids.** *Z. anal. Chem.* **131**, 106-13 (1950).—*C.A.* 44, 9855*b*.

The behavior of the exchange resin Wofatit F (cation exchange) of different grain sizes was studied with respect to unpolar adsorption ability for different acids. Mineral acids were hardly adsorbed at all. Weak, org. acids were adsorbed and the effect was greater with increasing mol. wt. The monobasic acids were adsorbed more than were dibasic acids.

4181. Fager, E. and Rosenberg, J. **Phosphoglyceric acid in photosynthesis.** *Science* **112**, 617-618 (1950).

Suspensions of the alga *Scenedesmus obliguus* were illuminated for 10-15 minutes in the presence of excess $C^{12}O_2$. Tracer (HCO_3^-) was added, illumination continued for 30-40 seconds, and the algae killed. The aqueous extract was dialyzed and deionized with a strong acid cation and a weak base anion exchanger. The anion bed was fractionally eluted with dilute ammonia.

4182. Futterknecht, Andre. **Use of ion-exchange resins in analytical chemistry.** *Chim anal.* **32**, 306-8 (1950).—*C.A.* **45**, 2362*g*.

Ion-exchange resins could be used for sepg. most inorg. ions, for sepg. many org. compds., and furnished the only means for rapidly isolating radio-isotopes. Two expts. were described.

4183. Gabrielson, Gunnar and Samuelson, Olof. **Utilization of ion exchangers in analytical chemistry. XVII. Determination of potassium in the presence of sulfate and phosphate.** *Svensk Kem. Tid.* **62**, 221-3 (1950).—*C.A.* **45**, 4169c.

The columns used contained beds (0.8 by 150 mm) of Amberlite IRA-400 (0.12-0.30 mm particle size), pretreated with *N* NaCl. In one series of expts., solns. (50 ml each) contg. 0.25-0.46 g K_2SO_4 were passed through at a rate of 3 ml/min., and the K detd. as perchlorate in the sulfate-free effluent. The method was also applied to the detn. of K in mixts. of KCl with Na_2SO_4 or NaH_2PO_4 (max. relative error: ±0.4%).

4184. Gapon, E. N. and Belenkaya, I. M. **Determination of the absorptive capacity of ion-exchange materials.** *J. Applied Chem. U.S.S.R.* **23**, 1419-20 (1950) (Engl. translation).—*C.A.* **46**, 8460*f*.

A weighed amt. of adsorbent was satd. with Ba^{++} by running 0.1 *N* $BaCl_2$ through it. Without washing, the Ba^{++} was eluted with 0.01 *N* HNO_3 and detd. as $BaSO_4$, and Cl^- was detd. as AgCl. Chernozem (Suma and Budarino) soils, Na Glauconite, alumina, and several zeolites were used.

4185. Gapon, E. N. and Zhupakhina, E. S. **Dynamic method of determination of the adsorption capacity.** *Doklady Akad. Nauk S.S.S.R.* **72**, 721-4 (1950).—*C.A.* **44**, 9769c.

A soln. of $Cu(NO_3)_2$ of a concn. so chosen that adsorption equil. was reached after passage of 200-250 ml and no Cu^{++} detected in the filtrate after passage of the 1st portion, was passed through a column of adsorbent 3-4 cm high, in a tube 2 cm in diam., by portions of 25 ml at a time, and the filtrates analyzed for Cu^{++}. The adsorption capacities of permutites, glauconite, and different kinds of soils were detd.

4186. Guntz, Antoine A. **Multiplication of ions by ion exchangers.** *Compt. rend.* **231**, 227-8 (1950).—*C.A.* **44**, 10462*i*.

If a soln. of a given cation was passed through an acid ion exchanger, and then the H ions thus obtained passed through an exchanger consisting of a neutral insol. salt, the acid salt of which was sol., the no. of cation equivs. in the soln. thus obtained would equal the no. of equivs. of the original cation times a multiplication factor. If the H-ion soln. was passed through $CaCO_3$, the reaction $2H^+ + 2CaCO_3 \rightarrow 2Ca^{++} + 2HCO_3^-$ liberated 2 equivs. of Ca^{++}.

4187. Gupta, S. L. **Titration curves of Amberlites IR-100 and IR-4B.** *Science and Culture* **15**, 325-6 (1950).—*C.A.* **44**, 7618*g*.

The Amberlite IR-100 resin was ground in a mortar and particles that did not settle after 8 hrs. of sedimentation were collected in 0.05 *N* HCl, filtered, and washed free of the HCl. Titration with NaOH in the presence of NaCl gave typical curves in which the addn. of salt before the titration depressed the pH. The same sedimentation procedure was used with the IR-4B resin, and the fine particles were collected in 0.05 *N* NH_4OH. The titration curve with dil. HCl exhibited 2 inflection points characteristic of a dibasic acid.

4188. Gupta, S. L.; Bose, Monisha, and Mukherjee, S. K. **Ion exchange in synthetic resins.** *J. Phys. & Colloid Chem.* **54**, 1098-1109 (1950).—*C.A.* **45**, 1404*f*.

A resorcinol-formaldehyde cation exchange resin and a *m*-phenylenediamine anion exchange resin were prepd. and studied. For the cation resin the exchange capacity with alkalies increased with time of contact, increased with increasing fineness of the samples, and increased when the resin-soln. vol. ratio was decreased. $Ba(OH)_2$ gave a greater exchange capacity than NaOH under the same conditions. The presence of neutral salts increased the exchange capacity, but the NaOH capacity increased relatively more than the $Ba(OH)_2$ capacity.

4189. Hachihama, Yoshikazu; Jodai, Sho; Sato, Hiroshi; Fukui, Eiichi, and Nakamura, Tadashi. **Lignin as raw material of synthetic resins. II. Cation-exchanging resin from sulfite pulping waste liquor.** *Mem. Inst. Sci. Ind. Research Osaka Univ.* 7, 167-8 (1950); *J. Chem. Soc. Japan, Ind. Chem. Sect.* **53**, 365-7 (1950).—*C.A.* **45**, 10659c; **46**, 11505c.

A 50-70% yield of cation-exchange resin was pptd. as a brown mass by refluxing 20 cc. sulfite waste liquor contg. 20% solids, with 4.4 cc. 30% formalin and 4-8 cc. H_2SO_4 (d. 1.80) for 5 hrs. Best resin was obtained in reaction of 2-3 hrs, exchanging 0.35-0.30 millimoles K per g resin.

4190. Higgins, G. H. and Street, K. Jr. **Note on the ion-exchange separation of europium, gadolinium, and terbium.** *J. Am. Chem. Soc.* **72**, 5321-2 (1950).—*C.A.* **45**, 2286*i*.

The elution of Y, Eu, Gd, and Tb from Dowex-50 by 5% NH_4 citrate at 97 °C was studied by use of radioactive tracers. Spectrographic measurements supplementary to the activity measurements showed the sample was sepd. into 3 fractions corresponding to Y, Tb, and Eu and Gd, resp. The more marked sepn. of Tb from Gd than Eu from Gd was related to the half-filled 4f configuration.

4191. Högfeldt, Erik; Ekedahl, Erik, and Sillén, Lars G. **Activities of the components in ion exchangers with multivalent ions. Activities of the barium and hydrogen forms of Dowex 50.** *Acta Chem. Scand.* 4, 828-9; 829-30 (1950).—*C.A.* **44**, 10442*h*.

An equation was developed and applied to exchange reactions on Dowex 50.

4192. Högfeldt, Erik; Ekedahl, Erik, and Sillén, Lars G. **Ion-exchange equilibria. I. The silver-hydrogen equilibrium on Wofatit KS and Dowex 50.** *Acta Chem. Scand.* 4, 1471-89 (1950) (in English).—*C.A.* **45**, 5005c.

The exchange $Ag^+ + HR \rightleftharpoons H^+ + AgR$ (R was the anion framework of the resin) was studied on Wofatit KS and Dowex 50 by chem. and e.m.f. methods of analysis; the equil. was attained from both sides. The mole-fraction range of AgR covered was 0.001-0.98. For the above reaction, the equil. const., *k*, was independent of ionic strength (0.100 and 0.020) for both exchangers.

4193. HOLM, LENNART W. AND WESTERMARK, TORBJORN. **The exchange of isotopic ions in cation exchangers.** *Acta Chem. Scand.* 4, 968-9 (1950).—*C.A.* 45, 2741*i*.

The exchange of Ag with its radioactive isotope was detd. by both batch and column ion exchange studies. The results indicated a rapid exchange between ions on the resin and their isotopic ions in the surrounding soln. and thus confirmed the existence of a dynamic equil. "Labeled" silver nitrate solns. were treated with a sulfonated polystyrene-type cation exchange resin previously satd. with silver ions.

4194. HONDA, MASATAKE. **Ion-exchange resin applied to chemical analysis. VII. Separation of fluoride from heavy metal ions. VIII. Separation of ions by means of the difference of adsorptive properties according to electric charge.** *J. Chem. Soc. Japan, Pure Chem. Sect.* **71**, 59-60; 118-20 (1950).—*C.A.* **45**, 5053*e*; 5053*f*.

F ion could be sepd. from interfering Al, Fe and Be by a cation-exchange resin. Mixts. of Li, Be, and Al salts whose concns. were 20, 16, and 42 mg/liter, resp., were passed through a column of cation-exchange resin and adsorbed. The adsorbed column was washed with 0.1 *N* HCl, 0.05 *N* $CaCl_2$ soln., and 4 *N* HCl successively. The first effluent contained Li, the 2nd Be, and the 3rd Al salts.

4195. HONDA, MASATAKE. **Exchange capacity of anion-exchange resins.** *J. Chem. Soc. Japan, Pure Chem. Sect.*, **71**, 183-6 (1950).—*C.A.* **45**, 4523*i*.

The role of anion (A) concn. and pH in liquid phase affecting the exchange capacity of anion exchange resins was studied. In solid phase pH depended upon pA, and according to the membrane equil.- pA + pH in the solid and liquid phases must be equal in equil. Hence the exchange capacity of resins was detd. by pA + pH in liquid phase. This was confirmed by expts. on the adsorption of acetates and chlorides.

4196. HONDA, MASATAKE. **Exchange equilibrium of weak electrolytic exchangers. II. Exchange capacity curves of several weak exchangers and measurement of their internal pH.** *J. Chem. Soc. Japan, Pure Chem. Sect.* **71**, 440-3 (1950).—*C.A.* **45**, 6006*a*.

The exchange capacity curves representing the relations between *E* and pH + pCl were detd. for Amberlites IR-4B and IRA-400 and *m*-phenylenediamine resin. The relation between *E*-(pOH + pNA) was detd. for Amberlite IRC-50. The internal pH values of resins were detd. directly by adsorbed indicators. pH values of polystyrene sulfonic acids, their salts, and IRC-50 (HR form) were 0, 3-6, about 4, resp.

4197. INABA, AYAKO AND SASAKI, TSUNETAKA. **Ion-exchange adsorption by coal. II. On the properties of coal treated with sulfuric acid.** *Mem. Faculty Sci. Kyūsyū Univ. Ser. C, Chem.* **1**, 211-16 (1950) (in English).—*C.A.* **46**, 3828*d*.

Coal grains treated with a mixt. of concd. H_2SO_4 and $K_2Cr_2O_7$ with $HgSO_4$ as a catalyst showed a cation exchange capacity. Four fifths of the Na^+ on coal was exchanged for Ca^{++} in soln. in 30 sec and all of it in 6 mins. The capacity for Ca^{++}-Na^+ exchange equil. was approx. 2 meq./g.

4198. JONES, J. IDRIS. **Coal tar bases. III. By-products of the hydrogenation of pyridine with Raney Ni.** *J. Chem. Soc.* **1950**, 1392-7.—*C.A.* **45**, 618*i*.

Ordinarily, investigations of these by-products involve much difficulty as to separating and characterizing the *N*-*n*-amylpiperidine, owing to the existence of other bases in the same fraction. However, a clear-cut separation of this piperidine derivative from the contaminative bases was made possible by selective elution from a cation exchanger.

4199. JUDA, WALTER AND MCRAE, WAYNE A. **Coherent ion-exchange gels and membranes.** *J. Am. Chem. Soc.* **72**, 1044 (1950).—*C.A.* **45**, 2286*f*.

New resinous sulfonic cation-exchange membranes had unusually high sp. elec. cond. and exchange capacities and a characteristic concn. potential of 54-5 mv., a sp. cond. of 0.02-0.03 ohm^{-1} cm^{-1}, and an exchange capacity of 0.4-0.6 milliequiv. per g of wet H-form material.

4200. JURKIEWICZ, JAN. **Static method of determining the coefficient of ion exchangers.** *Prace Badawcze Glownego Inst. Gornictwa* (Katowice), *Komun.* No. **75**, 12 pp. (1950).—*C.A.* **47**, 1988*h*.

Between 1.5 and 3 g of the ion exchanger was loaded into a small brass tube closed with a metallic gauze on both ends that fit by means of rubber stoppers into the necks of two bottles. One of them contained *V* cc. of a soln. of an ion suited to the type of the exchanger. Its concn. (S_o) must not be less than 5.0 meq./liter. The whole app. was mounted on an automatically revolving device which turned it over periodically; this forced the soln. to flow through the exchanger from one bottle into the other. The method was applied to a Na-ion exchanger Escarbo and it was found to be independent of the S_o and S values. The exchanged ion was Ca^{2+}.

4201. KAGAWA, IKUMI; SATO, SUSUMU, AND KASASHI, RYUZO. **Ion-exchange resins. I. Equilibrium condition of ion-exchange processes. II. Ion-exchange mechanism of anion exchangers.** *J. Chem. Soc. Japan, Ind. Chem. Sect.*, **53**, 85-7; 126-8 (1950).—*C.A.* **46**, 8460*i*.

The equil. consts. in the cation exchange between each of KCl, NH_4Cl, $CaCl_2$, $BaCl_2$, and the cation-exchange resin (a sulfonated Bakelite) were detd. The difference of the actions of anion exchanger (OH-resin) and of cation exchanger (sulfonic acid resin) could be attributed to the weak basic character of the former and the strong acidic character of the latter.

4202. KAKIHANA, HIDETAKE; NATSUME, HARUO, AND YASIMA, SHUNICHI. **Electric chromatography with cation-exchange resin column.** *J. Chem. Soc. Japan*, Pure Chem. Sect., **71**, 234 (1950).—*C.A.* **45**, 4599*d*.

Cu^{++} and Co^{++} could be sepd. by means of cation-exchange resin. The column of Amberlite IRC-50 contg. Cu^{++} and Co^{++} was kept in contact with the column which contained Amberite only, and d.c. at 100 v. was applied on the terminals of both columns.

4203. Kayas, Georges. **Complete separation of alkali metals by ion exchange.** *J. chim. phys.* 47, 408-10 (1950).—*C.A.* 45, 61*h*.

Na and K salts were eluted with 0.1 *N* HCl and Rb and Cs salts with *N* HCl. The progress of the sepn. was followed by means of tracers, with Na^{24}, K^{42}, Rb^{86}, and Cs^{134}. A plot of activity of eluant vs. vol. of eluant showed quant. sepn. of these salts by Amberlite IR 100 resin.

4204. Kraus, Kurt A. and Moore, George E. **Adsorption of protactinium from hydrochloric acid solutions by anion-exchange resins.** *J. Am. Chem. Soc.* 72, 4293-5 (1950).—*C.A.* 45, 2286*b*.

The distribution coeff. of Pa(V) between Dowex-1 and HCl soln. as a function of HCl concn. was low below 4 *M* HCl, but rose abruptly above this concn. Pa thus formed a negatively charged chloride complex which had a probable charge of minus one. Pa was quantitatively adsorbed from 8 *M* HCl, and the band was not moved appreciably by washing with 8 *M* HCl.

4205. Krishnamoorthy, C. and Overstreet, Roy. **Behavior of hydrogen ion in exchange reactions.** *Science* 111, 231-2 (1950).—*C.A.* 44, 6700*i*.

It was possible to calc. an adsorption energy for H ion that was consistent with its charge and at. wt. If an adsorbent in its H form was treated with a KCl soln., the equil. const., $k_{RH} = X[X + CK_{ad}]/C[C(T - K_{ad}) - X]$, where T = total exchange capacity of the adsorbent, K_{ad} = adsorbed K^+, C = const., and $X = K_{ad} - [HCl]/[KCl]$. For the synthetic resin "Ion X" the value of k_{RH} was 0.82 milliequiv. per g of adsorbent, and $C = 11.0$.

4206. Kubo, Shoji and Tsutsumi, Chuichi. **Gravimetric determination of phosphorus by the use of cation-exchange resin.** *Rept. Food Research Inst.* (Japan) 3, 87-9 (1950).—*C.A.* 47, 6818*g*.

The sepn. of PO_4^{3-} from interfering cations was made with a cation-exchange resin of H form and it was pptd. with magnesia mixt.

4207. Lisicki, Z. **Thermochemical method of determining the capacity of hydrogen-ion exchangers.** *Przemysl Chem.* 6 (29), 45-6 (1950).—*C.A.* 45, 10435*i*.

A comparative method of successive thermochem. measurements was used to det. the capacity of H-ion exchangers and the heat developed during neutralization. The method permitted the elimination of practically all thermometric and colorimetric corrections.

4208. Lynam, C. G. and Weil, H. **Movable-bed chamber technique in ion exchange.** *Mfg. Chemist* 21, 60-4, 77 (1950).—*C.A.* 44, 7100*b*.

The technique of removing satd. ion-exchange resins, replacing the satd. material with fresh material, and treatment of the satd. resin in a central plant was discussed. Radial-flow ion exchange was introduced as an alternative method.

4209. Mayer, Stanley W. and Schwartz, S. David. **The association of cerous ion with sulfite, phosphate, and pyrophosphate ions.** *J. Am. Chem. Soc.* 72, 5106-10 (1950).—*C.A.* 45, 2286*g*.

The distribution of Ce^{3+} between ion-exchange resin Dowex 50 and solns. of H_2SO_3, H_3PO_4, and $H_4P_2O_7$ was measured. The consts. for the reaction between Ce^{3+} and these acids were calcd. The assocn. consts. for $CeSO_3^+$, $CePO_4$, and $CeP_2O_7^-$ were 1.1×10^8, 3.4×10^{18}, and 1.4×10^{17}, resp.

4210. Mellor, D. P. **A possible method for the removal of trace elements from solutions.** *Australian J. Sci.* 12, 183 (1950).—*C.A.* 44, 10445*b*.

Ion-exchange resins were proposed in which a metal-complex-forming mol. was polymerized leaving some chelate-ring-forming groups free.

4211. Moore, George E. and Kraus, Kurt A. **Adsorption of iron by anion-exchange resins from hydrochloric acid solutions.** *J. Am. Chem. Soc.* 72, 5792-3 (1950).—*C.A.* 45, 3290*h*.

Elution expts. with tracer Fe^{59} and 0.023 cm^2 columns of Dowex-1 showed that the elution const. decreased rapidly with increasing HCl concn. above 1 *M*, reaching the value of 2×10^{-4} at 9 *M*. The behavior of Fe(III) was similar to Pa(V). Al, Cr, and rare-earth ions were practically not adsorbed from strong HCl soln.

4212. Mukherjee, Sudhamoy; Gupta, Manik Lal Sen, and Bhattacharyya, Nath. **Adsorption of acid, bases, and alkaloids by synthetic ion-exchange resins.** *J. Indian Chem. Soc.* 27, 156-68 (1950).—*C.A.* 45, 925*a*.

The adsorption of acids and alkalies on ion-exchange resins followed the Freundlich adsorption isotherm. The total acidities of a series of cationic resins as detd. by potentiometric titration may fall in a different order from that of the adsorptive powers as found from the adsorption isotherms. The anionic resins appeared to give true anion-exchange rather than mol. adsorption of acids. The order of adsorption of alkaloids on a series of cationic resins was dependent on the alkaloid.

4213. Odencrantz, June T. and Rieman, William III. **Determination of arsenic in insecticides. Application of ion exchange.** *Anal. Chem.* 22, 1066-7 (1950).—*C.A.* 44, 9105*c*.

The removal of As by distn. as $AsCl_3$ was avoided by passing a suitable soln. of the sample in dil. HCl through a column of 60-100 mesh Ion-X. After oxidation to As^{+5}, it was separated from interfering cations in 5 minutes by use of a cation exchange resin. Time and space savings were effected most readily when several samples were analyzed simultaneously.

4214. Oguri, Sutezô and Sekine, Yoshirô. **Removal of formic acid from formaldehyde.** *Science (Japan)* 20, 328-9 (1950).—*C.A.* 45, 10436*f*.

Com. HCHO contg. 47 mg HCOOH/100 cc. was treated with one-tenth of its wt of anion-exchange resin. The content of HCOOH was reduced to 6 mg/100 cc. after 20 hrs, and to below 2 mg/100 cc. after 100 hrs of treatment. The pH of the original com. HCHO (3.00) changed to 4.25 after 20 hrs, and reached 6.85 after 100 hrs. The loss of com. HCHO due to the adsorption on anion-exchange resin was within 1.0-1.5%.

4215. Ongaro, Dante. **Determination of exchange capacity of ion exchangers.** *Chimica e industria* 32, 264-8 (1950).—*C.A.* 44, 10444*f*.

Cationic exchangers were regenerated for 15 min. with 100 ml of 5% HCl, followed by 3 washings with distd. water and a 30-min. equilibration with 300 ml distd. water. Anionic exchangers were regenerated similarly with 100 ml of 5% Na_2CO_3 and equilibrated for 30 min. with 600 ml distd. water. The salt-forming capacity of cationic exchangers was detd. by adding a soln. prepd. from 80 ml distd. water and 20 ml *N* NaOH. The liquid was allowed to pass through in 15 min.; this was followed by 4-5 washings with a total of 300 ml of distd. water.

4216. Orlova, L. M. **Determination of free acidity in salt solutions with the aid of organolites.** *Zhur. Anal. Khim.* 5, 370-4 (1950).—*C.A.* 45, 925*c*.

This method consisted of exchanging the cation in soln. against the H of a cationite and titrating the soln. passed through the cationite. As exchange material was used CH_2O-resorcinol resin. The salts studied were K, Ba, Cu^{++}, Cr^{+++}, and Fe^{+++} chlorides and $Al_2(SO_4)_3$. From neutral solns. Cu and Ba absorbed well.

4217. Paléus, Sven and Neilands, J. B. **Preparation of cytochrome c with the aid of ion-exchange resin.** *Acta Chem. Scand.* 4, 1024-30 (1950) (in English).—*C.A.* 45, 2053*b*.

Cytochrome c was chromatographed on conditioned cation exchanger (Amberlite IRC-50). It lodged at the top of the column, and on every trial, a golden-colored impurity, protein in nature, appeared quickly in the effluent. It was eluted with 0.1 *M* $NH_4OHAcONH_4$ at pH 10.8. The original cytochrome c contained 0.24% Fe, and the front and tail fractions from the chromatogram contained 0.447% and 0.461% Fe.

4218. Pedinelli, Mario and Bovelacci, Franco. **An ion-exchange resin.** *Chimica e industria* (Milan) 32, 110-15 (1950).—*C.A.* 45, 3964*d*.

Dekation-K-1 was formed in an acid-catalyzed condensation of an alkali *p*-hydroxyphenylsulfonate with trioxymethylene. In H_2O the resin swelled by 50% of its original vol. The resin was insol. in org. and inorg. solvents and decomp. at 200°C. The exchange capacity was 800 milliequivs./1000 ml and 1.4 milliequivs./g.

4219. Reichard, Peter and Estborn, Bengt. **Preparation of desoxyribonucleosides from thymonucleic acid.** *Acta Chem. Scand.* 4, 1047-53 (1950).—*C.A.* 45, 3807*g*.

The crude desoxyribosides were purified by elution from a cation exchanger (Dowex 50), first with 0.1 *M* NH_4OAc buffer of pH 3.9, followed by 5% NH_3. The nucleosides were further purified by crystn.

4220. Rhodehamel, H. W. Jr.; McCormick, S. L., and Kern, S. F. **Crystalline dihydrostreptomycin base.** *Science* 111, 233 (1950).—*C.A.* 44, 5542*f*.

Dihydrostreptomycin base was prepd. by (1) titration of an aq. soln. of relatively pure dihydrostreptomycin sulfate to pH 12 with $Ba(OH)_2$, or (2) passing an aq. soln. over a strongly basic ion-exchange resin in the hydroxyl cycle.

4221. Saunders, L. and Srivastava, R. **The absorption of quinine by a carboxylic acid ion-change resin.** *J. Chem. Soc.* 1950, 2915-19.—*C.A.* 45, 1839*c*.

Absorption of quinine on Amberlite IRC-50 in acid form, followed the relation $dx/dt = ka(a-x)/x^2$, where a was initial soln. concn. in millimoles/100 ml, x was millimoles absorbed by 5 g of resin, and t was time in hrs. Data were obtained batchwise over 7 days and from column studies. The rate of absorption of quinine was largely controlled by the rate of diffusion of quinine mols. through the resin.

4222. Schubert, J. **Other methods. A. Chromatographic adsorption methods of quantitative separation.** *Natl. Nuclear Energy Ser.*, Div. VIII, 1, *Anal. Chem. Manhattan Project*, 693-704 (1950).—*C.A.* 45, 1899*i*.

The mechanism of ion-exchange absorption by means of resins, the principles underlying equil. adsorption, and adsorption under nonequil. conditions were explained. Suitable adsorbents now available were named and suitable app. shown. Analytical sepns. by cationic displacement and by formation of complex ions were discussed and the way to study systematically possible chromatographic procedures was pointed out.

4223. Schubert, Jack and Lindenbaum, Arthur. **Complexes of calcium with citric acid and tricarballylic acids measured by ion exchange.** *Nature* 166, 913-14 (1950).—*C.A.* 45, 4165*i*.

Dissocn. consts. of the complexes of Ca with citric and tricarballylic acid were measured by the degree to which tracer levels of a Ca^{45} were taken up by a synthetic org. cation exchanger in the presence of known concns. of the complex-forming anion. The pK_c for the citric acid complex was 3.38 ± 0.04; that for the tricarballylic acid, 1.82 ± 0.03.

4224. Schubert, Jack and Richter, John W. **The use of ion exchangers for the determination of physicochemical properties of substances, particularly radiotracers, in solution. III. The radio-colloids of zirconium and niobium.** *J. Colloid Sci.* 5, 376-85 (1950).—*C.A.* 44, 10446*b*.

The distribution coeffs. of Zr^{95} or Nb^{95} between a radio-colloid soln. and a cation exchange resin were detd. under a variety of conditions. There was a marked difference between cation-exchange adsorption and radiocolloidal adsorption by the exchange resin. These phenomena may be applied to the sepn. and purification of elements (e.g., sepn. of Zr from Cb) by ion exchange.

4225. Selke, W. A. and Bliss, Harding. **Application of ion exchange. Copper-Amberlite IR-120 in fixed beds.** *Chem. Eng. Progress* 46, 509-16 (1950).—*C.A.* 45, 4*g*.

Bivalent-univalent exchanges such as Cu-H and Cu-Na on Amberlite IR-120 followed a nonlinear equil. in dil. solns. in which the exchanging ion in the exchanger approached the total exchange capacity. This was equiv. to assuming no back "pressure" until the resin was satd. Cu-Mg exchange followed an approx. linear equil. over these concn. ranges.

4226. SHIMIZU, HIROSHI. **Ion-exchange synthetic resins. XXV. Preparation of resin from *p*-phenol sulfonic acid and formaldehyde.** *Chem. High Polymers (Japan)* 7, 155-8 (1950).--*C.A.* 45, 7725*g*.

Details of prepn. were described. Capacity of cation exchange against 0.5 *N* NaOH and NaCl was about 70% of the theory.

4227. SILLEN, LARS G. **Filtration through a sorbent layer. IV. The ψ condition, a simple approach to the theory of sorption columns.** *Arkiv Kemi* 2, 477-98 (1950) (in English).--*C.A.* 45, 2270*d*.

Various types of fronts obtained on eluting a uniformly loaded sorbent with a soln. of const. compn. were described. It was shown that calcns. involved could often be simplified. The case of ion-exchange resins was considered as well as ordinary absorption columns.

4228. SMIRNOV, A. S. AND BLUVSHTEĬN, M. M. **Effect of the solubility of the sorption compounds on the sorption capacity of cationites.** *Doklady Akad. Nauk S.S.S.R.* 70, 449-51 (1950).—*C.A.* 45, 4996*i*.

The active groups in both cationites were phenolic OH groups. Dynamic expts. were reported with a rate of filtration of 3 m/hr (10 ml/min.), with 0.002 *M* solns. of $Bi(NO_3)_3.5H_2O$, $PbCl_2$, $HgCl_2$, $CaCl_2.6H_2O$, and $FeSO_47H_2O$, at pH = 2 throughout (in order to avoid hydrolysis of the Bi salt).

4229. SONDERS, L. R.; ENRIGHT, D. P., AND WEYL, W. A. **Wettability, a function of the polarizability of the surface ions.** *J. Applied Phys.* 21, 338-44 (1950).—*C.A.* 44, 6701*c*.

Base-exchange expts. were described where the H ions present in the surface layers of bentonite and of a soda-lime glass were replaced by different cations. This substitution seemed to have no particular effect on the hydrophilic and rheological properties of the carriers as long as their surfaces were kept in contact with water. After drying, however, the surfaces that contained ions of high polarizability became hydrophobic, at least temporarily. A porous clay film would no longer absorb water instantaneously after having been treated with Ni^{++}, Mn^{++}, Hg^{++}, or similar ions with incomplete outer electron shells.

4230. SPEDDING, F. H. AND DYE, J. L. **Efficient separation of dysprosium and yttrium.** *J. Am. Chem. Soc.* 72, 5350 (1950).--*C.A.* 45, 2805*c*.

Two successive ion-exchange treatments yielded pure Y and Dy from ore concentrates. A preliminary elution with 0.1% NH_4 citrate at pH 5.8-6.1 from Nalcite H.C.R. resin sepd. Y and Dy from the other rare earths, and subsequent elution of Y-Dy fractions with 5% citrate at pH 2.8 gave Y and Dy that were spectrophotometrically pure.

4231. SPEDDING, F. H.; FULMER, E. I.; BUTLER, T. A., AND POWELL, J. E. **Separation of rare earths by ion exchange. IV. Variables involved in the separation of samarium, neodymium, and praseodymium.** *J. Am. Chem. Soc.* 72, 2349-54 (1950).--*C.A.* 46, 6533*i*.

With 0.5% citrate solns. as eluent, the effects of pH, temp., resin particle size, and flow rate on the elution of pure Sm^{+++} or Nd^{+++} were detd. From these results and from expts. on the elution of equimol. mixts. of Sm_2O_3 and Nd_2O_3 at varying pH and flow rate, the best of the conditions tested for sepn. were pH 3.80 at a linear flow rate of 0.5 cm/min. Under these conditions, the recoveries 99.5% pure oxides were 96 and 95% resp.

4232. SPEDDING, F. H.; FULMER, E. I.; POWELL, J. E., AND BUTLER, T. A. **The separation of rare earths by ion exchange. V. Investigations with 0.1% citric acid-ammonium citrate solutions.** *J. Am. Chem. Soc.* 72, 2354-61 (1950).—*C.A.* 46, 6996*i*.

Variables involved in the sepn. of Sm, Nd, and Pr with 0.1% citric acid-ammonium citrate soln. and Amberlite IR-100 resin were investigated. Both the degree of sepn. and the elution time increased as the pH of the eluant decreased. Optimum yields of pure rare earths for a given operating time were obtained at pH 6.0. The slower the flow rate and the smaller the size of the resin particles the less was the observed band overlap and the better the sepn.

4233. SWIETOSLAWSKI, W. **Classification of sorbents and ion exchangers.** *Przemysl Chem.* 6, (29), 41-3 (1950).—*C.A.* 45, 9994*b*.

All sorbents and ionites which were characterized by one function only (i.e., sorbents possess adsorption capacity and ionites the ability of ion exchange) were classified as ideal. The nonideal sorbents comprised those which possess either acidic or basic groups or had them absorbed or adsorbed. In both cases the sorbents took part in the ion-exchange process. The ionites might possess the ability of adsorption or absorption of mols. from the soln. and therefore might act as ion exchangers as well as sorbents.

4234. THOMPSON, S. G.; CUNNINGHAM, B. B., AND SEABORG, G. T. **Chemical properties of berkelium.** *J. Am. Chem. Soc.* 72, 2798-801 (1950).—*C.A.* 44, 9814*g*.

By use of LaF_3 carrier, unoxidized Cm, Bk, and unoxidized fraction of Am, Y, and rare earths were sepd. from the remainder of fission products. The group of Am, Cm, and Bk was sepd. by adsorption on a cation-exchange resin (Dowex 50). Elution of the resulting chromatogram with NH_4 citrate at 87°C gave sepd. fractions of the 3 elements. The order of elution in this group was the same as for their homologs, Tb, Gd, and Eu. The differences in rates, however, between neighboring actinides were greater than for the corresponding lanthanides.

4235. VAJNA, SANDOR. **Ion-exchanging resins. I.** *Magyar Kem. Floyoirat* 56, 88-96 (1950).—*C.A.* 46, 804*b*.

The regularities of ion exchange could be calcd. on the basis of the known laws of mass action used in other chem. reactions. Certain slight correction values were worked out to obtain more exact results. Small-scale exchange expts. were carried out with 1-mm globules of polyethylene resin in glass tubes. The resin bed was satd. with $CaCl_2$ or KCl, then regenerated with KCl or HCl.

4236. WOLLISH, ERNEST G. AND SCHMALL, MORTON. **Colorimetric determination of panthenol and pantothenates.** *Anal. Chem.* 22, 1033-7 (1950).--*C.A.* 44, 10605*a*.
Pantoyl lactone, one of the products from the hydrolysis of panthenol and pantothenates, formed the hydroxamic acid with NH_2OH in alk. soln. An Amberlite column IRA-400-OH adsorbed and eliminated interfering substances.

4237. YANG, JENG-TSONG. **Radionography. Specificity of ion exchangers. Separation of lanthanum and yttrium.** *Anal. Chim. Acta* 4, 59-67 (1950).—*C.A.* 44, 6333*c*.
Two French adsorbing resins have been studied by means of radioactive tracers, and their specificity was found to be very satisfactory. The adsorbing power in g ions was inversely proportional to the valence of the adsorbed ion, though const. to the ionic concn. The elution and sepn. of La and Y have been performed ionographically.

4238. YANG, JENG-TSONG. **The separation of protactinium from tantalum by ion exchange.** *Compt. rend.* 231, 1059-61 (1950).—*C.A.* 45, 3730*h*.
By a single operation the elements were sepd. by means of Amberlite IR-4B ion-exchange resin. A citrate soln. served as the complexing agent and the eluting soln. was HF brought to a pH of 3 with concd. NH_4OH. A 10-cc. pipet served as a column.

4239. YANG, JENG-TSONG. **Separation of traces of actinium^{227} from large amounts of lanthanum by ionic exchange.** *J. chim. phys.* 47, 805-6 (1950).--*C.A.* 45, 3746*g*.
Ac^{227} (3.12 millicuries) was sepd. from 160 mg of La in a column of ion-exchange resin (Amberlite IR-100) with an eluent of 5% NH_4NO_3 (pH 5.5). In a single manipulation, a product was obtained whose activity was 5.31 millicuries per mg.

4240. YOSHINO, YUKICHI. **Determination of minute amount of selenium with an ion-exchange resin.** *J. Chem. Soc. Japan*, Pure Chem. Sect., 71, 577-9 (1950).—*C.A.* 45, 6537*i*.
SeO_3^{--} could pass quantitatively through the column of resin at pH 0.7-5.0. Sepn. from Fe^{+++} was quant. only when the amt. of iron was less than about 10 times that of Se. The sepn. from considerable Zn was perfect. SeO_3^{--} could be quantitatively copptd. with $Zn(OH)_2$ and then sepd. from Zn with the ion-exchange resin.

4241. YOSHINO, YUKICHI AND KOJIMA, MASUO. **Separation of a small amount of titanium from iron by ion-exchange resin.** *Bull. Chem. Soc. Japan* 23, 46-7 (1950).—*C.A.* 45, 2366*a*.
Treatment of a soln. with 50% KCN or NaCN converted most of Fe to complex cyanide and copptd. the remainder with $Ti(OH)_4$. The ppt. was removed, dissolved with dil. H_2SO_4, dild. with H_2O, and passed through 5-10 g com. phenolsulfonic acid resin. Fe was eluted with 200 cc. 2 *N* KCN and the resin was washed with water. The Ti was eluted with 200 cc. 10% H_2SO_4 and detd. with H_2O_2 colorimetrically.

4242. ANDERS, HEINZ. **Removal of phenols by Wofatit from liquor obtained in low-temperature carbonization; regeneration of the filter, some results.** *Gas-u. Wasserfach* **92**, No. 17 (Gas), 238-42 (1951).—*C.A.* **46**, 332*h*.
Wofatit, an exchange resin, was successfully used for removing phenols and part of the fatty acids from the liquor resulting from low-temp. carbonization of coal. In a typical expt. the rate of flow of the liquor was 2 vols. of liquor/hr/vol. of Wofatit; the capacity was about 6 vols. of liquor/vol. of Wofatit before the effluent reached the max. permissible permanganate no.

4243. ANYAS-WEISZ, L.; SOLMS, J., AND DEUEL, H. **Determination and characterization of pectins by means of ion exchangers.** *Mitt. Lebensm. Hyg.* 42, 91-105 (1951).--*C.A.* 45, 6322*d*.
Aq. solns. of high-mol.-wt pectins and pectates were sepd. from all low-mol.-wt electrolytes by percolation through layers of cation exchangers in the H-form and anion exchangers in the OH-form. The free carboxyl and ester groups of the pectins were then detd. titrimetrically in the filtrate. Amberlite IR-120 (H-form) and IR-4B (OH-form) were used as ion exchangers. H_2O-insol. pectates, such as Ca pectate, must first be transferred into the H_2O-sol. Na salt. The pectin soln., which should not contain more than 0.5% pectin, was percolated dropwise through a continuous liquid column of 30 cc. each of cation and anion exchanger.

4244. AUSTERWEIL, G. V. **Selectivity and selective power of ion exchangers. I.** *Bull. soc. chim. France* **1951**, 528-31.—*C.A.* **46**, 3828*c*.
When an ion exchanger having a mobile cation was placed in contact with a soln. contg. 2 other cations, the *selectivity* was defined as the quotient of the equil. ionic ratio in the soln. divided by the equil. ionic ratio on the exchanger and was a function of the soly. and the polarity of the exchanger.

4245. AUSTERWEIL, GEZA V. **Selectivity of ion exchangers.** *Compt. rend.* **232**, 1481-3 (1951).—*C.A.* **45**, 8847*g*.
When a total of 1 g-equiv. of 2 cations ($x + y = 1$) was placed in contact with an exchanger having 1 g-equiv. of exchangeable ions, the selectivity S was the ratio of the quotient na/mb of the ions fixed on the exchanger and the quotient $x(1-a)/y(1-b)$ of the ions remaining in soln. m and n were mole fractions.

4246. BAFNA, S. L. AND SHAH, H. A. **Studies of a synthetic cation-exchange resin.** *Current Sci.* (India) 20, 233-4 (1951).—*C.A.* **46**, 2349*c*.
The capacity of a prepd. cation-exchange resin (in meq./g) was detd. by pH titration (2.7 at pH 7), by detn. of ash (as $BaSO_4$) in the Ba salt of the resin (2.28), by detn. of limiting exchange with $BaCl_2$ soln. (2.20), and by passing a soln. of NaCl through the column of the acid resin and detg. the H^+ content of the effluent (2.15).

4247. BHATNAGAR, M. S. **Organic adsorbents.** *Ind. Eng. Chem.* 43, 2108-12 (1951).—*C.A.* 45, 9993*i*.
The adsorption of inorg. and org. acids and bases and inorg. salts on phenol- and amine-HCHO resins was detd. An increase in adsorptive properties was experienced in the resins with an increase in the no. of OH groups in phenols and

amino groups in the amines. The acid-condensed phenolic resins adsorbed fatty acids according to Traube's order. An increase in adsorption was shown with an increase in group movement, with the polarizability of the adsorbed mol., and with the molar refraction.

4248. BONHOEFFER, K. F.; MILLER, L., AND SCHINDEWOLF, U. **Membrane-potential measurements on technical ion exchangers. I.** *Z. physik Chem.* **198**, 270-80 (1951).—*C.A.* **46**, 4883*d*.
Concns. of ions bound by the membrane were calcd. from measured potentials by means of a theoretical equation, and agreed in order of magnitude with analytical detns. From measured potentials activity coeffs. of bound K, Na, and Li were found to be 0.45, 1.2, and 2.1, resp.

4249. BONHOEFFER, K. F. AND SCHINDEWOLF, U. **Membrane-potential measurements on technical ion exchangers. II.** *Z. physik Chem.* **198**, 281-5 (1951).—*C.A.* **46**, 4883*e*.
The work was extended to a cation exchanger with strong acid groups. The agreement between calcd. and analytical data was even better, the relative uptakes of K, Na, and Li in this case agreeing quantitatively with calcns. based on membrane potentials.

4250. BRETON, E. J. JR. AND SCHLECHTEN, A. W. **Separation of copper from zinc by ion exchange.** *J. Metals* **3**, 517-21 (1951).
Ion exchange as a unit process in metallurgy would considerably extend the range of metal recovery operations. Carboxylic acid exchangers were required where sepns. must be carried at pH's greater than 5 and sulfonic acid cation exchange resins were preferred for removal of ions from acidic solns. The carboxylic acid cation exchangers may be employed for concn. of ions from very dil. solns.

4251. BRUNISHOLZ, G. AND BONNET, J. **Determination of boric acid. I. Separation of H_3BO_3 from metallic cations by ion exchange.** *Helv. Chim. Acta* **34**, 2074-5 (1951) (in French).—*C.A.* **46**, 2961*a*.
Metallic ions such as Fe^{3+}, Al^{3+}, Ni^{2+}, and Zn^{2+} as well as NH_4^+ could be removed from a pH 1-5 soln. of H_3BO_3 by passage through a sulfonic acid-type ion-exchange resin followed by 200 ml of H_2O to recover the H_3BO_3.

4252. BRUSSET, HENRY AND KIKINDAI, TIVADAR. **The positive character of the halogens.** *Compt. rend.* **232**, 1840-1 (1951).—*C.A.* **46**, 2943*h*.
An exchange of H^+ of Amberlite IR100H with I^+ of iodine nitrate and with Br^+ of bromine nitrate was noted. Solns. of iodine nitrate and bromine nitrate were prepd. in abs. EtOH, then transformed into sulfates by exchange of cations.

4253. BUSER, W. **Separation of alkali ions by ion exchange and complex formation.** *Helv. Chim. Acta* **34**, 1635-41 (1951) (in German).—*C.A.* **46**, 858*b*.
Of the alkali ions only Li^+ and Na^+ formed stable complexes with *uramil diacetic acid*. The relation between pH and extent of complex formation for Li^+ and Na^+ was shown graphically. To sep. Li^+ and Na^+ from K^+ by cation exchange, taking advantage of complex formation, the pH must be >9; to sep. Li^+ from Na^+ the pH must be 6.5-7.5 (90% Li complexed, < 10% Na complexed). Both Amberlite IR 120 and IRC 50 were useful.

4254. CONNICK, ROBERT E. AND MAYER, STANLEY W. **Ion-exchange measurements of activity coefficients and association constants of cerous salts in mixed electrolytes.** *J. Am. Chem. Soc.* **73**, 1176-9 (1951).—*C.A.* **45**, 6115*b*.
Ion-exchange equil. of Dowex 50 resin and an aq. soln. contg. a small concn. of Ce^{+++} ion and a relatively large concn. of $HClO_4$, $NaClO_4$, HCl, HNO_3, or Na_2SO_4 were measured. Relative values of activity coeffs. of the Ce^{+3} salts were calcd. from the data.

4255. COTELLO, ANA. **Preparation of synthetic cation-exchange resins from domestic raw materials.** *Industria y química* (Buenos Aires) **13**, 57-8, 61, 89-93, 103, 127-31, 142 (1951).—*C.A.* **47**, 233*g*.
Cation-exchange resins were prepd. from furfural and tannic exts. (ordinary and sulfited quebracho ext., ordinary and sulfited carob ext., and a 50:50 mixt. of ordinary and sulfited exts. from lignum vitae and *Astronium balansae*) in aq. and alc. medium. Capacity detns. were carried out with a soln. contg. $CaCl_2$ (250 p.p.m. expressed as $CaCO_3$) and NH_4Cl (96.5 p.p.m. as NH_3).

4256. D'ANS, J. AND BLASIUS, E. **Chromatography of electrolytes. II.** *Naturwissenschaften* **38**, 236 (1951).—*C.A.* **46**, 2442*b*.
A brief account of work with Dowex 2 as anion-exchange resin and Dowex 50 and Permutit RS as cation exchangers in the analysis and synthesis of various complex inorg. salts such as Co-NH_3 complexes and Cr-aquo compds.

4257. DAVIES, C. W. AND JONES, T. G. **Adsorption and swelling experiments with an amine-type ion exchanger.** *J. Chem. Soc.* **1951**, 2615-24.—*C.A.* **46**, 1840*c*.
Samples of Amberlite IR-4B were treated with Na_2CO_3 soln., washed with H_2O, and wet-sieved into several particle fractions. The exchange of the resins was studied with HCl and NaCl, and the data again cor. for the high CO_3 content (av. of 2.4 milliequiv./g). Extensive exchange with neutral salts occurred, owing to this residual CO_3 content. At all acid concns. above 0.04 *N* the H_2O adsorption was detd. almost entirely by the total concn. of the ambient soln., and was insentitive to the actual acid concn.

4258. DAVIES, C. W. AND THOMAS, G. GARROD. **Molecular adsorption on ion-exchange resins.** *J. Chem. Soc.* **1951**, 2624-7.—*C.A.* **46**, 1840*a*.
Samples of Wofatit C, Zeo-Karb 215, Amberlite IR 100, and Zeo-Karb H-1 were dry-sieved, and the adsorption of a no. of org. acids was studied. Blank detns. were run, sometimes giving considerable correction. Adsorption of org. acids on Wofatit C and Amberlite IR 100 could be represented by the Freundlich equation, and Traube's rule was followed by the mono- and dicarboxylic acids.

4259. DEUEL, H.; ANYAS-WEISZ, L., AND SOMS, J. **Contact exchange in ion exchange.** *Experientia* **7**, 294-5 (1951) (in German).—*C.A.* **46**, 1186*g*.

Regeneration of exchange resins was accomplished by contact with sol. or insol. polyelectrolytes in circulation in H_2O. With this technique it was possible to regenerate mixed-bed systems of cation and anion exchangers without sepn. of their resinous components.

4260. Deuel, H.; Solms, J.; Anyas-Weisz, L., and Huber, G. **Ion exchangers. II. Selective reactions of ion exchangers.** *Helv. Chim. Acta* **34**, 1849-53 (1951) (in German).—*C.A.* **46**, 2874*g*.
Selectivity was recognized in comparisons of the hydrolysis of low-mol,-wt esters or ethers (EtOAc, Me galacturonate, or maltose) and related high-mol.-wt compds. (polyvinyl acetate, Me polygalacturonate, or glycogen). The acidified form of the cation-exchange resin Amberlite IR-120 strongly catalyzed the hydrolysis of the low-mol.-wt compds. but had little or no catalytic effect on the high-mol.-wt compds. under identical conditions.

4261. Fitch, F. T. and Russell, D. S. **Separation of the rare earths by ion-exchange procedures.** *Can. J. Chem.* **29**, 363-71 (1951).—*C.A.* **46**, 373*i*.
The NH_4 salts of the iminodiacetic acids form complex ions with the rare-earth elements involving both one and two iminodiacetate ions. These acids were examd. as possible complexing agents in the chromatographic sepn. of the rare earths with cation-exchange resins since the stability of the rare-earth complex increases with at. no.

4262. Fronaeus, Sture. **Use of cation exchangers for the quantitative investigation of complex systems.** *Acta Chem. Scand.* **5**, 859-7 (1951) (in English).—*C.A.* **46**, 9932*a*.
The math. theory was developed for systems in which a central ion, M^{++}, and a complex ion, Ma^+, were taken up by the exchanger. Concn. changes in the resin phase of higher complexes with zero or neg. charge were neglected. If no cation complexes were formed, the calcns. were simplified. Exptl. measurements were made on cupric acetate solns. kept at const. ionic strength with $NaClO_4$.

4263. Funasaka, Wataru; Kawane, Makoto, and Hashino, Tomoyasu. **A rapid method for the determination of the sulfate radical with an ion exchanger.** *J. Chem. Soc. Japan*, Ind. Chem. Sect. **54**, 355-7 (1951).—*C.A.* **47**, 5308*a*.
Sulfate was quantitatively converted into H_2SO_4 by means of cation exchanger "Diaion K," and the resulting acid could be titrated with NaOH soln.

4264. Golovatyĭ, R. N. **Concentration of lead from aqueous solutions by ion-exchange resins.** *Gigiena i Sanit.* **1951**, No. 11, 55-6.—*C.A.* **46**, 2445*b*.
Ion-exchange resin in the acid state was used for the retention of Pb ions. A 20-cm layer of the resin in the tube was treated with a pass of 0.1 *N* $Pb(NO_3)_2$, washed with 10% HCl, then with distd. H_2O. The test specimen was then passed through (if its pH was under 3 it should be neutralized), and the retained Pb was eluted with 10% HCl after several min. residence; 2 more washings with 5% HCl completed the process.

4265. Gregor, Harry P. **Ion-pair formation in ion-exchange systems.** *J. Am. Chem. Soc.* **73**, 3537-8 (1951).—*C.A.* **46**, 1330*c*.
The calcd. and exptl. values were compared for the variation of the selectivity coeff., K_D, as a function of the fraction of the exchange capacity (X^i) taken up by an exchanging ion in the systems perchlorate-chloride and trichloroacetate-chloride plotted as log K_D vs. X^i_{Cl}.

4266. Gregor, Harry P.; Bregmen, J. I.; Gutoff, Fradelle; Broadley, Robert D.; Baldwin, David E., and Overberger, C. G. **Ion-exchange resins. Capacity of sulfonic acid cation-exchange resins.** *J. Colloid Sci.* **6**, 20-32 (1951).—*C.A.* **45**, 4112*i*.
The capacity of an ion-exchange resin was identical for 8 ions (H^+, Li^+, Na^+, K^+, NH_4^+, Me_4N^+, Me_3PhN^+). Bu_4N^+ and the bivalent ions showed somewhat divergent results. The resins were prepd. by polymerizing mixts. of styrene and divinylbenzene by the bead method at 90°C, sulfonating with H_2SO_4 at 90°C, removing unsulfonated resin by flotation, and conditioning the resin by alternate treatments with 1 *M* NaCl and 1 *M* HCl.

4267. Gregor, Harry P.; Collins, F. C., and Pope, Martin. **Ion-exchange resins. III. Diffusion of neutral molecules in a sulfonic acid cation-exchange resin.** *J. Colloid Sci.* **6**, 304-22 (1951).—*C.A.* **45**, 9994*g*.
Distribution coeffs., diffusion coeffs., and activation energies for the diffusion process were measured for aq. solns. of MeOH, EtOH, BuOH, iso-BuOH, AmOH, MeOAc, EtOAc, iso-BuOAc, and urea, by using a sulfonated polystyrene-divinylbenzene resin of uniform particle size. The equations of diffusion into a spherical particle described the diffusion process satisfactorily.

4268. Gregor, Harry P. and Bregman, J. I. **Ion-exchange resins. IV. Selectivity coefficients of various cation exchangers toward univalent cations.** *J. Colloid Sci.* **6**, 323-47 (1951).—*C.A.* **45**, 9994*h*.
The selectivity of a series of sulfonated polystyrene-divinylbenzene resins for univalent cations was examined experimentally. The selectivity was a function of: (1) ionic activity coeff. in the resin phase; (2) differences in ionic vol.; and (3) thermodynamic osmotic pressure.

4269. Gustavson, K. H. **Displacement of sulfate groups in chromium complexes by the functional groups of cation exchangers.** *Svensk Kem. Tid.* **63**, 167-70 (1951) (in English).—*C.A.* **46**, 1280*f*.
Analyses of aged dil. solns. of $Cr_2(OH)_2(SO_4)_2$ (total Cr in cationic form) by means of ion exchangers suggested that the sulfate groups were present as a bridge between 2 Cr atoms or attached to 1 Cr atom (less stable). The cationic complexes fixed by a sulfonic acid type exchanger contained 1 sulfate group on 4 Cr atoms.

4270. Gustavson, K. H. **The determination of sulfato groups in cationic chromium complexes by means of quaternary anion exchangers.** *J. Soc. Leather Trades' Chemists* **35**, 270-5 (1951).—*C.A.* **45**, 10634*h*.

In the analysis of Cr sulfates by cationic exchange resins, the compn. of the cationic Cr complexes was detd. indirectly by detn. of the Cr and SO_4 in the original and residual solns. There were some indications that the functional group of the resin (COOH or SO_3H) might penetrate the complex and displace SO_4 groups thereby giving low results for the acidity. This complication might be eliminated by use of the Cl salt of a strongly basic quaternary anion-exchange resin (Amberlite IRA-400 or Dowex 2A). The ionic SO_4 in the soln. was replaced by Cl ion and the complex-bound SO_4 was detd. directly in the residual soln. Only solns. free from noncationic Cr could be thus analyzed.

4271. Hawkins, M. B.; Garber, R. E., and Tompkins, E. R. **Remotely controlled equipment for fission-product separations by ion exchange.** *Natl. Nuclear Energy Ser.*, Div. IV, **9**, *Radiochem. Studies: The Fission Products*, Book 1, 310-17 (1951).--*C.A.* **47**, 6784*a*.

Ion-exchange app. was described to sep. 6 major fission products in concd. carrier-free solns. from pile-activated U. The product cations were alternately adsorbed and eluted from each of 3 or 4 columns ranging from 6 liter to 5 ml in series. Remote control from a central console was possible for flow rates, acidity, flow pattern, measurement of activity, and vol.

4272. Heijde, H. B. van der and Aten, A. H. W. Jr. **Adsorption curve of a rare earth in an ion-exchange column.** *J. Phys. and Colloid Chem.* **55**, 740-4 (1951).--*C.A.* **45**, 6896*d*.

The distribution curves of activated dysprosium ions on the resin (and interstitial soln.) along an exchange column after the initial adsorption and also after two different phases of elution with NH_4 citrate soln. were detd.

4273. Honda, Masatake. **The relation between pH of ion-exchange resin phase and the composition of the solution at equilibrium.** *J. Am. Chem. Soc.* **73**, 2943-4 (1951).--*C.A.* **45**, 8847*i*.

The adsorption of an acid (anion) or alkali (cation) by the resin could be considered a neutralization reaction which took place in the resin phase. When any exchange resin had adsorbed a definite amt. of an ion at equil., i.e. when the activity of the adsorbed ion was at a definite value, the pH in the resin phase should take a fixed value.

4274. Honda, Masatake. **Ion-exchange resins applied to analytical chemistry. IX.** *J. Chem. Soc. Japan*, Pure Chem. Sect., **72**, 361-4 (1951).—*C.A.* **46**, 847*h*.

Exchange-equil. consts. of $H^+—Ca^{++}$, $H^+—Be^{++}$, $Be^{++}—Ca^{++}$, $Be_2O^{++}—Ca^{++}$, $H^+—Al^{+++}$, and $Ca^{++}—Al^{+++}$ were measured for Amberlite IR-120, and conditions for the sepn. of Be^{++} and Al^{+++} were studied.

4275. Honda, Masatake. **The ion-exchange resin applied to analytical chemistry. X. Separation of basic aluminum ion.** *J. Chem. Soc. Japan*, Pure Chem. Sect. **72**, 555-9 (1951).—*C.A.* **46**, 3458*c*.

The Al solns. were prepd. by dissolving metallic Al in $AlCl_3$ soln. or by anion adsorption from $AlCl_3$ soln. with anion exchanger. The sepn. of cations was performed with Amberlite IR-120 and gelatinous polystyrol sulfonate. As a most stable basic cation $[(Al_2{}^{4+})]_n$ was confirmed. Other cations were shown to be mixts. of this ion and normal Al^{3+}.

4276. Honda, Masatake. **Ion-exchange resin applied to analytical chemistry. XI.** *J. Chem. Soc. Japan*, Pure Chem. Sect., **72**, 638-41 (1951).—*C.A.* **46**, 6027*i*.

By the adsorption of a suitable pH indicator, on a feebly colored ion exchanger, such as polystyrol sulfonic acid, a stable colored column was obtained. The adsorption was studied of silica by a strong basic anion exchanger, such as Amberlite IRA-400, with the resin column adsorbed with alizarin yellow-R. HCl and CO_2 strongly affected the adsorption of silica.

4277. Huffman, E. H.; Iddings, G. M., and Lilly, R. C. **Anion exchange of zirconium, hafnium, niobium, and tantalum in hydrochloric acid solutions.** *J. Am. Chem. Soc.* **73**, 4474-5 (1951).—*C.A.* **46**, 1330*d*.

Zr^{95} and Nb^{95} in 1 cc. 6-7 *M* HCl were sepd. by passage through a Dowex-2 column 8 cm long and 3 mm inside diam. and washing with 3 cc. acid. The elutriant and wash contained the Zr. The Nb was then washed from the column with about 4 cc. of 1.5-4.0 *M* HCl.

4278. Huffman, E. H. and Lilly, R. C. **Anion exchange of complex ions of hafnium and zirconium in hydrogen chloride-hydrogen fluoride mixtures.** *J. Am. Chem. Soc.* **73**, 2902-5 (1951).—*C.A.* **45**, 7908*h*.

Studies were made with Amberlite IRA-400 to det. the dependence of elution rate upon acid concn. and Cl^- concn. In high acid concns. (1.0 *M* HCl, 0.5 *M* HF) the rate was independent of H^+ and HF concn., but depended upon the 2nd power of Cl^- concn.

4279. Hume, D. N. **Removal of zirconium and niobium from Amberlite resin adsorbent.** *Natl. Nuclear Energy Ser.* Div. IV, **9**, *Radiochem. Studies: The Fission Products*, Book 3, 1521-2 (1951).—*C.A.* **46**, 6546*c*.

HF removed Zr and Nb activities adsorbed on Amberlite resin.

4280. Janus, J. W.; Kenchington, A. W., and Ward, A. G. **Rapid method for the determination of the isoelectric point of gelatin using mixed-bed deionization.** *Research* **4**, 247-8 (1951).—*C.A.* **46**, 320*e*.

Passage of a 1-10% gelatin soln. through a 50-cm column of mixed resins (2.5 parts anion-exchange resin Amberlite 400 to 1 part cation-exchange resin Amberlite IR 120) at 40°C gave almost complete removal of foreign ions. The pH of the soln. was indistinguishable from the isoionic point. The peaks obtained in opacity-pH curves were, for all except some acid-processed materials, very sharp. The treatment sharpened the peaks over those obtained from untreated material.

4281. Jurkiewicz, Jan and Zieliński, Henryk. **Examination of adsorptivity of the ion exchanger "Escarbo."** *Prace Glownego Inst. Gornictwa, Komun.* No. **94**, 11 pp. (1951) (English summary).—*C.A.* 47, 6216*h*.

The ion exchanger showed properties of both a cationic exchanger and of a surface sorbent. Sorption from aq. solns. and nonelectrolyte followed the pattern of the Feundlich equation. Removal of H_2SO_4 resulting from the cation exchanger was important, as the residual H_2SO_4 caused swelling of the Escarbo, decreasing its ion exchange ability. Also the change of the pH inside the "sponge" could be disadvantageous. Equil. for methylene blue solns. was attained after a much longer time.

4282. Kagawa, Ikumi and Kasashi, Ryuzo. **Ion-exchange resins. III. Influence of the distribution density of electrolyte radicals on the exchange equilibrium of anion exchanger.** *J. Chem. Soc. Japan*, Ind. Chem. Sect. 54, 177-81 (1951).—*C.A.* **47**, 1459*g*.

Ions in the resin phase were in a very different state than those in soln. The former should be in the state of so-called ion assocn. In view of this fact, a new equil. equation was derived.

4283. Kagawa, Ikumi and Kasashi, Ryuzo. **Ion-exchange resin. IV. Influence of temperature on the anion-exchange equilibrium and the heat of exchange.** *J. Chem. Soc. Japan*, Ind. Chem. Sect. **54**, 242-4 (1951).—*C.A.* **47**, 2568*e*.

Anion-exchange expts. were made for the systems NO_3-Cl, $\frac{1}{2}SO_4-Cl$, and $\frac{1}{2}SO_4-NO_3$ at 10, 37.5, and 50°C, and the exchange equil. consts. were detd. From the results, heat of anion exchange was calcd. The state of an ion in the resin phase corresponded to that in a highly concd. soln.

4284. Kakihana, Hidetake. **Inorganic analytical chemistry with ion-exchange resins. II. Separation of beryllium from aluminum.** *J. Chem. Soc. Japan*, Pure Chem. Sect., 72, 200-3 (1951).—*C.A.* **46**, 3449*b*.

When the soln. contg. Al, Be, and Ca ions in concn. less than 0.01 *N* passed through the phenolsulfonic acid-type exchanger satd. with Ca ion, Al was completely adsorbed, while most of the Be was found in the effluent. Beryllium adsorbed on the exchanger could be easily eluted with 0.01 *N* $CaCl_2$ soln.

4285. Kakihana, Hidetake. **Inorganic analytical chemistry with ion-exchange resins. IV. Determination of exchange-equilibrium constants of alkali-metal ions and the purification of potassium chloride.** *J. Chem. Soc. Japan*, Pure Chem. Sect., 72, 255-8 (1951).—*C.A.* **46**, 847*g*.

Exchange-equil. consts. of Li^+, Na^+, K^+, Rb^+, and Cs^+ with the H ion of the sulfonic acid of the cation exchanger were found to be 0.69, 1.24, 1.58, 2.30, and 2.62, resp. ($H_3O^+ = 1.00$).

4286. Ketelle, B. H. and Boyd, G. E. **The ion-exchange separation of the rare earths.** *J. Am. Chem. Soc.* **73**, 1862-3 (1951).—*C.A.* **45**, 7407*f*.

Sepn. of the Y-group rare earths from Gd, Eu, and Sm was effected with a 0.26 cm² by 97-cm 270/325-mesh Dowex-50 column at 100°C with citrate buffer at 100°C (pH 3.28) at 0.64 cm/min.

4287. Kikindaï, Tivadar. **Halogen cations.** *Bull. soc. chim. France* **1951**, 799-801.—*C.A.* **46**, 5476*h*.

Reaction of I_2 in abs. alc. with an ion-exchange resin gave $R^-H^+ + I_2 \rightleftarrows R^-I^+ + HI$. I^+ reacted with I^- to give I_2 (a reaction which can be used for analytical detn.), and with KCl and KBr to give ICl and IBr. I^+ salts hydrolyzed yielding IOH, which reacted according to $5\ IOH \rightarrow 2I_2 + HIO_3 + 2\ H_2O$. INO_3 added to cyclohexene gave $C_6H_{10}(NO_3)I$.

4288. Kikindaï, Tivadar and Cassel, Marthe. **The positive character of halogens.** *Compt. rend.* **232**, 1110-12 (1951).—*C.A.* **45**, 6456*d*.

A possibility of stabilizing the cations I^+ and Br^+ on the ion-exchange resin Amberlite I.R. 100H, and thereby proving the existence of these ions in abs. alc., was offered. A prepn. of salts contg. the pos. halogen ions was given, and the abs. exclusion of water from the alc. was emphasized.

4289. Kirshnaswamy, N. **Cation-exchange capacity of avaram resin.** *Proc. Indian Acad. Sci.* **33B**, 178-83 (1951).—*C.A.* **46**, 1840*g*.

Avaram cation exchanger, prepd. from the bark of *Cassia auriculata* (Venkataramanan, 1945) was compared with Amberlite IR 100 and Zeocarb resins in the H and Na cycle. Column and batch methods were used to study the exchange with $CaCl_2$ solns. The capacity of Avaram resin was the lowest of the 3 in the H cycle, and intermediate between the others in the Na cycle.

4290. Klyachko, V. A. **Nature of the selectivity of ionites.** *Doklady Akad. Nauk S.S.S.R.* **81**, 235-7 (1951).—*C.A.* **46**, 3827*g*.

Phenolsulfonic acid was condensed with HCHO, with the addn. of Na ethylenediaminetetraacetate which formed a sol. complex with Ca. It was preliminarily regenerated with 5% HCl, and treated with a soln. of 2 mg equiv. each of $CaCl_2 + NaCl$, actually took up 0.654 mg equiv./g, of which 0.623 mg equiv./g was Ca^{++}, i.e. 96% of the sum $Na^+ + Ca^{++}$, and gave back 98% of the Ca^{++} on regeneration with 10% HCl. Both active groups and a complex former were necessary for selective absorption. A cationite selective towards Ni was obtained by introducing dimethylglyoxime into the sulforesorcinol resin.

4291. Kraus, Kurt A. and Moore, George E. **Anion-exchange studies. I. Separation of zirconium and niobium in HCl-HF mixtures.** *J. Am. Chem. Soc.* **73**, 9-13 (1951).—*C.A.* **45**, 4524*f*.

The behavior of Zr(IV) and Nb(V) on the anion exchange resin Dowex 1 was studied in a no. of HF-HCl mixts. Sepn. of the 2 elements was excellent under a no. of conditions. Difficulties occurred only at low HCl concns. where E_{Zr} and E_{Nb} become approx. equal. Although Zr was usually eluted first, the elements could be eluted in reverse order under some conditions. In the case of Nb(V) at least three species were observed in 9 *M* HCl differing by two F^- ions each. The first two species, existing at low F^- concn., were probably oxygenated.

4292. Kraus, Kurt A. and Moore, Geo. E. **Anion-exchange studies. II. Tantalum in some HF-HCl mixtures.** *J. Am. Chem. Soc.* **73**, 13-15 (1951).—*C.A.* **45**, 4524*h*.

The anion exchange behavior of Ta (V) was studied for a no. of HCl-HF mixts. It adsorbed very strongly under most conditions, even in 9 *M* HCl. The species TaX_5F^- and $HTaX_5F_3^{-2}$ (where X was a chloride, fluoride, hydroxide, or 1/2 oxide ion) were tentatively identified.

4293. Kraus, Kurt A. and Moore, George E. **Anion-exchange studies. III. Protactinium in some hydrochloric acid-hydrofluoric acid mixtures—separation of niobium, tantalum, and protactinium.** *J. Am. Chem. Soc.* **73**, 2900-2 (1951).—*C.A.* **45**, 7845*e*.

By tracer techniques, elution studies were made on Nb, Ta, and Pa at 25°C with Dowex-1 resin.

4294. Kunin, Robert and McGarvey, Francis X. **Monobed deionization with ion-exchange resins.** *Ind. Eng. Chem.* **43**, 734-40 (1951).—*C.A.* **45**, 4524*b*.

At high regeneration levels the combination IR-120:IRA-400 exchangers gave H_2O of greater than 10,000,000 ohms per cm at a flow rate of 4 gal/ft³ min. The increased capacity of monobed operation was due to overcoming the detrimental effects of $CaSO_4$ pptn. in conventional dieonization. IRA-410 performed in a monobed at a much greater regeneration efficiency than the IRA-400 exchanger. The weak base-strong acid system, such as IR-120: IR-45 combination, possessed a high degree of regeneration efficiency and a low regeneration cost, but would not remove CO_2 or SiO_2. The strong base-weak acid system IRA-400 or IRA-410 with IRC-50 gives H_2O of reasonable quality but was rate-sensitive owing to the low rate of diffusion of electrolytes in carboxylic exchangers.

4295. Lescoeur, L. **Exchange titrimetry.** *Ann. inst. hydrol. climatol.* **22**, 51-8 (1951).—*C.A.* **46**, 10502*h*.

The total concn. of cations in an aq. soln. could be detd. by passing a portion of the soln. through a column of Zeocarb previously equilibrated with HCl and titrating the effluent with NaOH. Data on the compns. of a no. of natural waters found by this method were reported.

4296. Lindsay, F. K. and D'Amico, J. S. **Operating characteristics of a strongly basic anion exchanger.** *Ind. Eng. Chem.* **43**, 1085-7 (1951).—*C.A.* **45**, 7725*i*.

The order of decreasing affinity of Nalcite SAR (Dowex 2) for some anions was PO_4, SO_4, I, NO_3, Br, Cl, OH, HCO_3, F. The resin was insol. by all common solvents, was exceedingly resistant to phys. wear or attrition, and had a max. vol. expansion of 6% in changing completely from the Cl form to the OH form. The Cl form could be used up to 95°C, the OH form only to 50°C. The pH range of operation was 0 to 10.

4297. Lister, B. A. J. **Cation-exchange separation of zirconium and hafnium.** *J. Chem. Soc.* **1951**, 3123-8.—*C.A.* **46**, 4883*f*.

A virtually complete sepn. of Zr and Hf was obtained on a lab. scale by elution from a cation-exchange column with 1.0 *N* H_2SO_4 of the oxychlorides or oxynitrates prepd. from the mixed oxides, the over-all elution curves being measured radiochemically with 17-hr Zr^{97} and 45-day Hf^{181} tracers. The Zr was eluted first and the Hf then removed with 2 *N* H_2SO_4 and (or) 0.05 *M* $H_2C_2O_4$. Up to 95-98% Zr contg. < 0.01% Hf was recovered from a ZrO_2 contg. 1.5-2% HfO_2, and substantially complete sepn. was also obtained with a HfO_2 contg. 8% ZrO_2.

4298. Lowen, Warren K.; Stoenner, Raymond W.; Argersinger, Wm. J. Jr.; Davidson, Arthur W., and Hume, David N. **Studies of cation-exchange equilibrium on a synthetic resin.** *J. Am. Chem. Soc.* **73**, 2666-74 (1951).—*C.A.* **45**, 6879*f*.

Eight exchange systems on Dowex 50 were investigated, involving the ions Na^+, H^+, NH_4^+, Ag^+, Tl^+, Ni^{++}, and Ca^{++} in solns. of total ionic strength of approx. unity. The apparent discrepancies between the decrease in concn. of one ion in the soln. and the increase in concn. of the other probably arose from the absorption of water by the previously dried resin. In certain systems, especially those involving either silver or thallous ion, adsorption of electrolyte by the resin occurred also.

4299. MacNevin, Wm. M.; Riley, Mary G., and Sweet, Thomas R. **An ion-exchange experiment for quantitative analysis.** *J. Chem. Education* **28**, 389-90 (1951).—*C.A.* 45, 8931*i*.

An aq. soln. of a weighed sample of metal sulfates was passed through a column contg. a cation-exchange resin such as Dowex 50 which was treated with dil. HCl. The dil. H_2SO_4 resulting from the exchange was drawn off, titrated with standard NaOH, and the percentage of SO_3 calcd.

4300. Manecke, G. and Bonhoeffer, K. F. **Electrical conductivity of anion-exchange membranes.** *Z. Elektrochem.* **55**, 475-81 (1951).—*C.A.* **47**, 23*h*.

Ion-exchange membranes having various concns. of bound ions were made and their sp. conds. measured in KCl solns. of various concns. By use of exptl. values of ionic concn. and mobility, sp. cond. was calcd. and it agreed satisfactorily with the measured values.

4301. Marconi, Maria. **Titration of the anion in soluble salts, by ionic exchange.** *Chimica* (Milan) 6, 384-5 (1951).—*C.A.* **46**, 4427*a*.

The anions of some sol. org. salts could be titrated after passing the soln. through an ion-exchange column. For the titration, a mixed indicator was used of thymol blue and cresol red (3:1).

4302. Mayer, Stanley W. and Schwartz, S. David. **The association of cerous ion with iodide, bromide, and fluoride ions.** *J. Am. Chem. Soc.* **73**, 222-4 (1951).—*C.A.* **45**, 4524*e*.

The distribution of Ce^{+++} ion between cation exchange resin Dowex 50 and solns. of NaI, NaBr, NaF, and $NaClO_4$ was measured. The consts. for ion-pair formation between Ce^{3+} and the halides were calcd.

4303. McTaggart, F. K. and Newnham, I. E. **Use of radioactive tracers in the separation of hafnium and zirconium.** *Proc. Conf. Applications Isotopes Sci. Research, Univ. Melbourne* **1950**, 167-74 (1951).—*C.A.* **45**, 9389*e*.

A report was given of ion-exchange column expts. on the sepn. of these elements and of soly. studies on their hydroxides in basic soln. and on their phosphates in acid soln. Hf^{181} and Zr^{95} were used as tracers.

4304. Miller, Hoke S. and Kline, G. E. **Reactions of cesium in trace amounts with ion-exchange resins.** *J. Am. Chem. Soc.* **73**, 2741-3 (1951).—*C.A.* **45**, 6879*h*.

The distribution coeffs. for the exchange of Cs in trace amts. with both phenolsulfonic and nuclear sulfonic ion-exchange resins were detd. as a function of pH. Phenolsulfonic resin exhibited two pH ranges of strong adsorption. Cs was found to be selectively adsorbed by the phenolic groups in the presence of high concns. of sodium salts in alk. solns.

4305. Morton, F. **Properties and limitations of a cation-exchange resin. Laboratory examination of Zeo-karb 225.** *Lancet* **260**, 825-7 (1951).—*C.A.* **45**, 8321*e*.

Zeo-karb is an insol., gritty powder with a capacity of 2.5 meq. of cation/g. It is a synthetic org. resin based on polystyrene $(C_6H_5CH{:}CH_2)_n$ and contg. SO_3H groups. Zeo-karb exhibited a high relative affinity for Ca, less for K, and much less for Na. Mg trisilicate eliminated the acid produced during cation change but lowered the efficiency of Zeo-karb.

4306. Motoyama, Takuhiko and Okamura, Seizo. **Cation exchangers from polyvinyl alcohol.** *Chem. High Polymers* (Japan) **8**, 326-8 (1951).—*C.A.* **47**, 4522*i*.

Cation-exchange resins contg. sulfate groups were obtained by treating polyvinyl alc., polyvinyl acetate, or the mixt. with H_2SO_4 and oleum. The exchange capacity and the amt. of combined sulfate in the products was detd., and the results are summarized.

4307. Nagmatsu, Masatoshi. **Electrochemical studies on ion exchangers.** *J. Electrochem. Soc. Japan* **19**, 369-72 (1951).—*C.A.* **46**, 4701*c*.

The ion-exchange capacity of H-R type resin was detd. by the so-called "NaCl prepd. method" and also by the method utilizing the conductometric titration. Both methods gave practically the same results.

4308. Newnham, I. E. **Ion-exchange separation of hafnium and zirconium. I.** *J. Am. Chem. Soc.* **73**, 5899 (1951).—*C.A.* **46**, 10027*e*.

The ion-exchange sepn. of Zr and Hf was applied to a 2-g oxide mixt. contg. 20% HfO_2 yielding a fraction contg. 99.9% HfO_2.

4309. Oda, Ryohei; Shimizu, Hiroshi, and Tanabe, Takashi. **Preparation of a new anion-exchange resin.** *Bull. Inst. Chem. Research, Kyoto Univ.* **24**, 86 (1951) (in English).—*C.A.* **46**, 4701*b*.

A new kind of anion exchanger was prepd. by condensing *N,N'*-diphenylpiperazine with HCHO. The capacities of the resin were 2.38-4.57 meq. HCl per g, and 0.39-1.03 per cc., and the degrees of swelling were 1.04-2.60.

4310. Oda, Ryohei; Shimizu, Hiroshi, and Tanabe, Takashi. **Synthesis of a new anion-exchange resin.** *J. Chem. Soc. Japan*, Ind. Chem. Sect. **54**, 286 (1951).—*C.A.* **47**, 2909*d*.

The resin was prepd. by condensing 1,4-diphenylpiperazine with HCHO in the presence of HCl or H_2SO_4. The anion-exchange capacity was about 3 millimoles HCl/g. Sp. gr. was about 0.3.

4311. Pepper, K. W. **Sulfonated cross-linked polystyrene—monofunctional cation-exchange resin.** *J. Applied Chem.* (London) **1**, 124-32 (1951).—*C.A.* **45**, 6865*f*.

Styrene and divinylbenzene, as the cross-linking agent, were copolymerized in suspension with 1.5-3.0% of Promulsin as the suspension-stabilizer to form beads of cross-linked polystyrene. The particle size of the bead polymer was inversely related to the apparent viscosity of Promulsin and to the time of shaking. The beads were sulfonated by heating at 100°C with excess of H_2SO_4 in the presence of Ag_2SO_4 as the catalyst. The product was a hygroscopic gel and its cation-exchange properties were consistent with those for a monofunctional, strongly acidic material.

4312. Peremyslova, E. S. and Stashko, R. P. **Effect of temperature on the process of ion exchange on synthetic cationites.** *J. Appl. Chem. U.S.S.R.* **24**, 995-7 (1951) (Engl. translation); *Zhur. Priklad. Khim.* **24**, 877-9 (1951).—*C.A.* **47**, 4167*d*.

Solns. of $CaCl_2$ and KCl (0.01 *N*) were passed through Wofatit P (phenolsulfonic resin with—SO_3H groups mainly in the side chains) and Cationite PFSK (*p*-phenolsulfonic resin with—SO_3H groups mainly in the nucleus) at 2°, 15°, and 75°C. The apparent exchange capacity increased proportionally with temp., but the ratio of capacity for Ca to K remained const.; this indicated that the nature of the change of exchange capacity was the same for both Ca and K. The resin (1 g) was allowed to stand in 500 ml of 0.01 *N* $CaCl_2$ or NaCl at const. temp. and the acidity of the supernatant detd. at intervals. Equil. was attained faster at 75°C than at 15°C.

4313. Reichenberg, D.; Pepper, K. W., and McCauley, D. J. **Properties of ion-exchange resins in relation to their structure. II. Relative affinities.** *J. Chem. Soc.* **1951**, 493-9.—*C.A.* **45**, 6006*e*.

The relative affinity coeffs. (K_H^{Na}) were detd. at 0.1 *M* cation concn. in soln. For a resin of low cross-linking (2% divinylbenzene), K_H^{Na} was approx. unity and independent of the mole-fraction of Na ion on the resin (X_{NaR}). With resins of medium cross-linking (5 and 10% divinylbenzene), K_H^{Na} was greater than unity for all values of X_{NaR}, and showed a flat max. at a value of X_{NaR} of 0.4-0.5. For resins of high cross-linking (17 and 33% divinylbenzene), the max. disappeared and K_H^{Na} decreased sharply with increasing X_{NaR}, becoming less than unity at high values of X_{NaR}.

4314. Richardson, R. W. **Selective diffusion into ion-exchange resins. A new method for the purification of the direct cotton dyes.** *J. Chem. Soc.* **1951**, 910-14.—*C.A.* **45**, 8775*i*.

Ion-exchange resins (Deacidite B), capable of acting as molecular sieves, yielded ash-free effluents from aq. solns. of crude dyes. Dye-coupling components were sufficiently small to be completely adsorbed when present in the usual amts. expected in crude dyes. With dyes smaller than the class prepd. from benzidine, such as from naphthylamines, 1.5% of the resin may have been satd. and regeneration of the resin became troublesome because of slow outward diffusion of the dye.

4315. Saldadze, K. M. **Ultrapurification of weak electrolytes with ion-exchange resins.** *Doklady Akad. Nauk S.S.S.R.* **77**, 457-60 (1951).—*C.A.* **46**, 3367*a*.

The weak electrolyte (15-30% tech. citric or tartaric acid) was passed through a column filled with cation-exchange resins (wofatite R, SBS, or espatite K) and then through a column contg. anion-exchange resins (MG or MM-2N). The soln. was than passed in the same order through other columns at a speed of 5-10 m/hr. The ratio of column height to diam. was 10-15. AcOH, formic, and other acids were also purified.

4316. Samuelson, Olof and Gärtner, Fred. **Utilization of ion exchangers in analytical chemistry.** XVIII. *Acta Chem. Scand.* **5**, 596-602 (1951) (in English).—*C.A.* **46**, 7766*d*.

The degree of substitution of cellulose xanthate in viscose could be detd. with the aid of anion-exchange resins. Low-mol.-wt by-products from the formation of viscose were adsorbed on the resin.

4317. Samuelson, Olof and Schramm, Kerstin. **Use of ion exchangers in analytical chemistry. XXI. Determination of total salt concentration by means of anion-exchange resins.** *Svensk Kem. Tid.* **63**, 307-11 (1951) (in English).—*C.A.* **46**, 4952*d*.

A Dowex 2-resin bed (diam. 9 mm, length 140 mm, particle size 0.2-0.3 mm) was treated with 350 ml *N* NaOH and washed until free of alkali. Known amts. of KCl, Na_2SO_4, H_3PO_4+ NaOH, V_2O_5+ NaOH, H_2WO_4+ NaOH, and SO_2+ NaOH were dissolved separately, the solns. passed through a column as above (about 20 min.), and the effluents titrated (0.1 *N* HCl and methyl red).

4318. Sasaki, Tsunetaka and Inaba, Ayako. **Conductometric titration of cation-exchange resins.** *Bull. Chem. Soc. Japan* **24**, 20-4 (1951).—*C.A.* **46**, 5929*f*.

The exchange capacities and the exchange equil. consts. for Dowex 50, phenoxyacetic acid-HCHO resin, Amberlite IR-C 50, hydroquinone-HCHO, phenolsulfonic acid-HCHO, and sulfonated coal, all in the H-forms, were detd. by titrating with NaOH conductometrically. Time required to attain equil. was about 10 min., although for some resins, it was 30 min. in the final stage of the titration. Air free of CO_2 and satd. with H_2O vapor was passed through the soln. during titration. The analysis of the results of titrating a mixt. of 2 resins, each having one kind of exchange group, agreed with the results from the detn. of the sep. resins.

4319. Schubert, Jack. **Use of ion exchangers for the determination of physical-chemical properties of substances, particularly radiotracers, in solution. IV. Activity coefficients of barium nitrate in uranyl nitrate.** *J. Am. Chem. Soc.* **73**, 4488-9 (1951).—*C.A.* **46**, 6965*e*.

The activity coeffs. were measured for carrier-free $^{140}Ba^{++}$ in $UO_2(NO_3)_2$ by the use of the uranyl form of the cation-exchange resin, Amberlite IR-1. The value of $K_a = 14$ was obtained from a plot of log $K_{ex.}$ *vs.* $\sqrt{m}$ and an extrapolation to infinite diln. (K_a is the thermodynamic exchange const., $K_{ex.}$ is the concn. exchange const.).

4320. Schuler, Robert H.; Boyd, Alfred C. Jr., and Kay, Daniel J. **Experiments with ion-exchange resins.** *J. Chem. Education* **28**, 192-4 (1951).—*C.A.* **45**, 4977*a*.

Cu and Ag ions were adsorbed on Amberlite IR 100-H resin in a 50 cm column. These ions were eluted with *M* $NaNO_3$ at 4 ml/min. with the Cu being eluted first. The eluant was analyzed volumetrically for these two ions and the data are plotted as histograms.

4321. Selke, W. A. and Bliss, Harding. **Continuous countercurrent ion exchange.** *Chem. Eng. Progress* **47**, 529-33 (1951).—*C.A.* **46**, 299*c*.

A continuous ion-exchange system had been constructed in which essentially countercurrent flow was obtained in exhaustion and regeneration columns. In Cu-H exchange, a fluidized exhaustion column could be used because hydraulic classification according to the amt. of Cu on the resinous exchanger acted to maintain countercurrent action. Runs were made in which the recovery of Cu exceeded 99%.

4322. Shah, H. A. and Bafna, S. L. **Ion exchange. I. Equilibrium studies of three synthetic cation-exchange resins.** *Current Sci.* (India) **20**, 38-9 (1951).—*C.A.* **45**, 8820*a*.

The result of equil. studies of 3 synthetic exchange resins, Amberlite IR-100, Amberlite IR-105, and Amberlite IR-120, were reported. The pH titration curves for the 3 resins showed that excess of cation (here Na^+) increased the cation uptake of the resin at the same pH.

4323. Shimizu, Hiroshi. **Synthetic ion-exchange resins. XXX. Preparation of carboxylic acid-type cation-exchange resin (KH-4B).** *Chem. High Polymers* (Japan) **8**, 212-19 (1951).—*C.A.* **47**, 234*d*.

Cation-exchange resins of carbonic acid type were prepd. by treating phenoxyacetic acid with concd. H_2SO_4 to which formalin was added. The yield was 47%. The cation-exchange capacity of the resin was 98% of the theoretical value. Vitamin B_6 was completely adsorbed by the resin.

4324. Shimizu, Hiroshi; Shiba, Hidekiyo, and Oda, Ryohei. **Preparation of an anion-exchange resin from 2-amino-4-methylthiazole by condensation with formaldehyde.** *J. Chem. Soc. Japan*, Ind. Chem. Sect. **54**, 677-8 (1951).—*C.A.* **47**, 7137*a*.

In order to obtain a resin completely insol. in acid, 2-amino-4-methylthiazole, phenol, and HCHO were condensed. The ion-exchange capacity of the resin was about 4 millimoles/g.

4325. SPEDDING, F. H.; FULMER, E. I.; POWELL, J. E.; BUTLER, T. A., AND YAFFE, I. S. **The separation of rare earths by ion exchange. VI. Conditions for effecting separations with Nalcite HCR and one-tenth percent citric acid-ammonium citrate solutions.** *J. Am. Chem. Soc.* **73**, 4840-7 (1951).—*C.A.* **46**, 6997*b*.

Procedures were developed for the successful sepn. of the rare earths by using a high-capacity resin, Nalcite HCR, and 0.1% citrate soln. The high-capacity resin proved to be superior to a low-capacity resin, Amberlite IR-100, for the sepn. of the heavy rare earths. Er, Ho, and Dy were obtained in purities greater than 99%.

4326. SPIEGLER, K. S. AND CORYELL, C. D. **Electromigration in a cation-exchange resin.** *Science* **113**, 546-7 (1951).—*C.A.* **45**, 8321*f*.

The movement of ions in a resin column, followed with radiotracer technique, confirmed the hypothesis that wet resins acted like solns. of electrolytes. The electrode reactions were: anode, $4R^- + 2H_2O = 4HR + O_2(g) + 4e$; cathode, $4e + 4NaR + 4H_2O = 4Na^+ + 4R + 4OH^- + 2H_2(g)$, where R was the resin radical.

4327. STACH, H. **Evaluation of ion exchangers with particular emphasis on exchange rates.** *Angew. Chem.* **63**, 263-7 (1951).—*C.A.* **45**, 7725*h*.

Expts. were reported on the chem. constitution and reaction kinetics of 8 cation exchangers. The results were applicable to anion exchangers.

4328. STERN, HARRY. **Production of sodium hydroxide solution by ion exchange.** *Iowa State Coll. J. Sci.* **25**, 358-60 (1951).—*C.A.* **45**, 6896*e*.

When the exchange resin, Dow HCR, satd. with Na ions was brought into contact with a soln. of $Sr(OH)_2$, equil. was reached in a few min. The resulting soln. may contain as much as 3.5% NaOH. The optimum conditions were: 1.3 *N* $Sr(OH)_2$, and $Sr(OH)_2$ equiv. to 2.8 times the Na^+ on the resin. The resin could be recharged by the use of NaCl. The Sr^{++} could be sepd. from the soln. by pptn. as the basic chloride.

4329. TATUR, H. **Purification of dibutyl phthalate with mixed ion-exchange agents.** *Przemysl Chem.* **7**, 627-31 (1951).—*C.A.* **46**, 8425*e*.

Lab. expts. proved that purer dibutyl phthalate could be obtained by using mixed ion-exchange agents than with cation- and anion-exchange agents used separately.

4330. TEICHER, HARRY AND GORDON, LOUIS. **Separation of iron (III) from aluminum.** *Anal. Chem.* **23**, 930-1 (1951).—*C.A.* **45**, 7465*h*.

Fe^{+++} was converted into the red $Fe(CNS)_3$ complex which was easily removed by passing the soln. through a column contg. the anion exchanger Amberlite IRA-400A. at pH = 1. Then Al could be pptd. by NH_4OH and the ignited ppt. weighed as Al_2O_3. The recovery of 18 to 78 mg of Al to which 2 mg of Fe had been added was perfect in 11 expts.

4331. TEVEBAUGH, ARTHUR DAVID. **The properties of the citrate complexes of the rare earth ions and their adsorption on Amberlite resin.** *Iowa State Coll. J. Sci.* **25**, 367-8 (1951).—*C.A.* **45**, 6953*a*.

Absorption spectra of solns. contg. $NdCl_3$ and citric acid at different pH values indicated the existence of 4 citrate complexes. The gradual addn. of $Na_3C_6H_5O_7$ to a soln. of $LaCl_3$ or $NdCl_3$ or $SmCl_3$ produced, first, a decrease in pH and a ppt. One ppt. was $LaC_6H_5O_7 \cdot 2H_2O$. Amberlite IR-100 in the acid cycle was a moderately strong acid with a break in the titration curve at 8.58 milliequivs. of H^+ per 5 g of resin.

4332. WHEATON, R. M. AND BAUMAN, W. C. **Properties of strongly basic anion-exchange resins.** *Ind. Eng. Chem.* **43**, 1088-93 (1951).—*C.A.* **45**, 7726*f*.

Properties of Dowex 1 and Dowex 2, resins of the quaternary ammonium type cross-linked with divinylbenzene, were given. The resins were spherical particles of 20 to 50 mesh, exchange 1.2 equiv. per liter wet vol., and had a bulk d. of 45 lb ft^3 and a real d. of 1.15. The selectivity of the resins for univalent ions was about the same pattern for most anions with the exceptions that the Dowex 1 was less selective toward the OH anion than the Dowex 2. In dil. solns. the selectivity of the resins was greater for bivalent ions than univalent ions.

4333. WICKBOLD, REINHOLD. **Applications of cation exchange in chemical analysis.** *Z. anal. Chem.* **132**, 241-50 (1951).—*C.A.* **45**, 5557*i*.

The use of the resins Wofatit K and Wofatit KS were explained in detail. The purification of the com. sample, filling the column, capacity of effecting complete exchange, rate of adding the soln. and the results obtained with more than 25 different salt solns. were tabulated.

4334. WICKBOLD, REINHOLD. **Uses of cation exchange in chemical analysis. II.** *Z. anal. Chem.* **132**, 321-8 (1951).—*C.A.* **45**, 6953*g*.

A tippable column was described which permitted the removal of the adsorbed cations by running acid through the column in the opposite direction to that used in the removal of the adsorbed cations. The removal of the cations took place more readily with dil. HCl than with more concd. acid, and slow passage of the eluant in the reverse direction was more efficient.

4335. YAMABE, TAKEO AND SATO, SHUNICHI. **Ion-exchange equilibria.** *J. Chem. Soc. Japan*, Ind. Chem. Sect. **54**, 483-5 (1951).—*C.A.* **47**, 5738*e*.

The applicability range of an empirical formula for cation-exchange equilibrium had been studied with dianion K, and the results were summarized.

4336. YAMAMOTO, YUTAKA. **Anion-exchange adsorption from aqueous solutions of acids by anion-exchange resin. I. Anion-exchange equilibria.** *J. Chem. Soc. Japan*, Ind. Chem. Sect. **54**, 485-7 (1951).—*C.A.* **47**, 6217*a*.

The anion exchange adsorption equilibria by Diaion A in the aq. solns. of HCl and HOAc were expressed better by Langmuir's adsorption equation than by the Freundlich equation. The anion-exchange resin had max. exchange capacity.

4337. Yamamoto, Yutaka. **Anion-exchange adsorption from the aqueous solutions of acids by anion-exchange resin. II. Theory of anion-exchange velocity.** *J. Chem. Soc. Japan*, Ind. Chem. Sect. **54**, 569-71 (1951).--*C.A.* **47**, 6735*c*.
Possible rate-detg. factors for the anion-exchange velocity were discussed.

4338. Yamamoto, Yutaka; Maruyama, Takashi, and Shigaki, Meiten. **Anion-exchange adsorption from aqueous solutions of acids by anion-exchange resin. III. The rate-determining factor of anion-exchange process.** *J. Chem. Soc. Japan, Ind. Chem. Sect.* **54**, 701-4 (1951).—*C.A.* **47**, 7287*g*.
In the cases of HCl and AcOH the velocity of chem. reaction was rate-detd. for the concn. 0.2-0.4N. Either the velocity of diffusion inside the particle or the velocity of chem. reaction became rate-detg. for the concn. 0.01-0.02N according to the conditions of exchange.

4339. Yoshino, Yukichi. **Separation of arsenic from iron by ion-exchange resin.** *Bull. Chem. Soc. Japan* **24**, 39-41 (1951).—*C.A.* **46**, 6031*f*.
Both $AsO_3{}^{3-}$ and $AsO_4{}^{4-}$ in dil. HCl were recovered without loss on passing through a bed of 30-mesh phenolsulfonic acid-type cation-exchange resin in the H form or Na form. $AsO_3{}^{-3}$ was quantitatively sepd. from Fe^{2+} in mixts. of varying Fe/As ratio.

4340. Young, Norton. **Method for the preparation in the laboratory of a base-exchange material (artificial zeolite) of high quality.** *Rev. colombiana quim.* **4**, No. 1, 47-9 (1951).—*C.A.* **46**, 2717*d*.
Dissolve 46 g $Na_2SO_4.Al_2(SO_4)_3$ contg. 35% water of crystn. in 2500 ml water, add 20 g NaOH in 500 ml water, cool to 4°C, and add 83 g Na_2SiO_3 contg. 35.8% SiO_2 in 500 ml water with stirring and hold at 4°C for 18 hrs. Filter and allow to stand for 72 hrs when it can be cut and molded with the hands. Freeze out the water by holding at -15°C for 16 hrs. Thaw in running water, leaving an amorphous translucent substance whose particles are retained on a 20-mesh sieve. Allow to drain 72 hrs.

4341. Argersinger, W. J. Jr. and Davidson, Arthur W. **Experimental factors and activity coefficients in ion-exchange equilibria.** *J. Phys. Chem.* **56**, 92-6 (1952).—*C.A.* **46**, 7840*f*.
Aq. ion-exchange expts. with Dowex 50 showed that the total equil. compn. of an exchange system was detd. not only by the extent of simple ion exchange, but also by absorption of water and adsorption of electrolyte by the exchanger, and by the variation in apparent molal vol. of the solute during exchange.

4342. Bafna, S. L.; Pai, M. U., and Shah, H. A. **Ion exchangers. I. Sulfonation of Indian coal.** *J. Sci. Ind. Research* (India) **11B**, 134-6 (1952).—*C.A.* **47**, 2958*g*.
Powd. semi-bituminous coal was dried at 105-10°C and sulfonated 2 hrs at 200°C with 5% H_2SO_4 or 10% fuming H_2SO_4, the mixt. cooled, and the exchanger washed free of acid. It was transferred to a column, backwashed with tap H_2O, converted to the H-form with 5% HCl, washed with distd. H_2O, and dried to const. wt at 105-10°C. The exchange capacity was detd. by equilibrating 0.5 g of dried exchanger with 50 ml of 1 *N* $BaCl_2$ and titrating an aliquot of the soln. with standard NaOH.

4343. Bafna, S. L. and Shah, H. A. **Ion exchange. II. Studies of a synthetic cation-exchange resin HP-6.** *J. Indian Chem. Soc.* **29**, 611-14 (1952).—*C.A.* **47**, 1871*f*.
The resin contg. SO_3H, COOH, and OH groups, was prepd. The capacity of the resin in milliequiv. H/g dried resin, detd. was (*a*) by titration curve in the presence of NaCl, 2.27 and 2.84 at pH 7 and 11, resp., (*b*) by ash detn. 2.28, (*c*) by limiting exchange with $BaCl_2$ 2.20, and (*d*) by dynamic system with 0.5 and 0.01 *N* NaCl 2.15. On the basis of equiv. wts of replaceable H and the method of synthesis, a structure of the resin was postulated.

4344. Barker, George E. and White, Robert R. **Rates of alcoholysis and diffusion in ion-exchange resins.** *Chem. Eng. Progress Symposium Ser.* **48**, No. 4, *Reaction Kinetics and Transfer Processes*, 75-90 (1952); *Dissertation Abstracts* **12**, 457-8 (1952).—*C.A.* **47**, 2024*h*.
The rate of the reaction of EtOH and n-Bu acetate was detd. with fixed beds of cation-exchange resin as catalyst. The chem. reaction and diffusion of the various components within the resin controlled the rate. The specific-reaction-velocity const. of the alcoholysis reaction and the diffusivities of the components as functions of temp. were evaluated.

4345. Bergsma, F. **Selective membranes consisting of ion exchangers.** *Chem. Weekblad* **48**, 361-4 (1952).—*C.A.* **46**, 7841*a*.
The reduced mobility of one ion in the system ion exchanger-water made ion-exchanger plates suitable for selective membranes. Applications were: the electrolysis of NaCl solns. without rediffusion of the Cl^-, the sepn. of K^+ and Na^+, and the removal of ions from colloidal solns. by electrodialysis.

4346. Blasius, F. and Negwer, M. **Chromatography of electrolytes. III. Separation of heavy metals by their chloro complexes at elevated temperatures.** *Naturwissenschaften* **39**, 257-8 (1952).—*C.A.* **47**, 6303*c*.
Several heavy metals could be sepd. by chromatography on an anion-exchange resin in 30% HCl soln. at room temp. or with lower HCl concn. at higher temp. A column 2.2 cm in diam. and 28 cm long was used. This column contained 55 cc. of Permutite ES or Dowex 2 and was surrounded by a thermostat. Fe^{3+} and Mn^{2+} were sepd. in 10-15% HCl in a prewashed column at 80°C and at 2.5 cc. per min. (total 7 cc.) and washed afterwards with four 50-cc. portions of HCl of the same concn. and temp. For the Fe-Al sepn., the same procedure was followed. For Co-Ni sepn. 20% HCl was used; 150 cc. of soln. was passed at 1.5 cc. per min. at 80°C.

4347. Bonner, Oscar D.; Argersinger, William J. Jr., and Davidson, Arthur W. **Factors involved in cation-exchange equilibria.** *J. Am. Chem. Soc.* **74**, 1044-7 (1952).—*C.A.* **46**, 5407*f*.

Studies of the NH_4^+-H^+ and Ag^+-H^+ exchanges on Dowex 50 at 25°C in solns. of unit ionic strength showed that the equil. compn. of solid and liquid phases was detd. by various methods. H_2O absorption was a linear function of resin compn., but electrolyte adsorption depended in a more involved fashion on both resin and soln. compn. New data for the Na^+-H^+ exchange on Dowex 50 in solns. of ionic strength 1.0 and 0.3 *M* were detd.

4348. Bonner, Oscar D.; Davidson, Arthur W., and Argersinger, William J. Jr. **Activity-coefficient ratios of nitric acid and silver nitrate, and their application to ion-exchange equilibria.** *J. Am. Chem. Soc.* **74**, 1047-50 (1952).—*C.A.* **46**, 5407*h*.

E.m.f. measurements on cells of the type: $Ag|AgCl|HCl$ (0.2 *M*)$|HNO_3, AgNO_3|Ag$ were used for the calcn. of the ratios of activity coeffs. at 25°C of HNO_3 and $AgNO_3$ in solns. of varying acid-salt ratio and total ionic strengths ranging from 0.1 to 1.0 molal. These activity-coeff. ratios were combined with ion-exchange data for the Ag^+-H^+ equil. on Dowex 50. The activity coeffs. in the mixed resins were greater than unity.

4349. Bregman, J. I. and Murata, Yoshiaki. **Phosphonous and phosphonic cation-exchange resins.** *J. Am. Chem. Soc.* **74**, 1867-8 (1952).—*C.A.* **47**, 6217*d*.

The resins were the first to show a selectivity for Na over K. Potential applications of the resins included Na depletion in physiol. applications, rare earth sepns., and use in mixed-bed and reverse demineralization units.

4350. Brown, William F. and Rieman, William III. **Separation of titanium, zirconium, and thorium by ion exchange.** *J. Am. Chem. Soc.* **74**, 1278-82 (1952).—*C.A.* **46**, 6545*i*.

The nature of the complexes between metal and citrate ions was studied and some probable complexes given. Radio-chem. work with Ti^{51} showed that the radioactive isotope was sepd. from the normal isotopes to a certain extent.

4351. Brunisholz, G. **An analytical ion-exchange column.** *Helv. Chim. Acta* **35**, 1003-4 (1952) (in French).—*C.A.* **46**, 7378*c*.

The app. consisted of an upper reservoir with a float valve that shut off when the reservoir was empty, preventing air from entering the resin bed, and an evacuation system to remove air bubbles remaining from the bed.

4352. Brusset, Henry and Kikindai, Marthe. **Ionic exchange in nonaqueous solutions.** *Chim. anal.* **34**, 192-3 (1952).—*C.A.* **46**, 10778*c*.

By means of Amberlite IR 100 it was possible to remove the I^+ ions from a soln. in EtOH. When the resin RH reacted with I^+I^- the reaction could be expressed by the equation: $RH + I^+I^- = RI + HI$ and was manifested by loss of the total I and gain of H^+.

4353. Calmon, Calvin. **Application of volume change characteristics of a sulfonated low cross-linked styrene resin.** *Anal. Chem.* **24**, 1456-8 (1952).—*C.A.* **47**, 1315*f*.

The vol. of a sulfonated styrene resin cross-linked with 1% divinylbenzene (Permutit QX) depended upon the valence of the cation in the exchange position and the concn. of the soln. in equil. with the resin. Vol. changes of a column bed or a single sphere of the resin could be measured with similar results. Vol. ratios obtained were 1.0 for univalent ions, 0.47-0.53 for bivalent ions with the exception of Zn and ferrous ions which formed gelatinous ppts. and Sr, Ba, and Pb which formed insol. sulfonates, and 0.18-0.22 for trivalent ions. Bed vol. was shown to vary directly with concn. of NaCl or HCl up to 1 *N*.

4354. Cassidy, Harold G. **Electron exchange-polymers.** *Proc. Natl. Acad. Sci. U.S.* **38**, 934-7 (1952).—*C.A.* **47**, 1973*f*.

Resins that were reversibly oxidizable and reducible, and thus could be used to conduct oxidation-reduction reactions by ion-exchange techniques, were prepd. A column prepd. with filter aid and a resin prepd. from vinylhydroquinone and α-methylstyrene was run through several oxidation-reduction cycles with I_2, I^-, and $K_2Cr_2O_7$. The column lost some capacity, possibly because the mols., after repeated oxidation and reduction with resulting changes in shape and polarity, were caused to coil up and expose fewer and fewer active groups to the reagents.

4355. Clarke, J. T.; Marinsky, J. A.; Juda, W.; Rosenberg, N. W., and Alexander, S. **Electrochemical properties of a permionic anion membrane.** *J. Phys. Chem.* **56**, 100-5 (1952).—*C.A.* **46**, 7911*h*.

Data on cond., Donnan diffusion, and Cl^- transport no. showed that the Cl^- form of Permionic ARX-44 ion-exchange membrane was a partially dissocd. salt with an ionization const. between 0.1 and 1.

4356. d'Ans, J.; Blasius, E.; Guzatis, H., and Wachtel, U. **The use of anion exchangers in analytical and preparative chemistry.** *Chem.-Ztg.* **76**, 811-14, 841-4 (1952).—*C.A.* **47**, 3169*h*, 4781*a*.

Anion exchangers could be used for detg. cations in a salt or salt soln. Carbonate-free alkalies could be prepd. by passing the alkali over a strongly anionic resin. Ion exchange was possible by using nonaq. solvents as long as sufficient ionization took place. MeOH, EtOH, Me_2CO, $CHCl_3$, pyridine, PrOH and nitrobenzene were used. Quant. results for halogen compds. were obtained with MeOH, EtOH, and nitrobenzene.

4357. Davies, C. W. and Thomas, G. Garrod. **Ion-exchange resins as catalysts in the hydrolysis of esters.** *J. Chem. Soc.* **1952**, 1607-10.—*C.A.* **46**, 8291*e*.

Two cation-exchange resins (Amberlite IR-100, 20-40 mesh; and Wofatit C, 20-40 and 40-60 mesh) were used in the H form as catalysts for the hydrolysis studies of methyl acetate, ethyl acetate, *n*-butyl acetate, *n*-amyl acetate, and benzoyl acetate through the temp. range of 15-55°C. The rate consts. were increased by using a smaller-mesh resin. The results showed that Amberlite IR-100 was about 11 times more efficient than Wofatit C, a weakly acidic resin.

4358. Dranen, J. van. **An empirical formula for ion exchange.** *Rec. trav. chim.* **71**, 1157-8 (1952) (in English).—*C.A.* **47**, 8459*c*.

The results for a no. of published ion-exchange expts. were recalcd. by use of the empirical formula secant $(\pi x/2U) = kc + 1$, where k was an empirical const., c = total no. of equivs. of added cation present in the soln. at equil., x = the total no. of equivs. exchanged, and U = capacity of the exchanger. The formula gave reasonable agreement with observed facts for a no. of exchanges of alk. earth and alkali elements.

4359. Duncan, J. F. **A theoretical treatment of cation exchangers. II. Equilibria between an ion exchanger and an aqueous solution with common cation.** *Proc. Roy. Soc.* **A214**, 344-55 (1952).—*C.A.* 46 10778*a*.

The treatment of an ion exchanger as a concd. aq. polyelectrolyte was extended for an exchanger satd. with a single cation in equil. with a soln. contg. a salt of the same cation. Activity and osmotic coeffs. were derived for mixts. of electrolytes with resinates. Resinates of the sulfonated polystyrene type were discussed.

4360. Feldman, Isaac and Havill, Jean R. **Some ion-exchange studies of the polymerization of beryllium.** *J. Am. Chem. Soc.* 74, 2337-40 (1952).—*C.A.* **46**, 8460*g*.

The ion-exchange between Be solns. and the ammonium form of Dowex 50 resin was studied to det. the exptl. conditions under which polymerization of Be began. At an ionic strength of 0.1, pH 4.5, and temp. 37°C, the polymerization of Be in perchlorate soln. began when its concn. was raised to about 10^{-5} *M*.

4361. Fisher, S. A. and Meloche, V. W. **Ion exchange of rhenium from molybdenum.** *Anal. Chem.* **24**, 1100-6 (1952).—*C.A.* 46, 11029*a*.

When 10% NaOH solns. contg. perrhenate and a 3000-fold excess of molybdate were passed through an ion-exchange column contg. Amberlite resin, IRA 400, the Mo could be eluted into the effluent with 10% NaOH and the Re retained on the resin. A recovery of 99 ± 3% of the Re from the column was then effected by eluting with 7-8 *N* HCl.

4362. Fronaeus, Sture. **Ion-exchange study of the cerous sulfate system.** *Svenk Kem. Tidskr.* **64**, 317-24 (1952) (in English).—*C.A.* 47, 5221*b*.

The ionic strength was kept const. with $NaClO_4$, and the cerous concn. was measured with a tracer, Ce^{141}. The mononuclear complexes $CeSO_4^+$, $Ce(SO_4)_2^-$, and $Ce(SO_4)_3^{3-}$ were shown to exist for sulfate ion concns. ≦200mC. The complexity consts. were calcd. for those conditions. The $CeSO_4^+$ complex had small affinity for the exchange resin as compared to the cerous ion.

4363. Fronaeus, Sture. **The equilibria between nickel and acetate ions—ion-exchange and potentiometric investigation.** *Acta Chem. Scand.* 6, 1200-11 (1952) (in English).—*C.A.* 47, 5292*b*.

The investigation indicated the existence of $NiOAc^+$ and $Ni(OAc)_2$ at AcO^- concns. ≦0.5*M*. At 20°C and an ionic strength of 1*M*, the complexity consts. were 4.7 ± 0.6 and 18 ± 3, resp.

4364. Gabrielson, Gunnar and Samuelson, Olof. **Utilization of ion exchangers in analytical chemistry. XIX. Separation of aldehydes and ketones from organic acids.** *Acta Chem. Scand.* 6, 729-37 (1952) (in English).—*C.A.* **46**, 11039*h*.

Quant. sepn. could not be obtained by Amberlite IRA-400 in the free base form; the percent recovery in the effluent was 79.4, 85.5, 88.4, 0.025, 0.015, 37.7, 0.20, 100.8, and 100.3% for HCHO, furfural, PhCHO in H_2O, salicylaldehyde in H_2O, vanillin, MeCH:CHCHO, glyoxal, Me_2CO, and MeCOEt, resp. Amberlite IRA-400 (strongly basic type) in the Cl form could be used to sep. org. acids from most aldehydes and ketones, but the solns. were contaminated with Cl ion.

4365. Gabrielson, Gunnar and Samuelson, Olof. **Utilization of ion exchangers in analytical chemistry. XX. Separation of ketones from alcohols.** *Acta Chem. Scand.* 6, 738-43 (1952) (in English).—*C.A.* 46, 11039*e*.

Ketones were sepd. quantitatively from alcs. by absorbing of the ketone on an anion-exchange resin in the bisulfite form. The ketones were eluted from the column with hot H_2O. The column was prepd. by satg. Amberlite IRA-400 (particle size 0.12-0.30 mm, resin layer 550 mm deep and 9.8 mm diam. in column) with 500 cc. *M* $NaHSO_3$ and H_2O.

4366. Gabrielson, Gunnar and Samuelson, Olof. **Utilization of ion exchangers in analytical chemistry. XXII. Separations of aldehydes from ketones.** *Svensk Kem. Tid.* **64**, 150-6 (1952) (in English).—*C.A.* **46**, 9018*i*.

$Me_2CO-C_4H_3OCHO$, $Me_2CO-AcH$, and $EtCOMe-AcH$ mixts. were adsorbed on Amberlite IRA-400 columns (9.8 by 550 mm; particle size 0.12-0.30 mm) in the bisulfite form. Water (300 ml) effected complete elution of the ketones. The aldehydes were eluted quantitatively with 300 ml *M* NaCl (2 ml/min.). Because of the lesser stability of the Me_2CO bisulfite compd., more than 99% Me_2CO was eluted before C_4H_3OCHO could be detected in the effluent. Me_2CO in distillates from sulfite waste liquor and sulfite alc. was detd. by adsorption on an ion-exchange column.

4367. Gingold, K.; Rochow, E.; Seyferth, D.; Smith, A., and West, R. **Ionization of organometallic halides.** *J. Am. Chem. Soc.* 74, 6306 (1952).—*C.A.* **47**, 11905*c*.

Organosilicon ions of the type R_3Si^+, R_2Si^{++}, and RSi^{+++} were studied from a conductometric viewpoint. $(CH_3)_2Si$ ions were retained by a cation exchange resin; by elution and metathesis, various salts were prepd., including dimethyltin tungstate, molybdate, and sulfide.

4368. Glueckauf, E. **A theoretical treatment of cation exchangers. I. The prediction of equilibrium constants from osmotic data.** *Proc. Roy. Soc.* (London) **A214**, 207-25 (1952).—*C.A.* **46**, 10777*h*.

An interpretation of ion exchange in swelling materials could be made by treating the exchanger phase as a concd. aq. electrolyte. The water uptake of polystyrene sulfonates of different cross linkings was studied for various univalent cations. Calcns. were made for the osmotic properties of an unstrained resinate. The data showed that the anions did not contribute toward the statistical entropy terms of the solns.

4369. Goodall, R. R. and Mellor, N. **Electrometric titration of chloride. An improved form of end point half-cell containing a hydrogen-silver exchange resin.** *Anal. Chim. Acta* **6**, 373-8 (1952) (in English).—*C.A.* **46**, 7472*i*.

An end point half-cell suitable for use in Cl^- titrations had been prepd. by dipping a Ag rod into an aq. suspension of a cation-exchange resin which had been partly converted to the Ag form. Dowex 50 and Zeocarb 225 were suitable resins.

4370. Goudie, Alexander J. and Rieman, William III. **Determination of phosphate by ion exchange.** *Anal. Chem.* **24**, 1067-8 (1952).—*C.A.* **46**, 9470*g*.

A re-evaluation of the ion exchange procedure for the detn. of phosphate was necessary. The carbonate error could be eliminated by standardizing the base under the same conditions of analysis or by eliminating CO_2 in both the standardization and analysis. Diammonium citrate was used as a complexing agent for Fe^{3+} previous to regeneration by HCl.

4371. Gregor, Harry P.; Taifer, Mark; Citarel, Louis, and Becker, Ernest I. **Chelate ion-exchange resins.** *Ind. Eng. Chem.* **44**, 2834-9 (1952).—*C.A.* **47**, 3493*e*.

HCHO and o-aminophenol, anthranilic acid, or $m\text{-}C_6H_4(NHCH_2CO_2H)_2$ was used as the chelate monomers. Data were reported on the absorption from buffered solns. of Mg^{++}, Fe^{++}, Co^{++}, Ni^{++}, Cu^{++}, and Zn^{++} by the last named resin at pHs varying from 1 to 8 depending upon the cation-ion concns. of from 0.001 to 0.1 *M* and ionic strengths of from 0.025 to 1.0. Since the metallic ions were absorbed to different extents at different pH levels, sepns. were effected in favorable cases.

4372. Grossman, Jack J. and Adamson, Arthur W. **The diffusion process for organolite exchangers.** *J. Phys. Chem.* **56**, 97-100 (1952).—*C.A.* **46**, 7400*a*.

Particle- and film-diffusion mechanisms were rate-controlling for the exchange systems H-Cs and Na-Cs, resp., on Dowex 50, although intermediate diffusion characteristics were observable.

4373. Grunbaum, Benjamin W.; Schöniger, Wolfgang, and Kirk, Paul L. **Preparation of very dilute standard base by ion exchange.** *Anal. Chem.* **24**, 1857-8 (1952).—*C.A.* **47**, 1006*b*.

A strong base anion-exchange resin, Amberlite XE-67, reacted with 0.0010 *N* KCl soln. to provide a 0.0010 *N* KOH soln. for the titration of microgram quantities of fatty acids.

4374. Gustavson, K. H. and Holm, Britta. **The effect of the degree of crosslinking of cation-exchanging resins on their interactions with chromium complexes.** *Svensk Kem. Tid.* **64**, 137-45 (1952) (in English).—*C.A.* **46**, 8412*h*.

Sulfonated polystyrene resins crosslinked with 5, 8, 15, and 25 % $C_6H_4(CH{=}CH_2)_2$ were reacted with various chlorides, perchlorates, and sulfates of Cr. The lightly crosslinked resins removed the cationic Cr complexes completely.

4375. Haissinsky, Moise. **Electronic and solvent transfer in aqueous solutions of bi- and trivalent chromium. Separation of two ionic species by ion exchange.** *J. chim. phys.* **49**, No. 7/8, C133-6 (1952).—*C.A.* **47**, 941*b*.

The exchange between Cr^{++} and Cr^{+++} in aq. HCl or H_2SO_4 soln. was detd. by means of Cr^{51}. The ions were sepd. in a Dowex 50 column. All operations with Cr^{++} were performed under H_2. The column was eluted with HCl, $Cr(OH)_3$ was pptd. with NH_4OH and NH_4Cl, ignited to Cr_2O_3, and counted. The half life of the exchange reaction was less than 2 min. in HCl, 3 to 5 min. in H_2SO_4.

4376. Hale, D. K.; Hawdon, A. R.; Jones, J. I., and Packham, D. I. **The carboxylation of resorcinol and the separation of beta- and gamma-resorcylic acid by ion exchange chromatography.** *J. Chem. Soc.* **1952**, 3503-3509.—*C.A.* **47**, 5917*d*.

Complete sepn. of the acid from the β-isomer was effected by adsorbing the acids on a bed of weakly basic anion exchange resin in the chloride form and eluting with solns. of hydrochloric acid in water or aq. alc. Small scale expts. indicated that strongly basic anion exchangers were similarly amenable to the sepn. procedure. A process for the partial conversion of the gamma- to the beta-isomer was also developed.

4377. Hein, Fr. and Lilie, H. **The preparation of complex acids by the ion-exchange method.** *Z. anorg. u. allgem. Chem.* **270**, 45-48 (1952).—*C.A.* **47**, 1522*a*.

The synthetic resin Wolfatite A could be conveniently used in prepg. complex acids. The cations of complex salts were readily replaced by H ions at room temp. and a contact period of 15 min. The following complex salts produced the corresponding acids: $K_4[Fe(CN)_6]$, $K_3[Cu(CN)_4]$, $NH_4[(NH_3)_2Cr(SCN)_4]$, $K_3[Cr(SCN)_6]$, $K_3[Co(CN)_6]$, $K_4[Mo(CN)_8]$, $Na[Co(NO_2)_4en]$.

4378. Hirs, C. H. W.; Moore, Standford, and Stein, William H. **Isolation of amino acids by chromatography on ion-exchange columns; use of volatile buffers.** *J. Biol. Chem.* **195**, 669-83 (1952).—*C.A.* **47**, 10599*e*.

About 100 mg of each amino acid was isolated from protein hydrolyzates. To separate the basic amino acids, a strongly acidic cation exchanger was employed; for the acidic amino acids, a weakly basic anion exchanger; and for the neutral acids, two columns of strongly acidic cation exchanger. Elution was effected with ammonium formate or acetate buffers at pH 3 to 7. The buffers were removed by sublimation, the amino acids being obtained in crystalline form. All the amino acids (methionine excepted) were obtained analytically pure.

4379. Högfeldt, Erik. **Sorption isotherms on ion exchangers by e.m.f. titrations.** *Acta Chem. Scand.* 6, 610-11 (1952) (in English).—*C.A.* 46, 10775*h*.

H^+-satd. Wofatit KS under HNO_3 at 25°C was titrated with $AgNO_3$ soln. with use of Ag/AgI electrodes. The Ag^+ concn. was detd., the capacity by satg. the resin with H^+, expelling the H^+ with KNO_3, and titrating with NaOH. The isotherms agreed with those detd. by the batch-equil. method.

4380. Högfeldt, Erik. **Ion-exchange equilibria. II. Activities of the components in ion exchangers.** *Arkiv. Kemi* 5, 147-71 (1952) (in English).—*C.A.* 47, 6215*i*.

An ion exchanger contg. 2 ionic species was treated as a binary nonideal mixt. A certain amt. of the exchanger (R^-) was in equil. with a soln. contg. 2 ions $A_1^{z_1+}$ and $A_2^{z_2+}$. The mol. wts of the components could be chosen in 2 ways, giving 2 formal treatments. Application of the derived equations to existing data of Ag-H on Wofatit KS and Dowex 50, and Ba-H on Dowex 50 showed the preference of one method as the better approach.

4381. Holm, L. W. **Sectioned ion-exchange column: determination of the state of a substance in solution.** *Research* (London) 5, 286-8 (1952).—*C.A.* 46, 7827*f*.

A sectioned ion-exchange column, consisting of alternating bands of cation- and anion-exchange resins, could be used to obtain information about the behavior of a carrier-free radioactive substance. An expt. was described with P^{32} in the form of the orthophosphate showing the presence of a small amt. of filterable impurity and also cationic complexes or positively charged colloids.

4382. Honda, Masatake. **Ion-exchange resin applied to analytical chemistry. XII. Determination of adsorption band by a high-frequency method.** *J. Chem. Soc. Japan, Pure Chem. Sect.* 73, 529 (1952).—*C.A.* 47, 2625*f*.

The tube of a cation exchanger was inserted in the anode or grid coil of a high-frequency oscillator. Resin adsorbed with H^+, Na^+, or Ba^{++} showed different currents and by this method the portion of the resin contg. metallic ions could be detected.

4383. Honda, Masatake. **Measurement of pH in cation-exchange resin phase.** *Japan Analyst* 1, 122-5 (1952).—*C.A.* 47, 4688*d*.

Dimethyl yellow or naphthyl red was adsorbed in the almost colorless sulfonated polystyrene resin (R—H type), and its color change with the pH of soln. in various concns. (1 ~ 0.001*N*) of NaCl solns. was observed. As the concn. of NaCl increased, the pH of soln. at which color changed in the resin phase shifted to acid. Similar observation was made on a weakly acidic carboxylic resin (Amberlite IRC-50), but the color change was not sharp as in the former.

4384. Honda, Masatake; Yoshino, Yukichi, and Wariko, Tatsuki. **The solution of barium sulfate by ion-exchange resins.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 73, 348-9 (1952).—*C.A.* 47, 2568*d*.

When a mixt. of cation and anion exchanger was added to a suspension of $BaSO_4$ and the soln. shaken, the $BaSO_4$ was dissolved completely. This phenomenon was due to the adsorption of Ba^{++} and SO_4^{--} ions present in the soln.

4385. Kakihana, Hidetake and Yashiro, Kensuke. **Rapid analysis with an ion-exchanging resin. Volumetric determination of sulfate ion in copper sulfate and of free sulfuric acid in a mixture of copper sulfate and sulfuric acid.** *Japan Analyst* 1, 85-6 (1952).—*C.A.* 47, 1007*b*.

An approx. 0.1 *N* soln. of $CuSO_4$ was passed through a 10 ml Amberlite IR 120 (H type) column, which was then washed with 50 ml H_2O. The effluent was combined and the resulting H_2SO_4 was detd. by alkalimetry.

4386. Kawabe, Hiroshi and Yanagita, Masaya. **Synthesis and utilization of ion-exchange resins. I. Cation-exchange resin from salicylic acid.** *Repts. Sci. Research Inst.* (Japan) 28, 264-74 (1952).—*C.A.* 47, 4010*i*.

$C_6H_4(OH)CO_2H$ was condensed with HCHO (1:2 moles) with HCl (or H_2SO_4) catalyst at 99 C in 1.81 times ratio (reaction/emulsifying) to a sol. polynuclear resin which was then jellified with PhOH (0.7/1 mole I) at 98°C for 1 hr, dried, and powd. to pass through a 20-40 mesh. The resin was utilized in the extn. of streptomycin and nicotine.

4387. Kindt, B. H.; Balis, E. W., and Liebhafsky, H. A. **Alkalimetric determination of phosphate after separation of calcium by ion exchange.** *Anal. Chem.* 24, 1501-2 (1952).—*C.A.* 47, 4246*g*.

$H_2PO_4^-$ could be titrated to HPO_4^{-} after the removal of Ca^{++} by Dowex 50, by using a glass electrode, by freeing all reagents of CO_2 and carrying out the analysis in air contg. no CO_2. Good results were obtained in detg. 34.9-50.5% P_2O_5 in 5 samples.

4388. King, Edward L. and Dismukes, Edward B. **The separation, identification, and spectra of chromium. III. Thiocyanate cationic complexes.** *J. Am. Chem. Soc.* 74, 1674-5 (1952).—*C.A.* 46, 6981*a*.

The species $Cr(H_2O)_6^{+++}$, $Cr(H_2O)_5(SCN)^{++}$ and $Cr(H_2O)_4(SCN)_2^{+}$ were sepd. by use of ion-exchange techniques. The complex species were identified by detn. of the (thiocyanate)/(Cr(III)) ratio.

4389. Klement, Robert. **Separation of molybdenum from heavy-metal cations with the aid of ion-exchange resins.** *Z. anal. Chem.* 136, 17-25 (1952).—*C.A.* 46, 8568*i*.

If a slightly acid soln. contg. MoO_4^{2-} was treated with sufficient citric acid, a complex anion was formed which was not removed from soln. by passage through an H form of app. contg. Wofatit F, Amberlite IR 120, or Dowex 50 resin. After washing the column, all the Mo was in the eluate where it could be pptd. with oxine and the Mo detd. by weighing the oxinate or by bromometric titration of the ppt. Pb, Cu, Cr, Ni, Fe, and V were adsorbed by the resin.

4390. Kressman, T. R. E. **Ion-exchange separations based on ionic size.** *J. Phys. Chem.* 56, 118-23 (1952).—*C.A.* 46, 7400*c*.

Ionic size affected the mechanism of cation and anion exchange reactions by affecting both the position and rate of attainment of equil.; however, with a weakly basic, highly porous exchanger, the equil. position was independent of ionic size. For Zeo-Karb 225 the equil. exchange values for the following ions increased in the order NMe_{4}^{+}, NE_{4}^{+}, Na^{+}, $PhNMe_2CH_2Ph^{+}$, whereas if the satn. capacities of the resin were the same for all ions, the order should have been Na^{+}, NMe_{4}^{+}, NEt_{4}^{+}, $PhNMe_2CH_2Ph^{+}$. The rates of absorption of acids on De-Acidite-E and De-colorite decreased with increasing size of the acid mol. and increased with increasing valence. This applied not only to HCl and H_2SO_4, but also to the large org. dyes Orange G and Orange II.

4391. Lapidus, Leon and Amundson, Neal R. **The rate-determining steps in radial adsorption analysis.** *J. Phys. Chem.* **56**, 373-83 (1952).—*C.A.* **46**, 7396*g*.

Mass-transfer equations, based on various kinetic, liquid, and solid diffusion-rate mechanisms, were derived for the satn. of an initially empty radial adsorption disk. One ion-exchange and two adsorption systems were used in expts. to test the validity and usefulness of the equations under a variety of operating conditions.

4392. Leden, Ido. **The use of an anion-exchange resin to prove the presence of anionic complexes in some cadmium and copper salts.** *Svensk Kem. Tid.* **64**, 145-9 (1952) (in English).—*C.A.* **46**, 8563*a*.

A soln. of $Cd(ClO_4)_2$ was percolated through a column of Amberlite IRA400, pretreated with $NaClO_4$. Washing the 10-g column with 35 ml H_2O removed all the Cd, hence the $Cd(ClO_4)_2$ soln. had not contained any anionic complexes. Similar results were obtained for $CdSO_4$. A column satd. with Cl ions and treated with a $CdCl_2$ soln. had to be washed with six 25-ml portions of H_2O before the effluent was free from Cd ions. When NaCl was added to the $CdCl_2$ soln., 8 washings became necessary. Further treatment of the column with a $NaClO_4$ soln. to remove the Cl ions failed to give any Cd ions in the effluent.

4393. Lescoeur, L. **Exchange titrimetry and exchange potentiometry.** *Ann. inst. hydrol. climatol.* **22**, 59-66 (1952).—*C.A.* **46**, 10502*i*.

The pH of a soln. after exchange with Zeocarb, which was related to the concns. and hydrolysis consts. of the anions present, allowed further characterization of the sample.

4394. Linnenbom, V. J. **Separation of high-specific-activity sodium^{24} from large quantities of magnesium.** *J. Chem. Phys.* **20**, 1657-8 (1952).—*C.A.* **46**, 11029*d*.

Sepn. of Na^{24} from Mg was accomplished by ion exchange of the chlorides in neutral soln. on Dowex-50 resin (100 mesh) in a glass-free (polystyrene) column. Both Mg and Na were adsorbed. Elution with 0.1 *N* HCl removed the Na and left the Mg behind. Recovery of Na activity was quant. and sepn. from Mg was complete.

4395. Lister, B.A.J. and Hutcheon, J. M. **Preparation of pure hafnium by cation exchange.** *Research* (London) **5**, 291-2 (1952).—*C.A.* **46**, 8555*g*.

Pure Hf was prepd. from a Zr-Hf mixt. by absorbing the mixt. on the top section of a cation-exchange resin and eluting with *N* H_2SO_4 to remove the Zr. The Hf was then eluted from the column with 3 *N* H_2SO_4. An expt. showed 0.3% Zr impurity in the Hf eluate.

4396. Lister, B. A. J. and McDonald, L. A. **Zirconium chemistry.** *J. Chem. Soc.* **1952**, 4315-30.—*C.A.* **47**, 3664*h*.

Zr solns. in the concn. range 0.01 to 0.05 *M* contg. a radioactive Zr isotope were used in measurements of the rate of self-diffusion of the Zr species, the migration of Zr ions in an elec. field, the rate of diffusion of Zr ions into ion-exchange resins, the ionic charge of the Zr species absorbed on the resin, the ratio of anion to cation in the species absorbed on the resin, and the presence of Zr in the anionic form.

4397. Manecke, G. **Separation of ions in ion-exchange columns by ionophoresis.** *Naturwissenschaften* **39**, 62-3 (1952).—*C.A.* **47**, 378*g*.

A horizontal ion-exchange column, 8 cm long, 1.5 cm^2 cross-section was connected on both sides to electrode vessels, 120 v. d.c., 0.005 to 0.020 amps.; water flowed by the Pt electrodes. By virtue of the difference in migration rate of different ions in such a column, the ions could be sharply sepd.

4398. Manecke, G. **Electric conductance of cation-exchange membranes.** *Z. physik. Chem.* **201**, 193-210 (1952).—*C.A.* **47**, 7290*e*.

The membranes consisted of sulfonated PhOH-HCOH condensation products, and of sulfonated $PhCH{:}CH_2$-$C_6H_4(CH{:}CH_2)_2$, mixed polymers with different degrees of cross-linkages. The mean activity coeff. of the ions in the membrane was detd. from the K-ion concn. with high ion concns. outside the membrane, and from measurements of the membrane potentials with relatively low ion concns. From these membrane potentials the equil. const. for the exchange K-Na was calcd. and found to be in good accord with the exptl. results.

4399. Marconi, Maria. **Determination of the cationic exchange capacity of resins of sulfonic type.** *Chimica* (Milan) 7, 432-3 (1952).—*C.A.* **47**, 6217*b*.

The cationic exchange capacity of these resins could be detd. not only with neutralization reactions, but with oxido-reduction reactions, e.g.: $IO_3^- + 5I^- + 6H^+ \rightarrow 3I_2 + 3H_2O$. To 1 g of resin activated with *N* HCl, washed to a neutral reaction and suspended in H_2O, add 1 g KI and 5 cc. 0.1 *M* KIO_3, shake, and after 10 min. dil. with 100 cc. H_2O; titrate with 0.1 *N* $Na_2S_2O_3$ (starch indicator).

4400. Martin, J. Robert and Hayes, John R. **Application of ion exchange to the determination of boron.** *Anal. Chem.* **24**, 182-5 (1952).—*C.A.* **46**, 3902*f*.

Dissolve the sample contg. 0.03-20.0% B in water or dil. HCl, dil. to 50 ml, pass through a cation-exchange resin, and wash the bed with 200 ml of water. Nearly neutralize the effluent with NaOH, reflux 5 min., cool, and adjust the pH to 6.90. Make 0.6 *M* with invert sugar and titrate to pH 6.90 with standard NaOH.

4401. Merriam, C. Neale Jr.; Southworth, Raymond W., and Thomas, Henry C. **Ion-exchange mechanisms and isotherms from deep-bed performance.** *J. Chem. Phys.* **20**, 1842-6 (1952).—*C.A.* **47**, 4167*a*.

Exchange expts. of NaCl contg. Na^{22} on Amberlite XE-79 showed that solid diffusion was the rate-detg. step. The diffusion const. necessary to explain the results was estd. as 1.8×10^{-7}. The Na-Cs exchange isotherm was detd. by three series of expts. The av. capacity of the Me_2CO-washed Amberlite XE-79, detd. by treating three 5-g samples with 100 ml of 0.1970 M NaCl + Na^{22}, was 3.11 milliequiv./g.

4402. Michaels, A. **Simplified method of interpreting kinetic data in fixed-bed ion exchange.** *Ind. Eng. Chem.* **44**, 1922-30 (1952).—*C.A.* **47**, 354*i*.

The treatment was applicable to those high-exchange-rate reactions in which the exchange zone, i.e., the zone where the majority of the reaction occured, descended through the resin bed at const. velocity. The results could be extrapolated for the design of large ion-exchange units. The effect of bed height and liquor velocity on the capacity and rate of exchange of Na for H ions on acid-form Nalcite HCR (Dowex 50) was studied.

4403. Minami, Eiichi; Kakihana, Hidetake, and Fuzimoto, Masatoshi. **Inorganic analytical chemistry with ion-exchange resin. V. Electrometric determination of cations in the effluent from the cation exchanger.** *J. Chem. Soc. Japan,* Pure Chem. Sect. **73**, 368-70 (1952).—*C.A.* **47**, 2642*e*.

H, Rb, and Cs found in the effluent from the cation exchanger were detd. by measuring the electric cond. By this method the elution could be followed easily.

4404. Miyamoto, Shigeru and Sasaki, Tsunetaka. **Electrolytic regeneration of ion-exchange resin.** *J. Chem. Soc. Japan,* Pure Chem. Sect. **73**, 926-8 (1952).—*C.A.* **47**, 6277*h*.

Cation-exchange resins and anion-exchange resins could be regenerated up to almost 100% by selecting electrolytic conditions. Efficiency of elec. current and regeneration were detd. by the amt. of current and not by c.d. Electricity consumed was smaller the narrower the distance between the electrodes. Electrodes other than Pt caused corrosion or soln. of the electrode.

4405. Moore, Geo. E. and Kraus, Kurt A. **Anion exchange. IV. Cobalt and nickel in hydrochloric acid solutions.** *J. Am. Chem. Soc.* **74**, 843-4 (1952).—*C.A.* **47**, 4166*g*.

The anion-exchange behavior of Ni(II) and Co(II) in 0.5-12 M HCl was studied by detg. their elution consts., $E = dA/V$, where d was the distance (cm) an adsorption band moved when V cc. of eluent had passed through a column of A cm^2. Dowex-1 was used. The difference in the adsorption behaviors of Ni and Co was sufficient to permit excellent sepn.

4406. Mori, Yutaka and Meguro, Kenjiro. **Application of ion-exchange resin for the study of the properties of colloidal solutions. I. Purification of ferric hydroxide sol.** *J. Chem. Soc. Japan, Pure Chem. Sect.* **73**, 907-9 (1952).—*C.A.* **47**, 6217*c*.

Purification of Fe(OH)$_3$ sol. by ion-exchange resins Diaion A and B was studied. The results were compared with those of electrodialysis. Simultaneous use of cation and anion exchange resins gave a sol. of higher purity than does electrodialysis.

4407. Nagamatsu, Masatoshi. **Electrochemical studies on ion exchangers. II. Ion exchange reaction between cation-exchange resins of the sulfonic acid-type and neutral salt solutions.** *J. Electrochem. Soc. Japan* **20**, 123-8 (1952).—*C.A.* **47**, 423*c*.

Bivalent ions were exchanged to a greater extent than univalent ions and were very readily exchanged at low concns. The exchange reaction of "Daiya ion" reached equil. after about 30 min., and the exchange velocity satisfied a 1st-order or a 2nd-order rate equation at the beginning. This ion-exchange resin satisfied the mass-action equation.

4408. Nagamatsu, Masatoshi. **Electrochemical studies on ion exchangers. IV. Ion-exchange reaction between zeolite and neutral salt solutions.** *J. Electrochem. Soc. Japan* **20**, 203-6 (1952).—*C.A.* **47**, 423*f*.

The rate of the ion-exchange reaction, $Na_2(Zeolite) + CaCl_2 \rightleftarrows Ca(Zeolite) + 2NaCl$, was lower than that in sulfonic acid-ion-exchange resins. The logarithm of the equil. const. K_a of the reaction had a linear relation with m_{Na}/M, where m_{Na} was the equiv. Na ion in the liquid phase at equil. and M the capacity for replacing Ca with Na in the Ca (Zeolite).

4409. Nakanishi, Hisayoshi and Nagao, Sansei. **Application of ion-exchanging resin to routine analysis. Determination of total sulfate ion and silicofluoride ion.** *Japan Analyst.* **1**, 86-7 (1952).—*C.A.* **47**, 1007*a*.

Detn. of SO_4^{--} in Cu electrolytic refining soln. by an ion-exchanging resin (Amberlite IR 120) was in good agreement with the usual $BaSO_4$ method. The same procedure was employed to remove Sn from Sn electrolytic refining soln.

4410. Noggle, G. R. and Zill, L. P. **The quantitative analysis of sugars in plant extracts by ion-exchange chromatography.** *Arch. Biochem. Biophys.* **41**, 21-8 (1952).—*C.A.* **47**, 2090*c*.

Ion-exchange chromatography was used to sep. the sugars of plant exts. Quant. results were obtained for both plant exts. and recovery expts. Results were given for plant samples contg. sucrose, raffinose, stachyose, glucose, galactose, and fructose.

4411. Pepper, K. W.; Reichenberg, D., and Hale, D. K. **Properties of ion-exchange resins in relation to their structure. Part IV. Swelling and shrinkage of sulphonated polystyrenes of different crosslinking.** *J. Chem. Soc.* 3129-36 **(1952)**.

Two methods were described for determining the wt-swelling of ion exchange resins in bead form. It was shown from pycnometric measurements that the H–, Na–, and mixed forms of the resins obeyed the relationship: $(V_M)_H = (W_M)_H + 0.63$, where the first term was the swollen vol. and the sec the wt of water absorbed by an amt. of the M-form equivalent to 1 g of dry *H*-form. The effect on wt swelling was investigated for changes in degree of cross-linking, cationic compn., and concn. of ambient HCl solns.

4412. RADHAKRISHNA, B. P. **Separation of thorium and lanthanum by ionic exchange.** *Anal. Chim. Acta* **6**, 351-4 (1952) (in French).—*C.A.* **46**, 7453*e*.

A simple and efficient method was described for the sepn. of Th and La by ion exchange, especially by Amberlite IR 100, with a radioactive indicator. La was eluted first with citric acid, and then the Th was sepd. with H_2SO_4 as eluent. The sepn. was complete, and the method could be applied to all of the rare earth elements.

4413. RIEMAN, WILLIAM III AND LINDENBAUM, SIEGFRIED. **Analysis of mixtures of chloride and bromide by ion-exchange chromatography.** *Anal. Chem.* **24**, 1199-1200 (1952).—*C.A.* **46**, 9470*d*.

Halide mixts. were sepd. by chromatography on a strong-base anion-exchange resin column with $NaNO_3$ as the eluent. Eluent was passed through the column at a given rate, and fractions of the effluent analyzed by titration. The first set of fractions contained no halide; the second, Cl^-, and the third, Br^-. Capacity and interstitial volume of the column were detd. by treating the column with HCl, eluting all the Cl^- with $NaNO_3$. Titration of H^+ in the eluate gave interstitial volume.

4414. RYABCHIKOV, D. I. AND BUKHTIAROV, V. E. **Use of ion-exchange chromatographic method in the analysis of copper-iron ceramic alloys and bronzes.** *Zhur. Anal. Khim.* **7**, 377-83 (1952).—*C.A.* **47**, 4787*d*.

One of the cations remained unchanged while the others were transformed into complex anions. The cationite used was SBS and the rate of flow through the column was 4 ml/min. To sep. Cu and Fe, the latter was converted to $Fe_2(P_2O_7)_3$ at pH 10-11. Cu and Al were sepd. by converting Al to tartrate $Al_2(C_4H_2O_6)_3$ in an ammoniacal soln. Cu was sepd. from Al and Fe by changing Al and Fe to salicylates at pH 10. Mn was sepd. from Fe by treating their soln. with $(NH_4)_2C_2O_4$ at pH 5. This left Mn as Mn^{++} and Fe formed $Fe(C_2O_4)_3{}^{3-}$.

4415. RYABCHIKOV, D. I.; SENYAVIN, M. M. AND FILIPPOVA, K. V. **Comparative characteristics of some ion-exchanging substances.** *Zhur. Anal. Khim.* **7**, 135-44 (1952).—*C.A.* **47**, 1309*a*.

The phys. and mech. properties (vol.-wt, exchange capacity, swelling in various liquids, etc.) of 12 cationites and 11 anionites, both Soviet and foreign, were described.

4416. SAKAI, WATARU AND SEIYAMA, TETSURO. **Theory of ionic-exchange equilibria.** *Mem. Faculty Eng., Kyushu Univ.*, **13**, 95-117 (1952).—*C.A.* **47**, 21*h*.

The discussion was confined to the simple case of a uni-univalent ion exchange, and the ionic exchange reaction equation obtained was based on Bethe-Fowler's approximation. The theoretical equation was applied to exptl. results. Numerical relations between the adsorption equations of the Freundlich and Langmuir types and the chem. equil. equation were discussed.

4417. SAKAI, WATARU; SEIYAMA, TETSURO, AND NAGAMATSU, MASATOSHI. **Theory of ion-exchange equilibria. I. Derivation of equilibrium equation. II. The equilibrium equation and its application to experimental results.** *J. Electrochem. Soc. Japan* **19**, 343-5 (1951); **20**, 21-4 (1952).—*C.A.* **46**, 4318*g*.

In ion-exchange reactions, the exchanger phase caused anomaly in equil. An equation for ion-exchange equil. was derived, taking into account a lattice model for exchanging ions. Several characteristics of the equation were discussed. This equation might have been applied satisfactorily to various org. and inorg. ion exchangers.

4418. SALMON, J. E. AND TIETEZE, H. R. **The separation of quadrivalent and quinquevalent vanadium from phosphoric acid by ion-exchange resins. Some observations on the reduction of quinquevalent vanadium by ion-exchange resins.** *J. Chem. Soc.* **1952**, 2324-6.—*C.A.* **46**, 8997*h*.

Cation-exchange resins removed both V(IV) and V(V) from H_3PO_4 solns. Removal of V from K_3PO_4 solns. was influenced by the concn. of the K. Zeo-Karb 215 and 216 and Amberlite IR 120 reduced the V(V) to V(IV) as it was sepd., while Zeo-Karb 225 effected only partial reduction.

4419. SALOMON, L. L.; BURNS, J. J., AND KING, C. G. **Synthesis of L-ascorbic-1-C^{14} acid from D-sorbitol.** *J. Am. Chem. Soc.* **74**, 5161-5162 (1952).—*C.A.* **48**, 132*f*.

L-ascorbic acid was purified by treatment of the final hydrolysate with a weakly basic anion exchanger, Amberlite IR-120, in the acetate form. The ascorbic acid, adsorbed on a column of the resin, was eluted with 1 *N* hydrochloric acid. Fractions contg. no ascorbic acid, as detd. by titration, were discarded. Ascorbic acid was recovered almost quantitatively through this purification step. The use of an anion exchange column in the acetate form rather than in the free base form made unnecessary the prior use of a cation exchanger.

4420. SANSONI, BRUNO. **Use of ion-exchange resins as electron exchangers.** *Naturwissenschaften* **39**, 281(1952).—*C.A.* **47**, 6069*f*.

Oxidation-reduction ion exchangers were prepd. from strongly acid cation exchangers like Wofatite F, Amberlite IR 120, Dowex 50, and oxidation-reduction systems such as Fe^{2+}/Fe^{3+}, Sn^{2+}/Sn^{4+}, leucomethylene blue/methylene blue (LMB), or by treatment of anion exchangers like Wofatite M, Amberlite IRA 400, with hydroquinone/quinone, etc. The exchanger was reduced by $Na_2S_2O_4$ and oxidized by air or O_2.

4421. SAUNDERS, L. AND SRIVASTAVA, R. S. **Adsorption of organic bases by carboxylic acid ion-exchange resins. I. Equilibrium studies.** *J. Chem. Soc.* **1952**, 2111-18.—*C.A.* **46**, 10790*a*.

Quant. studies of the equil. distributions of NaOH, nicotine, pyridine, piperidine, ephedrine, and quinine between their aq. and alc. solns. and weak acid ion-exchange resins such as methacrylic acid resin and Amberlite IRC 50 resulted in classification into 2 groups. Weak bases follow the law (concn. of base in resin)/(concn. in equil. soln.) = const., while others mostly follow a logarithmic law.

4422. SCHUBERT, JACK. **Ion-exchange studies of complex ions as a function of temperature, ionic strength, and presence of formaldehyde.** *J. Phys. Chem.* **56**, 113-18 (1952).—*C.A.* **46**, 7400*g*.

The formation const., k_f, of the complex ion $(MA_n)^c$, where M was Sr^{++} or Ca^{++}, A was an anion, n was the no. of mols. of A relative to M, and c was the net charge of the complex, was related to the equil. ion-exchange formulation. Equilibrating Dowex 50 with the M and the listed ligands, at pH = 7.2-7.3, $\mu = 0.16$, and $t = 25°C$, and measuring the mat. of M in the resin and liquid phases showed that the M formed 1:1 complexes with the ligands. In the temp. range 3-40°C at const. μ, k_f of the Sr citrate complex was const., whereas decreasing μ increased its k_f. The presence of 10% HCHO had a great effect on the affinity of aspartic acid for the M.

4423. SCHUBERT, JACK AND LINDENBAUM, ARTHUR. **Stability of alkaline earth-organic acid complexes measured by ion exchange.** *J. Am. Chem. Soc.* **74**, 3529-32 (1952).—*C.A.* **46**, 11005*d*.

The formation constd. for the complex ions formed between Ca^{++} or Sr^{++} and a series of org. acids were detd. in barbital-buffered solns. at pH 7.2-7.3, ionic strength 0.16, and temp. 25°C by utilizing the equil. ion exchange on Dowex-50 resin of essentially carrier-free levels of radioactive cations. All complexes were of the 1:1 type. The logarithm of the formation consts. at 25°C between the org. anion from the parent acid listed and Ca^{++} and Sr^{++}, resp., were given.

4424. SEAL, KENNETH S. **The preparation of a cation-exchange resin.** *Pharm. J.* **168**, 343-4 (1952).—*C.A.* **46**, 9746*h*.

A procedure for converting Zeo-Karb 225, a synthetic resin based on polystyrene and contg. sulfonic acid groups, into the K form was outlined.

4425. SHAH, H. A. AND BAFNA, S. L. **Ion exchange. I. Three synthetic cation-exchange resins.** *J. Indian Chem. Soc.* **29**, 187-92 (1952).—*C.A.* **46**, 8787*f*.

The H forms of Amberlites IR-100, IR-105, and IR-120 were equilibrated with solns. of varying concns. of NaOH, 0.05 *N* in NaCl, and the acidity of the supernatants detd. by titration with standard acid or alkali. Plots of capacity of resin *vs.* pH of soln. showed that for Amberlites IR-100 and IR-105 the active groups were sulfonic below pH 10-10.5, and OH above. For IR-120 the sulfonic groups were active up to pH 14.

4426. SJÖSTRÖM, EERO. **Utilization of ion exchangers in analytical chemistry. XXIII. Separation of ketones.** *Svensk Kem. Tidskr.* **64**, 301-5 (1952) (in English).—*C.A.* **47**, 4248*c*.

The adsorption of ketones on Amberlite IRA-400 columns in the bisulfite form (9 by 450 mm; particle size 0.12-0.30 mm) was studied. $PhCOMe_3$ and Ph_2CO in 95% EtOH (500 mg/50 ml) were only slightly "retarded" by the resin, and were easily displaced by washing with the solvent. Camphor in EtOH was not adsorbed, but $CH_2(CH_2)_4CO$ in H_2O was taken up almost quantitatively (flow 1 ml/min.) and could be eluted with hot H_2O. Me_2:CHCOMe$_3$ and PhCH:CHCOPh in EtOH were only adsorbed quantitatively at very low flow rates (0.4 and 0.2 ml/min., resp.).

4427. SPEDDING, F. H. AND POWELL, J. E. **Quantitative calculation of the behavior of elution bands in the separation of rare earths on ion-exchange columns.** *J. Am. Chem. Soc.* **74**, 856-7 (1952).—*C.A.* **47**, 3652*f*.

A theory was given for the sepn. of rare earths on ion-exchange columns in the pH range 5.5-7.3 with 0.1% citric acid.

4428. SPEDDING, F. H. AND POWELL, J. E. **Quantitative theory of rare earth separations on ion-exchange columns.** *J. Am. Chem. Soc.* **74**, 857 (1952).—*C.A.* **47**, 3652*f*.

The method consisted essentially in adsorbing a mixt. of neutral rare earth chlorides on a high-capacity ion-exchange column and eluting them with 0.1% citric acid.

4429. SPIEGLER, K. S. AND CORYELL, C. D. **Electromigration in a cation-exchange resin. II. Detailed analysis of two-component systems.** *J. Phys. Chem.* **56**, 106-13 (1952).—*C.A.* **46**, 7840*h*.

Electromigration in a cation-exchange column flushed with deionized water was observed by tagging laminas of adsorbate with radiotracers and observing their migration in an elec. field. Cond. was ionic and the current was carried only by the cations. Broadening of the tagged band occurred as electrolysis proceeded. When Dowex-50 in the Na form was electrolyzed between Pt electrodes, the faster H ions produced at the anode penetrated the Na layer.

4430. STEINBACH, JOHN AND FREISER, HENRY. **Preparation of standard sodium hydroxide solutions by use of a strong anion-exchange resin.** *Anal. Chem.* **24**, 1027-8 (1952).—*C.A.* **46**, 8567*b*.

Standard 0.1 *N* NaOH was prepd. by passing a soln. of 2.922 g of NaCl in 50-100 ml of distd. water through 40 g of Amberlite IRA-400 in a 1.8 × 60 cm Jones reductor at a rate of 4 ml/min. into a 500-ml volumetric flask, and washing the resin with sufficient distd. water to make the soln. up to vol. The resin was regenerated with 2 liter of *N* NaOH made from 18 *N* NaOH.

4431. STRICKLAND, J. D. H. **Use of ion-exchange resins to determine the charge of an ion in aqueous solution.** *Nature* **169**, 620 (1952).—*C.A.* **46**, 6897*d*.

Application of the law of mass action to the equil. between two ions A and B whose charges were of the same sign, and an ion-exchange resin gave: $\log [k_1/(k_2 - k_1)] = (n_2 - n_1 + 1) \log C_B + \log(V/KWC)$, where k_1 and k_2 were values of some physically measurable property of ion A proportional to the no. of mols. of A, n_2 was the unknown charge of A, n_1 was the known charge of B, C_B was the concn. of B in V soln., K_c was the equil. const., W was the wt of resin, and C its capacity.. The plot of $\log k_1/(k_2 - k_1)$ *vs.* $\log C_B$ enabled n_2 to be evaluated.

4432. Sweet, Richard C.; Rieman, William III, and Beukenkamp, John. **Determination of alkali metals in insoluble silicates by ion-exchange chromatography.** *Anal. Chem.* **24**, 952-5 (1952).—*C.A.* **46**, 9465*c*.

The application of ion-exchange chromatography to the detn. of Li, Na, and K in insol. silicates was studied. The effect on the sepn. of altering the elution conditions was discussed. The procedure, with minor modifications, was also recommended for the detn. of alkali metals in other types of samples such as soap, biol. material, and salt mixts.

4433. Vermeulen, Theodore and Hiester, Nevin K. **Ion-exchange chromatography of trace components. A design theory.** *Ind. Eng. Chem.* **44**, 636-51 (1952).—*C.A.* **46**, 4860*g*.

A kinetic-diffusional theory was derived for trace sepns. by ion exchange, the appropriate *mass-transfer* coeffs. were evaluated for typical cases, and the method was applied to a proposed Ra-Ba sepn. The theory was based upon linear-equil. conditions i.e., the trace ions undergoing sepn. had soln.- and solid-phase concns. less than 10% of the carrier ion concn., the complexing agent, if used, was in substantial excess, and exchange directly between trace solutes was negligible.

4434. Vickery, R. C. **Separation of the lanthanons by ion exchange. A comparison of eluants.** *J. Chem. Soc.* **1952**, 4357-63.—*C.A.* **47**, 3169*i*.

AcOH, malic acid, tartaric acid, citric acid, glycine, nitrilotriacetic acid, and ethylenediaminetetraacetic acid, were compared as eluants for the rare earths from the NH_4 form of Dowex-50 resin. The efficiency of the sepn. at equal flow rates increased in the order given for the first four acids and then fell off. However, at a high pH and flow rates in excess of those with the first four acids, greater efficiencies were obtained with the last three compds. at equal molarities. This was attributed to the increased stability of the rare earth-eluant complex, which latter increased with eluant in the above given order.

4435. Waldock, Kenneth T. and Frizzell, Laurence D. **A study of the functional groups of cation exchangers by infrared absorption.** *J. Phys. Chem.* **56**, 654-7 (1952).—*C.A.* **46**, 8964*h*.

Infrared analysis of Zeo-Karb, Amberlite IR-1, Amberlite IR-100, Dowex-30, and Dowex-50 established the presence of sulfonic acid groups in all of them and the presence of O-H, C=C, and para groups. The O-H groups may be phenol groups. The evidence for -COOH in Zeo-Karb was also not beyond question. There was a structural similarity for Zeo-Karb, Amberlite IR-1, and Amberlite-100. Samples of the exchanger with adsorbed H^+ or other cations were prepd. as air-dried 20-40-mesh material.

4436. Westermark, Torbjörn. **Sheet ion exchangers. I. General aspects of synthetic ion exchangers in sheet form.** *Acta Chem. Scand.* **6**, 1194-9 (1952) (in English).—*C.A.* **47**, 6217*g*.

The nomenclature, prepn., properties, and applications were given for a sheet ion exchanger made by immersing plates, rods, or sheets of com. polystyrene in chlorosulfonic acid at room temp.

4437. Wheaton, R. M. and Harrington, D. F. **Preparation of cation-exchange resins of high physical stability.** *Ind. Eng. Chem.* **44**, 1796-1800 (1952).—*C.A.* **46**, 11505*b*.

Preswelling before sulfonation and slow diln. of the residual acid were important steps in the prepn. of spherical Dowex 50 (a sulfonated styrene-divinylbenzene copolymer). Maintenance of high H_2O content in the resin prior to use was also desirable. The progress of swelling was followed by observation of the polymer beads in polarized light.

4438. Wiklander, Lambert and Nilsson, Erik. **Equilibria in ion exchange. II. Influence of the mode of replacement.** *Acta Agr. Scand.* **2**, 197-209 (1952).—*C.A.* **47**, 6215*g*.

Continuous infinitesimal ion exchange, proceeding in systems where the capacity of the replacing ion per unit time was very low and the activity of the released ions in small owing to a more or less complete removal of these from the exchange system or by some sort of inactivation, was studied with Amberlite IR-100 satd. with either Li-K, Na-K, or Na-Cu, HCl being used as the replacing agent. Large replacements were compared with small successive replacements, and the equil. quotient of the mass law was related to the ratio of the percentage release of the two ions.

4439. Wilkes, J. F. **Corrosion problems in ion-exchange systems.** *Corrosion* **8**, No. 6, Topic of the Month 1-2 (1952).—*C.A.* **46**, 6577*g*.

When their exchange capacity became exhausted cation-resin beds could be reactivated by the use of 2-8% H_2SO_4 or 5-10% HCl. Anion exchangers were regenerated with soda ash, NaOH, or NH_3. Rubber-lined exchanger tanks were readily available and gave good service; multiple coats of baked phenolics were too brittle, and unlined exchanger tanks of Monel, Everdur, and stainless steel have given unsatisfactory operating experience. Larger piping may be rubber- or Saran-lined steel; the latter was available in smaller sizes.

4440. Zeegers, J. A. **Ion exchange as unit operation.** *Chem. Weekblad* **48**, 356-61 (1952).—*C.A.* **46**, 7378*b*.

Ion exchangers could be compared with rectification columns and treated by a similar graphic method of equil. curves and work lines. A well-defined stationary front moved through the exchanger during the exchanging process, which broadened during the regeneration. Operating along two different work lines during exchange and regeneration made it possible to convert equiv. quantities in both reactions.

4441. Zimmermann, M. **Rapid testing of ion exchangers.** *Angew. Chem.* **64**, 107-10 (1952).—*C.A.* **46**, 4146*a*.

Data were presented on the effect of particle size, H_2 and Na exchangers, evaluation of the shaking method and filtering test, and effect of regenerating agent and regenerating time. Many data were given.

4442. Alexander, G. B. **The preparation of monosilicic acid.** *J. Am. Chem. Soc.* **75**, 2887-8 (1953).—*C.A.* **47**, 9200*h*.

Pulverized cryst. $Na_2SiO_3.9H_2O$ was treated with an aq. slurry of "Nalcite" cation-exchange resin in the hydrogen form at 0°C. The liberated monosilicic acid was stabilized at pH 3 by a trace of H_2SO_4 in the soln. The degree of polymerization so obtained, measd. by the cryoscopic method, was 1.1.

4443. Bernhard, Sidney A. and Hammett, Louis P. **Specific effects in acid catalysis by ion-exchange resins. I. Hydrolysis of esters in 70% aqueous acetone.** *J. Am. Chem. Soc.* **75**, 1798-1800 (1953).—*C.A.* **47**, 7874*h*.

Sulfonated polystyrene-divinylbenzene cation-exchange resins, used as catalysts for the hydrolysis of carboxylic esters in 70% aq. acetone, showed slower reaction rates than did 0.44 *M* HCl. For 7 Me esters of the compn. RCO_2CH_3, the retardation observed with the resin catalyst paralleled the entropy of the gaseous compd. RH.

4444. Blasius, E. and Wachtel, U. **Detection of a polar pyridine-iodide complex by means of ion exchange.** *Z. anal. Chem.* **138**, 106-10 (1953).—*C.A.* **47**, 5837*h*.

In MeOH soln. a complex was formed which could be written $(I^+Py)I^-$. Permutite RS in the H^+ form could be used to remove it and elution could be accomplished with H_2SO_3 soln. but not with dil. HCl.

4445. Bonner, Oscar D. and Rhett, Vickers. **Equilibrium studies of the silver-sodium-hydrogen system on Dowex-50.** *J. Phys. Chem.* **57**, 254-6 (1953).—*C.A.* **47**, 5212*b*.

Equil. of the Ag-Na and Na-H exchanges on 2 samples of Dowex 50 were studied while a const. ionic strength of approx. 0.1 *M* was maintained. Comparison of these with another series of Na-H exchanges already reported showed a definite relation between the selectivity of the resin and the max. water uptake.

4446. Boyd, G. E. and Soldano, B. A. **Osmotic free energies of ion exchangers.** *Z. Elektrochem.* **57**, 162-72 (1953).—*C.A.* **47**, 9102*f*.

The thermodynamics of ion exchange electrolytes was discussed. The magnitudes of the osmotic free energies for two generally available ion-exchangers might have been estd. from v.p.-sp. vol. measurements. Free energies for ion exchange processes were developed using osmotic forces which were calcd. from vol. changes in the ion exchanger networks. Strongly basic and strongly acidic exchangers were employed.

4447. Calmon, Calvin. **Application of volume characteristics of sulfonated polystyrene resins as a tool in analytical chemistry. Determination of pH and dissociation constants of acids.** *Anal. Chem.* **25**, 490-2 (1953).—*C.A.* **47**, 6302*d*.

The effect of cross-linking of the polymer on the swelling of the dry sulfonated product in water was studied. The vol. relations of these exchangers in HCl solns. and when combined with cations of different valences were also detd. The cation exchangers contg. a divinylbenzene content of 1% or less were found to be the most sensitive to the vol. changes.

4448. Dizdar, Zdenko. **The use of ion exchangers for the separation, concentration, and determination of traces of cadmium in uranium.** *Rec. trav. inst. recherches structure matiere* (Belgrade) **2**, 85-8 (1953)(in English).—*C.A.* **47**, 6817*a*.

Solns. contg. Cd^{++} and UO_2^{++} ions (Cd:U 10^{-4} - 10^{-6}) were passed through Amberlite IR-120 columns of the following dimensions: cross-section 0.78 cm^2; length 19 cm; resin content 6.5g; and flow rate, 1 ml/cm^2/min. The U is eluted with 0.5*N* oxalic acid. After elution with *N* HCl, Cd was assayed polarographically and spectrographically. Complete sepn. was obtained.

4449. Dolar, Daro and Draganić, Zorica. **Separation of traces of rare earth elements from uranium with Amberlite IR-120 resin.** *Rec. trav. inst. recherches structure matiere* **2**, 77-83 (1953) (in English).—*C.A.* **47**, 6816*b*.

After adsorption in the column, UO_2^{++} was eluted with *N* oxalic acid. Ce, Eu, and Y could then be eluted with 5*N* HCl.

4450. Feinland, Raymond; Baldwin, David E., and Gregor, Harry P. **Sulfonated polystyrene-dichlorostyrene-divinyl benzene ion exchange resins.** *J. Polymer Sci.* **10**, 445-7 (1953).—*C.A.* **47**, 7252*c*.

The prepn. of sulfonic acid cation-exchange resins of lower exchange capacity than the fully sulfonated material by partial hydrolysis was unsuccessfully attempted by a variety of techniques. They were obtained by the sulfonation of a tripolymer. Preswelling in acetylene tetrachloride leads to smooth reaction and completion in 3 days at 90°C. The exchange capacities measured for swollen and unswollen systems and a comparison with the calcd. values for monosulfonation of all unchlorinated benzene rings showed that the capacity could be varied at will.

4451. Fronaeus, Sture. **An ion exchange and extinctiometric investigation of the nickel thiocyanate system.** *Acta Chem. Scand.* **7**, 21-31 (1953) (in English).—*C.A.* **47**, 8582*h*.

The cation-exchange method with Amberlite IR-105 and the extinctiometric method at 20°C and *M* concns. with $NaClO_4$ as supplemental salt checked each other, showing that only mononuclear complexes were formed. At pH 3, $NiSCN^+$ adsorbed on the resin was free within the resin phase and was not coordinated to structurally bound groups within the resin.

4452. Gabrielson, Gunnar. **Control of phosphating solutions.** *Metal Finishing* **51**, No. 4, 76-8 (1953).—*C.A.* **47**, 6816*a*.

An ion-exchange method for detg. phosphates and accelerators was described. For concentrates take 3-4 cc. and dil. to 100 cc.; for phosphating baths, dil. a sample with an equal vol. of H_2O. Pass 10 cc. of either soln. through a layer of sulfonic cation exchanger in the H form (height and diam. of resin layer are 150 and 9.8 mm, resp.). Wash the resin layer with about 50 cc. of H_2O. Titrate the eluate with 0.1 *N* NaOH first to a methyl orange end point and then against phenolphthalein. From the results of these titrations, the amts. of phosphate and accelerator could be calcd.

4453. Gilliland, E. R. and Baddour, R. F. **The rate of ion exchange.** *Ind. Eng. Chem.* **45**, 330-7 (1953).—*C.A.* 47, 6216*e*.

The ion pair Na-H was studied on Dowex 50 in order to evaluate factors in such exchange. The assumption that the rate of ion exchange was limited by the rate of mass transfer permitted the derivation of a no. of rate equations. The rate const. for ion exchange in a packed bed was not a function of bed height or of bed diam. (except as this affected the flow rate) so long as the column diam. was sufficiently greater than 20 times the particle diam. Both the resistance in the liquid phase and the resistance in the solid phase were important in detg. the total resistance to ion exchange in the range of concns. (0.01 to 1 *N*), particle diam. (0.022 to 0.100 cm), and flow rates (0.02 to 2.0 cm/sec) tested.

4454. Gillis, J.; Hoste, J.; Cornand, P., and Speecke, A. **Separation of niobium and tantalum by ion-exchange resins in an oxalic acid solution.** *Mededel. Vlaam. Chem. Ver.* **15**, 63-5 (1953).—*C.A.* 47, 12114*b*.

Nb and Ta were sepd. with the ion-exchange resin Dowex 2 in an oxalic acid soln. With a mixt. contg. equal wts of these two elements, it was possible in a single extn. to isolate Nb free of Ta with a 95% recovery. The recovered Ta contained about 1% Nb.

4455. Haagen, K. **Synthetic ion-exchange resins containing carboxyl and sulfonic acid groups.** *Z. Elektrochem.* **57**, 178-83 (1953).—*C.A.* 47, 8929*d*.

In this type of synthetic resin, the rate of salt formation for the carboxyl group was appreciably slower than for the sulfonic acid group. Titration curves showed the influence of swelling, resin particle, and pore size, as well as the effect of the sulfonic acid group upon the rate of salt formation of the carboxyl group.

4456. Hagerty, P. Frank II and Bliss, Harding. **Kinetics of ion exchange in the calcium cycle.** *Ind. Eng. Chem.* **45**, 1253-9 (1953).

The use of a strongly acidic cation-exchanger in the calcium cycle avoided regenerant trouble, because the regenerant was itself regenerated and its degree of utilization in any one operation was not important. The rate process was shown to be one of diffusional control, and the parameters governing the behavior were reported. Cu and Zn behaved similarly and could be essentially completely removed. Cr was not completely removed, because its rate of ionization was low. A procedure for the calculation of unit design in the Cu-Cd cycle was developed.

4457. Inoue, Yoshiyuki; Kawamura, Akira; Wada, Keizo, and Okamura, Hiroshi. **The reaction of chrome complex to the ion-exchange resin. I. The reaction between Amberlite IR-4B and oxalatochromate complex.** *Japan Analyst* **2**, 21-6 (1953).—*C.A.* 47, 6165*g*.

Ion-exchange behavior of pure $K[Cr(C_2O_4)_2(H_2O)_2]$ and $K_3[Cr(C_2O_4)_3]$ was investigated as an aid to the analysis of chrome tanning liquor. The column of regenerated *Amberlite IR-4B* was treated with NaCl, Na_2SO_4, Na_2HPO_4, NaH_2PO_4, $NaNO_3$, HCl, H_2SO_4, H_3PO_4, HNO_3, AcOH, or $(CO_2H)_2$ to form their salts. Then the soln. of either complex (0.1% as CrO_3) was passed, and the effluent was analyzed for Cr and $(CO_2H)_2$. The best result was observed on the resin treated with AcOH.

4458. Katzin, Leonard I. and Gebert, Elizabeth. **Absorption of inorganic salts from organic solvents onto anion-exchange resins.** *J. Am. Chem. Soc.* **75**, 801-3 (1953).—*C.A.* 47, 6069*h*.

Dowex A-1 was treated with HCl, NaCl, or $NaNO_3$, washed exhaustively, and air-dried to the desired degree. For $CoCl_2$, in acetone, on chloride resin the absorption decreased as the H_2O content of the resin decreased. In *tert*-butyl alc., the absorption of $CoCl_2$ was reduced. $Co(NO_3)_2$ showed similar absorption. $CoCl_2$ in acetone, on nitrate resin absorbed to a much greater extent (1.5 millimoles/g of resin) even in lower H_2O contents of resins. $Co(NO_3)_2$, in acetone, on chloride resin absorbed much less strongly.

4459. Kraus, Kurt A. and Moore, George E. **Anion-exchange studies. V. Adsorption of hydrochloric acid by a strong-base anion exchanger.** *J. Am. Chem. Soc.* **75**, 1457-60 (1953).—*C.A.* 47, 6735*d*.

The adsorption of HCl by the "strong base" anion-exchange resin Dowex-1 was detd. in the concn. range of 0.002 to 16 molal HCl for the aq. phase. The mean activity coeffs. of HCl in the resin phase were calcd. and it was found that the log of the coeff. increased linearly with the HCl molality of the resin phase.

4460. Kraus, Kurt A. and Moore, George E. **Anion-exchange studies. VI. The bivalent transition elements manganese to zinc in hydrochloric acid.** *J. Am. Chem. Soc.* **75**, 1460-2 (1953).—*C.A.* 47, 6735*e*.

The anion-exchange behavior of the bivalent transition elements Mn to Zn was studied in HCl solns. Their adsorbabilities differed sufficiently, as a function of HCl concn., to permit their sepn. The HCl concns. where noticeable adsorption occurred increased in the order Zn, Cu, Co, Fe, and Mn with no noticeable adsorption for Ni, even in concd. HCl.

4461. Mayer, Stanley W. and Freiling, E. C. **Ion exchange as a separation method. VI. Column studies of the relative efficiencies of various complexing agents for the separation of lighter rare earths.** *J. Am. Chem. Soc.* **75**, 5647-9 (1953).—*C.A.* 48, 3102*c*.

Using columns of Dowex-50 cation-exchange resin at 87°C, Sm-Eu and Eu-Tb sepn. factors were detd. for a number of complexing agents under dynamic conditions. The efficiencies of eluting conditions were detd. by comparing the purity of Eu and Sm obtained, as well as that of Y and Tb which likewise were difficult to sep. The order of selectivity was found to be: ethylenediaminetetraacetate > lactate = glycolate > malate ≧ citrate.

4462. Osborn, G. H. **Ion-exchange resins in analytical chemistry. Application of ion-exchange resins to the analysis of insoluble substances. Bibliography on the analytical exchange of ion-exchange resins.** *Analyst* **78**, 220-1; 221-52 (1953).—*C.A.* 47, 6301*g*.

These resins could be used to dissoc. many materials that were apparently insol. The column technique could not be used and the soln. must be shaken with an excess of the resin for protracted periods.

4463. Pfeiffer, P. W. **A graphical method for calculating ion-exchange columns.** *Chem. Eng. Sci.* **2**, 45-52 (1953).—*C.A.* **47**, 10394*g*.
The procedures for distn. and ion-exchange processes were compared.

4464. Reichenberg, D. **Properties of ion-exchange resins in relation to their structure. III. Kinetics of exchange.** *J. Am. Chem. Soc.* **75**, 589-97 (1953).—*C.A.* **47**, 6217*e*.
The kinetics of Na-H exchange on sulfonated cross-linked polystyrenes of 5 and 17% divinylbenzene content in bead form were investigated by an indicator method. For both resins the kinetics at high Na concn. in soln. ($>1N$) were clearly distinct from those at low concn. ($<0.05N$). At high concn. the rate was independent of the Na concn. and inversely proportional to the square of the particle radius. At low concn. the rate was proportional to the Na concn. and inversely proportional to the particle radius.

4465. Samuelson, Olof. **Use of ion exchangers in analytical chemistry. XXV.** *Z. Elektrochem.* **57**, 207-13 (1953).—*C.A.* **47**, 9205*g*.
Methods were described for the sepns. of cations, such as Fe^{3+}, VO^{2+}, CO^{2+}, Ni^{2+}, and Cu^{2+} quantitatively from solns. contg. alkali metals by means of anion exchangers in the citrate form. Anion exchangers, in the bisulfite form, could be used for the group sepn. of aldehydes, ketones, alcs., and acids.

4466. Schlögl, R. **Ionic mobility in exchangers.** *Z. Elektrochem.* **57**, 195-201 (1953).—*C.A.* **47**, 9116*d*.
Different methods for measuring ionic mobility were compared by using NaBr as the external electrolyte on both anionic- and cationic-exchange membranes. Ions of the same charge as the membrane showed a decrease in mobility with increased concn. of external electrolyte. Ions of a different charge showed an initial increase in mobility with increased concn. of electrolyte.

4467. Short, J. F.; Smith, P. G., and Twigg, G. H. **Temperature distribution in an ion exchange column.** *J. App. Chem.* **3**, 198-206 (1953).
A theoretical and experimental study on temp. distribution in an ion exchange column during exhaustion and regeneration was carried out. The theory evolved predicted that a "hot spot" moved along the column uniformly and at a const. peak temp. The predictions were verified experimentally with a strongly basic anion exchanger. Acetic acid was adsorbed on the resin and NaOH used for the regenerant liquid.

4468. Tanaka, Hiroshi and Meguro, Kenjiro. **Application of ion-exchange resin to the study of the properties of colloidal solution. II. Aging of vanadium pentoxide solution.** *J. Chem. Soc. Japan*, Pure Chem Sect. **74**, 48-50 (1953).—*C.A.* **47**, 6735*b*.
V_2O_5 was passed through anion and cation exchange resins, and the resulting change of viscosity was detd. as the measure of the progress of aging. The H^+ concn. was a decisive factor for aging as long as the VO_3^- concn. remained nearly const.

4469. Wheaton, R. M. and Bauman, W. C. **Ion exclusion.** *Ind. Eng. Chem.* **45**, 228-33 (1953).—*C.A.* **47**, 3623*c*.
By this unit operation aq. solns. of ionic and nonionic fractions could be sepd. into 2 primary components without heat or use of regenerants other than water for elution of the resin used. A sulfonated styrene-type medium cross linked (4-12%) fine-mesh resin was suggested. Sepns. described were HCl from AcOH, and NaCl from EtOH. Good sepn. was effected with low ionic concns.

II-9. Chromatography in Columns

4470. Strain, Harold H. **Petroleum-soluble fluorescent constituents of leaves.** *Nature* **137**, 947-7 (1936).—*C.A.* **30**, 6035¹.
The 1st portions of the percolate of petroleum ether exts. of dried leaf material, passed through magnesia and siliceous earth Tswett adsorption columns, contained colorless hydrocarbons recoverable in cryst. form. Other colorless substances were slightly adsorbed on the magnesia and could be recovered from subsequent portions of the percolate. Elution with petroleum ether and alc. gave strongly fluorescent crystals. The adsorbent magnesia itself was highly fluorescent and phosphorescent. Siliceous earth (Hyflo Super Cel, F.A. 501) contained small amts. of org. substances removable by washing with petroleum ether and alc.

4471. Flood, H. **Preparation and inorganic, chromatographic application of paper capable of ion exchange.** *Z. Anal. Chem.* **120**, 327-35 (1940).—*C.A.* **35**, 1341⁴.
At different places in a column of Al_2O_3 segregation of certain ions was found in definite zones, whereas some ions such as Na would pass through the column without being adsorbed. Whereas org. chromatography depended upon a stepwise adsorption of the mols. present in a soln., inorg. chromatography depended upon an exchange of ions of the soln. with the ions present as impurity in the Al_2O_3. The impregnation of a porous paper by capillarity was described and some analytical uses for tech. purposes were discussed. A simple way to impregnate the paper consisted in causing a ppt. of $Al(OH)_3$ to form in the pores of the paper; hydrated oxides of Cr and SiO_2 behaved similarly.

4472. Sellés, E. **Chromatograph and its applications.** *Anal. fís. quim. (Spain)* **36A**, 130-45 (1940).—*C.A.* **39**, 2684⁹.
Principles, technique, and app. were described. The relation between chem. structure and adsorption was discussed.

4473. Sinomiya, Tiro. **Compound formation and chromatographic adsorption of organic compounds.** *J. Chem. Soc. Japan* 61, 1221-6 (1940).—*C.A.* 37, 3990⁹.

Nitrotoluene and naphthalene substitution products dissolved in C_6H_6 were sepd. chromatographically in an activated alumina adsorption tube and with C_6H_6 or alc. + C_6H_6 as the sepg. liquid. The 2-component mol. compds. were suctioned out and dried, and the crystals were examd. for the deliquescence point and m.p. and arranged in terms of the chromatographic adsorption. The substituents of the aromatic compds. had the following order of adsorbability: CO_2H, $OH > NH_2 > NO_2 >$ Me, H.

4474. Troitskiĭ, G. V. **Separation of adsorption zones of colorless substances in chromatographic analysis by measurement of dielectric constant.** *Biokhimiya* 5, 375-80 (1940).—*C.A.* 35, 4794⁷.

Measurement of the dielec. const. gave a convenient way of detg. the adsorption zones of fat-sol. or water-sol. substances. Thus, the nonsaponifiable fraction of a bull's liver was adsorbed by a column of $Al(OH)_3$, and the boundaries of the adsorbed substances were detected by sound changes.

4475. Zechmeister, L. and Frehden, O. **Some applications of the "brush" method in chromatographic analysis.** *Bull. soc. chim. biol.* 22, 458-60 (1940).—*C.A.* 35, 3921².

An inorg. chromatogram on Al_2O_3 was prepd., the column slipped out of the tube, and tested for the various metals by applying longitudinal stripes of appropriate reagents to the column with a small brush.

4476. Bielenberg, W. and Fischer, L. **Chromatographic determination of hydroxybenzenes.** *Brennstoff-Chem.* 22, 278-80 (1941).—*C.A.* 37, 1952⁶.

The conditions under which PhOH, the crésols, *p*-xylenol, carvacrol, thymol and guaiacol coupled with diazotized *p*-$NO_2C_6H_4NH_2$, forming individual azo colors, and the conditions leading to chromatographic sepn. of the colors, were detd. The above hydroxybenzenes could be chromatographically identified in presence of one another.

4477. Cassidy, Harold G. and Wood, Scott E. **Chromatography of solutions containing a single solute.** *J. Am. Chem. Soc.* 63, 2628-30 (1941).—*C.A.* 35, 7802⁷.

The theory of chromatography proposed by Wilson was tested with data obtained from passing lauric acid in petroleum ether over carbon. The data were in reasonable agreement with the theory.

4478. Coleman, Geo. H. and Farnham, Alford G. **Azoyl derivatives of sugars and separation by chromatographic adsorption.** *Proc. Iowa Acad. Sci.* 48, 246-7 (1941).—*C.A.* 36, 3489⁹.

The chromatographic sepn. of α-d-glucose and fructose azoates was made, using silicic acid as an adsorbent. By using a mixt. of "Magnesol" and "Dicalite" as an adsorbent the following sepns. were made: lactose and galactose, sucrose and α-d-glucose, trehalose and β-d-glucose.

4479. Conner, R. T. and Straub, G. J. **Determination of thiamin by the thiochrome reaction.** *Ind. Eng. Chem., Anal. Ed.*, 13, 380-84 (1941).

The synthetic zeolite, Decalso, was used to absorb thiamin in order to separate it from substances interfering with the measurement of the fluorescence produced by the oxidation of thiamin to thiochrome with $K_3Fe(CN)_6$ in an alk. soln. Optimal conditions were given to elute the thiamin from the column by use of a hot 25% soln. of KCl or NaCl.

4480. Croatto, Ugo. **Chromatographic separation of the rare earths.** *Ricerca sci.* 12, 157 (1941).—*C.A.* 37, 2680⁴.

Chromatographic analysis was used to identify rare earths. This method possessed a no. of advantages. In particular the possibility of the chromatographic sepn. of La^{+++} and Ce^{+++} with Al_2O_3 as adsorbent was mentioned. Ce^{+++} was more strongly adsorbed than La^{+++}.

4481. Erämetsä, Olavi. **Chromatography of rare earths.** *Bull. comm. géol. Finlande* 14, 36-49 (1941).—*C.A.* 37, 3316⁵.

A mix. of rare earths was dissolved and passed through a tube filled with Al_2O_3 and the resulting chromatogram examd. spectroscopically and sometimes with *X*-rays. The adsorptive ability of Y appeared to be less than that of the real lanthanides. The addition of Rochelle salt to the solution had a remarkable effect on the adsorption.

4482. Erämetsä, Olavi; Sahama, Th. G., and Kanula, Viljo. **Chromatographic separation of the rare earths. I.** *Ann. Acad. Sci. Fennicae* **A57, No. 3,** 5-20 (1941).—*C.A.* 38, 4490⁵.

A tech. Y-Er nitrate of known compn. was passed through an Al_2O_3-filled tube at various pH values, and the rare-earth content of the various fractions was detd. The Y group was in general more strongly adsorbed than the Ce group and the adsorption was independent of the pH. Addn. of citric acid reversed the adsorption series in the La group.

4483. Pinterovic, Zvonimir. **Inorganic chromatography. I. Determination of iron.** *Kem. Vjestnik (Zagreb)* 15/16 45-51 (in German, 52) (1941-42).—*C.A.* 40, 4617⁶.

A tube 3 mm or 6 mm in diam., with funnel-shaped top, was filled with Al_2O_3 adsorbent. Solns. contg. Fe^{+++} in concns. of 2×10^{-6} to 4×10^{-3} poured into the tube gave a yellow color, which on development with $K_4Fe(CN)_6$ became blue. Curves representing height of the colored zone vs. concn. of Fe^{+++} were constructed.

4484. Trappe, Wolfgang. **Separation of biological lipides from their natural mixtures by means of adsorption columns. III. Separation of phosphorus- and nitrogen-free lipide fractions.** *Biochem. Z.* 307, 97-106 (1941).—*C.A.* 35, 4053³.

An Al_2O_3 (Brockmann) column permitted the sepn. of free fat acids with phosphatides from the total lipide ext. Frankonite KL, which gave the best results, was suspended in dil. HCl and heated on the water bath. This was washed several times with H_2O in the centrifuge, then with acetone until the acetone remained colorless. The powder was then heated with dil. NH_4OH, again washed with H_2O and finally dried at 120 °C. This very active adsorbent permitted the sepn. of hydrocarbons and cholesterol esters.

4485. Zechmeister, L.; Tóth, G.; Fürth, P., and Bársony, J. **Chromatographic separation of some β-glucosidases.** *Enzymologia* 9, 155-60 (1941) (in German).—*C.A.* 36, 790^1.

The chromatographic method was employed for the sepn. of some β-glucosidases of emulsin and *Merulius lacrimans*. The enzymes sepd. were: salicinase, cellobiase, amygdalase and gentiobiase. Al_2O_3 and bauxite were used as the adsorbents.

4486. Békésy, Nikolaus v. **A column for chromatographic adsorption that can be taken apart.** *Biochem. Z.* 312, 100-2 (1942).—*C.A.* 37, 6497^7.

The column was constructed of glass plates and cork separators, fastened with special clamps, and provided a rectangular cross section. The rectangular cross section minimized the formation of "hidden Zones." The column could be taken apart to remove the various zones after the chromatograph had been developed.

4487. Bielenberg, W. and Fischer, L. **Chromatographic determination of hydroxybenzenes. III.** *Brennstoff-Chem.* 23, 283-5 (1942).—*C.A.* 38, 531^1.

The study of the chromatographic sepn. of the azo colors of the hydroxybenzenes, formed by coupling with diazotized p-$NO_2C_6H_4NH_2$, was extended to other o-, m- and p-compds. About 400 pairs were studied. The exceptions were given in a table of 28 compds. for which positions in the Al_2O_3 column were given.

4488. Coleman, George H.; Farnham, Alford G., and Miller, Aaron. **Azoyl derivatives of sugars and separation by chromatographic adsorption.** *J. Am. Chem. Soc.* 64, 1501-2 (1942).—*C.A.* 36, 5781^4.

The following pairs of p-Phenylazobenzoyl derivs. were sepd. by chromatographic adsorption, using Magnesol (hydrous Mg silicate) as adsorbent with Dicalite as a filter aid: α-D-galactose + α-lactose, α-lactose + sucrose, and 4 other pairs; on Merck reagent silicic acid as adsorbent α-D-lactose + β-D-fructose, and 3 other pairs were sepd.

4489. Flood, H. and Smedsaas, A. **Inorganic capillarity analysis (chromatography) of metal complexes.** *Tids. Kjemi, Bergvesen Met.* 2, 17-19 (1942).—*C.A.* 37, 5334^8.

Chromatograms of $Cu(NO_3)_2$ soln. which had formed complex ions by treatment with glycine, Na tartrate and tartaric acid were shown. With glycine, the ionization of the complex was repressed by increasing the quantity of glycine added, and the quantity of Cu unadsorbed was increased at the expense of the adsorbed Cu. Good chromatograms were obtained with the glycine complexes of Ni and Co.

4490. Müller, P. B. **Standaridzation of activity of alumina for chromatography.** *Verhandl, Ver. Schweiz. Physiol.* 21, 29-31 (1942).—*C.A.* 38, 5469^4.

The heat evolved in treating Al_2O_3 with solvents (light petroleum) was reproducible and proportional to its chromatographic adsorption activity. When active and inactive products were mixed, the relation between content of active Al_2O_3 and evolution of heat was complex and dependent in a nonlinear manner on the compn. of solvent mixts.

4491. Polgar, A. and Zechmeister, L. **Isomerization of β-carotene. Isolation of a stereoisomer with increased adsorption affinity.** *J. Am. Chem. Soc.* 64, 1856-61 (1942).—*C.A.* 36, 5785^4.

The isomerization of β-carotene under the influence of a refluxing petr. ether soln., iodine catalysis, concd. HCl catalysis and melting the β-carotene was studied by means of chromatograms; a no. of pigments were indicated, 9-10 of which were stereoisomers of β-carotene. On addn. of I_2 all yielded a preponderant quantity of β-carotene and minor stereoisomers.

4492. Schwab, Georg-Maria and Issidoridis, A. **Inorganic chromatography. VI. Absorption spectra of adsorbed ions.** *Z. physik. Chem.* 53B, 1-19 (1942).—*C.A.* 37, 5653^6.

The absorption spectra of Cu, Cr (ic), Ni and UO_2 ions adsorbed on Al_2O_3 were detd. in reflected light. The position of the band and the absorption coeff. lay between those for the ion in soln. and the hydroxide and closely agreed with those for the basic salt.

4493. Smith, E. L. **Comments on the partition chromatogram of Martin and Synge.** *Biochem. J.* 36, xxii (1942)

The efficiency of the partition chromatogram of Martin & Synge was less than their theory indicated. The first factor was adsorption of organic acids by the silica. The second interfering factor was temporary neutralization of part of the acid by the alkali originally combined with the indicator. The third and most important factor was the change of partition coefficient with concn. The fatty acids from butter and margarine, resp., were distingused by the butyric acid band given by the former.

4494. Tiede, Erich and Schikore, Werner. **Chromatographic adsorption in the chemistry of phosphorescent substances.** *Ber.* 75B, 586-9 (1942).—*C.A.* 37, 3347^2.

Less than 1γ of Cu could be removed from $Zn(NO_3)_2$ by passage through Al_2O_3. Likewise Ca, Sr, Ba or Mg salts could be purified by chromatographic adsorption. The purification was improved by doubling the length of column of adsorbent or by passing the soln. through the column several times.

4495. Tiselius, Arne and Claesson, Stig. **Adsorption analysis by means of interferometric study.** *Arkiv Kemi, Mineral. Geol. Ser. B,* 15, No. 18, 1-6 (1942).—*C.A.* 38, 35^7.

The liquid was drawn through the adsorption column by air pressure, and the buret readings and index of refraction were noted at frequent intervals. From plotted values of the readings, a satisfactory detn. of the concn. of a soln. could be obtained with solns. of lauric, palmitic and myristic acids.

4496. Turba, Fritz and Richter, Margit. **The adsorption behavior of protein-degradation products. II. Chromatography of aminodicarboxylic acids on alumina.** *Ber.* 75B, 340-4 (1942).—*C.A.* 37, 3466^5.

Untreated Al_2O_3 was not sufficiently active for use in chromatography of amino acids; its activity was greatly improved by treatment with *N* HCl, but for full development it required the use of 0.05 *N* AcOH-acetate buffer at a ph of 3.3. Under these conditions aspartic and glutamic acids were quantitatively adsorbed and could be completely recovered by elution with dil. alkali, They could thus be quantitatively sepd. from glycine. alanine, leucine, serine, arginine, histidine, tryptophane, proline, cystine, and methionine.

4497. Turkevich, John. **Removal of adsorbents from chromatographic tubes.** *Ind. Eng. Chem., Anal. Ed.* 14, 792 (1942).—*C.A.* 37, 3^1.

After the development of the chromatogram, the solvent was just allowed to disappear from above the surface of the tube, the suction was stopped and the tube was placed horizontally on a paper placed on a table top. By means of a rubber stopper with gas inlet tube at the bottom of the chromatographic tube, gas pressure was introduced gently and periodically.

4498. Walker, F. T. and Mills, M. R. **Component glycerides of linseed oil—segregation by chromatography.** *J. Soc. Chem. Ind.* 61, No. 8, 125-8 (1942).—*C.A.* 36, 7332^7.

The glyceride groups were isolated by the methods of chromatographic analysis. Visual means were not available for sepg. the linseed-oil glycerides, but by cutting up the colorless chromatogram into segments and detg. the I_2 value of the adsorbed oil, the whole of the chromatogram could be explored. The fatty acids were adsorbed by Al_2O_3 in inverse order of their I_2 values, and the more satd. were retained at the top of the column, the most unsatd. passing through.

4499. Zechmeister, L. **Some new applications of chromatography.** *Math. naturw. Anz. ungar. Akad. Wiss.* 61, 36-40 (1942).—*C.A.* 39, 3759^5.

The application of the chromatographic method to the field of metal-ion detection was reviewed. Methods for the sepn. of stereoisomeric carotenoids and for the partial sepn. of certain β-glucosidases were described.

4500. Zechmeister, L. and McNeely, W. H. **Separation of *cis*- and *trans*-stilbenes by application of the chromatographic brush method.** *J. Am. Chem. Soc.* 64, 1919-21 (1942).—*C.A.* 36, 5806^8.

The application of the chromatographic brush method to stilbene and the *p*-Me and *p*-MeO derivs. was described. In each case the *trans* isomer possessed stronger adsorption affinity than the *cis* form and was located near the top of the Al_2O_3 column. After adequate development the 2 isomers were sepd. by a wide interzone. The method might also have proven useful for the study of the *cis*-*trans* shifts under the influence of light and other factors.

4501. Zechmeister, L.; McNeely, W. H. and Sólyom, G. **Chromatography of *cis*- and *trans*-benzoin and -anisoin oximes with application of the brush method.** *J. Am. Chem. Soc.* 64, 1922-4 (1942).—*C.A.* 36, 5807^2.

The chromatographic brush method, with an NH_4OH-$CuSO_4$ soln. as color reagent, was used for the detection and sepn. of *cis*- and *trans*-benzoin and -anisoin oximes on Neutrol Filtrol columns. In a mixt. composed of 2 stereoisomers, 1-2% of either form could be rapidly detected in the presence of the other.

4502. Cancino, José M. **Analytical and industrial aspects of chromatography.** *Actas y trabajos congr. peruano quím.* 2, I, 300-6 (1943).—*C.A.* 39, 3476^3.

The industrial value of chromatographic analysis was described in detail in reference to the prepn. of chlorophyll from nettles and the detn. of the presence of growth hormones.

4503. Croatto, Ugo. **Chromatographic separation of rare earths.** *Atti reale ist. veneto sci.* 102, 103-17 (1943).—*C.A.* 43, 6941*e*.

The sepn. of Ce^{4+} and La^{3+}, Ce^{4+} and Sm^{3+}, Ce^{4+} and Pr^{3+}, Ce^{4+} and Nd^{3+} nitrates by means of Al_2O_3 (which, if pptd. from $Al_2(SO_4)_3$ with NH_4OH was found to be the best adsorbent) was described. Ce^{4+} was made visible on the adsorption columns by treating the chromatograms with NH_4OH and H_2O_2. For the Ce^{4+}-La^{3+} mixt. it was found that the addn. of Fe^{3+} and Ca^{++} ions realized a more distinct chromatographic sepn. of Ce and La, which enabled a purification of the mixt. up to 95%.

4504. Currie, A. B. **Elutriation.** *Mfg. Chemist* 14, 194-7 (1943).—*C.A.* 37, 6163^5.

A review of the theory and practical application of various methods of elutriation.

4505. DeVault, Don. **The theory of chromatography.** *J. Am. Chem. Soc.* 65, 532-40 (1943).—*C.A.* 37, 3316^6.

Equations were derived for single and multiple solutes. When only one solute was present, if the adsorption isotherm was of the usual type, the front boundary of the band was sharp and tended constantly to sharpen itself in spite of diffusion, etc., whereas the rear boundary was broad and gradual. The quantitative agreement with experimental data, at least in the case of lauric acid on charcoal, was sufficiently good to justify the assumptions made. The partial differential equations for multiple solutes were given and the discontinuous solns. for multiple solute were discussed separately.

4506. Erämetsä, Olavi. **The chromatography of metals of the diphenyl thiocarbazone complex.** *Suomen Kemistilehti* 16B, 13-14 (1943).(in German).—*C.A.* 40, 4620^9.

The dithizonates of the heavy metals dissolved in CCl_4 were so strongly adsorbed on Brockmann's Al_2O_3 that only a narrow 2-mm upper band was obtained. On ordinary Al_2O_3 the metals Sb^{+++}, Sn^{++}, Ni^{++}, and Mn^{++} were completely adsorbed. Cu^{++} formed a gray-green ring at the top of the column, while Cd^{++} formed an orange ring below the Cu^{++}. Fe^{++} also formed an orange ring in this region, as did excess dithizone. Co^{++} gave a typical, rapidly wandering ring of blue-violet, while between Co^{++} and Cd^{++} nothing was adsorbed Zn^{++} formed a bright carmine-red ring below Co^{++}, while Hg^{++} and Hg^{+} formed an orange-yellow ring below the Zn^{++}.

4507. Farkas, Guillermo. **Chromatographic adsorption.** *Ph (Montevideo)* **1943**, No. 1/2, 18-22.—*C.A.* **38**, 1676^1.

App. and technique were described with a few general rules regarding the relation of structure and selective adsorption. This method was applicable in numerous org.-chem. fields, especially in the biol., e.g., in the sepn. of vitamins.

4508. Halfter. **A method for the separation of dinitro- and trinitrotoluene by chromatographic means.** *Z. ges. Schiess- u. Sprengstoffw., Nitrocellulose* **38**, 173-5 (1943).—*C.A.* **39**, 3671^1.

2,4-Dinitrotoluene (green on MgO, blue on $Ca(OH)_2$), 2,6-dinitrotoluene (weakly colored), 2,4,6-trinitrotoluene (TNT) (violet on MgO, light red on $Ca\ (OH)_2$) could be sepd. from each other by use of the chromatographic method with a column of pure MgO and $Ca(OH)_2$, 5:8, and a benzene-petr. ether solvent. The expt. was usually carried out so that the dinitro compds. passed into the filtrate. (The very strong coloration on MgO alone could serve for testing the solvent after washing.) The TNT remained adsorbed.

4509. Hamoir, G. **A new method for separation of a mixture of amino acids by chromatographic adsorption on Ag_2S.** *Compt. rend. soc. biol.* **137**, 734-5 (1943).*Biochem. J.* **39**, 485-90 (1945).—*C.A.* **39**, 3561^6; **40**, 3491^4.

Cysteine and cystine were adsorbed on pptd. Ag_2S at pH 2-3 and not eluted by dil. AcOH; methionine was adsorbed at pH 3; and glutamic and aspartic acids, histidine, tryptophan, phenylalanine, tyrosine, leucine, and arginine were adsorbed at pH 6-7 and eluted by very dil. AcOH.

4510. Karschulin, M. and Svarc, Z. **Chromatographic studies. I. Chromatographic analysis of elements of group IIb with the aid of active alumina from Lozovac (Croatia).** *Kem. Vjestnik (Arhiv Kem. i Tehnol.)* **17**, 99-105 (in German, 105) (1943).—*C.A.* **40**, 5352^9.

Active Al_2O_3, prepd. by roasting naturally occurring $Al(OH)_3$ at 600 °C, was used in the chromatographic analysis of As, Sb, and Sn. The properties of the adsorbent zone were investigated by prepg. a 5% gelatin suspension of the adsorbent plus the adsorbate, cooling and sectioning the gelatin sample longtiduinally. Addn. of Cd^{++} or Mn^{++} to the soln. contg. As, Sb, and Sn shifted the the Sn^{++} into the upper zone of the Al_2O_3 column. The chromatogram of the given element was washed with hot water and a 5% gelatin suspension poured over it. The column was cooled with water so as to solidify the gelatin adsorbed by the colored zone of the unknown, and the sample was sectioned longitudinally.

4511. Lecoq, H. **Microdetermination of lead by chromatographic analysis. Application to the analysis of water.** *Bull. soc. roy sci. Liège* **12**, 323-31 (1943).—*C.A.* **42**, 7464*g*.

Lead was detd. by adsorption on a column of Al_2O_3. The chromatograph was developed by the addn. of a 1% soln. of Na_2S. A sample of H_2O could be analyzed for Pb by this procedure by comparing the color developed in the unknown with the color produced by known concns. of Pb.

4512. Quarendon, R. **Chromatographic adsorption analyses.** *Mfg. Chemist* **14**, 201-4, 251-5 (1943).—*C.A.* **37**, 6517^3.

Although the method was developed for materials showing variable colors, it was applicable to colorless materials. Sepn. of isomers and other material of very similar properties was often possible.

4513. Schramm, Gerhard and Primosigh, Josef. **Quantitative separation of neutral amino acids by chromatography.** *Ber.* **76B**, 373-86 (1943).—*C.A.* **37**, 6516^4.

Chromatographic adsorption on activated charcoal and on Al_2O_3 in the presence of HCHO was described. Two g of the charcoal (Schering), of 28-mesh and freed from fines, formed a 4-cm column in a 12-mm adsorption tube through which 50 cc. of liquid flowed without suction in 2-3 hrs. The charcoal bed was washed with 5% AcOH to bring down its adsorptive capacity to a useful level. Glycine, alanine, serine, proline, methionine, valine, leucine, isoleucine (1-1.5 mg N in 2-5 cc. of 5% AcOH) added to the column and eluted with 5% AcOH, passed completely into the 1st 50-cc. eluate, whereas with phenylalanine, tyrosine and tryptophan no N_2 was found in the 1st eluate and only about 8.5, 4.6 and 0%, resp., in the 2nd eluate.

4514. Semtin, Halfter. **A chromatographic method for separating di- and tri- nitrotoluene.** *Z. ges. Schiess. u. Sprengstoffw. Nitrocellulose* **38**, 173-5 (1943).—*C.A.* **38**, 2902^2.

The mixt. used for adsorption contained 5 parts MgO and 8 parts $Ca(OH)_2$. MgO was colored violet by 2,4,6-trinitrotoluene, and with 2,4-dinitrotoluene gave a green color, while $Ca(OH)_2$ became bright red and blue, resp. Benzine and benzene were used as solvents.

4515. Swift, Clifton E.; Rose, W. Gordon, and Jamieson, G. S. **Preparation of purified methyl linoleate by chromatography.** *Oil & Soap* **20**, 249-50 (1943).—*C.A.* **38**, 655^4.

A column of alumina for chromatographic adsorption was prepd. by alternately pouring alumina and petr. ether (36°-60 °C) in small portions into a chromatograph tube (400 g alumina adjusted to a given activity in a tube 1-3/4 in. diam.) with a glass rod for stirring. A portion, 4 g Me esters of cottonseed oil in 150 ml of petr. ether, was introduced and the chromatogram developed with 1400 ml of petr. ether. The Me linoleate was eluted by rapidly forcing 2.5 liter more of petroleum through with pressure.

4516. VENTURELLO, GIOVANNI. **Chromatographic inorganic analysis.** *Ann. chim. applicata* **33**, 263-71 (1943).—*C.A.* **40**, 7041^{9}.

A series of chromatographic sepns. was described. The several constituents of the solns. were adsorbed on "Brockmann" Al_2O_3. A theoretical discussion was included.

4517. VENTURELLO, GIOVANNI. **Adsorption by alumina. Reply to a study of Siewert and Jungnickel.** *Atti reale accad. sci. Torino, Classe sci. fis., mat nat.* **79**, 260-2 (1943-44).—*C.A.* **41**, 4992*h*.

The adsorption was only in certain cases dependent on the sp. affinity, whereas in general it depended on the ionic charge, radius, and polarizability. The irregular position of bivalent Mn, which followed univalent Ag in the chromatographic series, was not in accord with the values of the soly. product of the carbonates, i.e., resp., $MnCO_3$ 10^{-11} and Ag_2CO_3 10^{-12}, but with the fact that the ions have the radius, resp., Mn 5.35 and Ag 6.10 A. and therefore have a different mobility.

4518. WACHTEL, JACQUES L. AND CASSIDY, HAROLD G. **Chromatography as a means of separating amino acids.** *J. Am. Chem. Soc.* **65**, 665-8 (1943).—*C.A.* **37**, 3466^{7}.

Details were given of the sepn. of glycine, dl-leucine, dl-phenylalanine and l-tyrosine. Two columns were used, 1 contg. 1.4 g of Darco G-60 charcoal and 3 g of pulped filter paper and the other 2.6 g of charcoal and 4 g of paper. The 1st column served the dual function of sepg. rapidly glycine and dl-leucine and more slowly dl-phenylalanine from l-tyrosine; after glycine and dl-leucine were washed from the 1st column, the column was developed with 5% aq. acetone until dl-phenylalanine began to appear in the percolate. The mixed glycine and dl-leucine fraction from the 1st column was concd. to about 20 cc. and applied to the 2nd column.

4519. WALL, MONROE E. AND KELLEY, EDWARD G. **Determination of pure carotene in plant tissue. Rapid chromatographic method.** *Ind. Eng. Chem., Anal. Ed.* **15**, 18-20 (1943).—*C.A.* **37**, 1102^{3}.

Ground dehydrated products were extd. with a mixt. of 30% acetone and 70% Skellysolve B and carotene was sepd. from interfering pigments by removal of most of the acetone, passage of the concentrate through a column of 3 parts Hyflo Super-Cel and 1 part of Micron Brand activated MgO, No. 2641, followed by elution with 3-5% acetone in Skellysolve B.

4520. WEIL-MALHERBE, H. **Experimental study of chromatography.** *J. Chem. Soc.* **1943**, 303-12.—*C.A.* **37**, 6516^{2}.

Quant. studies comprised the detn. of elution curves for benzopyrene, dissolved in mixts. of light petroleum fraction and benzene, on alumina and silica gel. The elution curve was a sigmoid curve, with characteristic threshold volumes; its exact form depended on the shape of the adsorbent column and on the particle size of the adsorbent. The threshold volume was studied as a function of the quantity of adsorbent, quantity of adsorbate, and the initial vol.

4521. WEISS, JOSEPH. **The theory of chromatography.** *J. Chem. Soc.* **1943**, 297-303.—*C.A.* **37**, 6516^{1}.

A general theory for the formation of a chromatogram in an adsorption column from a single substance and the process of development was derived on the basis of the Langmuir, Freundlich and linear adsorption isotherms.

4522. AUSTIN, C. R. AND SHIPTON, J. **The determination of carotene: a critical examination.** *J. Council Sci. Ind. Research* **17**, 115-26 (1944).—*C.A.* **38**, 5241^{1}.

An amt. of finely divided material contg. 100-200γ of carotene was weighed into a flask, covered with 20% aq. KOH, and brought to the boil on a hot plate. After cooling, 6 vols. of abs. alc. were added and the mixt. refluxed for 30 min. The ext. was filtered through sintered glass and the residue triturated with alc. and petr. ether until no further color was extd. The filtrate was adjusted to an alc. concn. of 55-75% and extd. twice with petr. ether. The bulked petr. ether exts. were washed 3 times with equal vols. of water and dried over Na_2SO_4. The soln. was passed through a column of activated MgO and the carotene eluted with 10% acetone in petr. ether.

4523. BAUERNFEIND, J. C.; BAUMGARTEN, W., AND BORUFF, C. S. **Adsorption phenomenon of β-carotene.** *Science* **100**, 316-17 (1944).—*C.A.* **39**, 10^{8}.

β-Carotene, dissolved in Skellysolve B, was adsorbed on activated Al_2O_3 and the chromatogram was developed with $CHCl_3$. Two pigments were formed. The top, narrow orange band "T" moved slowly and the lower, broad, β-carotene band passed rapidly down the column.

4524. BAUMGARTEN, W.; BAUERNFEIND, J. C., AND BORUFF, C. S. **Carotenoids in corn distillers' by-products.** *Ind. Eng. Chem.* **36**, 344-7 (1944).—*C.A.* **38**, 4088^{8}.

Chromatographic sepn. of the carotenoids of corn distillers' solubles, dried grains and dried grains with solubles indicated that the dried grains contained more carotene than the other by-products.

4525. BJÖRLING, CARL O. **Chromatographic assay of extractum and tinctura** *Nucis vomicae.* *Svensk Farm. Tids.* **48**, 137-9 (1944).—*C.A.* **39**, 1963^{6}.

Dissolve 0.2 g ext. (or 10g tincture) *nux vomica* in 5 cc. 70% alc. and suck it through 10 g dry Al_2O_3 in a glass tube of 1-cm bore. Elute with 4 portions hot 95% alc. To the filtrate add 20 cc. 0.01 *N* H_2SO_4, evap. off most of the alc., and titrate with 0.01 *N* borax, using methyl red and methylene blue as indicator.

4526. BJÖRLING, CARL O. **Evaluation of extracts and tinctures of** *nux vomica* **by adsorption analysis.** *Svensk Farm. Tid.* **48**, 161-5 (1944).—*C.A.* **39**, 1250^{2}.

Measured quantities of procaine-HCl or strychnine nitrate were dissolved in 5 or 10 ml EtOH and sucked through 10 g of Al_2O_3 (Merck, pure, water-free) in an adsorption column 1 cm in diam.

The column was washed 5 times with 5-ml portions of alc. The filtrate, dild. with an equal vol. of water, was titrated with $0.1\ N\ H_2SO_4$ to a green end point with bromophenol blue indicator.

4527. CHRISTENSEN, V. A. **Chromatographic analysis of alkaloids. I. Galenic preparations. 1. Analysis of tinctura** *nucis vomicae* **and extraction** *nucis vomicae*. *Dansk Tids. Farm.* **18**, 105-11 (1944).—*C.A.* **39**, 5403^3.

A mixt. of 25 g of tincture nucis vomicae and 15 g of abs. EtOH was passed through a column of 10 g Al_2O_3 in a 10-mm tube, or through 15 g of Al_2O_3 in a 13-mm tube. Fifteen cc. of EtOH was used as wash fluid. An equal vol. of H_2O was added to the alkaloid base and the mixt. titrated, bromophenol blue being used as an indicator.

4528. CHRISTIANI, A. V. AND ECK, VALERIE. **Separation of coprosterol and cholestanol with the aid of chromatographic adsorption analysis.** *Z. physiol. Chem.* **280**, 127-8 (1944).—*C.A.* **39**, 5406^3.

The isomers coprosterol and cholestanol could be sepd. by dissolving their mixt. in benzine, passing the soln. through a layer of alumina, eluting with 2:1 benzene-benzine, and evapg. each 100-cc. portion of filtrate *in vacuo* on the water bath. Since cholestanol was more strongly adsorbed on alumina than coprosterol, the eluate at first consisted principally of coprosterol, and evapn. of it yielded an oily residue.

4529. CLAESSON, STIG. **A self-registering apparatus for adsorption analysis.** *The Svedberg.* (Mem. Vol.) **1944**, 82-93.—*C.A.* **39**, 842^9.

A microinterferometric system in which the n was detd. as a function of the d. of soln. which had passed through a filter contg. a suitable adsorbent was made self-registering. Results were accurate within about 10^{-5} in n and 0.03 g in wt at max. sensitivity.

4530. CROWE, M. O'L. AND WALKER, A. **Fluorescence and absorption spectral data for pterinlike pigments synthesized by the diptheria bacillus and isolated by chromatographic analysis.** *J. Optical Soc. Am.* **34**, 135-40 (1944).—*C.A.* **38**, 2686^9.

4531. CROWELL, WM. R. AND KÖNIG, OTTO. **Improved apparatus for use in chromatography.** *Ind. Eng. Chem., Anal. Ed.* **16**, 347 (1944).—*C.A.* **38**, 3166^5.

A tube for use in chromatographic work was made from Lucite. A section along the entire length was removed and a tightly fitting piece made to close this opening. The tube could be opened for the detn. of the completeness of the adsorption and if necessary closed and the process continued.

4532. DUTTON, HERBERT J. **Adsorption analysis of colorless compounds: method and application to the resolution of stearic and oleic acids.** *J. Phys. Chem.* **48**, 179-86 (1944).—*C.A.* **38**, 5127^1.

A modification of a highly sensitive differential refractometer was described by means of which measurements of changes of n could be continuously made upon the percolate from adsorption columns during continuous flow.

4533. GORDON, A. H.; MARTIN, A. J. P., AND SYNGE, R. L. M. **Technical notes on the partition chromatography of acetamino acids with silica gel.** *Biochem. J.* **38**, 65-8 (1944).—*C.A.* **38**, 5472^5.

The extn. of Ac derivs. of amino acids on silica gel was discussed. The method of prepn. of the adsorption column and of the indicators employed were given.

4534. IIDA, TAKEO AND ISHIMOTO, KENZO. **Activation of Fushun alumina for chromatography.** *J. Pharm. Soc. Japan* **64**, 303-4 (1944).—*C.A.* **45**, 417*h*.

The $Al_2O_3 \cdot 3H_2O$ used for activation tests contained a minute amt. of alkali, and it was therefore given a pretreatment to remove the alkali. No activity was imparted by drying at 100-200 °C, but a powerful adsorption affinity was imparted by heating 1 hr at 300 °C. The product approximated Brockmann Al_2O_3 when heating was at 1000-1100 °C. The adsorptive affinity decreased with length of the heating period at equal temps., but the diffusibility increased. The adsorptive affinity of acid-washed Al_2O_3 was slightly stronger than that of water-washed Al_2O_3.

4535. LECOQ, H. **Analytical investigation of anions and cations by electrochromatography.** *Bull. soc. roy. sci, Liège* **13**, 20-6 (1944).—*C.A.* **42**, 6703*i*.

The adsorption was effected with the aid of an e.m.f. Expts. were conducted in the usual vertical glass tube contg. adsorbent with an e.m.f. of 80 v. between Pt electrodes at the top and bottom with no current, with the anode at the top, and with the cathode at the top. The most satisfactory distribution of anions was obtained with the anode at the bottom. The adhesive force between the adsorbed ions and the adsorbent was less than in ordinary chromatography. A 2nd app. consisted of two vertical tubes contg. adsorbent. In this process osmosis was assocd. with chromatography, and the ions migrated under the influence of the potential Cu, Pb, and Cd cations and CrO_4, AsO_4, and PO_4 anions were studied.

4536. LIDDELL, H. F. AND RYDON, H. N. **A new indicator for use in partition chromatography, 3, 6-disulfo- -napthalene-azo-N-phenyl- -naphthylamine.** *Biochem. J.* **38**, 68-70 (1944).—*C.A.* **38**, 5466^5.

The prepn. of the indicator was described in detail. It was recommended for use in the partition chromatographic sepn. of acetyl amino acids.

4537. LINDNER, ROLAND. **Chromatographic adsorption of radioactive atoms (radiometric adsorption analysis).** *Z. physik. Chem.* **194**, 51-65 (1944).—*C.A.* **42**, 8631*c*.

The process was applied to the sepn. of Pb and Bi in the form of their radioactive isotopes Th B and Th C. In this way a useful method of radiometric adsorption analysis was developed which could be applied to the classical radiochem. problem of the sepn. of Ra and Ba.

4538. MEUNIER, P. **Selective adsorption: chromatography.** *Chimie & industrie* **52**, 68-74 (1944).—*C.A.* **40**, 2711^1.

Two illustrative examples were given: (a) sepn. of carotenoids from paprika bark and detn. of provitamin A, and (b) detn. of tocopherol in blood serum. The practical uses to which chromatographic analysis may be put were outlined.

4539. MÜLLER, P. B. **The calorimetric standardization of the activity of adsorption agents for chromatographic analysis, with particular attention to Al_2O_3. II.** *Helv. Chim. Acta* **27**, 404-7 (1944).—*C.A.* **38**, 3921^7.

The expts. were carried out with solns. in petr. ether (of different degrees of purity), hexane, pure ethanol, and $CHCl_3$ as solvents and with 3 different samples of specially prepd. Al_2O_3. The sepn. of vitamin A ester and vitamin A alc. was studied. The results showed that there was a distinct proportionality between the heat effects and the adsorption activity. Reproducibility was accomplished only when care was taken to use the same adsorbent and solvents during the entire work.

4540. ÖHMAN, VALTER. **An example of the use of adsorption analysis in technical synthesis.** *The Svedberg* (Mem. Vol.) 1944, 413-18.—*C.A.* **39**, 1113^7.

The analytical problems arising from the direct electrochem. nitration of ethylene at an anode were solved by the methods of Tiselius and Claesson. The products were butyl nitrate, diglycol dinitrate, nitroglycol, ethyl nitrate and butyl nitrate.

4541. REED, GERALD; WISE, E. C, AND FRUNDT, R.J.L. **Quantitative separation of alcohol and ester forms of vitamin A by solvent extraction and chromatographic methods.** *Ind. Eng. Chem., Anal. Ed.* **16**, 509-10 (1944).—*C.A.* **38**, 5471^7.

Vitamin A alc. could be sepd. quantitatively from its esters by filtration of a soln. in ethylene dichloride through chromatographic columns of activated alumina. The activation and standardization of the alumina were described.

4542. SCHRAMM, GERHARD AND PRIMOSIGH, JOSEF. **Adsorption analysis of amino acids. II. Group separation of the complete mixture.** *Ber.* **77B**, 417-26 (1944).—*C.A.* **40**, 4622^3.

By a proper choice of adsorbents the mixed amino acids from proteins could be sepd. into 5 groups: (1) Aromatic amino acids; (2) basic amino acids; (3) acid amino acids; (4) those that gave stable compds. with HCHO: and (5) aliphatic neutral amino acids. A 10-cm column of silica gel was prepd. The soln. contg. the acids of groups 2 to 5 was run through the column at the rate of 4 drops per min. at atm. pressure, and the last of the soln. was transferred with a little H_2O. The acids of groups 3 to 5 were washed out quantitatively with 50 ml of H_2O. Those adsorbed were eluted with 100 ml of 20% AcOH. The anionotropic Al_2O_3 used for adsorbing group 3 was prepd. by treating Al_2O_3 (Merck) with HCl.

4543. SCHRAMM, GERHARD AND PRIMOSIGH, JOSEF. **Experiments on detecting the adsorption of amino acids with the eye.** *Ber.* **77B**, 426-7 (1944).—*C.A.* **40**, 4623^1.

Before the amino acid soln. was put on the column, it was colored with an appropriate chromatic indicator which was less strongly adsorbed. When Al_2O_3 was colored yellow with bromothymol blue, the amino acids of group 3 produced a white ring; if the Na salt of the indicator was used, it turned blue at the lower edge of the adsorption zone.

4544. SCHWAB, GEORG-MARIA; SIEWERT, G., AND JUNGNICKEL, H. **The alkaline reaction of aluminum oxides and the analysis of adsorption by aluminum oxide.** *Z. anorg. Chem.* **252**, 321-2 (1944).—*C.A.* **40**, 4275^9.

Titration by leaching alumina with a large amt. of H_2O and direct titration in the presence of H_2O and a large amt. of NaCl were compared. For some aluminas the results were comparative. The part of the Al oxide that was technically important for adsorption could not be leached with H_2O.

4545. STIMMEL, BENJAMIN F. **Method for preparing replicas of chromatograms.** *J. Chem. Education* **21**, 515 (1944).—*C.A.* **40**, 4932^7.

Crayola crayon of the desired color was extd. with benzene. The ext. was mixed with talc and centrifuged. The solid was dried and used in the column to make the replica.

4546. STRAIN, HAROLD H.; MANNING, WINSTON M., AND HARDIN, GARRETT. **Xanthophylls and carotenes of diatoms, brown algae, dinoflagellates and sea-anemones.** *Biol. Bull.* **86**, 169-91 (1944).—*C.A.* **38**, 5260^9.

The pigments were extd. with absolute MeOH contg. 0.5% $PhNMe_2$, and then transferred to petroleum ether after which the fractions were sepd. by chromatographic adsorption. Six species of diatoms each yielded the following xanthophylls: diatoxanthin, diadinoxanthin (both new), fucoxanthin, neofucoxanthin A, and neofucoxanthin B.

4547. SYNGE, R. L. M. **Analysis of a partial hydrolyzate of gramicidin by partition chromatography with starch.** *Biochem. J.* **38**, 285-94 (1944).—*C.A.* **39**, 1895^2.

Partition chromatography on silica gel gave poor quant. sepn., but the amino acids were found to travel as quite sharp bands in column chromatograms made with raw potato starch and developed with butanol satd. with water. Preliminary data were given on this technique, and behavior of known samples of dl-alanine, dl-valine and dl-leucine in such columns described. An identical sequence of bands was obtained on paper and on starch chromatograms.

4548. TUCKER, PAUL W. **New simplified chromatographic adsorption column.** *Chemist-Analyst* **33**, 65 (1944).—*C.A.* **38**, 5695^2.

A slight constriction was made in a tube of the proper size; on this was placed a Witt plate to hold the column and the tube was inserted in a rubber stopper that fitted in the neck of a suction flask.

4549. BEAUCOURT, J. H. AND MASTERS, D. L. **Chromatographic methods in inorganic microanalysis.** *Metallurgia* **32**, 181-4 (1945).—*C.A.* **39**, 5195^9.

Activated Al_2O_3 and ordinary dehydrated $Al(OH)_3$ were found to be effective absorbents and were preferable to others such as MgO, $BaSO_4$, and ZnO. Many heavy metal ions could be developed with $(NH_4)_2S$ to give black sulfide zones; Fe, Cu, and Co reacted with $K_4Fe(CN)_6$ to give blue, brown, and greenish zones, resp. With $(NH_4)_2S$ following zones were obtained: Pb^{++}, black; Ag^+, gray; Zn^{++}, white; Cd^{++}, yellow; Mn^{++}, flesh color. Certain ions could not be sepd. directly from aq. solns., since they formed mixed zones. Examples were Cr^{III}, Fe^{III}, Hg^{II}, and Co^{II}, Ni^{II}, Cd^{II}, Fe^{II}. However, if these were converted into amine or tartrate complexes, the order of adsorption could be altered and sepns. effected which were impossible with the simple ions.

4550. BERENBLUM, I. **3,4-Benzopyrene from coal tar.** *Nature* **156**, 601 (1945).—*C.A.* **40**, 1005^6.

A soln. of 10 g of the crude tar-distn. fraction in 100 cc. C_6H_6 and an excess of petr. ether was extd. after being filtered several times with concd. H_2SO_4 at 3°C. The combined H_2SO_4 exts. were dild. with H_2O, extd. with C_6H_6, the C_6H_6 ext. was washed with dil. NaOH, and dried. After diln. with twice its vol. of petr. ether, the soln. was passed through an Al_2O_3 column and eluted with C_6H_6-petr. ether (1:1).

4551. BINKLEY, W. W.; BLAIR, MARY GRACE, AND WOLFROM, M. L. **Isolation of constituents of cane juice and blackstrap molasses by chromatographic methods.** *J. Am. Chem. Soc.* **67**, 1789-93 (1945).—*C.A.* **40**, 481^7.

After fermentation with yeast and passage through Amberlite IR-100 and IR-4, 225 g of Cuban blackstrap yielded 35 g (15.6%) of a dark brown solid with a bitter taste and a raisin-like odor. This was acetylated at 95-8°C for 4 hrs. The filtrate from the dark-brown solid contained 8.9 g of glyceryl triacetate and 6.2 of a dark sirup. Most of the dark-brown solid and dark sirup was strongly adsorbed by Magnesol, a behavior indicative of a polymeric structure; this portion was not investigated. Elution of the Magnesol with 100:1 C_6H_6:EtOH gave 5.83 g of a golden-yellow sirup from which were isolated 0.215% (on basis of blackstrap) of inositol (as the hexaacetate), 0.05% of D-mannitol (as hexaacetate), and 0.07% of β-D-glucose (as pentaacetate) (details were given of the sepn.). Cane juice was found to contain 0.005% of inositol; blackstrap contained 0.134% of inositol and 0.186% of phytin inositol.

4552. BROUWER, TH. **Apparatus for chromatographic adsorption.** *Chem. Weekblad* **41**, 103-4 (1945).—*C.A.* **40**, 2039^2.

A micro column was described.

4553. CHRISTENSEN, V.A. **Alumina for chromatographic analysis (of alkaloid salts).** *Dansk Tids. Farm.* **19**, 29-48 (1945).—*C.A.* **39**, 5405^7.

To test the suitability of Al_2O_3, shake 20 cc. 1% procaine-HCl in 86% EtOH at frequent intervals for a period of 15 min. at about 20°C in a conical flask with 5 g Al_2O_3, filter, and titrate 10-cc. aliquots of the filtrate (after diln. with equal parts of H_2O) with 0.1 *N* HCl (bromophenol blue indicator). If the analysis was carried out chromatographically with so small a quantity of Al_2O_3 that not all of the acid residue was adsorbed, this was an excellent method for estg. the quality of the Al_2O_3. The adsorption was independent of the length of the column, but depended on the time of contact.

4554. CLAESSON, STIG. **Theory for frontal adsorption analysis.** *Arkiv Kemi, Mineral., Geol.* **A20**, No. 3, 14 pp. (1945) (in English); *Discussions Faraday Soc.* **1949**, No. 7, 34-8.—*C.A.* **41**, 1169*a*; **44**, 9769*g*.

The concn. of several constituents in soln. could be calcd. from frontal analysis, using Langmuir's isotherm, more simply than could be obtained by elution analysis.

4555. CLEAVER, CHARLES S.; HARDY, ROBERT A., AND CASSIDY, HAROLD G. **Chromatographic adsorption of amino acids on organic exchange-resins.** *J. Am. Chem. Soc.* **67**, 1343-52 (1945).—*C.A.* **39**, 4844^8.

The responses toward several amino acids (glycine, alanine, arginine, histidine, and glutamic acid) of a cation-exchange and an acid-binding synthetic organic resin (Amberlite IR-100 and IR-4) were reported. The influence of the following factors was investigated: type of resin, particle size, length of adsorption column, rate of flow, and concn. of amino acid and H ion in soln. The work included several binary and 2 ternary mixts., evidence regarding their separability being reported.

4556. COLEMAN, GEORGE H.; REES, DONALD E.; SUNDBERG, ROBERT L., AND MCCLOSKEY, CHESTER M. **Separation and identification of the products of hydrolysis and alcoholysis of methylated disaccharides.** *J. Am. Chem. Soc.* **67**, 381-6 (1945).—*C.A.* **39**, 1850^8.

Details were given of the chromatographic sepn. of the azoylated hydrolyzates (obtained by the 2nd method) from Me heptamethyl-β-gentioside, -β-melibioside, -β-Cellobioside, -β-lactoside, and -maltoside. The upper band formed was always the monoazoate, contaminated with a little of the diazoate band. With cellobiose it was necessary to sep. the upper band on a 2nd column.

4557. DYKYJ, J. AND CERNY, J. **A new method of quantitative chromatography of inorganic cations.** *Chem. Listy* **39**, 84-91 (1945).—*C.A.* **44**, 9868*h*.

A cationoid dye (methylene blue) adsorbed on starch was desorbed and replaced by inorg. cations. A chromatographic tube was filled with an aq. starch suspension. After sedimentation, a small amt. of methylene blue was added to the supernatant water, which, after draining formed a thin ring on the upper end of the starch column. When an inorg. cation soln. was passed through the column, it shifted the blue ring by a distance proportional to the amt. of the cation present. The method was suitable only for individual Mg, Ca, Sr, or Ba ions.

4558. GAJJAR, INDIRA M. AND REENIVASAYA, M. **Chromatographic adsorption of shark-liver oil on activated fuller's earth.** *J. Sci. Ind. Research* (India) **3**, 301-2 (1945).—*C.A.* **39**, 2895^2.

Shark-liver oil with a vitamin A activity of 10,570 I.U./g was passed through a column of activated fuller's earth. The 3 zones which were colored (top to bottom) red, orange, and yellow, were divided into 5 fractions. The eluates of the fractions had activities (top to bottom) of

211,000, 77,200, 5620, 6550, and 8170 I.U./g the activity of the filtrate was 5560 I.U./g.

4559. GLUCKAUF, E. **Chromatography of two solutes. Adsorption isotherms from chromatographic measurements.** *Nature* **156**, 205-6 748-9 (1945).—*C.A.* **39**, 4786^6.

The results obtained by Offord and Weiss (1945) were criticized.

4560. JACOBS, P. W. M. AND TOMPKINS, F. C. **Inorganic chromatography. II. Position, rate of advance, and width of adsorbate zones.** *Trans. Faraday Soc.* **41**, 395-400 (1945).—*C.A.* **39**, 5157^3.

Columns were prepd. by suspending 20 g Al_2O_3 in 50 ml water at 90°C and introducing this into tubes of 11 mm diam. under 10 cm Hg suction. The vol. of 0.1 *N* soln. of cations (Cu, Cd, Zn, Ni, Co, Mn, Mg) which traversed columns of equal length until detected in the filtrate was detd. It was found that $c_0/Q(dx/dt)_{c_0}$=const., where x was any distance from top of the column at time t, c_0 the initial concn., and Q the amt. of solute adsorbed per unit length of column in milliequiv. The rate of advance when developed with HCl and the relative positions were studied.

4561. JACOBS, P. W. M. AND TOMPKINS, F. C. **Inorganic chromatography. III. Elution curves.** *Trans. Faraday Soc.* **41**, 400-5 (1945).—*C.A.* **39**, 5157^5.

Cu bands were formed from neutral $CuSO_4$ solns. in columns (2.45 cm diam.) of Al_2O_3. The concn. distribution in soln. at the front part of the band after being advanced 3 cm was detd. and the corresponding distribution of adsorbed matter on the Al_2O_3 was calcd. from this and the isotherm. H_2SO_4 at 20 milliequiv./liter was used in the development, since the corresponding isotherm was linear up to a Cu concn. of 60 milliequiv./liter when the satd. value was attained. Al_2O_3 was unsuitable as an adsorbent in an inorg. chromatographic study.

4562. JACQUES, JEAN AND MATHIEU, JEAN PAUL. **Role of the dielectric constant in chromatography by fractional elution.** *Compt. rend.* **221**, 293-4 (1945); *Bull. soc. chim.* **1946**, 94-8.—*C.A.* **40**, 3323^9, 5977^1.

The adsorption on Al_2O_3 of benzophenone or anthracene dissolved in the following solvents was studied: hexane, benzene, Et_2O, $CHCl_3$, ethylene dichloride, 2-butanol, acetone, EtOH, and MeOH. The adsorption of binary mixts. of the solvents was also detd. The constituent of a binary or a ternary mixt. having the highest dielec. const. was most highly adsorbed. In binary mixts. that had one substance in common the adsorption of the constituent of higher dielec. const. varied as the abs. value of the difference of the dielec. consts.

4563. LAHIRI, A. **Chromatographic analysis of coal bitumen.** *Fuel* **24**, 66-73 (1945).—*C.A.* **39**, 3649^7.

The ext. was prepd. as a 10% soln. in $CHCl_3$ and the chromatogram was obtained on 115 × 3.5-cm columns of silica gel. Liquid chromatography was used and the columns were developed successively by petr. ether, petr. ether + 10% benzene, benzene, benzene + 5% EtOH, benzene + 20% MeOH, CS_2 satd. with MeOH, and a 1:1 mixt. of pyridine and CS_2 + 10% MeOH. The progress of development was observed by using a Hg discharge lamp and filter giving light at 365-400 mμ. Development yielded 20 zones and several of these were rechromatographed on magnesia or alumina columns with various solvents. The ultraviolet absorption spectra were given for 11 fractions.

4564. LAHIRI, A. AND MIKOLAJEWSKI, E. **Chromatographic separation of coal bitumens.** *Nature* **155**, 77-8 (1945).—*C.A.* **39**, 1748^1.

A high-pressure C_6H_6 ext. of coal was dissolved in C_6H_6 and chromatographed on silica gel. The chromatogram was developed by using the following 8 solvents in succeeding order: petr. ether, b. 60-80°C; petr. ether plus 10% C_6H_6; C_6H_6; C_6H_6 plus 1% EtOH; C_6H_6 plus 5% EtOH; C_6H_6 plus 20% MeOH; $CHCl_3$; and CS_2 satd. with MeOH. Fifteen different fractions were collected, sepn. being made on the basis of the color of the ultraviolet fluorescence of the percolate. Activated alumina and magnesia could also be used as adsorbents. Fuller's earth and floridin were not suitable, since they adsorbed too strongly.

4565. LEROSEN, ARTHUR L. **The characterization of silicic acid-Celite mixtures for chromatography.** *J. Am. Chem. Soc.* **67**, 1683-6 (1945).—*C.A.* **39**, 5156^8.

The terms evaluated were: S, V_c, R, and T_5, where S = length of adsorbent column contg. 1 unit vol. of solvent/length of unfilled tube required to contain the same vol. of solvent, V_c = rate of flow of the developing solvent through the column when a state of const. flow had been reached (mm/min.), R = rate of movement of the adsorbate zone (mm/min.)/rate of flow of the developing solvent (V_c), T_5 = the time in sec. required for a solvent to penetrate 50 mm into an initially dry column (9 × 75 ± 2mm) under a vacuum given by the water pump.

4566. LEVY, A. L. **A rapid and convenient method of filling chromatograph columns.** *Chemistry and Industry* **1945**, 380.—*C.A.* **40**, 1080^1.

The adsorbent and the solvent were placed in a separatory funnel equipped with a stirrer. The mixt. was allowed to flow through the top into the clean, dry column.

4567. LEW, B. W.; WOLFROM, M. L., AND GOEPP, R. MAX, JR. **Chromatography of carbohydrates and some related compounds.** *J. Am. Chem. Soc.* **67**, 1865 (1945).—*C.A.* **40**, 65^6.

Chromatography of carbohydrates and related poly-HO compds. on adsorptive clays was described; alcs., ethers, dioxane, ketones, acids, pyridine, and H_2O, alone or in admixt., were used as developers. The sepn. of D-glucose or D-mannitol and sorbitol; D-mannitol and dulcitol; 1, 4, 3, 6-dianhydrosorbitol, -D-mannitol, and -L-iditol; the detn. of the rate of lactonization of D-gluconic acid; and the isolation of ascorbic acid from lemon juice were given.

4568. MAIR, BEVERIDGE J. **Separation and determination of aromatic and mono-olefin hydrocarbons in mixtures with paraffins and naphthenes by adsorption.** *J. Research Natl. Bur. Standards* **34**, 435-51 (1945).—*C.A.* **39**, 4028^5.

The mixture was introduced into the top of a column of silica gel. When the sample was adsorbed, a desorbing liquid, such as EtOH, was added and pressure applied. This forced the hydrocarbons down the column where fractionation by adsorption occurred. The components of the sample issued from the bottom of the column in the order paraffins and naphthenes, mono-olefins, aromatics, and then desorber.

4569. McNEELY, W. H.; BINKLEY, W. W., AND WOLFROM, M. L. **Separation of sugar acetates by chromatography.** *J. Am. Chem. Soc.* **67**, 527-9 (1945).—*C.A.* **39**, 2492^4.

The chromatographic brush method of Zechmeister was applied successfully to the sepn. of well-characterized sugar acetates. Magnesol (synthetic hydrated $2MgO.5SiO_2$) was chosen as the most versatile adsorbent. The brush reagent streak on the extruded column reacted with the invisible zones at a rate characteristic of the compd. forming the zone.

4570. MEUNIER, PAUL. **Chromatography and mesomerism. The relation of the color of halochromism to (chemical) constitution in the group of carotenoids and vitamin D.** *Compt. rend.* **221**, 64-6 (1945).—*C.A.* **40**, 1715^7.

In the case of vitamin A_2 (absorption max. 639 mμ) complete rupture of the mol. was assumed, the ring being already open, when reacting with $SbCl_3$. The colors appearing in the course of ionizing adsorptions proved that all or part of the system of conjugated double bonds was free to oscillate and consequently not bound to the adsorbent.

4571. MICHAELIS, L. AND GRANICK, S. **Metachromasy of basic dyestuffs.** *J. Am. Chem. Soc.* **67**, 1212-19 (1945).—*C.A.* **39**, 3990^3.

The variability of color of an adsorbed dye was discussed as depending on the nature of the stainable substrate at which it was adsorbed. Absorption-spectra data were given for methylene blue, toluidine blue, oxonine, capri blue, crystal violet, fuchsin, malachite green, methylene blue, phenosafranine, and thionine in solvents and when adsorbed. As a model for a substrate stainable in the normal color a 3% soln. of nucleic acid at pH 4.6 was chosen; as a model for a substrate stainable in the metachromatic color a soln. or gel of agar at pH 4.6 was chosen.

4572. MITRA, B. N. AND SRINIVASAN, M. **Application of chromatography to explosives.** *J. Sci. Ind. Research* (India) **3**, 300-1 (1945).—*C.A.* **39**, 2879^2.

Impure styphnic acid was dissolved in C_6H_6 and adsorbed on talc or kaolin (which had been pretreated with dil. acid, washed, and dried). Red impurities were at the top, and (yellow) styphnic acid at the bottom. Impure T.N.T. was dissolved in toluene and adsorbed on talc. The filtrate contained T.N.T.; the adsorbate was probably D.N.T. with some T.N.T. M.N.T. was dissolved in toluene and adsorbed on anhyd. Na_2CO_3.

4573. OFFORD, A. C. AND WEISS, JOSEPH. **Chromatography of two solutes.** *Nature* **155**, 725-6; **156**, 570-1 (1945).—*C.A.* **39**, 4786^6; **40**, 1080^2.

The conclusions were in complete disagreement with the fundamental equation from which their results were derived, and were not compatible with exptl. results.

4574. REIMERS, F. **Chromatographic analysis of alkaloid salts. II.** *Dansk Tids. Farm.* **19**, 166-73 (1945).—*C.A.* **39**, 5405^9.

The chromatographic method was applied to the analysis of eucodal, nupercaine, and pantocain. Hyoscyamine-HBr and dicodid could not be analyzed chromatographically; the former because the acid residue was not bound completely in the column, the latter because the base washed out too slowly.

4575. WALKER, F. T. **The segregation of linseed-oil glycerides by chromatography.** *J. Oil Colour Chem. Assoc.* **28**, 119-34 (1945).—*C.A.* **39**, 5090^5.

A soln. of 2.5-3.0 g of linseed oil in 50 ml of *n*-hexane was passed through an absorption column (dimensions 8 in. × 1½ in.) contg. finely divided Al_2O_3, at the rate of approx. 200 ml per hr. The chromatogram was allowed to develop by percolating an addnl. 300 ml of *n*-hexane through the column at the same rate. The thin colored layer at the top was removed, the remainder of the column was divided into 1/2-in. sections and the oil removed by dissolving in a mixt. of equal parts of Et_2O and acetone.

4576. WALTER, JOHN E. **Rate-dependent chromatographic adsorption.** *J. Chem. Phys.* **13**, 332-6 (1945).—*C.A.* **39**, 4539^3.

The process of chromatographic adsorption was studied from the kinetic viewpoint, assuming a bimol. reaction between adsorbent and solute. Boundaries characteristic of equil. adsorption were obtained only if the time of passage of the soln. through the colnmn was greater than the half-life of the reaction by a factor of at least 100.

4577. WILLIAMS, T. I. **Chromatography.** *School Sci. Rev.* **26**, 154-61 (1945).—*C.A.* **39**, 3709^7.

Brief review of methods and applicable materials, with suggestions for class use.

4578. BERGDOLL, M. S. AND DOTY, D. M. **Chromatography in the separation and determination of the basic amino acids.** *Ind. Eng. Chem., Anal. Ed.* **18**, 600-3 (1946).—*C.A.* **41**, 56*a*.

A single adsorbent mixt. of 1 part of Lloyd's reagent and 2 parts of Hyflo Super Cel was used in the sepn. of lysine, histidine, and arginine. All of the amino acids were adsorbed, but all non-basic amino acids could be eluted with 0.5 *N* HCl, except cystine which must be converted into cysteine by reduction with Zn prior to the chromatographic sepn. Lysine could be eluted with 1*N* HCl, histidine with 0.125 *M* $NaHCO_3$, and arginine with pyridine.

4579. BINKLEY, W. W. AND WOLFROM, M. L. **Chromatographic isolation of cane-juice constituents.** *J. Am. Chem. Soc.* **68**, 1720-1 (1946).—*C.A.* **40**, 6855^6.

Normal La. cane-juice solids (5.8 g) were prepd. by ice sublimation and acetylated with Ac_2O and $ZnCl_2$ at -15° to -10°C for 3 hrs. The mixt. was allowed to warm to room temp. during 18 hrs; there resulted 3.2 g unreacted solids and 4 g of a viscous yellow sirup; 2 g of the sirup in 25 cc.

C_6H_6 was passed through a mixt. (170 g) of 5 parts of Magnesol and 1 part Celite; products identified were D-glucose (as pentaacetate), D-fructose (as tetraacetate), and sucrose (as octaacetate).

4580. Brockmann, Hans and Volpers, Fritz. **Method for chromatographic separation of colorless substances.** *Naturwissenschaften* **33,** 58 (1946).—*C.A.* **41,** 7200*a*.

Colorless adsorbed material was made visible by using a fluorescent adsorbent, such as Al_2O_3 with small amts. of heavy metal, or better with morine (also good for $CaCO_3$ or MgO). For SiO_2 adsorption small amts. of berberine were used. Ultraviolet light showed lighter and darker bands depending on the adsorbate.

4581. Claesson, Stig. **A study of the adsorption of normal, branched, and unsaturated fat acids and related compounds by means of adsorption analysis.** *Rec. trav. chim.* **65,** 571-5 (1946). (in English).—*C.A.* **41,** 1907*h*.

Flowing chromatography was used as an analytical technique for investigating fat acid mixts. A special silica prepd. by heating Merck's product at 800°C for 15 min. adsorbed all unbranched satd. fat acids from heptane to the same extent, regardless of mol. wt. Branched acids were adsorbed less than unbranched; unsatd. acids were adsorbed more than satd. The same rules were valid for the Me esters.

4582. Claesson, Stig. **Mathematical characteristics of adsorption isotherms in frontal analysis of several solutes.** *Arkiv Kemi, Mineral. Geol.* **A24,** No. 7, 7 pp. (1946) (in English).—*C.A.* **41,** 6834*f*.

When the equation for the isotherm was written $f_i(c_1, c_2, \ldots. c_n) = k_i c_i r(c_1, c_2, \ldots. c_n)$, where c_i was the concn. of the solute i in the presence of other solutes $1, 2, \ldots. i-1, i+1 \ldots. n$, k_1 was a const. which was characteristic for substance i, and $r(c_1, c_2 \ldots. c_n)$ was an arbitrary function, the validity of the formulas was greater than was suspected. The significance of the *displacement factor* r $(c_1, c_2 \ldots. c_n)$ was discussed.

4583. Claesson, Stig. **Studies on adsorption and adsorption analysis with special reference to homologous series.** *Arkiv. Kemi, Mineral, Geol.* **23A,** No. 1, 133 pp. (1946) (in English).—*C.A.* **40,** 3665^{6}.

The following homologous series were especially investigated, and phys. and chem. data presented in tables and graphs: fatty acids, ethyl esters of fatty acids, dibasic acids, and alcs. Frontal analysis was found to be the best method for analyzing compds. with long C chains, whereas displacement development was particularly selective for gases and vapors.

4584. Craig, Lyman C.; Golumbic, Calvin; Mighton, Harold, and Titus, Elwood. **Identification of small amounts of organic compounds by distribution studies. IV. Use of a solid phase.** *Science* **103,** 587-9 (1946).—*C.A.* **40,** 4581^{7}.

Solns. of 10 mg chrysene and 15 mg anthracene in 20 cc. cyclohexane (both pure and mixed) were shaken with Brockmann's alumina. A series of 10 tubes each contained 0.7 g alumina. The soln. was shaken 2 min. in the first tube, decanted into the second, shaken, and so on through the series. This was followed by 20 cc. cyclohexane, and the process repeated until all the tubes were filled. The data showed that a solid phase can be substituted directly for one of the liquid phases. The advantages are those common to chromatography.

4585. Cropper, F. R. **Some applications of chromatographic analysis in industry.** *Analyst* **71,** 263-5 (1946).—*C.A.* **40,** 4971^{9}.

An account of the practical use of chromatography in an industrial analytical lab.

4586. Georges, L. W.; Bower, R. S., and Wolfrom, M. L. **Chromatography of sugars and their derivatives.** *J. Am. Chem. Soc.* **68,** 2169-71 (1946).—*C.A.* **41,** 717*e*.

The suitability of a synthetic, hydrated Ca acid silicate (Silene EF) for the chromatography of sugars and their derivs. (alcs., glycosides, acetates, and Me ethers) was demonstrated. The streak (toward the alk. $KMnO_4$ indicator employed) and extrusive properties of this adsorbent were especially favorable. A table of adsorption series was given and the sepn. of mixts. of sugars and sugar alcs. illustrated.

4587. Glückauf, E. **Theory of chromatography.** *Proc. Roy. Soc.* (London) **A186,** 35-57 (1946).—*C.A.* **40,** 6932^{2}.

Chromatographic sepn. for 2 solutes, the adsorption of which followed a Langmuir isotherm, was analysed. Development of the bands, both with pure solvent and with a solvent contg. another solute, was discussed. Very simple conditions hold for both the vol. of solvent and the amt. of adsorbent required for complete sepn. of the 2 solutes. For substances difficult to sep., the min. amt. of adsorbent X_o (in g) was proportional to the quantities to be sepd. $(m_1 + m_2)$ (in mol.) and inversely to the satn. capacity of the adsorbent $(1/\beta)$ (in mol./g adsorbent) and to the square of the relative difference of the adsorption coeffs. (a_1 and a_2) of the solutes $X_o = \text{approx.}\ \beta(m_1+m_2)/[(a_2/a_1)-1]^2$.

4588. Gullstrom, D. K.; Burchfield, H. P., and Judy, J. N. **Chromatographic resolution of the quinone oximes.** *Ind. Eng. Chem., Anal. Ed.* **18,** 613-16 (1946).—*C.A.* **41,** 56*f*.

The isomeric quinone dioximes were adsorbed from acetone on columns of activated alumina in the order of their dipole moments, the *o*-isomer formed an upper orange band, the *p*-isomer a lower yellow band. The *o*-monoxime was adsorbed above the *o*-dioxime as a red band and the *p*-monoxime between the dioximes as a green band, probably as *p*-nitrophenol. Chromatographic adsorption was useful in the sepn. of *p*-monoxime from *p*-isomer and products of side reactions which took place during the nitration of phenol and oximation.

4589. Harris, Roberta and Wick, Arne N. **Preparation of silica gel for chromatography.** *Ind. Eng. Chem., Anal. Ed.* **18,** 276 (1946).—*C.A.* **40,** 3665^{5}.

A detailed procedure was given for the prepn. of silica gel suitable for partition chromatography. Material prepd. by this method was used in the isolation of pure penicillin.

4590. Korenman, I. M. and Kraĭnova, Z. V. **Micro chromatographic detection of cadmium.** *J. Applied Chem.* (U.S.S.R.) **19**, 604-(1946) (in Russian).—*C.A.* **41**, 2347*h*.

The soln. to be tested was treated with excess KCN, and passed over a column of activated silica gel; only $K_2Cd(CN)_4$ and $KAg(CN)_2$ were adsorbed among the complex cyanides which were decomposable by $(NH_4)_2S$. Elution of the column by KI soln. led to partial sepn. of the 2 salts; the development was done by $(NH_4)_2S$ soln. In the presence of Cd and Ag the color was orange, while Ag in absence of Cd gave black to gray color.

4591. Lew, B. W.; Wolfrom, M. L., and Goepp, R. Max, Jr. **Chromatography of sugar and related polyhydroxy compounds.** *J. Am. Chem. Soc.* **68**, 1449-53 (1946).—*C.A.* **40**, 7168⁸.

A chromatographic adsorption series (7 classes) of carbohydrates and some related substances were given in tabular form, the compds. being arranged in decreasing order of adsorptive strength.

4592. Lindner, R. **The separation of barium from radium by radiometric adsorption analysis.** *Naturwissenschaften* **33**, 119-21 (1946).—*C.A.* **41**, 7250*f*.

Ra and Ba could readily be sepd. by chromatographic adsorption on Al_2O_3 with radiometric detn. of activity. On elution of prepns. a few days old it was found that about 50% of the Rn remained on the alumina column. This was due to a "rebound" effect of the Rn formed from adsorbed Ra. A similar effect was found on adsorbing radioactive Pb (ThB); it could be desorbed only with great difficulty.

4593. Lindner, Roland and Peter, Otto. **Separation of radioactive yttrium earths in an adsorption column (radiometric adsorption analysis).** *Z. Naturforsch* **1**, 67-70 (1946).—*C.A.* **41**, 2349*b*.

A soln. of the yttrium earths was neutron-irradiated and adsorbed in an Al_2O_3 column. The chromatographic analysis was made by measuring the radioactivity throughout the column.

4594. Roberts, John D. and Green, Charlotte. **Separation of 2, 4-dinitrophenylhydrazones by chromatographic adsorption.** *Ind. Eng. Chem., Anal. Ed.* **18**, 335 (1946).—*C.A.* **40**, 3700⁵.

By means of Merck's silicic acid mixed with Super Cel in a 2:1 ratio, solns. of 2, 4-dinitrophenylhydrazine and its derivs. with acetaldehyde, propionaldehyde, acetone, and Me Et ketone could be sepd. satisfactorily. Each of these derivs. could be sepd. from mixts. with the others and with 2, 4-dinitrophenylhydrazine (strongly adsorbed) except for the hydrazone of acetone which could not be sepd. from that of propionaldehyde.

4595. Ruiz, Saenz Lascaño. **The analytical separation of a mixture of synthetic dyes. An application of the chromatographic method. I.** *Ind. parfum.* **1**, 187-91 (1946).—*C.A.* **42**, 5675*c*.

The chromatographic sepn. of various dyes in binary and ternary mixts. in both aq. and alc. soln. was studied on alumina. Since this was of basic character, it adsorbed best compds. with acid groups. Tartrazine O which contained 2 sulfone groups and one carboxylic group was adsorbed more strongly than the chemically related Pyrazolone Yellow J.

4596. Ruiz, Saenz, Lascaño; Chovin, P., and Moureu, H. **Relation between the structure and adsorbability of certain synthetic dyes. I.** *Bull. soc. chim.* 1946, 592-4.—*C.A.* **41**, 2901*i*.

Tartrazine O (azo deriv. of pyrazolone, contg. SO_3Na and COOH groups) was more strongly adsorbed on alumina than Flavazine L (contg. H and CH_3 in corresponding positions). Among 4 monoazo oranges, 2 sulfonated aminoazos, being less acid, were less adsorbed than 2 sulfonated hydroxyazos; the o-hydroxyazo deriv. of 2-naphthol was more adsorbed than the p-hydroxyazo deriv. of 1-naphthol.

4597. Schmah, Hans. **Preparation, alkaline properties, aging, and solubility of extremely pure aluminum hydroxide and application in chromatography.** *Z. Naturforsch* **1**, 322-3 (1946).—*C.A.* **41**, 5359*f*.

$Al(OH)_3$ gel was prepd. from Al ethylate and had an alk. surface reaction. It adsorbed KCl, $KClO_4$, or K_2SO_4 from neutral solns. to a pH of 8.5 to 9.5 depending on the method of prepn., relative amts. of adsorbent, and concn. of the adsorbate.

4598. Strain, Harold H. **Conditions affecting the sequence of organic compounds in Tswett adsorption columns.** *Ind. Eng. Chem., Anal. Ed.* **18**, 605-9 (1946).—*C.A.* **41**, 20*c*.

Variations of the adsorption sequence of 2 or more solutes were observed as a result of a change in solvents, concn. of solvents, adsorbents, temp., and H-ion concn. A mixt. of 2 chlorophylls and 2 xanthophylls yielded as many as 6 of the 24 possible sequences. The effect of the above variables on the adsorption sequence was demonstrated for mixts. of 2 to 4 solutes. Various pigments were used.

4599. Wilkes, John E. **High-speed filter for chromatographic analysis.** *Ind. Eng. Chem., Anal. Ed.* **18**, 329-30 (1946).—*C.A.* **40**, 3653³.

Considerable time was saved if Celite No. 545 was used in place of Hyflo Super Cel. Expts. with small quantities of riboflavin showed that the results of this substitution were satisfactory.

4600. Bendall, J. R.; Partridge, S. M., and Westall, R. G. **Displacement chromatography on cation-exchange materials.** *Nature* **160**, 374-5 (1947).—*C.A.* **42**, 435*b*.

Tiselius' "displacement development" modification of the chromatographic method was successfully applied to the sepn. of bases and amino acids. A mixt. of 3.0 millimols. of glycine and 3.4 millimols. of creatinine in 20 ml H_2O was adsorbed on a column of Zeo-Karb 215, and then developed with 0.043 *M* NH_4OH; glycine was displaced first, and emerged from the column before creatinine.

4601. Beyaert, M. and Cornand, P. **Extraction of the α and β acids of hops or lupulin.** *Congr. intern. inds. fermentation, Confs. et communs.* **1947**, 236-78.—*C.A.* **42**, 7927*b*.

Hops (or lupulin) were extd. with MeOH. The ext. was evapd. at reduced pressure and the residue extd. with petr. ether. The ext. was again evapd. and the residue treated with benzene. From this soln. the highly colored impurities were chromatographed on silica gel. The elutriate was evapd. and dissocd. in MeOH. Humulon (α acid) was pptd. with $Pb(OAc)_2$. The humulate was decompd. with H_2SO_4, and Humulon (α acid) extd. with petr. ether.

4602. BROCKMANN, HANS AND VOLPERS, FRITZ. **Chromatographic adsorption. II. A new process for the separation of colorless substances.** *Chem. Ber.* **80**, 77-82 (1947).—*C.A.* **41**, 3071*a*.

Pentamethoxyflavone on Al_2O_3, a fluorescent substance, did not react with the compds. to be adsorbed and was not removed in the elution process. Small amts. imparted to the Al_2O_3 a magnificent yellow fluorescence. Diphenylfluorindinesulfonic acid and salicylic acid also imparted a red and a blue fluorescence, resp., to Al_2O_3.

4603. CLAESSON, STIG. **A new method for the observation of zones of colorless substances on a chromatographic column.** *Nature* **159**, 708 (1947).—*C.A.* **41**, 5359*i*.

The zones could be detected on the column by observing the changes in *n* of the soln. in contact with the particles of the adsorbent. The tube was made by clamping 2 glass windows against a U-shaped metal plate. One window was rather thick and had polished edges. If the adsorbent was observed at the proper angle from a suitable distance (about 1 m), boundaries of the zones could be seen. The sensitivity was improved by using monochromatic light. In paper chromatography, the paper was placed under the glass.

4604. CLAESSON, STIG. **Some arrangements for adsorption analysis with large amounts of substances.** *Arkiv Kemi, Mineral. Geol* **A24**, No. 16, 9 pp. (1947).—*C.A.* **42**, 2539*b*.

It was found that the attachment of a filter with a small diam. to a larger one permitted a sharpening of the front. The shape of the front was not influenced when the vol. ratio did not exceed 5. An app. with 3 sections, each of 50 mm height and diam. of 10, 20, and 40 mm, showed a sharp front and permitted sepn. of mixts. of sucrose and raffinose or glucose, developed with 4% phenol soln. With a triple filter, and 100g of adsorbent, 2 to 10 g of pure substance can be sepd. from a mixt.

4605. COATES, J. I. AND GLÜCKAUF, E. **Theory of chromatography. III. Experimental separation of two solutes and comparison with theory.** *J. Chem. Soc.* **1947**, 1308-14.—*C.A.* **42**, 2490*d*.

Values calcd. from a chromatogram agreed with the calcns. for the Langmuir isotherm for mixts. of Cu and Mn ions on acid Zeo-Karb under the conditions: (1) the sum of the concns. of Cu and Mn be less than the H-ion concn.; (2) the total ionic concn. be less than 1 milliequiv. per cc.

4606. DUBRISAY, RENE. **Applications of chromatography to the separation of noble metals.** *Compt. rend.* **225**, 300-2 (1947).—*C.A.* **42**, 2204*a*.

If a dil. soln. contg. $AgNO_3$ or a salt of a salt of a noble metal was slowly poured through a glass tube contg. a known wt of finely powd. carbon, metallic Ag and noble metal collected in the upper part of the tube. After washing, drying, and weighing, the Ag could be dissolved in dil. HNO_3 and the noble metal by a suitable solvent. The nature and structure of suitable carbon, the most favorable temp., and the rate at which the soln. was added were discussed.

4607. GLÜCKAUF, E. **Adsorption isotherms from chromatographic measurements.** *Nature* **160**, 301 (1947).—*C.A.* **42**, 4020*a*.

A simplification was made of the method previously described for strongly colored solutes. The complete isotherm was detd. within ±1% without a single concn. measurement.

4608. GLÜCKAUF, E. **Theory of chromatography. II. Chromatograms of a single solute.** *J. Chem. Soc.* **1947**, 1302-8.—*C.A.* **42**, 2490*c*.

Equations were formulated for the development of a band for the relatively simple cases where the adsorption isotherm was concave or convex to the concn. axis, and for the sigmoid type of isotherm. The latter was calcd. from the elution curves with 0.25 *N* H_2SO_4 and $CuSO_4$ solns. on Zeo-Karb pretreated with a soln. of 0.14 *N* $CuSO_4$ and 0.11 *N* H_2SO_4. The isotherm agreed with the results from direct equil. measurements.

4609. GLÜCKAUF, E. AND COATES, J. I. **Theory of chromatography. IV. The influence on incomplete equilibrium on the front boundary of chromatograms and on the effectiveness of separation.** *J. Chem. Soc.* **1947**, 1315-21,—*C.A.* **42**, 2490*e*.

The effects of self-sharpening and of nonequil. on the final form of the front boundary were discussed and equations were derived. Curves were shown for the development of Mn and Cu bands from mixts. on Al_2O_3 by H_2SO_4 and of Cu and Co on Al_2O_3 by $MnSO_4$.

4610. GLÜCKAUF, E. **Theory of chromatography. V. Separation of two solutes following a Freundlich isotherm.** *J. Chem. Soc.* **1947**, 1321-9.—*C.A.* **42**, 2490*f*.

Equations were derived for the development of chromatograms for mixts. obeying the Freundlich adsorption isotherm and applied to available data for adsorption isotherms of succinic and oxalic acids on charcoal.

4611. GRACIAN Y TOUS, JAIME AND FIZARRO, AGUSTIN VIOQUE. **Separation of higher fatty acids by selective adsorption.** *Anales fis. y quim.* (Madrid) **42**, 109-22 (1947).—*C.A.* **41**, 5323*i*.

In chromatographic analysis of oleic and stearic acids, Al_2O_3 as adsorbent reacted chemically with the acids; this prevented adsorption and desorption. Silica gel was a satisfactory adsorbent.

4612. HOPF, PETER P. **Radial chromatography in industry.** *Ind. Eng. Chem.* **39**, 938-40 (1947).—*C.A.* **41**, 7167*a*.

Chromatographic adsorption could be accomplished by allowing the soln. to flow radially through an adsorbent. The flow could be assisted by rotating the cylinder contg. the adsorbent in a manner similar to a centrifuge.

4613. HULTIN, ESKI AND NORDSTRÖM, LENNART. **Adsorption analysis of some methylated carbohydrates.** *Svensk Kem. Tid.* 59, 19-21 (1947). (in English).—*C.A.* **41**, 3017*f*.

It was possible by frontal adsorption analysis to det. the different Me derivs. of glucose present in the hydrolyzate of methylated carbohydrates.

4614. LENNARTZ, H. J. **The solvent series for chromatographic adsorption analysis.** *Angew. Chem.* **A59**, 158-9 (1947).—*C.A.* **42**, 4020*b*.

The position of CS_2 in the series was established in expts. with other solvents as follows: petroleum ether, CS_2, CCl_4, C_2HCl_3, and benzene.

4615. LEROSEN, ARTHUR L. **Rate of movement of a chromatographic zone as a function of column position, initial concentration, and initial volume.** *J. Am. Chem. Soc.* **69**, 87-90 (1947).—*C.A.* **41**, 2304*c*.

The system silicic acid-benzene-*o*-nitroaniline was studied. The ratio *R* of the displacement of the zone of adsorbed material to the displacement of the developing solvent in the column was detd. for the leading and trailing edges of the zone. For the leading edge *R* was found to be independent of the column position and to vary with the initial concn. c_0 and to a less extent with the initial vol. v_0.

4616. LEROSEN, ARTHUR L. **Standardization of chromatographic adsorbents. Rate of flow of developing solvent.** *Anal. Chem.* **19**, 189-90 (1947).—*C.A.* **41**, 2958*i*.

In order to est. the usefulness of an adsorbent in columns of different dimensions and with a variety of solvents and pressures, a more general term was needed. A value, V_c, for a standard degree of packing, was proposed and its values for all conditions could be calcd. Results of expts. with silicic acid and lime as adsorbents and benzene and ligroin as solvents were within 10% of the calcd. values.

4617. LINDNER, ROLAND. **Radiometric adsorption analysis and its application to problems of nuclear physics.** *Z. Naturforsch.* **2a**, 333-4 (1947).—*C.A.* **42**, 2865*d*.

Chromatography on Al_2O_3 was recommended as a general sepn. method for radioactive elements. From Ba-Ra mixts., 80-90% of the Ba could be obtained free of Ra; from La-Pr mixts., 40% of the La was obtained pure.

4618. LINDNER, ROLAND. **Separation by adsorption of the cerium group of rare earths; in particular, their isotopes formed in uranium fission.** *Z. Naturforsch.* **2a**, 329-32 (1947).—*C.A.* **42**, 2865*c*.

Partial sepn. of rare earths from neutral soln. was obtained by an Al_2O_3 chromatographic column. A rare-earth activity of 13-d. half-life, from U fission, was sepd. from activities obtained by irradiation of rare earths and known to be assignable to La, Ce, Sm, and element 61. The 13-d. activity was assigned to Pr.

4619. LYANDA-GELLER, B. A. **Application of chromatographic adsorption to purification of penicillin.** *Mikro-biologiya* **16**, 61-5 (1947).—*C.A.* **42**, 9092*a*.

Chromatographic adsorption of pencillin from soln. in AmOAc on a column of silica gel (pretreated with $Ba(OH)_2$ soln.) yielded colored adsorption zones. In one the concn. of pencillin was several times larger than in the original soln. Bio-essays of successive zones showed that antibiotic activity of the eluate varied directly with N content, which was 0.51 to 2.54% in the AmOAc solns.

4620. MARTIN, A. J. P. **The principles of chromatography.** *Endeavour* **6**, 21-8 (1947).—*C.A.* **41**, 3677*f*.

Theory of chromatography was surveyed. Numerous examples were given, with colored illustrations, and partition chromatograms discussed.

4621. NEUWORTH, MARTIN B. **Chemical nature of coal hydrogenation products. I. Initial resolution by chromatography on alumina.** *J. Am. Chem. Soc.* **69**, 1653-7 (1947).—*C.A.* **41**, 6868*i*.

Ground coal was mixed with oxide catalyst and hydrogenated at 375°C and 1800 p.s.i. The volatile products distd. into a cooled trap, and were sepd. into 4 fractions by chromatography.

4622. POLSON, A.; MOSLEY, V. M., AND WYCKOFF, RALPH W. G. **The quantitative chromatography of silk hydrolyzate.** *Science* **105**, 603-4 (1947).—*C.A.* **41**, 5559*i*.

Partition chromatography based on differences of rates of flow in pairs of solvents showed the presence of eight amino acids in silk hydrolyzates. Quant. estns. were made by comparing color upon addn. of ninhydrin of standard and unknown amino acid concns.

4623. ROBINSON, G. **Some applications of inorganic chromatography.** *Metallurgia* **37**, 45-7, 107-8 (1947).—*C.A.* **42**, 2204*c*.

The method was used to det. the variation of Zn in a brazing alloy during branzing. A soln. of the alloy and standard Zn, Cu, and Ni solns. were passed through 8-hydroxyquinoline columns and banding occurred in the order, Cu (green), Ni (yellow), and Zn (yellow). Some inert material such as starch, kieselguhr, $BaSO_4$, SiO_2 gel had to be mixed with the reagent. Only the Zn complex was fluorescent in ultraviolet light. In detg. Zn loss in brazing, a chromatograph of a soln. of the original metal was compared with solns. of the brazing material during the process.

4624. SEASE, JOHN W. **Use of a fluorescent adsorbent for the chromatography of colorless compounds.** *J. Am. Chem. Soc.* **69**, 2242-4 (1947).—*C.A.* **42**, 147*a*.

By the use of a silica gel contg. a small quantity of fluorescent ZnS, the following order was found for decreasing adsorption affinity when developed with petr. ether: PhCH:CHCHO, xanthone, $p\text{-}O_2NC_6H_4CH_2Br$, $o\text{-}HOC_6H_4CHO$, azoxybenzene, $PhNO_2$, CHI_3.

4625. TISCHER, J. AND TOGEL, E. **The fluorescent chromatography of Perilla oil.** *Z. physiol. Chem.* **282**, 103-17 (1947).—*C.A.* **43**, 4031*i*.

Free fatty acids were removed from a benzene soln. of Perilla ocimoides seed oil by passage through Al_2O_3, followed by exact neutralization with alc. NaOH, followed by thorough washing.

The dried soln. was chromatographed through 7 Al_2O_3 columns. In ultraviolet light there were 6 zones. The zones blueish violet and dirty green were identified as mono- and diglycerides; yellowish bright blue, and di-and highly unsatd. triglycerides; deep blue and bright blue, triglycerides in increasing order of satn.; strongly iridescent yellowish silver grey; sterol esters; and colorless, waxes and carbohydrates.

4626. VELASCO, FERNANDO. **Methods of analysis by adsorption. Chromatography.** *Inform. quim. anal.* 1, No. 6, 125-34 (1947).—*C.A.* 43, 58*d*.
The methods were described with discussion, and the effects of the variables were discussed.

4627. AEPLI, OTTO T.; MUNTER, PAUL A., AND GALL, JOHN F. **Determination of γ-benzene hexachloride by partition chromatography.** *Anal. Chem.* 20, 610-13 (1948).—*C.A.* 42, 6981*f*.
The partition solvents were nitromethane and *n*-hexane; the supporting medium was silicic acid. Take 0.2-0.3 g of triturated sample and heat to boiling with 25 ml of mobile solvent (*n*-hexane satd. with $MeNO_2$). Stopper and shake 5 min. and decant through a Buchner funnel into a Kohlrausch flask. Repeat the extn. with 10-ml more of mobile solvent. Wash the residue and flask with five 10-ml portions of the same solvent. Make up to 100 ml in the K. flask and use 25 ml to prep. the chromatogram. Carefully run through silicic acid at the top of the column and wash down with 100 ml of the solvent and collect about 10-ml in the fraction collector at the bottom of the tube.

4628. APPLEZWEIG, NORMAN. **Ion-exchange adsorbents as laboratory tools.** *Ann. N. Y. Acad. Sci.* 49, 295-314 (1948).—*C.A.* 42, 5300*h*.
The use of ion-exchangers were reviewed, with suggestions for their application in chromatography.

4629. BASU, A. N. AND GLENN, R. A. **Chemical nature of coal hydrogenation product. II. Progress in further chromatography of primary coal hydrogenation products on silica gel.** *Fuel*, 27, No. 3, 96-9 (1948).—*C.A.* 42, 9116*a*.
The bands obtained by Neuworth using chromatographic technique upon liquid coal hydrogenation products were resolved further by re-chromatographing on silica gel. Acetylable compds. were concd. in the most strongly adsorbed fractions, whereas the O and N compds. were distributed throughout the column.

4630. BRADFIELD, A. E. AND PENNEY, M. **Catechins of green tea. II.** *J. Chem. Soc.* 1948, 2249-54.—*C.A.* 43, 3394*a*.
By rechromatographing previous fraction on a series of columns contg. silica (sepd. from a fine fraction by sedimentation in H_2O), using ether and a mixt. of AcOEt and CCl_4 as solvents, the following components were sepd: (-)-eqicatechin gallate, (±)-catechin, and (-)-gallocatechin gallate.

4631. CLAESSON, STIG. **Frontal analysis and displacement development in chromatography.** *Ann. N. Y. Acad. Sci.* 49, 183-203 (1948).—*C.A.* 42, 5300*d*.
The work of Tiselius and his coworkers was described.

4632. DEITZ, VICTOR R. **Surface Areas of some solid adsorbents of possible use in chromatography.** *Ann. N. Y. Acad. Sci.* 49, 315-23 (1948).—*C.A.* 42, 5300*e*.
The com. solid adsorbents available in the U. S. were listed with their surface areas, and densities.

4633. DERBY, JAMES V. JR. AND DEWITT, JAMES B. **Comparison of methods for the determination of carotene.** *J. Assoc. Offic. Agr. Chemists* 31, 704-8 (1948).—*C.A.* 43, 6948*d*.
The prepd. exts. of carotene were chromatographed and the optical d. of the purified pigments were measured between 400 and 500 mμ. On the basis of the ratios of various extinction coeffs. and the extinction coeff. at 450 mμ the carotene content of dehydrated alfalfa meal by the modified A.O.A.C. method was 43% higher than the Wall and Kelley procedure; 34% higher than the alc. KOH method; and 13% higher than the sapon. modification of the A.O.A.C. method.

4634. DIEMAIR, W. AND NEU, H. **Adsorption of amino acids.** *Z. anal. Chem.* 128, 566-83 (1948).—*C.A.* 43, 3746*c*.
Expts. were described of the influence of the duration of hydrolysis (of milk albumin, rape seed, beechnut, and soya) upon the products formed, the sepn. of the amino acids in the protein hydrolyzates, the chromatographic adsorption of the various products, and the detn. of tryptophan and S present in org. combination. By means of activated charcoal (Carboaraffin C) followed by Floridin XXF "extra" and Filtrol-Neutrol a good quant. sepn. could be made.

4635. DUGAN, L. R. JR.; BEADLE, B. W., AND HENICK, A. S. **A chromatographic study of autoxidized methyl linoleate.** *J. Am. Oil. Chemists' Soc.* 25, 153-7 (1948).—*C.A.* 42, 6142*e*.
A 1-in. diam. column of Na-Al silicate was used as adsorbent for esters after being wetted with iso-octane. The esters were eluted in sections from the column by using 100 ml of ethanol and then made up to definite vol. and aliquots taken for spectrophotometric studies and detns. of peroxide content. The column adsorbed the greater portion of the oxygenated substances.

4636. DUPONT, G.; DULOU, R., AND VILKAS, M. **The preparation of alumina for chromatography.** *Bull soc. chim. France* 1948, 785-6.—*C.A.* 43, 1535*b*.
Tech. Al_2O_3 hydrate was converted to γ Al_2O_3 by calcining at 500°C for 1 hr. The calcine was soaked in concd. HCl for 2-3 hrs with occasional stirring. The mixt. was washed by decantation till the supernatant liquid clarified in 2-3 min. After washing to neutrality, the product was dried at 105°C.

4637. EDMAN, PEHR. **Technique for partition chromatography on starch.** *Acta. Chem. Scand.* 2, 592-6 (1948).—*C.A.* 43, 4036*i*.
The pretreatment of the starch, the prepn. of the column, and the operational procedure were given. An automatic cut collector was described.

4638. Fischer, Werner and Kulling, Achim. **Chromatography of electrolytes on aluminum oxide.** *Naturwissenschaften* 35, 283-4 (1948).—*C.A.* 44, 2820*e*.

The adsorption of ions on alumina was studied. With Na-contg. γ-alumina, the exchange of Na against other dissolved ions took place in equiv. amts. With Na-contg. or Na-free alumina, a 2nd type of adsorption took place in which both cations and anions were adsorbed from the soln. in equiv. amts.

4639. Fuks, N. A. and Chetverikova, L. S. **Use of partition chromatography in analytical chemistry. I. Analysis of hexachlorocyclohexane.** *Zhur. Anal. Khim.* 3, 220-5 (1948).—*C.A.* 43, 8978*g*.

Nitromethane was used as mobile solvent, isooctane as mobile solvent and specially prepd. silica gel for the column. Chromatography gave, after adsorption of the γ-isomer, 1% of a new product which proved to be a new isomer of heptachlorocyclohexane. Besides this, the α-, and δ-isomers were obtained.

4640. Fulda, W. **Preparation of pure alumina from solutions of bauxite in dilute NaOH.** *Metall* **1948**, 397-9.—*C.A.* 43, 9393*i*.

Air-dried, finely crushed (5000 mesh/cm^2) bauxite was dissolved in 8-15% NaOH soln. (8 g bauxite per liter soln. in 5 hrs at 200°C and 10-15 atm.) filtered at about 100°C, and pptd. by seeding with hydrated Al_2O_3 at an initial temp. near 100°C, and with const. stirring for 12 hrs.

4641. Galinovsky, F. and Vogl, O. **Chromatographic separation of epimeric alcohols.** *Monatsh.* 79, 325-6 (1948).—*C.A.* 43, 2894*f*.

A 20-cm tube 16 mm in diam. packed with Al_2O_3 was used. Mixts. of cholestanol and epicholestanol or of cholesterol and epicholesterol dissolved in benzene were sepd. A 1:1 benzine-genzene mixt. eluted the epiforms and the solutes with not more than one recrystn. gave correct m.ps. The Al_2O_3 was treated with ether in a Soxhlet extractor to remove the other compd. of each pair.

4642. Gapon, E. N. and Gapon, T. B. **Mechanism of the formation of chromatograms.** *Doklady Akad. Nauk S.S.S.R.* 60, 817-20 (1948).—*C.A.* 42, 8572*b*.

Chromatograms were classified as molecular, exchange, and pptn. A typical mol. chromatogram was the sepn. of EtOH and MePh vapors on active charcoal. Exchange chromatography was illustrated by the sepn. of Cu and Co^{++} (upper zone Cu^{++}) on permutites, bentonite clays, Ba aluminate, ZnO, Al_2O_3.

4643. Gapon, T. B. and Gapon, E. N. **Precipitation chromatography.** *Doklady Akad. Nauk S.S.S.R.* 60, 401-4 (1948).—*C.A.* 42, 6603*e*.

The method of pptn. chromatography used columns made up of a carrier (Al_2O_3, $Al(OH)_3$, SiO_2 gel, etc.) mixed with a pptg. reagent. The column could be used either dry or wet. The following examples were discussed: Dry column of SiO_2 gel with Na_2SiO_3 as precipitant, column of Al_2O_3 with KI as precipitant, columns of Al_2O_3 with Ag_2SO_4 and Al_2O_3 with NH_4CNS (1:9) as precipitants, and a wet column of Al_2O_3 with $FeCl_3$ as precipitant. The operation could be reversed, the mixt. of salts being poured in first, the soln. of the precipitant next; the chromatogram would form at some place in the columns.

4644. Gottlieb, Sidney. **Separation of tropic and atropic acids by partition chromatography.** *J. Am. Chem. Soc.* 70, 423 (1948).—*C.A.* 42, 2246*f*.

Tropic and atropic acids could be sepd. by passage of the $CHCl_3$ soln. through a column of silicic acid. Atropic acid, being more sol. in $CHCl_3$, moved rapidly through the column; tropic was found in the upper band.

4645. Hagdahl, Lennart. **Technical improvements in adsorption analysis.** *Acta. Chem. Scand.* 2, 574-82 (1948).—*C.A.* 43, 3264*f*.

The use of constriction pieces between units of coupled filters improved the sharpness and regularity of the fronts. With the Tiselius Claesson interferometer, "layering" in the cuvette caused a blurring of the fringes and consequently inconsistent results. This was eliminated by a mixer placed between the column and cuvette.

4646. Hellstrom, Nils. **Identification and determination of polycyclic hydrocarbons by ultraviolet absorption and chromatographic adsorption.** *Acta Chem. Scan.* 2, 319-32 (1948).—*C.A.* 43, 3182*f*.

Distn. of a highly refined tar lubricating oil from fir stumps gave a principal fraction which gave evidence of contg. hydrocarbons by C_6H_6 structure. Adsorption of the distd.. fraction+ added retene on Super-Filtrol from C_7H_{16} solvent (followed by frontal analysis and use of ultraviolet spectra) showed the types of hydrocarbons present and order of adsorption to be C_6H_6, $C_{10}H_8$ phenanthrenes (including the added retene). Addn. of both retene and phenanthrene in known amts. before adsorption and analysis of fractions showed that retention vols. could not be used to calc. compns. of the oils, partly because of too great a difference in adsorption of hydrocarbons of C_6H_6 structure and retene and partly because of indistinctness of the step characterizing $C_{10}H_8$ hydrocarbons.

4647. Hiester, Nevin K. and Vermeulen, Theodore. **Elution equations for adsorption and ion exchange in flow systems.** *J. Chem. Phys.* 16, 1087-9 (1948).—*C.A.* 43, 464*i*.

General kinetic equations were derived for the elution bell for any fractional extent of previous satn. Satn. and elution equations were also derived for cases involving more than one "memory" term.

4648. Hough, L.; Jones, J. K. N., and Wadman, W. H. **Application of paper partition chromatography to the separation of the sugars and their methylated derivatives on a column of powdered cellulose.** *Nature* 162, 448 (1948).—*C.A.* 43, 2542*b*.

In a tightly packed column (12 in. high and 1 1/4 in. diam) contg. Whatman ashless filter tablets rubbed through an 80-mesh sieve, 2- and 4-component mixts. of sugars were sepd. with individual recoveries of 95-100% when the components differed widely in R_G values. Butanol satd. with water contg. 1% NH_3 was used as the mobile phase.

The time for any particular sugar to emerge was proportional to its R_G value.

4649. Jones, Francis T. and Bickoff, E. M. **Crystalline characteristics of four carotene isomers.** *J. Assoc. Offic. Agr. Chemists* **31**, 776-81 (1948).—*C.A.* **43**, 6881*g*.

The isomers were prepd. from a com. product by chromatographic adsorption. All-trans-β-carotene was platy with tendency to cluster. All-trans-α-carotene crystals were similar. Neo-β-carotene B crystals grew only in spherulitic aggregates.

4650. Kamienski, B. **Dielectric theory of selective adsorption (chromatography).** *Bull. intern. acad. polon. sci., Classe sci. math. nat., Ser. A*, **1947**, 1-4 (1948) (in English).—*C.A.* **43**, 6883*a*.

The relative powers of adsorption of various materials from various solvents on common adsorbents were interpreted qualitatively on the basis of electrostatic attraction of dipoles.

4651. Kretovich, V. L. and Bundel, A. A. **Chromatographic determination of dicarboxylic amino acids in plants.** *Doklady Akad. Nauk S.S.S.R.* **61**, 861-4 (1948).—*C.A.* **43**, 3746*e*.

The plant material was inactivated by boiling EtOH and then extd. with H_2O; the ext. was passed over Al_2O_3 in a chromatographic column, pretreated with dil. HCl; after this elution was effected with 3 *N* KOH. Neutral (except cystine) and basic amino acids were not adsorbed in the acidic column. Cystine was retained, apparently due to formation of an insol. Al salt.

4652. Labruto, G. and D'Alcontres, G. Stagno. **Behavior of several double and complex salts with regard to chromatographic adsorption. II.** *Ann. chim. applicata* **38**, 320-5 (1948).—*C.A.* **44**, 1842*f*.

Solns. of KCN and $CuSO_4$ were mixed in proper proportions to form $K_3Cu(CN)_4$, and the mixt. was passed through a 42 × 2.3 cm column of activated charcoal. The filtrate contained no Cu^{++} or K^+, and only 0.6% of the CN^- taken; it contained all of the SO_4^{--}. When KCN and $CdCl_2$ solns. were mixed to form $K_2Cd(CN)_4$ and passed through the column, the filtrate contained no K^+ or Cd^{++}, but contained 2.6% of the CN^- and all of the Cl^-. All of the constituent ions of K_2HgI_4, $K_3Fe(CN)_6$, and $K_3Co(NO_2)_6$ were adsorbed by the column.

4653. Lennartz, H. J. **Chromatographic adsorption analysis of isomorphous mixtures.** *Z. anal. Chem.* **128**, 271-9 (1948).—*C.A.* **42**, 6199*f*.

Most hydrophilic adsorption agents could be easily tested with respect to their activity for true adsorption or addn. adsorption. The following adsorption agents were arranged in the order of diminishing activity: Al_2O_3, MgO, $CaSO_4$, CaO, talc, $Ca_3(PO_4)_2$, milk sugar. Many org. compds. could be sepd. by chromatography.

4654. Ovenston, T. C. J. **Chromatographic method for the identification and estimation of mineral jelly in propellant explosives.** *Analyst* **73**, 616-17 (1948).—*C.A.* **43**, 1979*i*.

Ext. 5 g of the ground or sliced propellant with Et_2O in the usual manner and remove the ether *in vacuo*. Ext. the residue insol. in Et_2O with 4 portions of light petroleum (b. 40-50°C), reduce the vol. of the exts. to about 25 ml, and pour into a chromatographic Al_2O_3 column. Wash the unadsorbed mineral jelly through the column with light petroleum with a vol. such that all of the other constituents remain adsorbed.

4655. Peterson, Merlin H. and Johnson, Marvin J. **The estimation of fatty acids of intermediate chain length by partition chromatography.** *J. Biol. Chem.* **174**, 775-89 (1948).—*C.A.* **42**, 8240*f*.

The higher fatty acids were removed by extn. of the aq. soln. with thiophene-free benezene followed by passage through a macro-chromatogram packed with Celite 545 moistened with 33 *N* H_2SO_4, the column being developed with benzene. Capric and the higher fatty acids passed through the column whereas caprylic and the lower acids were left on the column. Capric acid was sepd. by subsequent passage through a micro-chromatogram contg. 35 *N* H_2SO_4, the capric appearing as a sep. zone in the effluent. If the chromatogram was prepd. with 30.5 *N* H_2SO_4 as the nonmobile phase, caproic and caprylic acids appeared as a sep. zone in the effluent, while butyric and lower fatty acids remained on the column.

4656. Ramsey, L. L. **Separation of butyric and isobutyric acids by partition chromatography.** *J. Assoc. Offic. Agr. Chemists* **31**, 164 (1948).—*C.A.* **42**, 3704*g*.

The sepn. was made on a silicic acid column with water as the immobile solvent and $CHCl_3$ contg. a small percentage of *n*-BuOH as the mobile solvent. The sepn. was incomplete and the bands visibly overlapped. A single passage through the column detected a min. of about 10% isobutyric acid present in butyric acid as an impurity, and about 30% butyric added to isobutyric acid.

4657. Ramsey, L. L. and Patterson, W. I. **Separation and determination of the straight-chain saturated fatty acids C_5 to C_{10} by partition chromatography.** *J. Assoc. Offic. Agr. Chemists* **31**, 139-50 (1948).—*C.A.* **42**, 3704*d*.

The acids were sepd. on a column of silicic acid, with MeOH as the immobile solvent, 2, 2,4-trimethylpentane as the mobile solvent, and bromocresol green as indicator. The identification was confirmed by adding an approx. equal amt. of an authentic sample of the suspected acid and testing of the chromatographic homogeneity of the mixt. on a fresh column.

4658. Sacconi, Luigi. **Inorganic chromatographic adsorption.** *Gazz. chim. ital* **78**, 583-91 (1948).—*C.A.* **43**, 2542*a*.

Data were given contributing to a general systematic scheme of analysis, and attempting to explain the mechanism of chromatographic adsorption on Al_2O_3.

4659. Schikore, Werner and Muller, Ernest Gerhard. **Adsorptive purification in phosphorescence chemistry I.** *Z. anorg. Chem.* **255**, 327-30 (1948).—*C.A.* **43**, 1659*e*.

Ammoniacal $ZnSO_4$ was run through a column contg. Al_2O_3 pretreated with an alc. soln. of dimethylglyoxime (Ni) or α-nitroso β-naphthol (CO) or Al_2O_3 sandwiched about a layer of the solid reagent. Removal of traces of Fe from water glass used as an adhesive in prepg. a phosphorescent screen was carried out.

4660. SCHROEDER, W. A. **Some experiments in systematic quantitative chromatography.** *Am. N. Y. Acad. Sci.* **49**, 204-17 (1948).—*C.A.* **42**, 5371*d*.
The materials analyzed were propellants and explosives. Reagent silicic acid, prewashed with anhyd. solvents to increase its activity, proved the most suitable adsorbent. It was usually mixed with Celite 535 to raise the rate of filtration. "Double zoning" occurred frequently; i.e., when a presumably homogeneous compd. was chromatographed, it produced 2 well-sepd. zones which could not be distinguished by other than chromatographic methods, and each of which, when eluted and rechromatographed, again produced 2 zones.

4661. SEASE, JOHN W. **The use of fluorescent silica gel mixtures in the chromatography of colorless compounds.** *J. Am. Chem. Soc.* **70**, 3630-2 (1948).—*C.A.* **43**, 1711*d*.
Addn. of 2.5% Zn silicate to silica gel-2.5% ZnS adsorbing media increased the ultraviolet excitation range. Sepns. of 40 binary mixts. involving 25 compds. (mostly aldehydes, ketones, esters, and aromatic amines) were described.

4662. SHEMYAKIN, F. M. AND MITSELOVSKII, E. S. **Chromatographic separation of cations with the aid of o-hydroxyquinoline, β-naphthoquinoline, and cupferron.** *Zhur. Anal. Khim.* **3**, 349-53 (1948).—*C.A.* **43**, 8973*b*.
The *o*-hydroxyquinoline was used by itself, the others were mixed with potato starch in a ratio 1:1 by vol. A soln. contg. 2 cations in concns. of 0.05 *M* each was carefully percolated through the adsorber and the widening of adsorption bands with time was observed. The pairs of cations analyzed were: Cu-Fe, Cu-Ni, Cu-Co, Co-Ni, Ni-Fe, and Co-Fe. Only Co-Ni formed 2 distinct bands.

4663. SHEMYAKIN, F. M. AND MITSELOVSKII, E. S. **Kinetics of chromatographic separation of pairs of colored ions on aluminum oxide.** *Doklady Akad. Nauk S.S.S.R.* **61**, 289-92 (1948).—*C.A.* **42**, 8572*g*.
Sharp sepn. of various pairs of salts of Fe^{+++}, Fe^{++}, Cu^{++}, Ni^{++}, and Co^{++}, Cr^{+++}, was obtained in Al_2O_3 columns 65 mm high, 7 mm in diam. Essential conditions of sharp and uniform boundaries were homogeneity of the grain size of Al_2O_3, absence of air bubbles, good wettability and slow (dropwise) addn. of the soln. The rates of the progress of the front of the band with given ion pairs followed the law $x = X\ (1 - e^{-kt})$, where x = distance swept by the front of the band during the time t, X = limiting distance reached by the front at equil.

4664. STEIN, WILLIAM H. AND MOORE, STANFORD. **Chromatography of amino acids on starch columns. Separation of phenylalanine, leucine, isoleucine, methionine, tyrosine, and valine.** *J. Biol. Chem.* **176**, 337-65 (1948).—*C.A.* **43**, 2266*g*.
The effluent from chromatographic columns of potato starch was collected in regular series of small fractions of known vol., and amino acids were detd. by a quan. photometric ninhydrin method. The fully automatic fraction-collection machine was based on the interruption of a light beam by each drop of effluent. The first 6 amino acids emerging from the column (when the sample consisted of a known mixt. of 18 amino acids) could be made to appear as distinct peaks on the effluent curves and permitted quant. detn.

4665. THOMAS, HENRY C. **Chromatography: a problem in kinetics.** *Ann. N. Y. Acad. Sci.* **49**, 161-82 (1948).—*C.A.* **42**, 5300*g*.
A kinetic theory was proposed which led to a Langmuir-type isotherm at equil. The rate was assumed to be detd. by chem. effects alone and equal to the rate of adsorption minus the rate of desorption. The former was assumed proportional to the product of the "concn. of empty holes" on the adsorbent and the concn. in soln. of the material being adsorbed; the latter was first order with respect to the concn. of adsorbed material. The adsorption of anthracene from cyclohexane soln. by com. activated alumina gave qual. agreement.

4666. VAVON, GUSTAVE AND GASTAMBIDE, BERNARD. **Chromatographic separation of cis and trans cyclone isomers. Case of borneol, isoborneol and menthol, neomenthol.** *Compt. rend.* **226**, 1201-3 (1948).—*C.A.* **42**, 8571*e*.
In the chromatographic sepn. of *cis*- and *trans*-cyclanols, e.g., menthol and neomenthol, and borneol and isoborneol, the steric effect was such that the *trans* isomer was more strongly adsorbed. The alc. mixt., dissolved in petr. ether, was completely adsorbed by a column of adsorbent alumina and eluted with: (1) petr. ether; (2) C_6H_6 or CCl_4; (3) ether; and finally $CHCl_3$ or MeOH.

4667. WEISS, D. E. **Modified activated carbon adsorbents for continuous fractional adsorption.** *Nature* **162**, 372-3 (1948); *Discussions Faraday Soc.* **1949**, No. 7, 142-51.—*C.A.* **42**, 8571*b*; **44**, 9769*d*.
Adsorbents which permitted adsorption and desorption to be controlled by pH adjustment could be prepd. by adsorption of a surface-active, or water-insol. acid (e.g. fatty acids or lecithin) as a primary adsorbate on the usual adsorbents such as alumina, activated charcoal, and carbon black. The adsorbent acquired the properties of a primary adsorbate and formed, under alk. conditions, salts with cations or bases, which could be considered as a secondary adsorbate. These could be eluted by acid, thus eliminating use of org. solvents and permitting immediate re-use of the prepd. adsorbent. Similarly cationic surface-active agents could be used as primary adsorbate to prep. adsorbents for acids or anions.

4668. WHITE, JONATHAN W. JR. AND DRYDEN, EDWIN C. **Separation of aliphatic alcohols by chromatographic adsorption of their 3,5-dinitrobenzoates.** *Anal. Chem.* **20**, 853-5 (1948).—*C.A.* **43**, 67*i*.
Forty pairs of the 3,5-dinitrobenzoates of aliphatic alcs. (C_1 to C_6) were subjected to chromatographic adsorption. Under ultraviolet radiation, bands of adsorbed nonfluorescent material

resulted in an absence or diminution of fluorescence. Silicic acid, pretreated with rhodamine 6G, was used as adsorbent, hexane as sample solvent, 5% ether in hexane for development and ether for elution. The degree of sepn. possible varied.

4669. ZECHMEISTER, L. **Sterochemistry and chromatography.** *Ann. N. Y. Acad. Sci.* 49, 220-34 (1948).—*C.A.* 42, 5300*f*.

The sepn. of optical antipodes and diastereoisomers with optically active and inactive adsorbents was reviewed, including the behavior of *cis-trans* isomers towards various adsorbents as a function of the structure of the isomers.

4670. ALEXANDER, GUY B. **The chromatographic separation of perrhenic and molybdic acids.** *J. Am. Chem. Soc.* 71, 3043-6 (1949).—*C.A.* 43, 8794*b*.

The equil. adsorption of perrhenic and molybdic acids on Norit approached the exchange isotherm behavior in the range studied. There was sufficient difference in the adsorption characteristics of perrhenic and molybdic acids to permit a quant. chromatographic sepn. of these compds. with 1.95 *N* H_2SO_4 as the solvent and developing agent and Norit as the adsorbent.

4671. BACH, RICARDO O. **Attempts at inorganic chromatography. I. Estimation of small quantities of cupric ion.** *Anales asoc. quim. argentina* 37, 55-68 (1949).—*C.A.* 43, 7859*e*.

Cu^{++} was studied by chromatographic absorption on ZnS. The sample (alloy or mineral) was treated by the usual methods; the insol. matter filtered off, and the filtrate contg. Cu^{++} was neutralized and made slightly ammoniacal. The pH was adjusted to 5 with AcOH. Ten to 25 cc. of soln. contg. 0.1 to 1.0 mg of Cu^{++} was dild. to a convenient vol. and passed through the column. Cu, when present in alloys to the extent of 0.01 to 1.0%, could be detd. by this technique. Mixts. of salts of Hg, Ag, Bi, and Cu were successfully sepd. into 4 zones.

4672. BACH, RICARDO O. **Attempts at inorganic chromatography. II. Estimation of small amounts of cadmium ion in the presence of zinc and copper ions.** *Anales asoc. quim. argentina* 37, 69-78 (1949).—*C.A.* 43, 7859*f*.

Cd^{++} could be adsorbed chromatographically on ZnS. In an ammoniacal cyanide soln. 1.0 mg of Cd could be detected in the presence of Zn and Cu. This technique was successfully applied to minerals and alloys contg. 0.01 to 1.0% Cd by first removing Fe, Mn, etc., by the usual methods.

4673. BELL, D. J. AND PALMER, ANNE. **Quantitative analysis of mixtures of 1,3,4,6-tetramethyl-, 1,3,4-trimethyl-, and 3,4-dimethylfructoses by partition chromatography.** *J. Chem. Soc.* 1949, 2522-5; *Nature* 163, 846 (1949).—*C.A.* 44, 8285*i*; 43, 6947*d*.

The sepn. was carried out on a silica-water column. An aq. soln. of the sugars was extd. with $CHCl_3$, the $CHCl_3$ replaced by toluene soln. applied to the column. The first compd. was eluted with toluene contg. 0.33% EtOH, the second with $CHCl_3$ contg. 5% BuOH, and the third with MeOH. The H_2O phase from the original extn. was evapd. and the residue dissolved in $CHCl_3$. This soln. was applied to the column. The second compd. was eluted with $CHCl_3$ contg. 0.5% BuOH.

4674. BILLE, R. **Aromatic adsorption index for chromatographic adsorbents.** *Svensk Kem. Tid.* 61, 141-5 (1949).—*C.A.* 44, 313*i*.

The index depended upon the ability of the adsorbent to adsorb selectively aromatic hydrocarbons from a hydrocarbon mixt. The test was as follows: A sample (3 g) of adsorbent, predried at 150°C for 2 hrs, was shaken with 10 ml of a 50-50 mixt. by vol. of heptane and toluene for 30 min. in an adsorption vessel. The aromatic adsorption index was the difference between the *n* of the original hydrocarbon mixt. and that of the hydrocarbon mixt. after contact with the adsorbent multiplied by 10^4.

4675. BROCKMANN, HANS. **Chromatography of colorless substances and the relation between constitution and adsorption affinity.** *Discussions Faraday Soc.* 1949, No. 7, 58-64.—*C.A.* 44, 9772*b*.

Adsorption of *p*-substituted stilbenes from CCl_4 soln. and of *p*-substituted azobenzenes from C_6H_6 soln. gave the same order of adsorption affinity with complete sepn. possible of adjacent compds. The functional groups in order of decreasing affinity were COOH, $CONH_2$, OH, NH_2, COOMe, NMe_2, NO_2, OMe, H. Variation in H_2O content yielded bentonite in 5 grades of activity, SiO_2, $CaSO_4$, and MgO in 3 grades, and $CaCO_3$ in 2 grades.

4676. BROCKMANN, HANS AND VOLPERS, FRITZ. **Chromatographic adsorption. IV. Separation of colorless substances with fluorescent adsorbents.** *Chem. Ber.* 82, 95-103 (1949).—*C.A.* 44, 900*f*.

The chromatographic adsorption of colorless compds. was made visible by the use of fluorescent adsorbents. The effect of functional groups on the adsorption affinity was examd. and a new process for the prepn. of fluorescent adsorbents described. In the first expts. an Al_2O_3 was used with certain heavy heavy metals added to produce fluorescence. The adsorbed particles were to a certain degree transparent to UV, particularly if *n* of the solvent was similar to the adsorbed particles. The outermost layer of an adsorption column then formed a more or less transparent cover through which a part of the UV could penetrate to the inner layers of the column and, vice versa, the fluorescent light originating here could penetrate outward.

4677. BURRIEL, F. AND PEREZ, F. PINO. **Application of chromatographic technique in the detection of traces of nickel.** *Anales real soc. espan. y quim.* 45B, 749-56 (1949); *Anal. Chim. Acta* 3, 468-75 (1949).—*C.A.* 44, 3837*i*, 10584*b*.

On passing unknown solns. through a small column filled with dimethylglyoxime, small amts. of Ni^{++} were detected in the presence of a large excess of disturbing ions. One hundred γ Ni^{++} in 1000, 2000, and 5000 times as much Co^{++} in neutral soln. produced, after washing, characteristic red fringes in a column 7 mm diam. × 30 mm packed with 0.2 g dimethylglyoxime + 1 g $CaCO_3$ mixt. In neutral soln. 2γ Ni^{++} alone was detected positively;

1γ, uncertainly. Two-tenths γNi^{++} in 10,000 times as much Co^{++}, in 10% ammonia soln., was clearly seen in a column 4 mm diam. × 15 mm filled with dimethylglyoxime.

4678. Cassidy, Harold G. and Nestler, F. H. Max. **Chromatography of the carboxylic acids.** *Discussions Faraday Soc.* **1949**, No. 7, 259-64.--*C.A.* 45, 1840*b*.

The principles and chief methods of application of chromatography as used in the sepn. of fatty acids were discussed. The application of elution analysis, frontal analysis, displacement analysis and partition chromatography were reviewed.

4679. Claesson, Stig. **Adsorption analysis of high-molecular substances.** *Arkiv Kemi, Mineral. Geol.* **26A**, No. 24, 29 pp. (1949) (in English).—*C.A.* 43, 6037*h*

Chromatographic adsorption analysis was made with charcoal as adsorbent. More peaks were shown on a distribution curve than ultra-centrifuge studies on the same material. The rate of adsorption and amt. adsorbed were low and the amt. adsorbed decreased with increasing mol. wt. Frontal analysis of very dil. solns. with large filters with the adsorbent and a flow rate of low was the best procedure for analytical purposes. Theoretical considerations indicated that the frontal analysis diagrams extrapolated to zero concn. gave an upside down picture of the wt-distribution function. The expts. were done with polymethyl methacrylate and nitrocellulose at various concns. in acetone and in acetone-methanol mixts.

4680. Claesson, Stig. **High-molecular-polymer separation.** *Discussions Faraday Soc.* No. 7, 321-5 (1949).—*C.A.* 44, 7620*b*.

The difficulties assocd. with chromatographic sepn. of high-mol. substances were discussed. Normally, the rate of adsorption was low, requiring an extremely low flow-rate to reach equil. Curves of very dil. solns. in Me_2CO of polymethyl methacrylate and polyvinyl acetate obtained by frontal analysis on Carboraffin-Supercel provided information about the mol.-wt distribution that agreed well with results obtained by other methods.

4681. Cook, A. H. **Chromatographic separation of natural compounds.** *Nature* **164**, 300-2 (1949).—*C.A.* 43, 8234*e*.

Chromatography did more than any other experimental advance to overcome the difficulties of isolating less abundant substances.

4682. Cuckow, F. W.; Harris, R. J. C., and Speed, F. E. **Simple fraction-collecting machine for chromatographic analysis.** *J. Soc. Chem. Ind.* (London) **68**, 208-9 (1949).—*C.A.* 43, 8756*a*.

Successive small fractions of the percolate from a chromatographic column were collected by the machine which had 60 stations. The app. was activated by a clock mechanism and solenoid arrangement and collected each sample according to a predetd. time.

4683. d'Ans, Jean and Heinrich, Gisela. **Chromatography of electrolytes.** *Naturwissenschaften* **36**, 317-18 (1949).—*C.A.* 44, 5757*c*.

Columns of Brockmann Al_2O_3 were treated with excess metal salt soln. (0.1 to 0.8 molar), the soln. removed with little water, and the ions removed with 10% HCl. Cation and anion were detd. in the eluted material. A few quant. results are given. Although two Al_2O_3 materials had practically equal Na content, a Merck product retained more ions than a Riedelde Haen product.

4684. Dunabin, J. E.; Mason, H.; Seyfang, A. P., and Woodman, F. J. **Spectrographic examination of chromatographic columns.** *Nature* **164**, 916 (1949).—*C.A.* 44, 2403*i*.

With Al_2O_3 as adsorbent, the dithizone complexes of a no. of metals were sepd. chromatographically and sections were examd. with an ultraviolet spectrograph. Quantities of Cd between 0.1 and 0.5γ could be detd. with a standard deviation of 10%. This represented concns. of 0.02 to 0.1 p.p.m. on a 5-g sample.

4685. Fisher, R. B.; Parson, D. S., and Holmes, R. **Chromatographic analysis.** *Nature* **164**, 183 (1949).—*C.A.* 43, 8298*h*.

The partition of substances between aq. and nonaq. phases affected the distribution of substances around the center of the spot. These spots were usually markedly elliptical.

4686. Gapon, E. N. **Aluminum oxide for chromatographic analysis.** *Zavodskaya Lab.* **15**, 126 (1949).—*C.A.* 43, 5328*a*.

A suspension of $Al(OH)_3$ (1 g/10 ml) in water must have pH 6-6.3 to be satisfactory for chromatography. Ignition at 900-1000°C for 4-5 min. was recommended. The product was suitable for cation analysis; for anion analysis it must be treated with *N* HNO_3 or $HClO_4$.

4687. Gapon, E. N. and Gapon, T. B. **Chromatography of ions. I. Theory of chromatometry.** *Zhur. Obshchei Khim. (J. Gen. Chem.)* **19**, 1627-34 (1949); *J. Gen. Chem. U.S.S.R.* **19**, No. 9, a49-57 (1949) (English translation).--*C.A.* 44, 1778*g*, 6230*h*.

In the case of pure cation exchange, the length of the zone of the i th ion in an ideal ion-exchange chromatogram should be proportional to the concn. of the ion and to the vol. v of soln. passed. The linear adsorption capacity Q was defined by $Q= gS/L$ (mg equiv.)/cm, L being the length of the column in cm, g its wt, S the amt. of the exchange ion (mg equiv.)/g; in terms of the diam. d of the tube (cm) and the bulk wt of the adsorbent W (g/ml), $Q=d^2WS/4$. In expts. with Al_2O_3 and 0.1 *N* solns. of $CuCl_2$ and $Co(NO_3)_2$ 1:1 vol., both the upper Cu^{++} and the lower Co^{++} zone increased in length linearly with the v.

4688. Gapon, T. B. and Gapon, E. N. **Chromatographic analysis of ions. II. Exchange cationic chromatograms of Cu^{++}-Co^{++} and Co^{++}-Ni^{++}.** *Zhur. Anal. Khim.* 4, 131-5 (1949).—*C.A.* 44, 2820*g*.

By passing a soln. contg. equal amts. of Cu^{++} and Co^{++} through an adsorption column, the relation between the length of the zone (L) occupied by a cation and the vol. of soln. (v) used was found to be $L= av+ B$, where a and B were consts. An ideal chromatogram was defined as one consisting of clearly defined zones each of which contained only one ion, and the voids were filled with soln. contg. only the ions displaced from the adsorbent. Co and Ni were effectively sepd. by using a specially prepd. adsorbent. The latter was obtained by mixing carefully prepd. 2% solns. of Na aluminate and Na silicate.

4689. GLUECKAUF, E. **Theory of chromatography. VI. Precision measurements of adsorption and exchange isotherms from column elution data.** *J. Chem. Soc.* 1949, 3280-5.—*C.A.* 44, 9771*d*.

The elution of 250-mesh Na-"Dowex 50" was studied with 0.2 *N* HCl at a flow rate of 0.00175 cm per sec. The no. of theoretical units in the column was detd. by elution of the column contg. Na^{24} with 0.2 *N* $Na^{23}Cl$. Reliable adsorption data could be obtained even with disturbance of the rear boundary by diffusion and nonequil. phenomena.

4690. GLUECKAUF, E.; BARKER, F. H., AND KITT, G. P. **Theory of chromatography. VIII. The separation of lithium isotopes by ion exchange and of neon isotopes by low-temperature adsorption columns.** *Discussions Faraday Soc.* 1949, No. 7, 199-213.—*C.A.* 44, 9771*f*.

In the sepn. of Li^7 the enrichment was less than expected. The sepn. of Li isotopes was studied with *N* AcOLi on Zeo-Karb H.I. with a diffusion coeff. of about 10^{-6} cm^2 per sec and a grain size of 0.015 mm diam. at a flow rate of 0.0004 ml per sec. The sepn. of Ne isotopes on charcoal at -196°C was also studied to test predictions by the theory. The method was not adapted to isotope sepn. in bulk when the sepn. factor was small.

4691. GOETZ-LUTHY, NYDIA. **Separation of primary, secondary, and tertiary amines by chromatographic adsorption analysis.** *J. Chem. Education* 26, 271-2 (1949).—*C.A.* 43, 6113*a*.

Mixts. (mg quantities) of 2-aminoquinoline, with the methyl and di-methyl derivatives were sepd. quantitatively with an activated alumina column.

4692. HELLSTRÖM, NILS AND BORGIEL, HENRYK. **Chromatography.** *Acta Chem. Scand.* 3, 401-7 (1949).—*C.A.* 44, 5651*c*.

An app. which recorded on a photographic paper changes in refractive power of a soln. leaving a filter vs. the amt. of soln. was discussed.

4693. HOUGH, L.; JONES, J. K. N., AND WADMAN, W. H. **Quantitative analysis of mixtures of sugars by the method of partition chromatography. IV. Separation of the sugars and their methylated derivatives on columns of powdered cellulose.** *J. Chem. Soc.* 1949, 2511-16.—*C.A.* 44, 1853*d*.

Simple sugars in admixt. were sepd. on a semimicro-scale by the use of columns of powd. cellulose. A full description was given of an automatic receiver changer. By these means the following mixts. were sepd. nearly quantitatively into their components: rhamnose, arabinose, ribose and galactose, and 2,3,4,6-tetramethyl-, 2,4,6-trimethylglucose, 2,4-dimethylxylose, and 2,4-dimethylgalactose.

4694. JENSEN, WALDEMAR. **Chromatographic analysis of tall oil.** *Finnish Paper Timber J.* 31, 225-7 (1949)(in English).—*C.A.* 43, 9442*c*.

Quant. analysis for neutral components of raw or distd. tall oil was carried out by chromatography of 1-g samples on 20-25 g of Al_2O_3 in a 20-mm-diam. tube, with dry Et_2O or petroleum ether (b. 42-52°C) as solvent. The neutral components were quantitatively eluted with 200 ml Et_2O or 600 ml petr. ether, except that in the latter case the phytosterol remained adsorbed on the column.

4695. KAJANNE, PAAVO. **Reactivation of adsorptive alumina (spent in organic chromatography).** *Acta Chem. Scand.* 3, 639-43 (1949) (in English).—*C.A.* 44, 971*b*.

Successful reactivation was obtained by allowing spent Al_2O_3 to trickle down an inclined quartz tube, heated to 700°-800°C by a thermal element, against a brisk countercurrent of O_2. Under proper conditions a first class Al_2O_3, with negligible elutable material, was obtained.

4696. KOFLER, W. **Separation and purification of organic compounds by means of sublimation through adsorptive substances.** *Monatsh.* 80, 694-701 (1949).—*C.A.* 44, 3407*b*.

An app. was described whereby impure compds. or a mixt. could be heated generally below their m.ps. and sublimed under reduced pressure and by means of a "carrier gas" were passed through a column of an adsorptive substance maintained at the same temp. The sepn. was effected as with a chromatogram.

4697. LEVI, ALFRED A. **Methods for extending the scope of partition chromatography.** *Discussions Faraday Soc.* 1949, No. 7, 124-8.—*C.A.* 47, 4167*g*.

The technique of partition chromatography could be extended to mixts. of substances with limited solubilities in H_2O: (1) by using as stationary phase a solvent immiscible or only partly miscible with the flowing phase; (2) by using as stationary phase a substance that reacts reversibly with some of the components of the mixt.; (3) by applying the technique of displacement development.

4698. MARTIN, MONIQUE; YANG, JENG-TSONG, AND DAUDEL, PASCALINE. **Application of radioactivity to the study of chromatographic analysis.** *Anal. Chim. Acta* 3, 222-5 (1949) (in French).—*C.A.* 43, 8271*d*.

The fixation of Cl^-, Br^-, and I^- ions on Al_2O_3 chromatographic columns was studied by means of radioactive elements and a Geiger counter. The masses of ions adsorbed were roughly proportional to their at. wts, and their nos. were not sensibly dependent upon their natures. Cl^- ions were much more easily washed out than Br^- ions, and the latter were a little more readily eluted than I^- ions. This order was the same as with the Amberlites.

4699. MEINHARD, JAMES E. AND HALL, NORRIS F. **Surface chromatography.** *Anal. Chem.* 21, 185-8 (1949).—*C.A.* 43, 2114*i*.

Mix 3.5 g of Celite+ 6.2 g of reagent Al_2O_3 with 18 ml of water. Heat, with stirring, on the steam bath until coagulation is complete. Allow to cool, triturate with 2.5 ml more of water, apply the creamy mixt. to some of the surface of microscope slides and spread to a depth of 2 mm.

Dry in a dust-free atm. Add the sample of soln. to the surface by means of a capillary pipet. Develop with water of suitable solvent and ripen with a gas such as NH_3, H_2S, or I_2. Ripening can also be accomplished with a dye soln.

4700. NIJKAMP, H. J. **The chromatographic determination of the short-chain volatile fatty acids.** *Chem. Weekblad* 45, 480-2 (1949).—*C.A.* 44, 977*e*.

The silica gel (400 mg) was triturated with 0.08 cc. 0.2 *N* NaOH and 0.08 cc. 0.4% bromocresol green soln. The mixt. was rinsed with several small portions CCl_4 in 6 vols. of BuOH, which had been allowed to stand in contact with water. The gel settled in the glass into a column about 3.5 cm high. Since the volatile fatty acids possessed different distribution coeffs., the mixt. formed several bands. The acid from each band was titrated with 0.01 *N* NaOH.

4701. OVENSTON, T. C. J. **Chromatography in an explosives laboratory.** *J. Soc. Chem. Ind.* 68, 54-9 (1949).—*C.A.* 43, 5593*d*.

Silica gel admixed with Celite 535 was found to be the most suitable adsorbent for the study of propellants and high explosives. Light petr. ether mixed with acetone, benzene, or ethyl ether was used for chromatogram development. Adsorption series with these solvents were given for a no. of the compds. studied. The streak tests used to locate zones of colorless compds. on the extruded column were described.

4702. OVENSTON, T. C. J. **Chromatographic examination of propellant explosives.** *Analyst* 74, 344-51 (1949).—*C.A.* 43, 8138*i*.

There were 24 ether-sol. ingredients which could be sepd. and identified by chromatography. For all except mineral jelly, a good adsorbent was a mixt. of silica gel and Celite 535. The developing solvents were usually light petroleum (b.p. 40-50°C) mixed with C_6H_6 or Et_2O.

4703. PARTRIDGE, S. M. AND WESTALL, R. G. **Displacement chromatography on synthetic ion-exchange resins. I. Separation of organic bases and amino acids using cation-exchange resins.** *Biochem. J.* 44, 418-28 (1949).—*C.A.* 43, 8806*h*.

"Zeo-Karb 215" was used in a packed column and a mixt. of amino acids resolved into a series of fractions. Each contained ampholytes of similar isoelec. point, but a difference of 0.5-1.0 pH unit was required to effect a useful sepn. between any 2 components. Fine grinding was found to be essential for the production of wide bands. Generally, resins graded between 40 and 60 mesh/inch were found satisfactory.

4704. PINTEROVIC, ZVONIMIR. **Inorganic Chromatography. II. Adsorption of tin on a column of alumina.** *Bull. soc. chim. Belges* 58, 522-7 (1949).—*C.A.* 44, 9771*i*.

A suspension of Al_2O_3 in H_2O, previously heated to remove air, was used to fill a 25-cm tube, 2.7-6.0 mm in diam. For Sn the best chromatographs were obtained by reacting Sn (excess) with HCl; this soln. was added to the tube previously impregnated with 0.375 *N* HCl; the tube was rinsed with H_2O and developed with H_2S soln. The order of adsorption was Bi^{3+}, Sb^{3+}, Sn^{4+}, Sn^{2+}, and As^{3+} for a soln. contg. 50-500 mg of these in 100 cc. of 10% tartaric acid.

4705. ROBINSON, G. **Separations of 8-hydroquinoline columns.** *Discussions Faraday Soc.* 1949, No. 7, 195-8.—*C.A.* 45, 20*d*.

Zn was sepd. from a Cu-Ni-Zn alloy by use of a 10-cm column of 60-mesh 8-hydroxyquinoline and starch and a wash soln. of 5% NaOAc. Application to steel analysis was unsatisfactory owing to interference from Fe, although Mo, Mn, Ni, and V gave characteristic bands. Further applications were hindered by difficulty of distinguishing the yellow bands of other elements.

4706. SACCONI, LUIGI. **Inorganic chromatographic adsorption. II. The buffer action of active alumina surfaces.** *Gazz. chim. ital.* 79, 141-52 (1949).—*C.A.* 43, 8293*i*.

Chromatographic adsorption of cations on alumina was hydrolytic, and depended primarily on the surface buffer action of the Al_2O_3 itself. A study of Al^{+++}, Pb^{++}, Cu^{++}, and Fe^{+++} (nitrates) ions on a column of active Al_2O_3, with NH_4 aurintricarboxylate as developing agent, showed that Al and other ions were adsorbed together at the head of the column. Al ions liberated from the Al_2O_3 were then absorbed whenever a soln. of an acid or a soln. of Pb, Cu, or Fe was passed through the column. The adsorption of cations on Al_2O_3, with deposition of basic compds., depended on a decrease in H-ion concn. by the Al_2O_3 functioning as surface buffering agent.

4707. SACCONI, LUIGI. **Inorganic chromatographic adsorption. III. Influence of ionic hydration on chromatographic adsorption. Chromatography of complex cobaltiamminic compounds.** *Gazz. chim. ital.* 79, 152-64 (1949).—*C.A.* 43, 8295*b*.

Adsorption of cobaltiammino complexes was governed chiefly by the dimensions and polarizability of their coordinated radicals; ionic hydration was a fundamental factor in the adsorption of cations on Al_2O_3. Eight complexes were prepd. Since ion adsorption on Al_2O_3 involved the preferential adsorption of H_2O mols. polarized by aquo ions, forms of Al_2O_3 having the highest adsorptive capacity had the greatest tendency to become hydrated.

4708. SACCONI, LUIGI. **Surface buffer action of alumina in inorganic chromatography.** *Nature* 164, 70-1 (1949).—*C.A.* 43, 8234*d*.

The mechanism of inorg. chromatographic adsorption on activated Al_2O_3 was discussed. Detns. of the heats of hydration on tech. and pure Al_2O_3 showed that inorg. chromatographic adsorption was based mainly on the preferential adsorption for polarized H_2O of aquo ions.

4709. SACCONI, LUIGI. **The mechanism of inorganic chromatographic adsorption on alumina.** *Discussions Faraday Soc.* 1949, No. 7, 173-9.—*C.A.* 45, 20*c*.

The adsorption of inorg. salts on alumina was regarded as a hydrolytic adsorption followed by Al^{+++}-H^+ or Na^+-H^+ ion exchange. Adsorbability was proportional to the polarizing power of the ions and the polarizability of groups coordinated to the ions. Hydrated ions were adsorbed strongly because of the orientation of the coordinated H_2O groups.

4710. SCHROEDER, W. A.; MALMBERG, EARL W.; FONG, LAURA L.; TRUEBLOOD, KENNETH N.; LANDERL, JANET D., AND HOERGER, EARL. **Chromatographic investigations of smokeless powder. Derivatives of diphenylamine formed in double-base powders during accelerated aging.** *Ind. Eng. Chem.* 41, 2818-27 (1949).—*C.A.* 44, 1707*c*.

Chromatographic and spectrophotometric analyses were used to study the reaction products formed from the stabilizer, diphenylamine, during accelerated aging (at 71°C) of a double base powder, JP204. The structure of the various compds. affected their chromatographic properties on silicic acid; the position of the nitro group affected the adsorption affinity.

4711. SCHWAB, GEORG-MARIA. **Nature and applications of inorganic alumina chromatography.** *Discussions Faraday Soc.* 1949, No. 7, 170-3.—*C.A.* 45, 60*c*.

Absorption spectra of chromatographic bands on alumina showed that the bands contained basic aluminates. Chromatography was applicable to qual. analysis in conjunction with the usual group sepns. Except Al, all members of the $(NH_4)_2S$ group were separable in one operation.

4712. SCHWAB, GEORG-MARIA AND GHOSH, AMALENDRA NARAYAN. **Chromatographic separation and x-ray identification of platinum metals.** *Z. anorg. chem.* 258, 323-31 (1949).—*C.A.* 43, 8304*d*.

The chromatographic sepn. of the Pt metals from chloride solns. upon basic Al_2O_3 columns was studied; $RuCl_3$ was unsuitable because of its hydrate isomerism and hydrolysis for chromatographic purposes, but with Ir and Rh chlorides the difficulty was overcome. The complex chlorides of Ir-Pt-Pd-Rh were adsorbed in that order. The Pt metals were sepd. easily from other metals with the exception of Fe.

4713. SEASE, JOHN W. **Location of colorless chromatographic zones with an ultraviolet-sensitive multiplier phototube.** *Anal. Chem.* 21, 1430-1 (1949).—*C.A.* 44, 2891*a*.

The position of colorless compds. in a chromatographic column was detected by illuminating the column with a narrow slit of ultraviolet light and measuring the intensity of the scattered light with a 1P28 multiplier phototube. Decreases in photo-current indicated the zones.

4714. SHEARON, WILL H. JR. AND GEE, OWEN F. **Carotene and chlorophyll. Commercial chromatographic production.** *Ind. Eng. Chem.* 41, 218-26 (1949).—*C.A.* 43, 5543*f*.

The chopped, dehydrated alfalfa was extd. with hexane in a 2 stage process, and the concd. ext. selectively adsorbed in towers filled with activated charcoal. The concentrate was pumped into the towers from the bottom; the chlorophyll, adsorbed most readily, formed the lowest band, followed by xanthophyll and carotene. When carotene first appeared in the eluate at the top, pumping of the crude was stopped, and the carotene fraction was eluted by feeding fresh hexane into the bottom of the tower. The xanthophyll was similarly eluted with hexane-iso-PrOH, but for elution of the chlorophyll, the flow of liquid was reversed and the eluant (hot C_6H_6-iso-PrOH) was pumped in at the top of the tower.

4715. SHEPARD, CHARLES C. AND TISELIUS, ARNE. **The chromatography of proteins. The effect of salt concentration and pH on the adsorption of proteins on silica gel.** *Discussions Faraday Soc.* No. 7, 275-85 (1949).—*C.A.* 44, 7619*f*.

Adsorption of proteins on silica gel was studied in batch expts. and on chromatographic columns. In the batch expts. 0.1% protein soln. was carefully shaken with weighed amts. of the gel for 30 min. avoiding denaturation, the adsorbent was centrifuged off, and the residual protein in soln. detd. by absorption at 278 mμ. For expts. at different pH, the gel was suspended in H_2O, the desired pH adjusted with HCl or NaOH, the suspension centrifuged and dried at 105°C. The effect of salt concn. on the adsorption of proteins was studied with buffer solns. The max. amt. of adsorption of albumins and globulins was about the same, but with serum albumin and ovalbumin max. adsorption was seen only with high salt concns.

4716. SHIBATA, MURAJI. **The chromatographic adsorption of metallic ions.** *Science* (Japan) 19, 570-1 (1949).—*C.A.* 45, 7845*f*.

When an aq. soln. of metallic ions was allowed to pass through a layer of Al_2O_3, chromatographic adsorption occurred in the following order: Bi^{2+}, Fe^{3+}, Hg^{2+}, Pb^{2+}, Cu^{2+}, Zn^{2+}, Co^{2+}, Cd^{2+}, Ni^{2+}, Fe^{2+}, and Mn^{2+}. It was assumed that the ions were adsorbed by the electrostatic forces on the uniformly charged surface of the Al_2O_3. When the values $-Ze^2/R$ were calcd., with the radius of hydrated ion as R, their order of magnitude agreed well with the order of the chromatographic adsorption.

4717. SRIKANTAN, B. S. AND KRISHNAN, V. **Chromatographic estimation of alloys.** *J. Indian Chem. Soc.* 26, 415-18 (1949).—*C.A.* 44, 2890*c*.

Optimum condition for the estn. of Cu in brass and bronze were exptly. detd. Freundlich's equation was modified to get an expression relating the length of the adsorbed column to the quantity of the metal ion. The equation was $C_1/C_2{}^{1/n} = h_1/h_2$, where h_1 and h_2 were the lengths of the chromatograms at concns. C_1 and C_2, resp.; n had to be detd. experimentally for each cation.

4718. STEIN, WILLIAM H. AND MOORE, STANFORD. **Amino acid composition of β-lactoglobulin and bovine serum albumin.** *J. Biol. Chem.* 178, 79-91 (1949).—*C.A.* 43, 5812*i*.

Hydrolyzates of β-lactoglobulin and bovine serum albumin were analyzed chromatographically using starch columns.

4719. STEWART, A. **The function of adsorbent activity in the chromatographic separation of certain anthraquinone compounds.** *Discussions Faraday Soc.* 1949, No. 7, 65-79.—*C.A.* 44, 10446*i*.

The mean relative movements of adsorption bands of the substituted anthraquinone compds., 1-chloro, 1-methylamino, 1-amino, 1-dimethylamino, 1-amino-

4-methyl, 2-amino, 1,4-diamino, and 1,4,5-triamino were detd. as a function of H_2O deactivation of activated Al_2O_3 and $MgCO_3$. Weakly adsorbed compds. showed a max. increase at low H_2O addns., whereas strongly adsorbed compds. showed the increase at higher H_2O addns.; these facts permitted control of the band movement. The latter was practically independent of activating temp. of $Al(OH)_3$ dehydrated from 250° to 550°C.

4720. Tanaka, Minoru; Ashizawa, Takashi, and Shibata, Muraji. **Chromatography for inorganic compounds.** *Chem. Researches* (Japan) 5, *Inorg. and Anal. Chem.*, 35-52 (1949).—*C.A.* 43, 8945*h*.

Use an Al_2O_3 column at pH 7.6, moistened with a little 48% EtOH and add the soln. to be tested. Wash with H_2O and develop by the addn. of $(NH_4)_2S$. This gave the characteristic color of ions at different layers. By combination of dithizone analysis and chromatography, the presence of Co 0.001 γ, Ni 0.001 γ, An 0.000 γ, Cu 0.05 γ was measured.

4721. Trueblood, Kenneth N. and Malmberg, Earl W. **Chromatographic properties of silicic acid-celite.** *Anal. Chem.* 21, 1055-8 (1949).—*C.A.* 43, 8945*i*.

Seven com. samples of SiO_2 were investigated by mixing 1.75 parts (based on the wt after removal of free water) with 1 part of celite. Free water was detd. by heating to 200°C and structural water by igniting. 4-nitrotriphenylamine and ethyl centralite were used to compare the relative adsorptive strengths of the samples. After prewashing with 0.2 V ml of ether, V ml of 1:1 acetone-ether, 0.8 V ml of ether, V ml of ligroin, and 0.2 V ml of the solvent used as developer (V= vol. required to wet column completely), 5 of the 7 samples had very similar adsorptive powers. Existing differences could be correlated with the content of structural water. Complete removal of structural water led to loss of adsorptive strength.

4722. Venturello, Giovanni and Saini, Guido. **Chromatographic separations of the metals in the platinum group.** *Ann. chim. applicata* 39, 375-80 (1949).—*C.A.* 45, 8398*e*.

The chromatographic sepns. were effected by adsorbent columns of alumina and the following reagents: Benzidine gave ppts. of various colors with all the elements of the Pt group. Sodium sulfide, showed the Rh. Thiourea indicated Os when Ir was present. Thiobarbituric acid showed the presence of Rh.

4723. Wolfarth, J. S. and Glenn, R. A. **Chemical nature of coal hydrogenation products. III. Further chromatographic resolution of band III-IV oil on alumina.** *Fuel* 28, 253-7 (1949).—*C.A.* 44, 305*a*.

Chromatograph on alumina of the pentane-soluble fraction resolved this material into at least 7 distinct fractions. The sequence of adsorption, in contrast to that on silica gel, was determined primarily by the total O-and N-contents of the compds. present instead of their acetylability. Investigation of the chromatographic fractions after acid and alkali extn. showed the major part of the O-recovered to be in an inert form such as an aromatic or cyclic ether and also that the major part of the N was probably in a fused pyrrole ring.

4724. Yanovskiĭ, M. I. **Theory of chromatography on nonhomogeneous surfaces. Calculation of the maxima of desorption curves from the distribution functions of surface portions over heats of adsorption.** *Doklady Akad. Nauk S.S.S.R.* 69, 655-7 (1949).—*C.A.* 45, 6457*c*.

The distribution function $p(Q) = ds/dQ$ over heats of adsorption Q on a surface s, is related to the chromatographic parameters by $p(Q) = vc/M\chi RT$ (M= wt of unit length of the sorbent column).

4725. Zechmeister, L. **Adsorption and some constitutional and steric properties.** *Discussions Faraday Soc.* 1949, No. 7 54-7.—*C.A.* 44, 9769*h*.

The orientation of mols. in the fixation of org. mols. on an adsorbent was detd. by certain groups designated as "anchoring groups." For α-carotene, β-carotene, and γ-carotene, the stereoisomer contg. a single, peripherally-located *cis* double bond was adsorbed above the corresponding all-*trans* compd., whereas both of these essentially straight types were adsorbed more strongly than the spatial forms having a centrally-located *cis* double bond.

4726. Bach, Ricardo O. **New experiments on inorganic chromatography.** *Industria y química* (Buenos Aires) 12, 283-6, 301 (1950)—*C.A.* 45, 7463*h*.

Good results were obtained with org. media, on activated Al_2O_3. $Fe(CNS)_3$ and $Co(CNS)_2$ dissolved in Et_2O could be sepd. by washing with Et_2O, the Fe zone remaining fixed, and the Co zone being slowly displaced downward. In C_6H_6 soln. the Co^{2+} compd. of *β-nitrosonaphthol* could be sepd. on an activated Al_2O_3 column from the corresponding Fe^{2+} and Cu^{2+} compds., but the 2 latter decomp. more or less rapidly, and only the Co compd. could be recovered by prolonged washing.

4727. Beroza, Morton. **Chromatographic separation employing ultraviolet absorbancy ratios.** *Anal. Chem.* 12, 1507-10 (1950).—*C.A.* 45, 2813*b*.

Impurities were detd. in chromatographic zones by subjecting a systematic collection of chromatographic fractions to a detn. of ultraviolet absorbency ratios. The method was used for the sepn. of alkaloids from a mixt.

4728. Boldingh, J. **Fatty acid analysis by partition chromatography.** *Rec. trav. chim.* 69, 247-61 (1950).—*C.A.* 44, 6348*h*.

Natural and synthetic elastomers were used as carriers for the immobile solvent in partition chromatography. With systems contg. benzene absorbed in vulcanized *Hevea* rubber and with a strong polar solvent as the mobile phase, a straight quant. micro detn. of the satd. *n*-fatty acids from C_6 to C_{18} could be made. Hydroxy fatty acids also were readily sepd. from their mixts. with *n*-fatty acids.

4729. Booth, V. H. **Apparatus for pressure and suction regulation in chromatographic columns.** *Analyst* 75, 109-11 (1950).—*C.A.* 44, 4728*d*.

The simplest expedient was to lead a gas under pressure through a stopper at the top of the chromatographic tube. A simple app. was shown of which the upper part served to apply gas pressure and the lower part for the control of suction.

4730. Brumberg, E. M.; Berezhnaya, I. N.; Dutkinskiǐ, V. P., and Manoǐlov, S. E. **The use of ultraviolet light in chromatographic analysis with the adsorption column.** *Doklady Akad. Nauk S.S.S.R.* **74**, 747-50 (1950).—*C.A.* **45**, 8391*i*.

As the eluate came off the column, it passed between an ultraviolet source and a fluorescent screen; this permitted visual or photoelec. monitoring of any solutes which absorbed the light exciting the fluorescence.

4731. Burma, D. P. and Banerjee, B. **Preparation and standardization of aluminum oxide from the locally available aluminum hydroxide for chromatographic separation.** *Science and Culture* **15**, 442-3 (1950).—*C.A.* **44**, 9770*c*.

Five grades of activated Al_2O_3 were prepd. from locally available granular aluminum hydroxide of grain size of 100-200 mesh. The effectiveness of the different grades was checked by the use of azobenzene, p-methyoxybenzene, Sudan yellow, Sudan red, p-aminoazobenzene, p-hydroxyazobenzene, and Minosa hormone. Directions were outlined.

4732. Craig, Lyman C. **Partition chromatography and counter-current distribution.** *Anal. Chem.* **22**, 1346-52 (1950).—*C.A.* **45**, 911*i*.

The design and operation of a completely automatic, 220-cell, glass distribution train was briefly described. Exptl. distribution patterns of mixtures of amino acids and of fatty acids, obtained from this app., were compared with calcd. values. The study led to a slightly different concept of a continuous fractionation process such as partition chromatography.

4733. Cruse, K. and Mittag, R. **Colorimetric determination and chromatographic separation of sym-trinitrobenzene and m-dinitrobenzene.** *Z. Anal. Chem.* **131**, 273-8 (1950).—*C.A.* **45**, 500*c*.

Sym-trinitrobenzene could be detd. accurately by the red colored complex which it formed with EtONa in benzene soln. *m*-Dinitrobenzene could likewise be detd. in ultraviolet light. When both of these compds. were present, a chromatographic sepn. could be effected by means of freshly-activated MgO in benzene.

4734. Di Giacomo, Angelo and Rispoli, Giuseppe. **Pectin as an absorbent in chromatographic analysis.** *Boll. lab. chim. provinciali* (Bologna) **1**, No. 4, 13-15 (1950).—*C.A.* **46**, 3445*g*.

Pectin extd. from lemon rinds, repptd. twice, dried, and ground was proposed as a packing material for chromatographic columns. It was used successfully for the sepn. of $Co(NO_3)_2$ and $Cu(NO_3)_2$, of Orange No. 1 from tartrazine, of Victoria Scarlet from Orange No. 1 and from tartrazine.

4735. Fuks, N. A. **Preparation and standardization of aluminum oxide for chromatographic analysis of organic substances.** *Zavodskaya Lab.* **16**, 878 (1950).—*C.A.* **45**, 971*c*.

Com. Al_2O_3 activated by gradual heating to 300-400°C for 1 hr and ground to 180-200-mesh size. Treatment with hot 0.1 *N* HCl yielded the "acid" alumina, most suitable for org. detns., after thorough washing. For standardization a soln. of azobenzene and *p*-methoxyazobenzene in isoöctane-C_6H_6 was recommended. Prepns. with lower activity were obtained by shaking with progressively larger amts. of H_2O (2-16%).

4736. Gabrielson, Gunnar and Samuelson, Olof. **Utilization of ion exchangers in analytical chemistry. XVI.** *Svensk Kem. Tid.* **62**, 214-20 (1950) (in English).—*C.A.* **45**, 4168*i*.

$NaHSO_3$ (400 ml of *M*) was passed through a column of Amberlite IRA-400 (9.8 by 140 mm) to convert it to the bisulfite form, and the column washed with H_2O. Next, 50 ml of a soln. containing 1.2 to 4.1 milliequivs. aldehyde was passed through the column (about 25 min.), followed by washing with H_2O (about 400 ml). Quant. adsorption has been obtained for CH_2O, $(CHO)_2$, AcH, MeCH:CHCHO, PhCHO, $C_6H_4(OH)CHO$, $CH_3O(OH)C_6H_3$-CHO, and C_4H_3OCHO. The adsorption of acetone and MeEtCO has also been studied. Both were adsorbed almost quantitatively, but were removed readily by washing. This observation has led to a method for quant. sepn. of aldehydes and ketones.

4737. Gapon, E. N. and Shuvaeva, G. M. **"Aluminate" aluminum oxide for chromatographic ion analysis.** *Doklady Akad. Nauk S.S.S.R.* **70**, 1007-10 (1950).—*C.A.* **44**, 7708 *f*.

Dissolve 100 g of Al in 1 1.30% NaOH and dil. to 2% concn. of $NaAlO_2$. Treat the soln. with CO_2 to ppt. $Al(OH)_3$. Filter and wash to pH 8 with hot H_2O. Dry at 100-30°C, heat 10 min. at 800°C and suspend the product for use (1 g per 6 ml H_2O), giving pH 9.4-9.6. Cations were sharply adsorbed on the product from aq. solns. and Na ions appeared in the filtrate. For anion adsorption the product was treated with *N* HNO_3, followed by washing with H_2O.

4738. Gault, Henry and Ronez, Christiane. **A device which permits rapid separation of the zones formed in the course of chromatographic adsorption.** *Bull. soc. chim. France* **1950**, 587-8.—*C.A.* **44**, 10383*g*.

An app. consisting of rigidly supported glass cylinders of different lengths and the same diam. was used as a column for chromatographic sepns.

4739. Granger, Camille and Zwilling, Jean P. **Separation and determination of several hexachlorocyclohexane compounds by adsorption on silica with the method of chromatography.** *Bull. soc. chim. France* **1950**, 873-6.—*C.A.* **45**, 2371*c*.

Fifty g of silica contg. 15-20% H_2O was mixed with 150 cc. of petr. ether and introduced into the top of the column. N_2 was passed over the silica layer (to remove the excess of solvent) so that the ether flowed at approx. 600 cc./hr. The clear liquid was added and the ether was flushed through the column and 20-cc. fractions contg. octachlorocyclohexane and heptachlorocyclohexane were recovered. From 600 to 1000 cc. petr. ether was poured through to ext. the γ-isomer. CCl_4 extd. the Δ isomer.

4740. Hansen, Robert S.; Gunnar, Keith; Jacobs, Alfred, and Simmons, C. Robert. **The adsorption**

separation of zirconium and hafnium. *J. Am. Chem. Soc.* 72, 5043-5 (1950).—*C.A.* 45, 2805*e*.

For sepn. of Zr from Hf most satisfactory results were obtained by preferential adsorption of Hf from a MeOH soln. of $ZrCl_4$ and $HfCl_4$ by silica gel. Other solvents were investigated, as well as effects of concn., flow rate, and gel properties. Hf products of 30-60% concn. could be obtained in good yields by differential stripping of the silica gel.

4741. HARVALIK, ZABOJ V. **Electronic image converter and its use in chromatography.** *Anal. Chem.* 22, 1149-51 (1950).—*C.A.* 45, 436*g*.

The image converter consisted of an objective lens system, a tube (CV-147) which converted infrared or ultraviolet light to visible light of 525 mμ, and an eyepiece. An application for the detection of zones on a chromatographic column was suggested.

4742. HASKINS, J. F. AND HOGSED, M. J. **The alkaline oxidation of cellulose. II. Chromatography of acetylated carbohydrate acids.** *J. Org. Chem.* 15, 1275-7 (1950).—*C.A.* 45, 2202*f*.

The mixt. of 120-500 mg of the carbohydrate derivs. in $CHCl_3$ was passed through a column 35 mm in diam. of a 3:1 mixt. of Mallinckrodt A.R. silicic acid and Celite and the zones were developed with C_6H_6-AcOH(30:1). The order of adsorption of various acetylated carbohydrate derivs. was detd. to be: amides > phenylhydrazides > acids > lactones > nitriles.

4743. HOLMAN, RALPH T. **Crossing over, a new technique in displacement analysis with the Tiselius-Claesson interferometer.** *Anal. Chem.* 22, 832-3 (1950).—*C.A.* 44, 8824*i*.

The Tiselius-Claesson interferometric adsorption analysis app. had the disadvantage of a limited range of concs. which could be measured in any given expt. This was overcome by introducing the effluent liquid into the comparison channel which was ordinarily filled with pure solvent at a time when the concn. of the solute of the effluent was constant. If the 2 channels were connected so that the effluent traversed one after the other after passing through a spacer with a definite vol. (2 ml) then one could det. the difference in concn. between the 2 channels.

4744. HOWARD, G. A. AND MARTIN, A. J. P. **Separation of the C_{12}-C_{18} fatty acids by reversed-phase partition chromatography.** *Biochem. J.* 46, 532-8 (1950).—*C.A.* 44, 10446*g*.

Sepn. of longer-chain fatty acids was attempted by evolving a partition chromatogram in which the less polar phase was stationary. This was accomplished by the use of kieselguhr treated with dichlorodimethylsilane vapor rendering it "unwettable" by strongly polar solvents. The most suitable systems for use with straight-chain satd. fatty acids from lauric to stearic were aq. MeOH-octane or aq. Me_2CO-medicinal paraffin, but unsatd. substituted fatty acids behaved the same.

4745. HOYER, HERBERT. **Hydrogen-bridge bonding and chromatographic separation of isomeric substances.** *Kolloid-Z.* 116, 121 (1950).—*C.A.* 44, 6230*i*.

Chromatographic sepns. of mono-, di-, tri-, and tetrahydroxyanthraquinones were made on silica gel with benzene, chlorobenzene, and methylene chloride as the solvents. All mols, with OH groups exclusively in the 1, 4, 5, and 8 positions easily permeated the columns, whereas all compds. that also carried OH groups in the remaining positions were adsorbed. 1,4,5-trihydroxyanthraquinone and 1,4,5,8-tetrahydroxyanthraquinone permeated the silica gel column easily, whereas 2-hydroxyanthraquinone was adsorbed. A similar role of H-bridge bonding in adsorption was shown for hydroxynitro and hydroxyazo compds.

4746. JØRGENSEN, P. FISCHER. **Identification of Phenylosazones by chromatography.** *Dansk Tids Farm.* 24, 1-8 (1950).—*C.A.* 44, 2893*e*.

Phenylosazones of hexoses, pentoses, methylepentoses, and tetroses with unbranched C chains were differentiated by chromatography. $CaCO_3$ was used as adsorbent and 3% EtOH(94%) in $CHCl_3$, 5% EtOH(94%) in acetone and 1 part acetone with 1 part $CHCl_3$, were used as developing fluids. All phenylosazones were used in $CHCl_3$ soln.; sepn. of sorbose, glucose, galactose, altrose, xylose, arabinose, rhamnose, fucose, and erytrulose was obtained.

4747. JØRGENSEN, P. FISCHER. **Chromatographic investigation of frangula fluidextract.** *Dansk Tids. Farm.* 24, 111-27 (1950).—*C.A.* 44, 6083*i*.

Frangula fluidext. in petr. ether was chromatographed on $CaCO_3$, particle size 3.5 μ. The following substances were adsorbed: chrysophanic acid + emodin monomethyl ether, chrysophanic acid anthrone + emodin anthrone monomethyl ether, aloe emodin. If 10 to 20% EtOH contg. $CHCl_3$ was used as solvent and the soln. chromatographed on 20 μ $CaCO_3$ particles, the following substances were sepd.: frangula emodin, 2-(hydroxymethyl)-anthraquinone frangulin and its corresponding base, difrangulin and its base, a condensation product of frangula emodin anthrone and a condensation product of partly oxidized frangula emodin anthrone.

4748. KAMIEŃSKI, B. **Potentiometric chromatography. V. Electrometric adsorption analysis in inorganic chemistry.** *Bull. intern. acad. polon. sci., Classe sci. math. et nat.*, Ser. A, **1950**, 73-7 (in English).—*C.A.* 46, 4417*h*.

An Sb electrode sealed in a glass capillary tube was used for the detection of Cu ions passed through an Al_2O_3 adsorption column. Changes in the potential were observed when the Cu ions reached the vicinity of the Sb electrode.

4749. KÜHN, KONRAD. **Enrichment of molybdenum in dilute solutions by adsorption.** *Z. anal. chem.* 130, 210-22 (1950).—*C.A.* 44, 5181*d*.

From molybdate soln. with enough free H_2SO_4 to make the pH ~ 4-6, Mo was adsorbed more readily than SO_4^{--}, Cl^-, NO_3^-, or ClO_4^- by a column of Al_2O_3. Then by washing the column with dil. NH_4OH, almost all the Mo was recovered.

4750. LEROSEN, A. L.; MONAGHAN, P. H.; RIVET, C. A.; SMITH, E. D., AND SUTER, H. A. **Streak reagents for chromatography.** *Anal. Chem.* 22, 809-11 (1950).—*C.A.* 44, 8816*f*.

Reagents were described for the detection on the chromatographic column of the following compds.: 1,3-Pentadiene, cyclohexene, $BuNH_2$, Et_2NH, Et_3N, $PhNH_2$, PhNHEt, $PhNEt_2$, $PhNMe_2$, Ph_2NH, Ph_3N, MeOH, EtOH, PhOH, $COMe_2$, PhOMe, PhCl, AcOH, BzOH, $MeNO_2$, $PhNO_2$, C_6H_6, and CS_2. The adsorbents used were Special Filtrol, silicic acid, Florisil, MgO, $CaCO_3$, $Ca(OH)_2$, and $CaHPO_4 \cdot 2H_2O$.

4751. LYNAM, C. G. AND WEIL, HERBERT. **A new plant for radial chromatography.** *Mfg. Chemist* **21**, 195-9, 205 (1950).—*C.A.* 44, 7594*c*.

A stationary radial chromatographic seperator was described with an exchangeable inner container contg. the adsorbent. The latter consisted of an assembly of 5 concentric perforated tubes covered with gauze and sealed at the top and bottom, the positions of which corresponded to the boundaries between the zones of the various constituents of a mixt. to be sepd. The soln. was fed through an inner perforated pipe and with the aid of valves. When development of the chromatogram had proceeded to the desired stage, the entire inner container was removed, a new one put in place, and the charged adsorbent from the first container removed by emptying the contents of each ring separately into a tank.

4752. LYNAM, C. G. AND WEIL, HERBERT. **Combination-columns in chromatographic technology.** *Ind. Chemist* **26**, 109-12 (1950).—*C.A.* 44, 5158*i*.

Details were given on large-scale chromatographic columns which could be mechanically disassembled into sections and separately eluted.

4753. MACMORRAN, GEO. H. **Chromatography of senna and related compounds.** *J. Pharm. and Pharmacol.* **2**, 773-82 (1950).—*C.A.* 45, 3563*h*.

Heavy $MgCO_3$ gave promising results. It dissolved readily in dil. acids, thus liberating the adsorbed substances, which may be extd. by an immiscible solvent. Acetylation of the hydroxyanthraquinone derivs. before chromatography reduced the extent to which they were adsorbed, and made elution easier.

4754. MARSHALL, LAWRENCE M. AND DACOSTA, WM. A. **Cumulative frequency distribution in manual chromatography.** *Science* **111**, 155-6 (1950).—*C.A.* 44, 8817*c*.

The vol. of effluent was plotted on arithmetic probability paper against the cumulative percentage of solute collected. A mixt. of succinic acid (normal) and fumaric acid (abnormal) was analyzed by using a 4-mm internal-diam. column contg. 0.5 g silica gel with 10% tet-AmOH in $CHCl_3$ as the mobile phase.

4755. MARVEL, C. S. AND RANDS, R. D., JR. **Separation of organic acids.** *J. Am. Chem. Soc.* **72**, 2642-6 (1950).—*C.A.* 46, 8826*a*.

Procedures were outlined for the sepn. of H_2O-sol. org. acids by using partition chromatography satisfactory for the detection and detn. of acids in mixts. The "peak effluent vols." of 36 acids had been detd. by a standard procedure. Only 5-80 mg of the mixts. was required. With an increasingly polar solvent, it was possible to sep. mixts. contg. 2-7 H_2O-sol. acids or other less polar compds. As little as 0.5 mg could be detected in an 80-mg sample. The immobile phase was H_2O-adsorbed on silicic acid. The developing liquid or eluant was made progressively more polar to develop the more H_2O-sol. acids, accomplished by adding increasing amts. of BuOH to $CHCl_3$.

4756. MEINHARD, JAMES E. AND HALL, NORRIS F. **Surface chromatograph - refinements in apparatus and technique.** *Anal. Chem.* **22**, 344-51 (1950).—*C.A.* 44, 8279*g*.

The chromatography of solns. of 0.1 *M* $NiCl_2$ in 0.6 *N* HCl and 0.4 *N* HCl and of 0.1 *M* $CuCl_2$ in 0.6 *N* HCl was studied by using specially designed pipets so that the ratio of sample vol to developer (H_2O) vol. was accurately controlled. The process was carried out on glass slides coated with a rigid adsorbent, the chromatograms were colored by application of mordant dyes, and the zone radii accurately measured by means of a specially constructed transparent scale.

4757. MILIČEVIĆ, B. **Possibility of qualitative and quantitative analysis based on the separation of ions by means of chemical exchange.** *Bull. soc. chim. Belgrade* **15**, 167-71 (1950) (English summary).—*C.A.* 46, 6038*i*.

The sepn. of I^- and Br^- was carried out on a $PbCl_2$ column and that of Ag^+ and Cu^{2+}, and Ag^+ and Pb^{2+} on a Zn dust column with the conventional chromatographic technique. In the upper part of the column a yellow zone of PbI_2 was formed, below which a $PbBr_2$ zone was visible under ultraviolet light. The length of these zones served as a basis for the detg. I^- and Br^- in their mixts. The Ag^+-Cu^{2+} and Ag^+-Pb^{2+} sepns. in the Zn dust column were less satisfactory.

4758. MONAGHAN, PATRICK H.; SUTER, HANS A., AND LEROSEN, ARTHUR L. **Characterization of some chromatographic adsorbants.** *Anal. Chem.* **22**, 811-13 (1950).—*C.A.* 44, 8816*b*.

The rate of migration of a zone of *o*-$NO_2C_6H_4NH_2$ in C_6H_6 was detd. on different grades of silicic acid, silica gel, silicates, alumina, $CaCO_3$, MgO, charcoal, ZnO, $ZnCO_3$, CaO, $CaHPO_4$, $Ca_3(PO_4)_2$. The order of decreasing adsorption affinity for *o*-$NO_2C_6H_4NH_2$ was roughly: acid silicates, silica gel, silicic acid, alk. oxides, alk. hydroxides. Mg-contg. adsorbants were stronger than the corresponding Ca compds.

4759. NEWING, M. J. **Surface properties of polar silicones.** *Trans. Faraday Soc.* **46**, 755-62 (1950).—*C.A.* 45, 1805*i*.

Silicones with terminal —OH group were sepd. by chromatography. Force-area and potential-area curves on water showed that at low pressure all silicone mols. lay flat on the water surface. Silicones as *boundary lubricants* on *steel* were discussed in relation to the possible orientation of the monolayers on the metal surface.

4760. RAMSEY, L. L. AND HESS, S. M. **Collaborative study of a chromatographic method for the volatile fatty acids.** *J. Assoc. Offic. Agr. Chemists* **33**, 848-54 (1950).—*C.A.* 45, 491*h*.

Two samples in duplicate consisting of an aq. soln. of the volatile acids were analyzed by 22 analysts in 17 labs. with a chromatographic method. The study showed that the method was sufficiently accurate for studies of decompn. in foods.

4761. Rosen, A. A.; Sundstrom, K. V. Y., and Vogel, W. F. **Separation of 2,4-dinitrophenylhydrazones of some substituted benzaldehydes by chromatographic adsorption.** *Anal. Chem.* **24,** 412-13 (1952).—*C.A.* 46, 4956*g*.

The adsorption of the 2,4-dinitrophenylhydrazones of 12 substituted benzaldehydes contg. one or more OH, MeO, or EtO groups was studied. The adsorbent selected was a uniform mixt. of silicic acid and Celite, with pure benzene used as the solvent both for adsorption and for development of the chromatogram. All binary combinations of the 14 compds. studied were tested.

4762. Rosen, J. B. and Winche, Warren E. **The admittance concept in the kinetics of chromatography.** *J. Chem. Phys.* **18,** 1587-92 (1950).—*C.A.* 45, 6007*a*.

Chromatographic processes with linear kinetics were represented by a system admittance for the case where the influent concn. varied sinusoidally. The admittance was obtained for a variety of assumed rate-controlling mechanisms. It depended strongly on the type of kinetics obeyed by the system. The results indicated exptl. techniques for detg. the kinetics of these processes. Representative results obtained with an electronic analog computer were presented for a case of non-linear kinetics.

4763. Schweitzer, George K. and Talbott, C. K. **Resolution of optically active inorganic stereoisomers by adsorption on quartz.** *J. Tenn. Acad. Sci.* **25,** 143-7 (1950).—*C.A.* 46, 11004*e*.

A column of *l*-rotatory quartz powder was used to effect the partial resolution of Cr and Co complexes. The *l*-rotatory quartz powder had a selective adsorptive power towards these racemic complexes. Multiple columns greatly enhanced a sepn.

4764. Shemyakin, F. M. **Importance of chromatographic adsorption for the formation of rhythmic structures.** *Kolloid. Zhur.* **12,** 392-5 (1950).—*C.A.* 45, 925*c*.

When periodic pptns. of RY formed during diffusion of RX into MY soln., the RY ppts. acted as chromatographic adsorbents on RX. The ions of MX were less retarded by the ppts. and diffused ahead of RY ions. This explained the discrete formation of ppts. The results of diffusion of MY into RX soln. may be different from those of diffusion of RX into MY because RY may differently adsorb MY and RX.

4765. Shemyakin, F. M. and Mitselovskiĭ, E. S. **Chromatographic determination of traces of iron in concentrated sulfuric acid.** *Zavodskaya Lab.* **16,** 748 (1950).—*C.A.* 45, 974*e*.

The acid was passed through a micro-column of silica gel, which was then treated with 0.5-1.0 ml satd. $K_4Fe(CN)_6$; a blue color indicated Fe; sensitivity was 6 γ.

4766. Sillén, Lars Gunnar. **Filtration through a sorbent layer. V. Final form fronts and broadening fronts.** *Arkiv Kemi* 2, 499-512 (1950)(in English).—*C.A.* 45, 2270*e*.

In the equil. case where solute and sorbent were in equil. at all times, two types of fronts were encountered, sharp fronts and broadening fronts. In the nonequilibrium case two types of fronts were also encountered: the front which tended toward a final form and then moved on through the column with the same speed as the equil. front would have had and secondly the broadening fronts.

4767. Srikantan, B. S. and Krishnan, V. **Possibility of separating copper and silver zones in an alloy of copper and silver by zinc chromatographically.** *J. Indian Chem. Soc.* 27, 34-6 (1950).—*C.A.* 44, 6767*b*.

The usual chromatographic order Cu-Ag-Zn with alumina as absorbent was reversed in dil. solns. to Cu-Zn-Ag. This was shown to be due to the preferential adsorption of Zn^{++} over the Ag^+ in dil. solns. The adsorption of Zn^{++} from $ZnSO_4$ solns. of different concn. was detd. as above, the Zn being detd. by titration with $K_4Fe(CN)_6$ soln. with Ph_2NH as indicator. At lower concns. there was greater adsorption of Zn^{++} per g of alumina than the Ag^+, while at higher concns. more Ag^+ was adsorbed than Zn^{++}. The method may be used in the analysis of Cu-Ag alloys.

4768. Strain, Harold H. **Distribution in adsorption columns. Separation of xanthophylls and chlorophylls.** *Ind. Eng. Chem.* **42,** 1307-10 (1950).—*C.A.* 44, 8734*c*.

Weakly adsorbed materials such as *n*-heptyl alc. on MgO adsorbent may reduce the adsorption of a pigment and also cause zone doubling. A pigment soln. contg. strongly adsorbed impurities such as hydroquinone, phloroglucinol, ethylene, glycol, resorcinal, *o*-cresol, *o*-phenylene-diamine, acetamide, glycerol, or 8-hydroxyquinoline put upon a MgO column followed by a pigment soln. free of impurity often yielded two widely sepd. pigment zones.

4769. Tanaka, Minoru and Shibata, Muraji. **Inorganic chromatography. I. Confirmation of fundamental conditions and its applications for semimicro chemical analysis.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 71, 254-6(1950).—*C.A.* 45, 4525*a*.

Working conditions of inorg. chromatography using Al_2O_3 as adsorbent were studied. Adsorbed ions were developed by $(NH_4)_2S$ soln. and their orders of adsorption are as follows: (top) Bi^{+++}; (Hg^{++}, Fe^{+++}); (Pb^{++}, Cr^{+++}); Cu^{++}; (Ag^+, Zn^{++}); Tl^+; (Co^{++}, Cd^{++}, Ni^{++}, Fe^{++}); Mn^{++} (bottom).

4770. Tanaka, Minoru and Shibata, Muraji. **Inorganic chromatography. II. The mechanism of chromatographic adsorption.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 71, 312-14 (1950).—*C.A.* 45, 4997*c*.

Expts. confirmed neither the older assumption that the phenomena depended on ionic exchange between the ions in the soln. and the Na ion held by the adsorbent, nor the newer theory that the cause was the different relative rates of formation of the insol. hydrous metal oxides. Filter paper used as the adsorbent gave concentric rings for the various ions, the order of which agreed with the usual chromatography.

4771. Tiselius, A. and Hagdahl, L. **Note on "carrier displacement" chromatography.** *Acta Chem. Scand.* 4, 394-5 (1950).—*C.A.* 44, 9856*d*.

Homologous alcs. (1% in 0.1 N HCl) were used for the displacement of amino acids and peptides in sharply divided segments from active charcoal and on filter paper. Examples given (solvent and carrier) were valine, tert-BuOH, and H_2O; leucine, tert-BuOH, and sec-BuOH; methionine, sec-BuOH; and tert-BuOH; leucylglycylglycine, iso-AmOH, and BuOH; phenylalanine, AmOH, and iso-AmOH; and glycyltryptophan, $PhCH_2OH$, and AmOH.

4772. Trueblood, Kenneth N. and Malmberg, Earl W. **An experimental study of chromatography on silicic acid celite. The applicability of the theory of chromatography.** *J. Am. Chem. Soc.* **72,** 4112-24 (1950).—*C.A.* 45, 1840*e*.

4-nitroaniline, N-ethyl-4-nitroaniline, 4-nitrodiphenylamine, N, N-diethyl-4-nitroaniline, 4-nitrotriphenylamine, and Et centralite, were chromatographed and a variety of developing mixts. and rates of development were investigated. Adsorption isotherms on silicic acid-celite were found to be essentially linear in the range of concns. most important in practical chromatography on this adsorbent. Rates of development in mixts. were demonstrated to be the same as those of the same compds. developed separately. A technique was developed for detg. precisely the distribution of a compd. in a zone on a column.

4773. Tunitskii, N. N. and Cherneva, E. P. **Dynamic theory of adsorption and chromatography. I. Broadening of chromatographic bands and adsorption fronts.** *Zhur. Fiz. Khim.* 24, 1350-60 (1950).—*C.A.* 45, 6896*g*.

Chromatographic processes were treated statistically. A sharp adsorption band was broadened because of the fluctuation of the lifetime of the particles in the adsorbed state. Two relations were then derived: $(x - \bar{x})^2 = 2Kt$ (1) and $(t - \bar{t})^2 = 2Bx$, which were valid both when diffusion in the liquid or the adsorption was rate-detg. and when the limiting step was the diffusion through the adsorbent particles. A linear adsorption isotherm was assumed throughout. Exptl. data obtained with a cation exchanger confirmed the theory.

4774. Ullmann, M. **Chromatography of soluble starches.** *Kolloid-Z.* **116,** 10-18 (1950).—*C.A.* 44, 6178*d*.

Starch was adsorbed selectively on an Al_2O_3 column from aq. soln. By means of I_2-KI solns. the adsorbed starch components which form colored complexes with I_2 showed visible sepn. zones of dark blue, light blue, and light violet. The adsorptive capacity of the Al_2O_3 was changed if the column was pretreated with HCl; darker shades and sharper sepn. of the colored zones were obtained. The Al_2O_3 column should be given only sufficient pretreatment with HCl to give best results with the absorbate.

4775. Vahrman, M. **Estimation of the hydrocarbons in primary tars by hot chromatography.** *Nature* **165,** 404-5 (1950).—*C.A.* 44, 9137*h*.

Hydrocarbons in samples of primary coal tar were detd. by using a steam-heated 6 × 1/2 in. column of silica gel. Before use, the silica was sized between 100 and 200 mesh and ignited at 500°C. The tar (5 g) was melted on the column and eluted with 100-120°C ligroin until the eluant was colorless (3-4 hrs). The eluant was evapd. on an oil bath under vacuum to const. wt.

4776. Weiss, D. E. **Industrial fractional adsorption techniques.** *Roy Australian Chem. Inst. J. & Proc.* 17, 141-56 (1950).—*C.A.* 44, 10383*d*.

An industrially useful continuous fractional adsorption process must: (a) be able to adsorb fractionally from aq. soln.; (b) have free countercurrent flow between adsorbent and solution; (c) permit of simple regeneration of the adsorbent. Countercurrent flow may be achieved by using an adsorbent of different sp.gr. from the solution especially by froth flotation techniques, enabling both "sink" and "float" processes to be used. Industrial application of such processes depended on the development of suitable adsorbents, and work was being done with surface modifiers of both the org. solvent and the electrolyte type.

4777. Wendel, Kurt. **Chromatographic analysis.** *Planta* 37, 604-11 (1950).—*C.A.* 44, 4306*c*.

In a study of the material to be used in the adsorption column for the detn. of leaf pigments, the sepn. of chlorophylls was more effective with starch than with powd. sugar. Decompn. of the pigments could be avoided by the use of purified peroxide-free ether and avoiding exposure to light and air.

4778. Al-Mahdi, A. K. and Wilson, Cecil L. **Chromatography of organometallic complexes.** *Mikrochemie ver. Mikrochim. Acta* **36/37,** 218-23 (1951).—*C.A.* 45, 5071*h*.

Chromatography could be used to sep. inorg. ions that form complexes with org. compds. by the use of org. reagents. Sepns. of Cu, Fe, and Ni cations could be made by means of Na diethyldithiocarbamate both qualitatively and quantitatively. The accuracy of a detn. could be increased by converting to another complex after the chromatographic sepn. had been effected.

4779. Asahara, Teruzo; Konishi, Yotaro; Kuroda, Yusuke, and Mashino, Minoru. **Chromatographic separation of fatty acids.** *J. Chem. Soc. Japan,* Ind. Chem. Sect. **54,** 70-2 (1951).—*C.A.* 47, 1407*i*.

The sepn. of fatty acids was carried out with calcined MgO, CaO, and Al_2O_3 as adsorption medium. Each of the MgO and CaO was mixed with EtOH, and Al_2O_3 with petr. ether made into slurry and filled in cylinders. The combination of MgO and CaO gave better results than either alone.

4780. Ashizawa, Takashi. **Chromatographic analysis of metals by organic reagents.** *Repts. Balneol. Lab. Okayama Univ.* **1951,** No. 5, 1-42 (English summary).—*C.A.* **46,** 7927*h*.

Alumina, diatomaceous earth, aluminate, $MgCO_3$, $CaCO_3$, urea-formaline resin, heulandite, mordenite, desmine, chabazite, etc., were used as adsorbents. A large no. of org. reagents were tried. The detn. of Cu, Zn, Ni, and Co in rocks; Fe, Cu, Zn, Ni, and Co in plants; Cu and Zn in urine; Hg in rocks; Bi in rocks; and Cu, Zn, Ni, and Co in natural waters, were reported.

4781. BACH, RICARDO O. AND GARMENDIA, ANTONIO A. **Experiments in inorganic chromatography. IV. Separation, detection, and determination of cobalt ion.** *Anales asoc. quim. argentina* **39**, No. 191, 11-17 (1951).—*C.A.* **46**, 9016*f*.

Chromatographic sepn. of metal ions from organometallic compds. were useful in qual. or quant. analyses of small amts. of metal ions, as illustrated by the addn. compd. formed by Co and β-nitroso-α-naphthol. Alumina columns were used. The limits of identification were detd. in some detail.

4782. BAILEY, A. **Ultraviolet absorption spectra of chromatographic fractions of lignins.** *J. Am. Chem. Soc.* **73**, 2325-6 (1951).—*C.A.* **45**, 9264*i*.

Each of the chromatographic fractions of lignins could be identified by its absorption curve alone. Chem. differences between the fractions existed and fluorescence observations were valid indications of such chem. differences.

4783. BAILEY, H. C. AND KNOX, J. H. **Determination of aldehydes in combustion products.** *J. Chem. Soc.* **1951**, 2741-2.—*C.A.* **46**, 9018*g*.

A soln. (1-5 cc contg. about 0.2 millimole of aldehyde) was passed down a tube (8 mm in diam.) packed with Ag_2O to a depth of 10 cm, the sample washed through with H_2O to a total vol. of 25 cc, and the resulting soln. titrated with KSCN. The sepn. and detn. of individual aldehydes was achieved by converting the Ag salts of the soln. obtained from the Ag_2O column with NaCl to the Na salts and further to the free acids which were sepd. by chromatographic adsorption on buffered SiO_2.

4784. BROCKMANN, H. AND BEYER, E. **Chromatographic adsorption. V. The chromatographic separation of colorless compounds by means of fluorescent adsorbents.** *Angew. Chem.* **63**, 133-6 (1951).—*C.A.* **45**, 5485*d*.

Fluorescent adsorbents, illumination technique, and photographic recording of colorless zones were investigated.

4785. CRAIG, LYMAN C.; HAUSMANN, WERNER; AHRENS, EDWARD H. JR., AND HARFENIST, ELIZABETH J. **Determination of weight curves in column processes.** *Anal. Chem.* **23**, 1326-7 (1951).—*C.A.* **46**, 299*b*.

App. for the rapid evapn. of samples taken from different parts of a column was described. This made possible a rapid detn. of distribution curves in chromatography, ion exchange, and countercurrent distribution processes.

4786. DEAN, JOHN A. **Isolation and determination of cobalt as the nitroso R salt complex by chromatographic ion exchange.** *Anal. Chem.* **23**, 1096-7 (1951).—*C.A.* **45**, 10125*a*.

Application was made to steels and Cu- and Ni-base alloys. The red color complex was developed as usual. The soln. was passed through a 5-6 cm column of alumina previously washed with dil. $HClO_4$ and the red band remained at the top of the column. After washing the column with hot *M* HNO_3 (70-80 °C), the Co-complex was eluted with *M* H_2SO_4, and the color read in a photometer at 500-520 mμ. Excess dye must be present. Fe must be completely oxidized.

4787. DEAN, JOHN A. **Modified method for potassium—removal of fluoride and sulfate ions by chromatographic ion exchange.** *Anal. Chem.* **23**, 202-4 (1951).—*C.A.* **45**, 3287*e*.

The sample was dissolved in HF and $HClO_4$, extd. with water, and passed through an acid-alumina exchange-adsorption column. The column removed F^- or SO_4^{--} ions and added ClO_4^- ions to the soln.

4788. DURSO, DONALD F.; SCHALL, ELWYN D., AND WHISTLER, ROY L. **Automatic fraction collector for chromatographic separations.** *Anal. Chem.* **23**, 425-7 (1951).—*C.A.* **45**, 4971*g*.

The circuit diagram and construction details were given for an automatic app. designed to admit 4 successive developing solvents to a column and collect each effluent separately. The app. had been applied to guaran, xylan, and starch hydrolyzates.

4789. FUNAKUBO, EIICHI AND MATSUMOTO, YUTARO. **The theory and application of chromatography.. 1. Rate of displacement of the chromatographic zone in respcct to anthracene.** *J. Chem. Soc. Japan, Pure Chem. Sect.* **72**, 402-6 (1951).—*C.A.* **46**, 850*a*.

There was a regular relation between the time of development and the rate of displacement when the benzene soln. of anthracene was developed in an alumina column. An idea of the fatigue of adsorbent was proposed to explain the exptl. results.

4790. FUNAKUBO, EIICHI; MATSUMOTO, YUTARO, AND INOUE, AKIRA. **The theory of chromatography and its applications. II. Rate of displacement of the chromatographic zone in regard to anthracene, anthraquinone, and carbazole.** *J. Chem. Soc. Japan., Pure Chem. Sect.*, **72**, 439-41 (1951).—*C.A.* **46**, 4884*b*.

The rates of displacement of the adsorption bands were studied for anthraquinone and carbazole and a mixt. consisting of these 2 compds. and anthracene in the Al_2O_3-C_6H_6 system.

4791. GORDON, B. E.; WOPAT, FRED JR.; BURNHAM, H. D., AND JONES, L. C. **Analysis of mixtures of aldehydes and ketones.** *Anal. Chem.* **23**, 1754-8 (1951).—*C.A.* **46**, 3459*c*.

A chromatographic sepn. of the 2, 4-dinitrophenylhydrazones was made in mixts. of aldehydes and ketones. A 2:1 weight ratio of silicic acid and Celite activated at 170°-200 °C for 24 hrs was used as an adsorbent. Et_2O-petr. ether mixts., concn. specified for various sepn., were used for developing and eluting. Relative strengths of adsorption were: formaldehyde > acetaldehyde > acetone > propionaldehyde > methyl ethyl ketone = N-butyraldehyde > isobutyraldehyde.

4792. GRANT, R. A. AND STITCH, S. R. **A volume-actuated fraction collector for use in chromatography.** *Chemistry & Industry* **1951**, 230.—*C.A.* **45**, 5460*b*.

The design of a pressure-actuated Hg switch and the assocd. electro-mech. system for fraction collection was presented.

4793. Grasshof, H. **A chromatographic-colorimetric method for the determination of minute amounts of acid.** *Angew. Chem.* **63**, 219-20 (1951).—*C.A.* **45**, 6539*a*.

Detailed directions were given for detg. acids by means of chromatographic adsorption of the acid soln. and a standard dye soln. (Orange GG, Casella) on alkali-free Al_2O_3 and subsequent colorimetric analysis of the elutriate obtained with NaOH soln. Data were given for AcOH, HCl, H_2SO_4, and CO_2.

4794. Hall, David A. **Simplified coupled filter system for adsorption chromatography.** *Nature* **168**, 124 (1951).—*C.A.* **46**, 10698*i*.

In place of a mixer for carrier displacement adsorption chromatography, a jet was placed at the bottom of the series of coupled filters for direct delivery into a fraction collector. The improved columns were useful in sepg. mixts. of small amts. of aromatic acids.

4795. Hesse, Gerhard. **The rate factor of adsorption processes in chromatographic columns.** *Z. Elektrochem.* **55**, 60-5 (1951).—*C.A.* **45**, 9335*c*.

Adsorptive capacities of active charcoal, silica gel, and Al_2O_3 for *o*-xylene were 35, 5.4, and 2.5%, with *T* values (time to reach one half of final pressure) of 12, 28, and 1 sec, resp. Values of *T* for the components of the mixt. (benzene, *o*-, *m*-, and *p*-xylenes, EtPh) on a silica gel were 2, 13, 9, 8, and 8 sec, resp. Since separability of constituents depended on differences in their *T* values, sepn. of all but *p*-xylene and ethylbenzene in the mixt. should be possible, and this was true exptly.

4796. Holman, Ralph T. and Hagdahl, Lennart. **Tiselius-Claesson interferometric adsorption analysis apparatus.** (Improvements in design and use.) *Anal. Chem.* **23**, 794-7 (1951).—*C.A.* **45**, 7388*e*.

Complete details were given for the construction and operation of a modified Tiselius-Claesson adsorption analysis app. The app. may be used for chromatographic displacement sepns. as well as elution, frontal, and carrier displacement sepns.

4797. Holman, Ralph T. and Williams, William T. **Displacement analysis of lipides. VI. Separation of unsaturated acids.** *J. Am. Chem. Soc.* **73**, 5285-9 (1951).—*C.A.* 46, 9325*i*.

Displacement chromatography was used for the sepn. of unsatd. fatty acids. Charcoal was the adsorbent and aq. EtOH the solvent. Satd. and unsatd. acids of the same chain length (4-18 C atoms) were sepd. Nonconjugated unsatn. decreased adsorption; carboxyl-conjugated conjugation increased adsorption. The conjugated octadecadienoic acid (not carboxyl-conjugated) was adsorbed less strongly than stearic acid, whereas conjugated octadecatrienoic acid was adsorbed more strongly than stearic acid.

4798. Hoyer, H. **Hydrogen-bridge bonding and chromatographic separation.** *Z. Elektrochem.* **54**, 413-18 (1950); *Kolloid-Z.* **121**, 121-9 (1951).—*C.A.* **45**, 6528*e*.

Adsorption of a variety of aminoanthraquinones was detd. by passing C_6H_6 solns. through columns packed with silica gel or Al_2O_3. Compds. in which a H-bridge formed passed through the column; the others were adsorbed. This provided a method for sepg. isomers, 1,2-, 1,3-, 1,6-, or 1,7-dihydroxyanthraquinones which were adsorbed while the other isomers passed through a calcite-packed column.

4799. Hoyer, H. **Hydrogen-bridge bonding and chromatographic separation of mercapto compounds.** *Kolloid-Z.* **122**, 142-3 (1951).—*C.A.* **45**, 8848*c*.

The chromatographic method using silica gel columns was used to sep. 1- and 2-mercaptoanthraquinones. The results indicated the presence of inner H-bridge bonding for the 1-mercaptoanthraquinone. Both the chromatographic and spectroscopic methods showed that the SH..O bond was weak.

4800. Ishii, Ryuichiro. **Carotene production by microorganism. II. Activation of alumina for chromatographic analysis of carotenoid pigments.** *J. Fermentation Technol.* (Japan) **29**, 313-16 (1951).—*C.A.* **47**, 2648*a*.

Alumina (0.5 kg) was added to 1.5 liter of *N* H_2SO_4 and the mixt. was heated at 60-70°C for 15 min. under const. stirring. After repeating 3 times it was washed with hot water until neutral. This alumina was similarly treated 3 times with 1.5 liter of 0.5 *N* NaOH 3 times with careful washing. After filtering the alumina was heated at 305-375°C for 2 hrs.

4801. James, T. H. and Vanselow, W. **Chromatographic investigations related to photographic theory.** *J. Am. Chem. Soc.* **73**, 5617-22 (1951).—*C.A.* **46**, 2431*f*.

Elution chromatography, with AgBr as the adsorption medium and aq. C_5H_5N solns. as the chromatographic developer, was applied to the sepn. of a series of photographic sensitizing and desensitizing dyes. The chem. sensitizer, allylthiourea, displaced all of these dyes with about equal ease and was absorbed more strongly than any of them.

4802. Kirchner, J. G.; Miller, John M., and Keller, G. J. **Separation and identification of some terpenes by a new chromatographic technique.** *Anal. Chem.* **23**, 420-5 (1951).—*C.A.* **45**, 5075*f*.

A "chromatostrip" was prepd. by coating a glass strip with a slurry of silicic acid adsorbent, starch binder, and $ZnCdS_2 + Zn$ silicate fluorescing agent. The dried strip was spotted with the terpene mixt. and a solvent of 15% EtOAc in hexane was allowed to ascend the strip in a test tube. The resolved compds. were located by ultraviolet light or by spraying with various reagents, such as fluorescein followed by Br_2 vapor for olefin double bonds.

4803. Knox, Kerro and Thomas, Henry C. **The Jones reductor: a model for the kinetics of chromatography.** *J. Chem. Phys.* **19**, 224-7 (1951).—*C.A.* **45**, 6456*f*.

The Jones reductor could be made to assume a steady state of operation in the reduction of $Fe_2(SO_4)_3$. The rate-limiting process was the diffusion of Fe^{+++} through a static film of soln. around the solid particles. This was particularly evidenced by the exponential dependence of the extent of reduction on the square root of the flow rate. The behavior of the reductor as a function of Zn-ion concn., Zn amalgam particle size, and temp. also agreed with this result.

4804. Kretovich, V. L.; Drozdova, T. V., and Petrova, I. S. **Chromatographic determination of volatile fatty acids.** *Doklady Akad. Nauk S.S.S.R.* **80**, 409-12 (1951).—*C.A.* **46**, 1923*c*.

The soln. of the acids was neutralized with 0.1 *N* NaOH, evapd. to dryness, and 2 drops of 18 *N* H_2SO_4 and 0.1 g Na_2SO_4 added. The soln. was extd. 5 times with 1% BuOH in $CHCl_3$ (total 6 ml) and then placed in a tube with prepd. silica gel (silica gel ground with aq. bromocresol green, then treated with 1 drop NH_4OH until blue, suspended in 1% BuOH-$CHCl_3$ soln., and transferred to the tube), and forced through by a pressure bulb. AcOH gave a yellow band, $PrCO_2H$ light green, and HCO_2H white with yellow edges near top of tube.

4805. LeRosen, Arthur L.; Monaghan, Patrick H.; Rivet, Charles A., and Smith, Edgar D. **Specificity of chromatographic adsorbents.** *Anal. Chem.* **23**, 730-2 (1951).—*C.A.* **45**, 7407*g*.

The factors responsible for the adsorption of a given substance on a given adsorbent were studied and a math. function relating the interactions in the chromatographic system to the movement of the adsorptive zone was constructed. Preliminary work indicated that, for the compds. studied, the adsorption could be accounted for in terms of donor-acceptor and H-bonding interactions and also that the C side chain acted to decrease adsorption.

4806. Ling, Chi-Shau. **Note on the purification of 2, 4-dinitrotoluene from toluene by the aid of chromatography.** *J. Chinese Chem. Soc.* **18**, 135-6 (1951) (in English).—*C.A.* **46**, 2965*c*.

Chromatography was suggested as a means of sepg. 2, 4-$(NO_2)_2C_6H_3$ Me, from other mono- and trinitrated toluenes. MgO was used as the absorbent and Me_2CO as solvent. TNT was strongly absorbed producing a violet zone at the top of the column, the dinitro compd. was poorly absorbed forming a green zone at the bottom; other products passed into the soln.

4807. Lynam, C. G. and Weil, H. **Radial chromatographic pilot plant.** *Can. Chem. Processing* **35**, 471-8 (1951).—*C.A.* **45**, 9309*c*.

Arrangements were shown for overcoming difficulties arising from batch character of chromatography. The plant described primarily for sepn. by chromatographic adsorption or partition could also be adapted to fractionations in which other types of chromatography were involved.

4808. Matsumoto, Yutaro and Funakubo, Eiichi. **The theory and the application of the chromatographic adsorption method. IV. Oxidation of anthracene in the course of the chromatographic procedure. V.** *J. Chem. Soc. Japan, Pure. Chem. Sect.*, **72**, 731-3, 733-6 (1951).—*C.A.* **46**, 5930*d*.

When anthracene (0.5 g) in 130 cc. C_6H_6 was filtered through a column (16 mm in diam. and 16 cm in length) of activated Al_2O_3, a very small portion of anthracene was oxidized to anthraquinone (about 0.5 g).

4809. Miller, John M. and Kirchner, J. G. **New type of chromatographic column.** *Anal. Chem.* **23**, 428-30 (1951).—*C.A.* **45**, 4971*c*.

A rigid column of adsorbent (e.g. silicic acid) in a matrix of gypsum was prepd. by mixing 32 parts silicic acid, 8 parts plaster of Paris, and 60 parts H_2O and allowing the mixt. to harden around a central glass rod in a rectangular mold. The column was activated by drying. It had several advantages over a packed glass column: the distribution of adsorbent was always perfectly uniform, it was adapted to ascending development, it could be examd. by radiation of 230-90 mμ which was absorbed by glass, extrusion was unnecessary before applying a streak reagent and the streak could be scraped off without destroying the column, it was easily shifted to different solvents successively, and zones showed uniform distribution through column cross sections.

4810. Mowery, Dwight F. Jr. **Chromatographic adsorption. I. An efficient utilization of finely powdered adsorbents.** *J. Am. Chem. Soc.* **73**, 5047-9 (1951).—*C.A.* **46**, 8461*c*.

A lab. chromatographic column operating at pressures up to 120 lb/in^2 was described. A method of air-blowing was adopted which improved flow rate and allowed complete elution of adsorbed sugars from Florex XXX. Elution curves for glucose and fructose from airblown Florex XXX, Florex-Celite, and Celite columns were obtained.

4811. Mowery, Dwight F. Jr. **Chromatographic adsorption. II. The separation of D-glucose and D-fructose.** *J. Am. Chem. Soc.* **73**, 5049-52 (1951).—*C.A.* **46**, 8461*d*.

Quant. data were obtained for the chromatographic sepn. of D-glucose and D-fructose mixts. by means of air-blown Florex XXX. Cryst. D-fructose was prepd. in good yield from sucrose, and a rough calcn. indicated that 10 lb of D-fructose could be produced per day from sucrose in a 1 × 6-ft column at 200 lb pressure.

4812. Partridge, M. W. and Chilton, J. **Reversed-phase partition chromatography.** *Nature* **167**, 79-80 (1951).—*C.A.* **45**, 5559*g*.

Glass powder "wetted" with $CHCl_3$ and then mixed with water satd. with $CHCl_3$ would pack in a column and could be used in the sepn. of *o*- and *p*-nitroaniline and *o*- and *p*-nitrophenol.

4813. Pearl, Irwin A. and Dickey, Edgar E. **Lignin and related products. IV. Separation of syringaldehyde and vanillin by chromatography.** *J. Am. Chem. Soc.* **73**, 863-4 (1951).—*C.A.* **45**, 5657*i*.

Vanillin and syringaldehyde could be sepd. by adsorption on a mixt. of Magnesol and Celite No. 535 (5:1 by wt.) (which had been washed with dil. HCl) and elution with 50:1 petr. ether (b. 65-

110 °C)-EtOH; recoveries from mixts. were 99 and 98%.

4814. RAO, N. R.; SHAH, K. H., AND VENKATARAMAN, K. **Chromatographic separation of vat dyes.** *Current Sci.* (India) **20**, 66-8 (1951).—*C.A.* 45, 8775*h*.

A procedure for the chromatographic sepn. of vat dyes using aqueous tetraethylenepentamine, $NH_2(CH_2CH_2NH)_3$, $CH_2CH_2NH_2$, and $Na_2S_2O_4$ was described.

4815. SCHÄFER, HAROLD AND NEUGEBAUER, WALTER. **Inorganic chromatography.** *Naturwissenschaften* **38**, 561 (1951).—*C.A.* 46, 10748*f*.

The reaction between $CuCl_2$ and γ-Al_2O_3 had 3 stages: (1) phys. adsorption (considerable; it could be eluted), (2) immediate pptn. of $Cu_2(OH)_3Cl$ brought about by OH groups remaining on the γ-Al_2O_3, (3) slow continued pptn. of $Cu_2(OH)_3Cl$ by rehydration of Al_2O_3.

4816. SCHNEIDER, K. W. AND OBERKOBUSCH, R. **Analysis of phenol mixtures, using rectification and chromatography.** *Brennstoff-Chem.* **32**, 110-17 (1951).—*C.A.* 45, 5573*b*.

In addn. to theoretical investigations of the migration velocity of pure substances in adsorber columns, adsorption expts. were carried out with definite binary mixts. The expts. showed that the *o*-substituted hydroxybenzenes had less adsorption affinity for Al_2O_3 than the isomeric *p*- or *m*-substituted compds.

4817. SEN GUPTA, N. C. AND GUPTA, A. **Standardization of silica for adsorption chromatography.** *Science and Culture* **17**, 265-6 (1951).—*C.A.* 46, 10049*f*.

Silica gel was activated by drying at 180°-200 °C for 6 hrs, standardized by mixts. of toluene, chlorobenzene, or nitrobenzene, and petr. ether, was tested with respt to activity. The plotted curves from the exptl. results appeared to follow Langmuir's adsorption isotherms.

4818. SMITH, EDGAR D. AND LEROSEN, ARTHUR L. **Effect of side chain on the chromatographic adsorption of some ketones.** *Anal. Chem.* **23**, 732-5 (1951).—*C.A.* 45, 7407*i*.

The effect of the side chain on the strength of chromatographic adsorption on $CaCO_3$, silicic acid, and Florisil was studied, also included were the straight-chain methyl ketones from C_3 to C_{20}. The rates of movement of the adsorbate zones down the adsorbent columns were used as a measure of adsorption strengths. Generally, the ketones appeared to be adsorbed because of interactions between carbonyl-O and the adsorbent. The heavier the side chain, the smaller was the adsorption strength, although in certain cases periodic increases in adsorption affinity were observed with increasing length of side chain.

4819. THOMAS, HENRY C. **Solid diffusion in chromatography.** *J. Chem. Phys.* **19**, 1213 (1951).—*C.A.* 46, 3366*h*.

The simple case of isotopic exchange, where a linear isotherm was to be found, was treated for a slightly idealized system. If 2 columns, differing in length and in the radii of the spheres of adsorbent, were set up, the breakthrough curve of one should be immediately deducible from that of the other.

4820. ULMANN, M. **Chromatographic studies on the decomposition of potato starch by malt amylase.** *Biochem. Z.* **321**, 377-87 (1951).—*C.A.* 45, 7810*h*.

The selective adsorption of Al_2O_3 (treated or untreated with HCl) has been utilized to study the digestive products of potato starch chromatographically. The amylase prepn. very rapidly splits the complex aggregates between amylose and amylopectin. The further hydrolysis of the latter leads to the formation of 2 dextrins which give a brown reaction with I_2 and which can be sepd. on Al_2O_3.

4821. ULMANN, M. **Changes of state (phase) in diluted starch solutions. I. Chromatographic investigations.** *Kolloid-Z.* **123**, 105-13 (1951).—*C.A.* 46, 8930*c*.

A bipartite (acid-basic) Al_2O_3 column was found best-suited for the chromatography of starch; 0.0025 *N* I-KI soln. was used to make the adsorbed starch particles visible. Depending on degree of diln. and on mech. treatment of the soln. (shaking) characteristic zone changes were obtained on the chromatographic column. Potato-starch solns. showed more complicated conditions than correspondingly concd. pudding-flour solns. Shaken solns. were more easily filtered and showed a different chromatogram.

4822. WISE, W. S. **Chromatographic estimation of aqueous solutions of acids.** *Analyst* **76**, 316-17 (1951).—*C.A.* 45, 6968*d*.

To eliminate the necessity of dissolving in a solvent before placing on the column, a little silica gel was added to the acid. The aliquot used should contain about 0.001 equiv. of total acid. A mixt. of 28.1% butyric acid, 15.6% propionic acid, 39.1% acetic acid, and 17.2% formic acid, gave the respective values 28.4, 15.1, 39.5, and 17.1%.

4823. YANOVSKII, M. I. **Chromatographic method of determination of adsorption isotherms, isobars, and isosteres.** *Zhur. Priklad. Khim.* **24**, 661-6 (1951).—*C.A.* 47, 22*b*.

The adsorption isotherm was derived from the chromatographic desorption curve by graphic integration. Isobars and isosteres were detd. from series of desorption curves at different temps.

4824. ZECHMEISTER, L. **Paper disk columns in glass chromatographic tubes.** *Science* **113**, 35-6 (1951).—*C.A.* 45, 3204*d*.

A Tswett tube could be packed with filter paper disks if the latter were cut with a precision punch and die to a diam. equal to the av. inside diam.= 0.05 cm of the tube. This app. had the advantages of the chromatopile and those of a closed system.

4825. ZHUKHOVITSKII, A. A.; ZOLOTAREVA, O. V.; SOKOLOV, V. A., AND TURKEL'TAUB, N. M. **New method of chromatographic analysis.** *Doklady Akad. Nauk S.S.S.R.* **77**, 435-8 (1951).—*C.A.* 46, 11011*b*.

A stream of diluent (air) was applied while the furnace which heats consecutive sections of the adsorbing column, and causes desorption, was moved down the column. This "chromathermographic" method permitted variation of the velocity of the air stream, the temp. of the furnace, and its velocity. The air stream distributed the components at different spots of the temp. field, and kept them sepd. by preventing either acceleration or slowing down. The method was illustrated by a plot of sepn. of 105 g of a mixt. $CH_4 + C_2H_6 + C_2H_4 + C_3H_8 + C_3H_6 + C_4H_8 + iso\text{-}C_4H_8$, in terms of the vol. of air passed for $\alpha = 40$ cc/min., $d = 1\text{-}2$ mm, $V/n = 60$ m, $T_n = 150\,°C$. The plot showed 7 distinct peaks.

4826. Alm, R. S.; Williams, R. J. P., and Tiselius, Arne. **Gradient elution analysis. I. A general treatment.** *Acta Chem. Scand.* **6**, 826-36 (1952) (in English).—*C.A.* **47**, 6301*h*.

An eluting medium was used whose compn. was continuously changed by the addn. of a solvent of high eluting power at a known rate to a known initial vol. of another solvent of lower eluting power in a mixing chamber which drained into the column.

4827. Alm, R. S. **Gradient elution analysis. II. Oligosaccharides.** *Acta Chem. Scand.* **6**, 1186-93 (1952) (in English).—*C.A.* **47**, 6301*i*.

Gradient elution analysis was used in a chromatographic analysis of α-Schardinger dextrin contg. a mixt. of mono- to hexasaccharides and dextrin. Charcoal was mixed with an equal amt. of Celite and pretreated by satn. in a column with stearic acid in 96% EtOH; the charcoal was filtered, stirred with 50% EtOH, and again filtered; the operation was repeated with 20% EtOH and 100 fractions (0.5 cc. each) obtained.

4828. Al-Mahdi, A. K. and Wilson, Cecil L. **Chromatography of organo-metallic complexes. II.** *Mikrochemie ver. Mikrochim. Acta* **40**, 138-40 (1952).—*C.A.* **47**, 2643*h*.

Pairs of inorg. cations were sepd. by means of the complexes formed with Na diethyldithiocarbamate with the solvents $CHCl_3$ or C_6H_6 and a column filled with activated Al_2O_3. All possible binary combinations of Co^{++}, Cu^{++}, Fe^{+++}, and Ni^{++} were studied. In about half the cases, a very satisfactory sepn. was possible.

4829. Boggs, L. A.; Cuendet, L. S.; Dubois, Michel, and Smith, Fred. **Simple fractionating device for chromatographic analysis. Application to the study of carbohydrates.** *Anal. Chem.* **24**, 1148-51 (1952).—*C.A.* **47**, 4660*e*.

The construction and operation of an app. of general use for collecting 200 fractions of eluates from a chromatographic column was described. By the use of phenol satd. with H_2O and a column of cellulose powder a no. of simple sugars have been sepd. By using methyl ethyl ketone-H_2O azeotrope as the solvent. mixts. of methylated sugars could be readily resolved into their components.

4830. Burstall, F. H.; Swain, Patricia; Williams, A. F., and Wood, G. A. **Inorganic chromatography on cellulose. XI. Separation of tantalum from niobium and its application to quantitative analysis.** *J. Chem. Soc.* **1952**, 1497-1504.—*C.A.* **47**, 3753*i*.

To the metals or oxides in a Pt dish, add a few drops of water, a little HNO_3, and 5-10 ml of 20 *N* HF. Evap. to dryness. To the residue add 1 g NH_4F, 6 ml of water, and 2 ml of HF. Prep. a column from a slurry of cellulose in EtCOMe. After passing through the column, the Ta and Nb were nearly completely retained. Ext. the Ta with EtCOMe satd. with water and the Nb with a soln. of 7.5 ml HF in 92.5 ml of EtCOMe.

4831. Burstall, F. H. and Williams, A. F. **Inorganic chromatography on cellulose. Determination of tantalum and niobium in high and low-grade complex minerals and ores.** *Analyst* **77**, 983-99 (1952).—*C.A.* **47**, 1537*f*.

Moisten the weighed metals or oxides in a Pt dish, add a few drops of HNO_3 and 10-20 ml of 40% HF. Finally, evap. the resulting soln. to dryness and dissolve the residue in exactly 8 ml of dild. HF. Cover, heat, and after 10 min. add 1 g of NH_4F and heat for another 10 min. in the covered dish. Ext. this soln. with a column of activated cellulose, and treat the column with 100 ml of a soln. of EtCOMe satd. with water. In all, use 250 ml of this solvent. The eluate will then contain the Ta fraction. Then by a mixt. of 7.5 ml of 40% HF to each 92.5 ml of EtCOMe, ext. the Nb.

4832. Chapon, L. **Simple apparatus for the automatic collection of fractions in microchromatography.** *Bull. soc. chim. France* **1952**, 538-9.—*C.A.* **46**, 9346*d*.

Each fraction was collected in a siphon which emptied into one of a no. of flasks on a turntable; the decrease in wt of the siphon during emptying caused the breaking of an elec. contact which made the table turn until the next flask was in position to receive the next fraction.

4833. Cheftel, Rose Irène; Munier, Roger, and Macheboeuf, Michel. **Microchromatography ou paper of nonvolatile, water-soluble aliphatic acids. II. Utilization of an alkaline solvent phase followed by an acid solvent phase for two-dimensional chromatography.** *Bull. soc. chim. biol.* **34**, 380-7 (1952).—*C.A.* **47**, 1008*i*.

The sepn. and identification of oxalic, malonic, succinic, fumaric, maleic, malic, adipic, sebacic, glycolic, lactic, citric, tartaric, and aconitic acids were studied.

4834. Danielsson, Carl Erik. **A new type of preparative chromatographic paper column.** *Arkiv Kemi* **5**, 173-6 (1952) (in English).—*C.A.* **47**, 5634*b*.

A cylinder, 30 cm high and 10 cm in diam. was made by rolling filter paper on a 1-cm rod. The interior was filled with paraffin. Rings of filter paper (8 cm outside, 3 cm inside diam.) contg. the soln. to be examd. were placed on the cylinder. A 2nd cylinder, 10 cm high with a hole on the topside, served as a cap. The solvent in the top was maintained at a const. level by being fed from an inverted flask. Zones of const. compn. of valine, alanine, and glycine were found at 35, 45, and 57 mm from the center.

4835. DiModica, G. and Rossi, P. F. **Separation by chromatography of unsaturated organic acids.** *Chim. anal.* **34**, 271-3 (1952).—*C.A.* **47**, 1543*i*.

Special attention was given to linoleic and linolenic acids. A soln. in acetone was poured on a very cold column of Al_2O_3 and the column was eluted with acetone under slight pressure of N_2. The least sol. linolenic acid was absorbed more than the more sol. linoleic acid which, in turn, was absorbed more than was the still more sol. oleic acid.

4836. Donaldson, Kenneth O.; Tulane, Victor J., and Marshall, Lawrence M. **Automatically increasing solvent polarity in chromatography.** *Anal. Chem.* **24**, 185-9 (1952).—*C.A.* **46**, 4862*b*.

An automatic device was described that permitted the delivery of solvent gradually increasing in polarity for better resolution of org. acids on silica gel columns.

4837. Drake, Birger. **Chromatography combined with automatic recording of electrolytic conductivity. I. Description of an apparatus and applications to the analysis of amino acids and peptides.** *Arkiv Kemi* **4**, 401-20 (1952) (in English).—*C.A.* **47**, 1544*f*.

An automatic continuous recording of the resistances due to concn. changes in eluates from adsorption columns was described. An "unbalanced voltage" was fed through an amplifier to a phase-discriminating circuit; the output was applied to an elec.-mech. arrangement controlling one of the bridge resistances so that balance was restored. The advantages were a linear response to concn. changes.

4838. Drake, Birger and Gardell, Sven. **Chromatography combined with automatic recording of electrolytic conductivity. II. The analysis of a mixture of glucosamine and galactosamine.** *Arkiv Kemi* **4**, 469-72 (1952) (in English).—*C.A.* **47**, 1544*h*.

The electrolytic resistance of the effluent from a chromatographic column filled with Dowex 50 was recorded automatically and continuously. The column was calibrated with known solns. and mixts. of glucosamine and galactosamine hydrochlorides. The amts. of these in the hydrolyzate of a polysaccharide from beef cornea were then detd. by this method, and colorimetrically.

4839. Drew, Frederick D.; Marshall, Lawrence M., and Friedberg, Felix. **Separation of keto acids by cellulose columns.** *J. Am. Chem. Soc.* **74**, 1852-3 (1952).—*C.A.* **47**, 5846*h*.

γ-Methiol-α-ketobutyric, α-ketobutyric, pyruvic, oxalacetic, and α-ketoglutaric acids were sepd. by adsorption on Solka-Floc BW100 and elution with BuOH-decyl alc. with gradually increasing concn. of BuOH. The acids emerged in the order given.

4840. Duin, H. van. **Partition chromatography of homologous series.** *Biochim. et Biophys. Acta* **9**, 580 (1952).—*C.A.* **47**, 2245*e*.

The concept of retention vol. was introduced to derive a relation for partition chromatography of homologs. Once the slope for a given aliphatic series had been established, it was possible to identify homologs by their retention vols. when the behavior of one member of the series on the column was known.

4841. Dustin, J. P. **Description of a chromatographic fraction collector for multiple applications.** *Ind. chim. belge* **17**, 257-60 (1952).—*C.A.* **46**, 6867*a*.

An app. was described based on the photoelectrical principle. It was possible to collect simultaneously 4 series of 180 fractions of 10 ml or corresponding amts. of larger fractions.

4842. Faucher, Joseph A. Jr.; Southworth, Raymond W., and Thomas, Henry C. **Adsorption studies on clay minerals. I. Chromatography on clays.** *J. Chem. Phys.* **20**, 157-60 (1952).—*C.A.* **46**, 6459*h*.

With the aid of chromatographic columns contg. a clay mineral dispersed on asbestos, ion-exchange processes were studied. The results of isotopic exchanges showed that the columns did not run under equil. conditions. A correction procedure was possible which served to produce isotherms for cases of true ion exchange.

4843. Fillinger, Harriett H. and Trafton, Lois Ann. **Chromatographic analysis for metal ions.** *J. Chem. Education* **29**, 285-7 (1952).—*C.A.* **46**, 7472*f*.

In the analysis of group I, of the cations, a single Al_2O_3 column and 1 reagent, K_2CrO_4, sufficed; reddish-orange (Hg), yellow (Pb), and dark rust-colored (Ag) bands were obtained in the order stated (top to bottom). For the Cu group, one Al_2O_3 column and 3 reagents were used; *p*-dimethylaminobenzylidenerhodanine in EtOH, Na_2SnO_2, and Na_2S. For the As group, 3 columns and 3 reagents were required; a hot concd. soln. of $Na_2S_2O_3$, a satd. soln. of cacotheline, and a strong soln. of $AgNO_3$. For the Zn group, 2 columns and 4 reagents were used; concd. $K_3Fe(CN)_6$ soln., diethylaniline in H_2SO_4, a fresh mixt. of $NaBiO_3$ and HNO_3, and a soln. of KCNS in Me_2CO. For the Al group, 2 columns and 4 reagents: $Pb(NO_3)_2$, $K_4Fe(CN)_6$, dimethylglyoxime, and Aluminon. For the alk. earth group, 2 columns and 2 reagents were necessary: (*p*-nitrophenylazo) resorcinol and NaOH.

4844. Gapon, E. N. and Belen'kaya, I. M. **Precipitation chromatography of ions.** *Kolloid. Zhur.* **14**, 323-37 (1952).—*C.A.* **47**, 1459*h*.

If a soln. of 2 metal nitrates was filtered through a column of a mixt. of NaI with Al_2O_3 or silica gel, 2 iodide layers formed; AgI was prepd. above (i.e. before) HgI_2 which pptd. before $BiI_3 \rightarrow PbI_2 \rightarrow Cu_2I_2$. After the completion of the filtration, the iodide zones might contract to rings, or move up the column, or form new ppts. (of Ag_2HgI_4, $AgBiI_4$, or $PbHgI_4$), or become sepd. by a coloreless zone (if HgI_2 was one of the components). HgI_2 alone might form 2 zones, namely of the yellow (below) and the red (above) modifications. Analogous zones occurred when metal nitrates were filtered through a column moistened with a Na silicate soln.; Al_2O_3 and starch could not be used instead of silica gel. The earliest ppt. was $HgSiO_3$, followed by $Fe(OH)_3$, UO_2SiO_3, $CuSiO_3$, Ag_2SiO_3, $CoSiO_3$, and $NiSiO_3$, in this order, except that Co and Ni gave a common zone.

4845. Glenn, R. A.; Wolfarth, Joy S., and Dewalt, C. W. Jr. **Refractometric adsorption analyses. Use of automatic recording differential refractometer.** *Anal. Chem.* **24**, 1138-43 (1952).—*C.A.* **46**, 9461*e*.

The battery-operated, continuous, automatic recording differential refractometer was adapted for following the progress of liquid chromatographs of colorless materials. Integration of the area under the curve in a refractogram obtained by the use of the automatic recording refractometer permitted detn. of the individual components in the percolate from an adsorption column by utilizing the additive property of the *n*. Quant. refractometric adsorption analyses according to this technique were reported for the first time. Analyses of methylcyclohexane-toluene mixts. on silica gel were presented.

4846. Heinrich, Gisela. **Temperature dependence of column chromatography of electrolyte solutions.** *Naturwissenschaften* **39**, 257 (1952).—*C.A.* **47**, 6302*c*.

Expts. on chromatography of $CuSO_4$ solns. on standard Brockmann Al_2O_3 columns at temps. ranging from 20° to 80°C indicated that the duration of the test decreased from 61 to 47 min. and that at higher temps. up to 75% increased adsorption of the ions took place. This held for different types of Al_2O_3, for Ni as well as for Cu, and at concns. varying from 0.8 to 0.1*M*.

4847. Hesse, G.; Daniel, Irmgard, and Wohlleben, G. **Aluminum oxide preparations for chromatographic analysis and experiments on their standardization.** *Angew. Chem.* **64**, 103-7 (1952).—*C.A.* **46**, 6338*i*.

A no. of chromatographic adsorbents were evaluated for filtration speed, adsorption activity, activity series for a no. of different org. compds., activity stages, exchange activities, and adsorption velocity. Three types of Al_2O_3 prepns. were developed which possess const. properties.

4848. Higuchi, Takeru; Hill, Norman C., and Corcoran, Geraldine B. **Chromatographic separation and determination of dicarboxylic acids, C_4 to C_{10}.** *Anal. Chem.* **24**, 491-3 (1952).—*C.A.* **46**, 6039*g*.

Sebacic, azelaic, suberic, pimelic, and lower straight-chain dicarboxylic acids in mixts. contg. any or all of these acids were detd. The method, a modification of that of Marvel and Rands was based on chromatographic sepn. of the acidic components on a partition column with either pH 5.40 citrate buffer (for sepn. of acids above adipic) or water (for sepn. of acids below adipic) as the internal phase.

4849. Hilliard, Leland B. and Freiser, Henry. **Chromatographic separation of metallic chelates.** *Anal. Chem.* **24**, 752-4 (1952).—*C.A.* **46**, 11041*h*.

Various metals were sepd. by adsorption chromatography of $CHCl_3$ solns. of metallic 8-hydroxyquinolinates on silicic acid columns and elution with $CHCl_3$ and $CHCl_3$-EtOH mixts. Cu(II), Ni(II), Co(II), Fe(III), Al(III), Ga(III), and In(III) were sepd. by this procedure after extn. from aq. soln. at pH 5.0 and Pb(II), Bi(III), Zn(II), and Cd(II) after estn. at pH 10.0.

4850. Huisman, T. H. J. and Krans, S. A. **A simple fractionator for column chromatography.** *Chem. Weekblad* **48**, 1007-9 (1952).—*C.A.* **47**, 5180*d*.

The collector consisted of a sheet metal top and bottom circle 65 cm diam. About 120 holes were drilled around the edge to receive glass collecting tubes. An elec. clock and relay caused the ring to move one space at predetd. intervals. It was used to sep. amino acids from urine by the use of Dowex 50.

4851. James, A. T. and Martin, A. J. P. **Gas-liquid partition chromatography. A technique of the analysis of volatile minerals.** *Analyst* **77**, 915-32 (1952).—*C.A.* **47**, 1529*e*.

A gas-liquid partition column for the sepn. of volatile acids and bases and an automatic buret for detection and detn. by titration was described. With 4-ft columns having a stationary phase consisting of a mixt. of a liquid silicone and stearic acid, all normal and iso acids from formic to undecanoic acid could be sepd., and by the use of a 11-ft column all the isomers of valeric acid could be resolved. In sepg. volatile bases, advantage was taken of their H-bonding power so that by the use of H-bonding and non-H-bonding stationary phases, many amines could be sepd. and different types of amines distinguished.

4852. Kegeles, Gerson and Sober, Herbert A. **Automatic recorder for interferometry and refractometry of streaming solutions. Applicable to chromatographic analysis.** *Anal. Chem.* **24**, 654-60 (1952).—*C.A.* **46**, 6869*c*.

An instrument which used a cell-focusing cylindrical-lens optical system together with a vertically driven photographic plate combined with an interferometer and an automatic-recording prism cell was described. The instrument could be employed as an automatic-recording prism-cell device, as a continuous-recording interferometer with monochromatic light, or as a continuous concn. gradient recorder.

4853. Kember, N. F. **Inorganic chromatography on cellulose. VII. Determination of thorium in monazite and of thorium and uranium in uranothorianite.** *Analyst* **77**, 78-85 (1952).—*C.A.* **46**, 3454*f*.

The procedure consisted in prepg. a HNO_3 soln. of monazite sand free from phosphate and allowing it to percolate through a cellulose column previously prepd. in ether contg. 12% HNO_3. $Th(NO_3)_4$ passed quantitatively into the solvent but most other inorg. compds. remained in the column. The ether was removed and the Th recovered from the eluate by pptn. as oxalate and ignition to ThO_2. The method could also be used in the analysis of uranothorianite for both U and Th.

4854. Kirkwood, John G. and Brown, Raymond A. **Diffusion-convection. A new method for the fractionation of macromolecules.** *J. Am. Chem. Soc.* **74**, 1056-8 (1952).—*C.A.* **46**, 5406*d*.

The new method proposed was based on the principles of the Clusius column. Horizontal transport of the macromol. components in a vertical convection channel was produced by thermodynamic interaction with a diffusing low-mol.-wt substance to which the channel walls were permeable.

4855. Kurtz, Floyd E. **Chromatography of methyl stearate, methyl oleate, methyl linoleate, and methyl linolenate: a concept of amplified chromatographic separations.** *J. Am. Chem. Soc.* **74**, 1902-9 (1952).—*C.A.* **47**, 6310*c*.

More effective sepn. than previously reported of C_{18} esters, judged on the basis of completeness and time involved, were obtained. More effective sepns. than otherwise obtainable were predicted by the proper use of solutes of intermediate adsorption affinities.

4856. Lapidus, Leon and Amundson, Neal R. **Mathematics of adsorption in beds. VI. The effect of longitudinal diffusion in ion-exchange and chromatographic columns.** *J. Phys. Chem.* **56,** 984-8 (1952).—*C.A.* **47,** 9065*c*.

Equations were derived for cases of local equil. and of mass transfer at particle surface in which equil. was linear. Calcd. results for local equil. showed that sharp boundaries were smoothed out for low ratios of fluid velocity to diffusion coeff.

4857. Laskowski, D. E. and Putscher, R. E. **Dielectric indicator for column chromatography.** *Anal. Chem.* **24,** 965-9 (1952).—*C.A.* **46,** 8902*g*.

The feasibility was detd. of using the oscillator section of a thermal regulator (Thermocap relay) as a dielec.-const.-sensitive device for detecting colorless components in the effluent stream of a chromatographic column.

4858. LeRosen, Arthur L.; Movarek, Richard T., and Carlton, Jack K. **Streak reagents for chromatography.** *Anal. Chem.* **24,** 1335-6 (1952).—*C.A.* **46,** 11017*i*.

A number of streak reagents were used for the detection of org. compds. on silicic acid columns.

4859. Lien, Oliver G. Jr.; Peterson, Elbert A., and Greenberg, David M. **Automatic fraction collector for column chromatography.** *Anal. Chem.* **24,** 920-1 (1952).—*C.A.* **47,** 3*d*.

Description of a device for the collection and drying of radioactive fractions directly in the counting planchets. The app. operated on the const. time-interval principle and involved a continuously rotating table and an automatically positioned delivery tip.

4860. Lister, B. A. J. **The chromatographic purification of inorganic salts on activated alumina.** *J. Applied Chem.* (London) **2,** 280-3 (1952).—*C.A.* **46,** 8555*c*.

Solns. of Zn, Cd, Mn, Mg, Ca, Sr, and Ba salts, and of Na and NH_4 tungstates were freed from trace impurities of Fe, Cu, Ag, and Pb by one pass through a column of activated alumina. In most cases the contaminant contents of the resulting solns. were <2.0 p.p.m. Fe was the least completely removed, owing to the presence of colloidal $Fe(OH)_3$.

4861. Löfgren, Nils M. **Qualitative separation of purines, pyrimidines, and nucleosides by paper chromatography.** *Acta Chem. Scand.* **6,** 1030-5 (1952) (in English).—*C.A.* **47,** 3759*b*.

On strip paper the components of any mixt. of adenine, guanine, xanthine, hypoxanthine, cytosine, uracil, thymine, adenosine, guanosine, cytidine, uridine, and thymidine could be identified in ultraviolet light.

4862. Marshall, Lawrence M.; Donaldson, Kenneth O., and Friedberg, Felix. **Chromatographic resolution of organic acids with progressively changing solvents.** *Anal. Chem.* **24,** 773-5 (1952).—*C.A.* **47,** 72*c*.

A technique was described for computing chromatographic positions and the migration of several org. acids in several solvent systems. This permitted the chromatographic procedure to be scaled upward or downward. The possibilities of this newer type of chromatography were illustrated by exptl. data.

4863. Mercer, R. A. and Williams, A. F. **Inorganic chromatography on cellulose. XIII. Determination of tantalum and niobium in low-grade phosphatic and siliceous ores.** *J. Chem. Soc.* **1952,** 3399-3403.—*C.A.* **47,** 1537*d*.

The chromatographic method was extended to ores contg. less than 0.1% $Ta_2O_5 + Nb_2O_5$. The sample was digested with $HCl + NH_4F$ and placed on a column of cellulose. Ta was extd. with EtCOMe which was satd. with water and the column was then equilibrated with EtCOMe contg. 12.5% of 40% HF by vol. In one procedure, the sample was chromatographed directly and, in the other, a preliminary acid hydrolysis treatment was given in order to get rid of most common cations. For low-grade ores, 10 g of sample were needed to get weighable quantities of $Ta_2O_5 + Nb_2O_5$ and a preliminary sepn. of these earth acids was necessary.

4864. Miller, John M. and Kirchner, J. G. **Improvements in chromatographic techniques for terpenes.** *Anal. Chem.* **24,** 1480-2 (1952).—*C.A.* **46,** 11050*e*.

Chromatostrips were used to check the effluent fractions from a silica (with 5% starch) column. Details were given for the prepn. of this adsorbent. The filling of the column with an aq. slurry was shown to give more uniform zones than dry packing.

4865. Misato, Tomomasa and Fukunage, Kazuo. **Determination of γ-BHC by chromatography.** *J. Agr. Chem. Soc. Japan* **26,** 24-7 (1952).—*C.A.* **47,** 5605*c*.

The partition chromatographic method was improved, and the amts. of reagents (hexane, nitromethane, silica gel, etc.) and the size of app. were reduced $\frac{1}{3}$-$\frac{1}{5}$. By this method γ-BHC was sepd. from the other isomers and hepta- and octachlorocyclohexane with accuracy.

4866. Monaghan, P. H.; Moseley, P. B.; Burkhalter, T. S., and Nance, O. A. **Detection of chromatographic zones by means of high-frequency oscillators.** *Anal. Chem.* **24,** 193-5 (1952).—*C.A.* **46,** 4860*b*.

An app. was described for the detection of colorless zones on chromatographic columns. Portions of the columns under test were placed between the plates of a capacitor in the tank circuit of a high radiofrequency oscillator.

4867. Mottier, M. and Potterat, M. **Study of some liposoluble dyes by chromatography with alumina disks. Fixation of chromatograms on alumina disks.** *Mitt. Lebensm. Hyg.* **43,** 118-23; 123-5 (1952) (in French).—*C.A.* **46,** 7942*f*.

The soln. to be examd. was dropped from a pipet onto the center of an alumina disk and eluated with the following solvents: pentane, CCl_4, benzine, $CHCl_3$, ether, acetone, abs. alc., and H_2O. Since the disks were very sensitive, their fixation by satg. them with melted paraffin was suggested.

4868. Ovenston, T. C. J. **Double zoning and the homogeneity test in column chromatography.** *Nature* **169**, 924-5 (1952).—*C.A.* 46, 11011*f*.

The homogeneity test was affected by double zoning which may occur when the column is treated with a weakly developing solvent following earlier treatment with a stronger one either in a prewashing step or during actual development of the chromatogram. Secondary zones may also occur when adsorbates undergo chemical change during chromatography or by the action of light or oxidation on inactive adsorbents. Confirmation of one zone should be made.

4869. Parker, C. A. **Chromatography of rubber accelerators and antioxidants on silica gel.** *Nature* **170**, 539-40 (1952).—*C.A.* 47, 2528*e*.

Silica gel (Celite) permitted chromatographic adsorption of some compds. from acetone exts. of vulcanized rubbers without the destruction of labile compds., as occurred when Al_2O_3 columns were used. Portions of the ext. corresponding to 0.2-0.4 g of rubber were chromatographed on a column 1 cm in diam. The positions of the zones were found by streaking the extruded columns with appropriate reagents.

4870. Pearl, Irwin A. and Beyer, Donald L. **Separation of vanillic and protocatechuic acids by chromatography.** *Anal. Chem.* **24**, 1366 (1952).—*C.A.* 46, 11050*h*.

The acids were sepd. on a Magnesol column (acid-washed, air-dried overnight, and moistened with benzene) and eluted with benzene-EtOH (10:1). The extruded column was streaked with $FeCl_3$ and the zones were extd. with acetone; recoveries were 97% of each acid from mixts.

4871. Roginskiĭ, S. Z. and Yanovskiĭ, M. I. **Theory of chromatography on nonhomogeneous surfaces. I. Determination of the distribution function of portions of a solid surface over heats of adsorption from the desorption curves.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* **1952**, 59-63.—*C.A.* 46, 6897*f*.

Given an exptl. adsorption curve $\Phi(c)$, the distribution function could be derived by graphic differentiation $\rho(Q) = (1/RT)d\Phi(c)/d \ln c$. Practically, the detn. of the adsorption isotherm in the range of small coverages may present difficulties. In such cases, use could be made of the desorption curves. With the aid of the fundamental equation of chromatography, valid for both adsorption and for desorption in a stream of pure solvent, $\rho(Q) = cV/MxRT$, where V = vol. of solvent (or diluent gas) passed, x = distance from the entrance of the column, and M = wt of one cm of the adsorption layer.

4872. Roginskiĭ, S. Z. and Yanovskiĭ, M. I. **Theory of chromatography on nonhomogeneous surfaces. III. Dynamics of the adsorption of mixtures on nonhomogeneous surfaces.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* **1952**, 64-73.—*C.A.* 46, 6898*c*.

The case of a mixt. of 2 adsorbable substances was detd. by the functional relation $Q_2 = \phi(Q_1)$ between the heats of adsorption Q_1 and Q_2 of the 2 components on the same portion of the surface. With a mixt. of one less adsorbable component 1 and more readily adsorbable component 2 passed in a vol. V_0 of carrier gas, two sorption waves developed, the 1st of which contained 1 at a concn. c_1^1 higher than its initial c_1^0. At const. ratio c_2^0/c_1^0, a decrease of the sum $c_1^0 + c_2^0$ caused the range occupied by component 1 to decrease gradually.

4873. Ryan, W. and Williams, A. F. **Inorganic chromatography on cellulose. VIII. The use of a "compound column" of alumina and cellulose for the determination of uranium in minerals and ores containing arsenic and molybdenum.** *Analyst* 77, 293-6 (1952).—*C.A.* 46, 7470*g*.

By adding activated Al_2O_3 to the cellulose and placing the mixt. on top of the usual cellulose column and with ether-HNO_3 as eluant the Mo and As are adsorbed while U passes into the eluate. Decomp. the sample contg. the equiv. of 100-150 mg. of U_3O_8 with $HNO_3 + HF$, remove the latter by repeated evapn. with HNO_3 and, if necessary, fuse any residue with KOH in a Ni crucible. Evap. to dryness, add 4 ml. of 25% HNO_3 and add the cool soln. to the adsorbing column.

4874. Sato, Takuya R.; Norris, William P., and Strain, Harold H. **Apparatus for continuous electrochromatography.** *Anal. Chem.* **24**, 776-8 (1952).—*C.A.* 47, 1*f*.

The construction of 12-in. and 24-in. electrochromatographic cells and their supports was described. The quant. sepn. and recovery of Ca^{45++}, $P^{32}O_4^{---}$, and Ag^+ from CrO_4^{--} were described. The high potential across the cell presented considerable hazard during its operation.

4875. Sen, Binayendra Nath. **Chromatography with calcium sulfate rods in the qualitative copper-cadium and arsenic-antimony-tin separations.** *Z. anorg. u. allgem. Chem.* **268**, 99-100 (1952).—*C.A.* 46, 6995*g*.

A $CaSO_4$ rod on which there were 1 or 2 drops of unknown soln. was placed in a test tube contg. dil. HCl so that the unknown soln. was 2-4 cm above the HCl surface. After the HCl soln. had stopped climbing, H_2S passed over the rod gave sulfide zones, the color of which indicated (a) Cd or Cu or (b) Sb, Sn, or As (the last named in each case moved the highest).

4876. Shemyakin, F. M. and Romanov, D. V. **Effect of the composition of zeolites on their chromatographic properties.** *Kolloid. Zhur.* 14, 376-8 (1952).—*C.A.* 47, 1460*b*.

The chromatographic efficiencies of 36 ppts. obtained by mixing NaOH, $Al_2(SO_4)_3$, and Na_2SiO_3 (in H_2O) in various ratios were compared. The mixts. (*a*) Na_2O 18.6, Al_2O_3 5.1, SiO_2 9.0 mol., (*b*) Na_2O 15.5, Al_2O_3 5.1, SiO_2 12.0, and (*c*) Na_2O 12.4, Al_2O_3 5.1, SiO_2 15.0 caused the best sepn. of Cu, Cr, Co, and Fe ions. The width x of a band increased with time t according to $x = x_0 (1-e^{-kt})$, where x_0 and k were const.

4877. Smith, E. D.; Mueller, William A., and Rogers, L. N. **Chromatographic determination of purity of chloroacetic acid.** *Anal. Chem.* **24**, 1117-19 (1952).—*C.A.* 46, 9471*f*.

The respective acid zones were located on the adsorbent column by use of acid-base indicator streak reagents and analyzed by cutting the zones out and then eluting and titrating each separately. The procedure provided a reasonably accurate analysis of chloroacetic acid, and, with somewhat less accuracy, detns. may also be made of AcOH and Cl_2HCCO_2H.

4878. SMITH, E. LESTER. **Pitfalls in partition chromatography.** *Nature* **169**, 60-2 (1952)

A single solute could give rise to two and sometimes three bands on kieselguhr partition chromatograms run with n-butanol. Double zoning could be caused by a water-logged film at the top of the column. A fall in temperature could produce this result. Alternatively, double zoning with vitamin B_{12b} as solute could be caused by an over-dry section at the top of the column arising from solvent under-saturated with water. Triple zoning could arise from the successive operation of both causative factors.

4879. ULMANN, M. **Starch chromatography.** *Stärke* **4**, 73-7 (1952).—*C.A.* **47**, 3593*a*.

Five ml of 0.1% starch soln. was adsorbed on 5-6 g of Al_2O_3 in an 8-mm tube and the chromatogram was developed with 0.0025 *N* iodine-KI soln. Treatment of the upper half of the column with 0.2% HCl gave an "acidic-basic" column resulting in more selective adsorption and better zone sepn. Amylopectin was adsorbed by acid-treated alumina; during development amylose moved to the basic alumina while amylopectin remained on the acidic alumina.

4880. ULMANN, M. **The amylose in potato starch; chromatographic investigations.** *Makromol. Chem.* **9**, 76-95 (1952).—*C.A.* **47**, 6688*e*.

When a starch soln. was chromatographed on an Al_2O_3 column, the upper part of which was acid (pH 4.5) and the lower basic (pH 8.2), amylopectin was held in the upper part and amylose in the border zone (pH 7) and the lower part. With I_2-KI soln., amylopectin was light violet, while amylose consisted of a central wide zone (medium blue) and narrow upper and lower zones (light blue). Amylose prepd. by adsorption to cellulose or $Al(OH)_3$ was shown to contain amylopectin.

4881. VANDENHEUVEL, F. A. AND HAYES, E. R. **Partition chromatography of aliphatic acids.** *Anal. Chem.* **24**, 960-5 (1952).—*C.A.* **46**, 9019*d*.

Details were given for packing and using a silicic acid column for the sepn. of C_2-C_{12} monocarboxylic acids and C_4-C_{10} dicarboxylic acids. Band boundaries were detected by allowing the eluate at const. flow rate to neutralize known vols. of 0.01 *N* NaOH added at timed intervals.

4882. WILLIAMS, A. F. **Inorganic chromatography on cellulose. IX. The use of alumina and cellulose adsorbents for the determination of thorium and the simultaneous determination of thorium and uranium in ores.** *Analyst* **77**, 297-306 (1952).—*C.A.* **46**, 7471*a*.

Although $Th(NO_3)_4$ could not be extd. from a cellulose adsorbent in the presence of phosphate by ether + HNO_3, an extn. could be made from an Al_2O_3 adsorbent. Then if there was a cellulose column beneath the Al_2O_3 column, $Th(NO_3)_4$ could be extd. free from other ions. The method was extended to the chromatographic detn. of U and Th in the same sample.

4883. WILLIAMS, R. J. P. **Gradient elution analysis.** *Analyst* **77**, 905-14 (1952).—*C.A.* **47**, 1530*c*.

Expts. were described on the resolution of amino acids and of peptides in cases where the standard procedures were unsatisfactory. In the gradient method described, there was also a temp. gradient along the column so that the procedure resembled a continuous fractional crystn. process.

4884. WILLIAMS, TREVOR I. AND WEIL, HERBERT. **Definition of chromatography.** *Nature* **170**, 503 (1952).—*C.A.* **47**, 3652*h*.

Chromatography was used in a different sense long before Tswett used the term. The definition proposed was: those processes that allow the resolution of mixts. by sepn. of components in concn. zones on or in phases different from those in which they were originally present, irrespective of the nature of the forces causing transfer of substances between phases.

4885. BISHOP, J. R. AND LIEBMANN, H. **Determination of aluminum and zinc after their chromatographic separation from tin-lead alloys.** *Analyst* **78**, 117-22 (1953).—*C.A.* **47**, 4240*h*.

Dissolve 2 g of alloy in 9 ml of concd. HBr + 1 ml of Br. Add 5 ml of 60% $HClO_4$ and boil until a clear colorless melt remains. Dissolve it in 70 ml of 6 *N* HCl, evap. to about 20 ml, add 20 ml of water, cool in ice, and filter off the $PbCl_2$. Evap. until fumes of $HClO_4$ cease, cool, add 10 ml of 6*N* HCl, cool in ice, and again filter. This soln. could be used for detg. Al but before detg. Zn further sepn. of $PbCl_2$ was necessary. To det. Zn, evap. to dryness, add 1 mg of Fe as $FeCl_3$ soln. and again evap. To the dry residue add a little 6*N* HCl and add 0.5 ml of *n*-BuOH. Transfer to a cellulose column and finally wash with 100 ml of eluent prepd. from 80 ml of 6*N* HCl + 1920 ml of freshly distd. BuOH. Det. the Zn polarographically and the Al similarly.

4886. DALE, JEAN C. AND KING, E. J. **Adsorption of dyes, amino acids, proteins, and metal hydroxides on quartz.** *Arch. Ind. Hyg. Occupational Med.* **7**, 484-9 (1953).—*C.A.* **47**, 12432*d*.

When powd. SiO_2 was treated with acid fuchsin, aurin, azocarmine, Biebrich scarlet, eosin, phloxine red, neutral red, acridine red, crystal violet, methyl green, Nile blue sulfate, thionine blue, and Victoria blue, only the last 7 listed, which were basic in reaction, were adsorbed. Proteins from cerebrospinal fluid, ascitic fluid, and serum may be adsorbed on SiO_2 particles, with the max. occuring near the isoelec. point.

4887. DUIN, H. VAN. **Partition chromatography of homologous series. II.** *Biochem. et Biophys. Acta* **10**, 198-9 (1953).—*C.A.* **47**, 4239*h*.

An extension of the use of partition curves for the identification of compds. of a homologous series.

4888. GUEST, R. J. **Determination of thorium in ores by the column method.** *Can. Dept. Mines* *and Tech. Surveys, Tech. Paper* No. 1, 24 pp. (1953).—*C.A.* 47, 6305*c*.

A rapid and accurate method was described for detg. 0.01-1.0% ThO_2 in ores. The column was prepd. from 50 g activated alumina, stirred to a homogeneous mass, with ether contg. 12.5% HNO_3. A procelain disk, covered by a disk of Whatman's 41 H paper, was placed in the bottom of the column. A 5-cm layer of activated cellulose was added with the aid of the ether-HNO_3 mixt. Activated alumina was added until a 6-cm layer was formed and this covered with the ether-nitric acid. The unknown soln. was transferred to the column and washed until 500 ml of effluent was obtained. If U was to be detd., or less than 1% Th was present, a second-column extn. was made. The U could be detd. as usual and the Th pptd. as oxalate from about 0.3 *N* HCl and ignited to ThO_2.

4889. Roubaud-Valette, J. **Theoretical study of chromatography.** *J. chim. phys.* **50**, 117-34 (1953).—*C.A.* 47, 6735*h*.

A detailed study of possible adsorption mechanisms led to 3 possible hypotheses; absorption in the interior of the gel and reversible or irreversible surface adsorption. Only the reversible surface adsorption could explain the exptl. results.

4890. Sen, Binayendra Nath. **Asbestos chromatography.** *Australian J. Sci.* **15**, 133 (1953).—*C.A.* 47, 4781*e*.

The technique of asbestos chromatography was extended to the following sepns.: Hg^+ from Pb^{++} (in *N* KI soln.), Hg^{++} from Pb^{++} (0.2 *N* KI), Hg^{++} from Cu^{++} (0.5 *N* KI), Pb^{++} from Cu^{++} (0.5 *N* KI), Cu^{++} from Fe^{+++} (H_2O with 15-20% PrOH), Fe^{+++} from Zn^{++} (dil. NH_4OH), Co^{++} from Ni^{++} (H_2O with 25-30% PrOH), and Mn^{++} from Zn^{++} (H_2O).

4891. Shuvaeva, G. M. and Gapon, E. N. **Secondary adsorption of ions on aluminate aluminum oxide.** *Zhur. Anal. Khim.* **8**, 50-2 (1953).—*C.A.* 47, 4687*e*.

Chromatographic tubes 0.6-1.0 cm. were filled with aluminate Al_2O_3 used as a suspension in 1 *N* HNO_3. The salt solns. used in these expts. were 1*N*. The following solns. were passed: $CuSO_4 + Cu(NO_3)_2$, $CoSO_4 + Co(NO_3)_2$, $NiSO_4 + NiCl_2$, $UO_2(NO_3)_2 + K_2SO_4$, $Cr_2(SO_4)_3 + UO_2(NO_3)_2 + K_2SO_4$, $UO_2(NO_3)_2 + K_2SO_4 + CuSO_4$, $Cr_2(SO_4)_3 + CuSO_4$, $CuSO_4 + CoSO_4$, $CuSO_4 + NiSO_4$, and $CoSO_4 + NiSO_4$. Formation of secondary-ion-exchange chromatograms on the anion exchanging Al_2O_3 corresponded to the adsorption of ions on cation-exchanging Al_2O_3.

4892. Vanselow, W. and James, T. H. **Influence of quaternary salts on photographic development and their effectiveness as chromatographic developers.** *PSA Journal* **19B**, 36-9 (1953).—*C.A.* 47, 2071*d*.

The relative effectiveness of several quaternary salts in displacing adsorbed carbocyanine and merocyanine dyes from AgBr was detd. in a chromatographic column. The effectiveness in a series of pyridinium salts increased in the order: methyl, *n*-heptyl, *n*-nonyl, *n*-decyl, *n*-undecyl, *n*-dodecyl. The effectiveness of a given quarternary ion in displacing an adsorbed merocyanine dye increased markedly when excess KBr was added to the soln.

II-10. Chromatography on Paper

4893. Flood, H. and Smedsaas, A. **The adsorption series in inorganic capillarity analysis (chromatography).** *Tids. Kjemi, Bergvesen Met.* **1**, 150-1 (1941).—*C.A.* 37, 4319³.

With the new technique and with paper impregnated with Al_2O_3 as adsorbent, the adsorption series, aside from the position of Cd between Zn and Ni-Co, of certain ions in aq. soln. agreed well with previous work. TiO^{++} was between Sb^{+++} and Bi^{+++}, VO^{++} between Pb^{++} and Cu, Sn^{++++} (hard to develop but after reduction with Fe powder detectable with cacothelin in the series near H^+), Sn^{++} before Fe^{+++} and after Sb^{+++}, and Ba^{++}, Sr^{++} and Ca^{++} after Mn^{++}.

4894. Krüger, Deodata. **The absorption of methylene blue by cellulose.** *Klepzig's Textil-Z.* **44**, 647-50 (1941).—*C.A.* 36, 5641³.

In threads and foils of regenerated cellulose the absorption of methylene blue was considered to be a typical adsorption phenomenon whose range depended on the size of the surface available to the dye mols. which formed a unimol. layer on top of this surface. In the case of oxycelluloses (superbleached cellulose) the amt. of methylene blue taken up under definite conditions was taken as an empirical measure of the formation of carboxyl groups formed from the primary alc. groups of the cellulose chain mols. under the influence of the oxidizing medium.

4895. Flood, H. and Smedsaas, A. **The influence of cations upon one another in inorganic capillarity analysis.** *Tids. Kjemi, Bergvesen Met.* **2**, 1-5 (1942).—*C.A.* 37, 4319⁵.

If $M_2{}^+$ was adsorbed less readily than $M_1{}^+$, then when $M_2{}^+$ was added to a soln. contg. $M_1{}^+$, the chromatographic zone of $M_1{}^+$ increased as the concn. of $M_2{}^+$ increased. The proportionality of the zone width with respect to the quantity of ions introduced led to the assumption of constancy in the ion distribution in the chromatograms. This view was confirmed by studies of Cu^{++} and Mn^{++} chromatograms; even through a Mn zone contg. Cu distributed through it, the Mn was almost constantly distributed through the entire zone.

4896. Goto, Hidehiro and Kakita, Yachiyo. **Fluorescence analysis. XIV. Application of the chromatographic method to fluorescence analysis by using filter paper.** *J. Chem. Soc. Japan* **63**, 120-3 (1942).—*C.A.* 41, 3010*a*.

A piece of filter paper was soaked in an aq. suspension of $Al(OH)_3$ and dried. The dried paper was dipped in a soln. contg. the cation to be detected and developed with oxine soln. The oxine compds. of Al and Cd, Zn, Mg, Ca, Zr, or Be were fluorescent.

4897. Flood, H. **Adsorption of anions in inorganic capillary analysis.** *Tids. Kjemi, Bergvesen Met.* 3, No. 2, 9-12 (1943).—*C.A.* 38, 2895^8.

Paper, impregnated with Al_2O_3, could be made suitable for capillary analysis of anions by treatment with a strong acid ($HClO_4$). The adsorption order of a series of anions was detd. Cations were partly adsorbed in the anion zones which was analogous to the secondary adsorption of anions in cation zones.

4898. Consden, R.; Gordon, A. H., and Martin, A. J. P. **Qualitative analysis of proteins: a partition chromatographic method using paper.** *Biochem. J.* 38, 224-32 (1944).—*C.A.* 39, 537^5.

The procedure for making two-dimensional chromatograms with strips of filter paper was described. Amino acids were sepd. in such chromatograms and revealed with ninhydrin. By such means most of the amino acids found in a wool hydrolyzate, or in an artificial mixt. of 22 amino acids, could be demonstrated.

4899. Iijima, Shunichiro; Sato, Tetsuko, and Kamoshita, Takeko. **Microanalysis by inorganic chromatography. I. Fundamental studies.** *Bull. Inst. Phys. Chem. Research (Tokyo) Chem. Ed.* 23, 181-6 (1944).—*C.A.* 42, 7197*i*.

A test paper was prepd. on which $Al(OH)_3$ was pptd. A definite amt. of a given soln. was allowed to be absorbed by the strips of the test paper; then the paper was developed with $K_4Fe(CN)_6$ soln. for Fe^{+++} or dimethyglyoxime for Ni^{++}. A straight-line relation between the height of the colored portion of the test paper and the concn. of the soln. was found within the limits of the expt., i.e. 1-5 mg of Ni per cc.

4900. Iijima, Shunichiro and Sato, Tetsuko. **Microanalysis by inorganic chromatography. II. Detection and determination by means of an aluminum hydroxide test paper.** *Bull. Inst. Phys. Chem. Research (Tokyo) Chem. Ed.* 23, 233-8 (1944).—*C.A.* 42, 7197*i*.

By using $Al(OH)_3$ test paper ions such as Cu, Cd, Pb, Fe, Co, and Zn, as well as mineral acids could be detd. The limit of concn. was 0.1-0.05 mg per cc. for Cu, Cd, Pb, Fe, Co, and Zn and 0.5-0.05 *N* for mineral acids.

4901. Iijima, Shurichiro and Sato, Tetsuko. **Microanalysis by inorganic chromatography. III. Detection and determination by means of chromium hydroxide test paper and silicic acid test paper.** *Bull. Inst. Phys. Chem. Research (Tokyo) Chem. Ed.* 23, 284-8 (1944).—*C.A.* 42, 7198*c*.

The $Cr(OH)_3$ test paper had certain advantages over $Al(OH)_3$ test paper in testing for certain cations. Its use was described.

4902. Burmistrov, S. I. **Qualitative reactions of primary arylamines.** *Zhur. Anal. Chim.* 1, 265-71 (1946).—*C.A.* 43, 5344*a*.

Five reactions for identifying primary arylamines were described. For these tests a soln. contg. 1-2 mg/ml of arylamine in a volatile solvent, e.g., ether, benzene, $CHCl_3$, EtOAc or Me_2CO, was applied on a strip of filter paper. After the solvent evapd., the reagent, dimethylaminobenzaldehyde, m-nitraniline, 1-naphthol, or phenol, was applied on the filter paper as benzene solns. contg. 2 mg of reagent per ml. After the paper dried, it was exposed to a gaseous reagent, such as NH_3, HCl, Br, or alkyl nitrite. The specific reactions of 58 compds. were listed.

4903. Hopf, Peter P. **Chromatographic "spot" tests.** *J. Chem. Soc.* 1946, 785-6.—*C.A.* 41, 923*d*.

Filter paper treated with an absorbent contg. a suitable developer acted like a chromatographic column towards a soln. contg. certain constituents. The colored zones were specific to the constituent, solvent, developer, and pH, and could be used for comparative analysis. A paper that was dipped in a soln. contg. peptized Al_2O_3 and formaldoxime hydrochloride gave with a neutral soln. of ferromanganese a stain of definite position and color. Paper impregnated with Al_2O_3 and 8-hydroxyquinoline gave with a soln. in dil. aqua regia a black outer zone due to Fe and a central yellow spot due to Mo.

4904. Partridge, S. M. **Application of the paper partition chromatogram to the qualitative analysis of reducing sugars.** *Nature* 158, 270-1 (1946).—*C.A.* 40, 7275^2.

A filter-paper chromatogram of five monosacharides using collidine as solvent was presented.

4905. Church, H. F. **Cationic exchange reactions of cellulose and their effect on insulation resistance.** *J. Soc. Chem. Ind.* (London) 66, 221-6 (1947).—*C.A.* 42, 755*i*.

When exchange was complete with a given cation, equal nos. of ions were attached to the cellulose, irrespective of the wt or valency of the ion. Possible mechanisms to satisfy this requirement were considered. The quantity of acid liberated by treating the fully "H-exchanged" paper with a neutral salt soln. was a correct indication of the exchange capacity, provided absorption effects were avoided. The nature of the cation used to effect exchange had a considerable effect on the elec. resistivity of cellulose when the major part of the moisture had been removed.

4906. Consden, R.; Gordon, A. H., and Martin, A. J. P. **Identification of lower peptides in complex mixtures.** *Biochem. J.* 41, 590-6 (1947).—*C.A.* 42, 3015*g*.

The identification of a large proportion of the dipeptides was based upon ionophoresis in silica jelly and subsequent partition chromatography on paper. An app. was described for the removal of salts from solns. of amino acids and peptides.

4907. Drake, Birger. **A new adsorption apparatus and the separation of aspartic and glutamic acids.** *Nature* 160, 602-3 (1947).—*C.A.* 42, 1086*c*.

A flexible canula with a capillary drop tip was connected to the effluent end of the adsorption column and placed below a rotating drum on which filter paper was fastened. The tip was lifted to the drum periodically, and a drop of eluate deposited which could later be developed colorimetrically. Aspartic and glutamic acids were sepd. in this app., contg. Amberlite IR-4 as adsorbent, by elution with 0.05% AcOH followed by *N* HCl.

4908. Fink, R. M.; Dent, C. E., and Fink, K. **Application of filter paper partition chromatography to radioactive tracer studies.** *Nature* **160**, 801-3 (1947).—*C.A.* 42, 2304*g*.

Exts. from the thyroids of rats killed 24-48 hrs after intravenous administration of I^{131} were run on a phenol-collidine 2-dimensional chromatogram. The chromatogram was placed against x-ray film to yield a radio-autograph which indicated little radioactivity in the spot of thyroxine but much in the position for diiodothyroxine and inorg. iodide and several unidentified substances. One-dimensional chromatograms, with phenol and collidine, resp., also showed sepd. bands, except that thyroxine and iodide were in the same position in the collidine chromatogram.

4909. Flood, A. E.; Hirst, E. L., and Jones, J. K. N. **Quantitative estimation of mixtures of sugars by the paper chromatogram method.** *Nature* **160**, 86-7 (1947).—*C.A.* 41, 6591*g*.

Two paper sheets were used. One was sprayed with ammoniacal $AgNO_3$ to locate the sugars. The corresponding areas on the other paper were extd. under a reflux condenser, and the sugars detd. with Somogyi's micro Cu reagent.

4910. Hawthorne, J. R. **Micro-estimation of sugars separated on the filter paper chromatogram.** *Nature* **160**, 714-15 (1947).—*C.A.* 42, 2209*a*.

A method capable of sepg. and estg. as little as 40γ of a sugar, accurate to within about 5%, was described. Two-component mixts. were sepd. by chromatography, with BuOH-AcOH-H_2O as solvent. The spots were dissolved, transferred to paraffin cups, and analyzed by hypoiodite oxidation.

4911. Keston, Albert S.; Udenfriend, Sideny, and Levy, Milton. **Paper chromatography applied to the isotopic derivative method of analysis.** *J. Am. Chem. Soc.* **69**, 3151-2 (1947).—*C.A.* 42, 2308*f*.

The *p*-iodo phenylsulfonyl (I^{131}) derivs. from 1 mg amino acids were extd. with ether, the residue was dissolved in 0.5 ml EtOH-NH_3, an aliquot equiv. to 1-7γ placed as a transverse line on Whatman No. 1 paper, and the chromatogram developed with pentanol satd. with 2 *N* NH_4OH.

4912. Lugg, J. W. H. and Overell, B. T. **Partition chromatography of organic acids on a paper sheet support.** *Nature* **160**, 87-8 (1947).—*C.A.* 41, 6591*i*.

BuOH satd. with aq. AcOH was used as the mobile phase, removed at the end by drying at 60°C. The dried sheets were sprayed with a soln. of bromophenol blue (40 mg/100 ml 95% alc.), the spots excised and extd. with H_2O, and detns. made by titration. The spots had fine tails but were well defined. The R_F values decreased slightly with decreased concns. of the acids. Mixts. of 20γ each of malic, tartaric, and citric acids were resolved with ease.

4913. Vischer, Ernst and Chargaff, Erwin. **The separation and characterization of purines in minute amounts of nucleic acid hydrolyzates.** *J. Biol. Chem.* **168**, 781-2 (1947).—*C.A.* 41, 6596*b*.

Purines in nucleic acid hydrolyzates were sepd. by unidimensional partition chromatography on paper, similar to the procedure developed for the sepn. of amino acids.

4914. Winsten, Walter A. and Spark, Arthur A. **Penicillin types produced by** *P. Chrysogenum Q*-176. *Science* **106**, 192-3 (1947).

P. chrysogenum Q-176 could produce no less than 8 penicillins when grown on the usual corn steep liquor-lactose medium. The presence of the penicillins was proven by a paper partition chromatographic method.

4915. Arden, T. V.; Burstall, F. H.; Davies, G. R.; Lewis, J. A., and Linstead, R. P. **New method for the separation, detection, and estimation of inorganic compounds.** *Nature* **162**, 691-2 (1948).—*C.A.* 43, 2888*f*.

Paper chromatography had been extended to inorg. compounds. Ca, Sr, and Ba could be sepd. as chlorides with pyridine contg. 4% KSCN as solvent. Na rhodizonate was used for the development of Ba and Sr, alizarin for Ca. Al, Ga, In, and Zn had been studied as chlorides with BuOH contg. HCl. Al and Ga were developed with Aluminon but dithizone was used for In and Zn. V could be sepd. by diethyl ether or 2-methyltetrahydrofuran contg. HNO_3 and H_2O_2.

4916. Block, Richard J. **Estimation of amino acids on paper chromatograms.** *Science* **108**, 608-9 (1948).—*C.A.* 43, 5341*h*.

Good results were obtained by first sepg. the protein hydrolyzate into dicarboxylic, basic, and neutral amino acid fractions by adsorption successively on an anion exchange and then on a cation exchange resin. The eluates from the resins were chromatographed separately on paper strips, and then revealed by spraying with ninhydrin.

4917. Boldingh, J. **Application of partition chromatography to mixtures insoluble in water.** *Experientia* 4, 270-1 (1948).—*C.A.* 42, 7599*i*.

Filter paper (S. & S. 595) was impregnated with dild. vulcanized rubber latex, dried, and rinsed with EtOH and Me_2CO. The rubber content was approx. 30% by wt. In these strips the rubber was the fixed phase, and an org. solvent acted as the mobile phase. Sepn. of several fatty acid esters from MeOH or MeOH-Me_2CO 1:1 solns. were affected on the strips. Sudan IV in 50% aq. MeOH was used to trace the ester spots.

4918. Brown, F.; Hirst, E. L.; Hough, L.; Jones, J. K. N., and Wadman, H. **Separation and identification of methylated sugars on the paper chromatogram.** *Nature* **161**, 720 (1948).—*C.A.* 42, 6274*c*.

Many methylated sugars could be identified on the paper chromatogram with the same app. and solvents as for the sepn. of the simple sugars. The chromatogram was allowed to run until the solvent had advanced about 40 cm from the starting line. The paper was then dried and sprayed with ammoniacal $AgNO_3$, and on warming, the positions of the sugars were indicated by brown spots. Tetramethyl D-glucose was used as a standard.

4919. Crammer, J. L. **Paper chromatography of flavine nucleotides.** *Nature* **161**, 349-50 (1948)

Collidine, and a butyl alcohol-acetic acid mixture (shake 4 parts butyl alcohol with 1 part glacial acetic acid and 5 parts water, and use the upper layer), were two very suitable solvents for separating various flavine compounds. As little as $0.01 \mu g$ flavine was detected on the paper.

4920. Ekman, Birger. **Paper chromatography of primary aromatic amines.** *Acta Chem. Scand.* **2**, 383-4 (1948) (In English).—*C.A.* **43**, 2263*b*.

Spots of primary aromatic amines on filter paper were developed by org. solvents and diazotized by spraying with 0.2% $NaNO_2$ in 0.1 *N* HCl. A red-violet color was then developed by spraying with 0.2% *N*-ethyl-*l*-naphthylamine-HCl in EtOH.

4921. Fisher, R. B.; Parsons, D. S., and Morrison, G. A. **Quantitative paper chromatography.** *Nature* **161**, 764 (1948).—*C.A.* **42**, 5792*b*.

Amino acids were assayed quantitatively by (a) measurement of max. extension of a spot upon a paper chromatogram and (b) by measurement of the outline of a spot with a planimeter. Log relationships of concn. to area were shown.

4922. Flood, A. E.; Hirst, E. L., and Jones, J. K. N. **Quantitative analyses of mixtures of sugars by the method of partition chromatography. I. Standardization of procedure.** *J. Chem. Soc.* **1948**, 1679-83.—*C.A.* **43**, 1290*b*.

Full details were given for spotting the sugar mixt., locating the sepd. sugars on the paper strip, leaching out the individual sugars and for their detn. Standardized controls involving the use of given amts. of known sugar solns. obviated the necessity of reagent standardizations and use of a specific sugar as the "reference compd." in each individual detn. All chromatograms were run for 45 hrs at 20°C, with BuOH (40%), EtOH (10%), and H_2O (50%).

4923. Forsyth, W. G. C. **Color reagents for the paper chromatography of sugars.** *Nature* **161**, 239-40 (1948).—*C.A.* **42**, 4087*a*.

The use of resorcinol and naphtharesorcinol in addn. to the usual ammoniacal $AgNO_3$ as a color reagent in the chromatographic detn. of sugars permitted pos. identification of reducing as well as nonreducing sugars.

4924. Haugaard, Gotfred and Kroner, Thomas D. **Partition chromatography of amino acids with applied voltage.** *J. Am. Chem. Soc.* **70**, 2135-7 (1948).—*C.A.* **43**, 137*i*.

Two-dimensional chromatography was developed to overcome the difficulty of detecting the bands of amino acids whose R_F values lie close together. Optimum conditions were the use of an impressed voltage of 100 for 16-18 hrs at a controlled temp. with paper buffered with M/15 phosphate soln. at pH 6.2. The R_F values for the amino acids were: serine 0.21, glycine 0.28, alanine 0.49, valine 0.74, leucine 0.82, proline 0.86, aspartic acid 0.16, glutamic acid 0.32, lysine 0.17, and arginine 0.32.

4925. Hird, F. J. R. and Trikojus, V. M. **Paper partition chromatography with thyroxine analogues.** *Australian J. Sci.* **10**, 185-7 (1948).—*C.A.* **42**, 8852*e*.

Thyroxine, thyroxine-O-methyl ether, and 3,5-diiodothyronine were sepd. on paper chromatograms when the stationary phase was 2 *N* NH_4OH and the mobile phase was a mixt. of equal vols. of BuOH and amyl alc. (b.p. 128-132°C). R_F values were given.

4926. Hotchkiss, Rollin D. **The quantitative separation of purines, pyrimidines, and nucleosides by paper chromatography.** *J. Biol. Chem.* **175**, 315-32 (1948).—*C.A.* **42**, 8861*g*.

Purines and pyrimidines in nucleic acid, and several related compds., could be sepd. by the movement of a boundary of BuOH along paper strips. Cytosine, uracil, adenine, and thymine could be isolated from mixts, and from hydrolyzates of nucleic acids, and under favorable circumstances guanine could be recovered.

4927. Lederer, Michael. **The chromatographic Separation of antimony.** *Anal. Chim. Acta* **2**, 261-2 (1948).—*C.A.* **43**, 61*e*.

Sb^{+++} was sepd. from all common metallic ions by adsorbing one drop of the soln., slightly acidified with HCl, on a strip of filter paper, developing with H_2O, and exposing the strip to H_2S vapors after the liquid front had traveled 10 cm. An orange patch close to the original spot indicated Sb.

4928. Lederer, Michael. **Paper chromatography of the noble metals.** *Nature* **162**, 776-7 (1948).—*C.A.* **43**, 3743*c*.

A mixt. or alloy contg. Au, Pt, Pd, Cu, and Ag was dissolved in aqua regia and dild. with as much more water. A drop of this soln. was placed on a paper cylinder and the cylinder developed by allowing it to stand for 24 hrs in a dish of butanol satd. with *N* HCl in an atm. satd. with *N* HCl and butanol. Ag (black) deposits where the drop of soln. was placed while Cu (black), Pd (orange), Pt (yellow) and Au (yellow) lie in that order above it.

4929. Longenecker, William H. **Glass trough for filter paper partition chromatography.** *Science* 107, 23, (1948).--

A trough was described to serve as a reservior into which the filter paper dips.

4930. Lugg, J. W. H. and Overell, B. T. **One- and two-dimensional partition chromatographic separations of organic acids on an inert sheet support.** *Australian J. Sci. Research* Ser. A, **1**, 98-111 (1948).—*C.A.* **43**, 6946*i*.

Procedures were developed at 20°C for "one-" and "two-dimensional" partition-chromatographic sepns., on Whatman No. 1 filter paper, of mixts. of relatively nonvolatile org. acids. Ionization, and adsorption of the acids by the paper, were suppressed by swamping both the stationary and mobile solvent phases with a volatile acid (formic or acetic). Formic acid was superior because at high concn. it permitted well-difined bands of the test acids to travel down the sheets and conferred upon the bands highly characteristic R_F values.

4931. PARTRIDGE, S. M. AND WESTALL, R. G. **Filter-paper partition chromatography of sugars. I. General description and application to the qualitative analysis of sugars in apple juice, egg white, and fetal blood of sheep. II.** *Biochem. J.* 42, 238-50, 251-3 (1948).—*C.A.* 42, 4636*c*,*e*.

A soln. of $AgNO_3$ in NH_4OH was used as a spraying reagent to reveal the position of the sugars on the filter paper chromatograph. Ionic sepn. of a salt occurring on paper chromatograph might be regarded as analogous to the process occurring in ion-exchange reagents, the cellulose apparently acting as the reagent.

4932. POLSON, A. **Quantitative partition chromatography and the composition of Escherichia coli.** *Biochim. et Biophys. Acta* 2, 575-81 (1948).—*C.A.* 43, 3875*f*.

Quant. estn. of amino acids could be made by comparison of developed chromatograms of the unknown and standard amino acid solns. In a one-dimensional analysis series, glycine, threonine, alanine, and aspartic and glutamic acids were paper chromatographed in a water-satd. *m*-cresol soln. contg. 0.3% NH_3. At the end of the run the paper was dried at 100°C, sprayed with a 0.1% ninhydrin in BuOH, and warmed at 100°C for 10 min.

4933. RUTTER, L. **Modified techinque in filter-paper chromatography.** *Nature* 161, 435-6 (1948).—*C.A.* 42, 4863*i*.

A wicklike "tail" formed in the center of an 11-cm filter paper, was immersed in the soln. under test. After a sufficient amt. had been adsorbed, the chromatogram was developed by immersing the tail in the proper soln. The various bands on the main chromatogram were cut apart and eluted separately.

4934. SMITH, E. C. BATE. **Paper chromatography of anthocyanins and related substances in petal extracts.** *Nature* 161, 835-8 (1948).—*C.A.* 42, 6893*h*.

Natural and some synthetic chlorides of anthocyanins and flavones were identified and sepd. by partition chromatography on paper, with and without treatment with NH_3 vapor, their reaction with ammoniacal $AgNO_3$, and their R_f values (relative distance moved by the solute in relation to liquid) in butanol-acetic acid-H_2O (40:10:50 by vol.).

4935. STEWARD, F. C.; STEPKA, W., AND THOMPSON, JOHN F. **Apparatus for partition chromatography on paper.** *Science*, 107, 451-2 (1948).—*C.A.* 42, 4798*g*.

The app. of Longenecker was modified for greater ease of construction and freedom from breakage by the use of troughs of sheet metal with a V-shaped cross section, with welded end plates, coated with resistant enamel. The end plates also supported two lengths of 10-mm glass rod above the edges of the trough to carry the partition paper. A third glass rod was laid down the center to hold the edge of the paper in place.

4936. VERDIER, CARL HENRIC DE AND AGREN, GUNNAR **Paper chromatographic analysis of amino acids and peptides in tissue extracts and enzyme hydrolyzed proteins.** *Acta Chem. Scand.* 2, 783-96 (1948) (in English).—*C.A.* 43, 4314*a*.

In 2 dimensional runs with a 0.1% soln. of cupron in the first direction, comparisons were made of the resolving capacity of collidine with that of pyridine-AmOH. There was little advantage in using collidine. Comparisons were made of several methods of prepg. blood filtrates for paper chromatography.

4937. WIELAND, THEODOR. **The retention analysis and its usefulness in the quantitative evaluation of paper chromatograms and paper ionopherograms of synthetic amino acid mixtures.** *Angew. Chem.* A60, 313-16 (1948).—*C.A.* 43, 2660*c*.

The procedure for a retentiometric acid detn. was described and the evaluation of paper chromatograms and ionopherograms was presented.

4938. WIELAND, THEODOR AND FISCHER, EDGAR. **Retention analysis, a quantitative ultramicromethod.** *Naturwissenschaften* 35, 29 (1948).—*C.A.* 44, 2403*e*.

Drops of glycine solns. in different concns. were placed at 1 cm from the edge of a 7 cm wide filter paper (SS 575), and immersed 3 mm in a soln. of 0.1% $Cu(OAc)_2$ in tetrahydrofuran (10% H_2O). The soln. was allowed to rise 5 cm, the strip was then air dried and "developed" by spraying with a 0.1% dithioöxalic diamide soln. in acetone contg. 10% H_2O. A sharply defined Cu salt picture appeared with V-shaped depressions at the upper edge quantitatively showing the amt. of glycine present.

4939. WILLIAMS, ROGER J. AND KIRBY, HELEN. **Paper chromatography using capillary ascent.** *Science* 107, 481-3 (1948).—*C.A.* 42, 5494*f*.

In the analysis of amino acid mixts., the solvents were allowed to ascend a filter paper cylinder by capillary action. The method and various modifications were described which approx. doubled the sensitivity of the method for amino acids. Modifications also made possible the production of two-dimensional chromatograms. A considerable no. of descending and ascending chromatograms were made under parallel conditions, and the ascending ones were in general definitely superior.

4940. WINEGARD, HERBERT M.; TOENNIES, GERRIT, AND BLOCK, RICHARD J. **Detection of sulfur-containing amino acids on paper chromatograms.** *Science* 108, 506 (1948).

A method for the detection of cystine, cysteine, and methionine on paper chromatograms was described employing K iodoplatinate. This reagent was found stable for at least two weeks at room temp. For spraying purposes, a 1:6 dilution gave the best compromise between contrast and sensitivity.

4941. WINSTEN, WALTER A. **A simplified apparatus for one-dimensional paper partition chromatography.** *Science* 107, 605 (1948).—*C.A.* 42, 5724*a*.

The centers of 2 halves of an ordinary Pyrex Petri dish, 3 1/2 in. in diam., with lips facing upward were connected by fusing them to a solid glass rod, 3/8 in. in diam. and 16 in. long. The double trough was then placed in a glass humidifying chamber. The bottom trough served to contain the aq. soln. which provided the necessary humid atm., and the upper trough contained the org. solvent used for development. The glass rod was wound with absorbent cotton and wet with the soln. used in the lower trough. The paper strip chromatograms, suitably folded to dip into the org. solvent and to hand down from the upper trough, were held in place by a thin, solid glass rod bent in a great arc. A wire guard was placed around the circumference of the upper trough to hold the paper away from the side of the trough over which they hang.

4942. WINSTEN, WALTER A. AND EIGEN, EDWARD. **Studies on the streptomycin complex using paper partition chromatography.** *J. Am. Chem. Soc.* 70, 3333-9 (1948).—*C.A.* **43**, 819*h*.

The developing agent was a mixt. of BuOH and piperidine, contg. *p*-$MeC_6H_4SO_3H$. The 2 latter could be varied within wide limits. After development of the chromatogram and removal of solvents, the dried strip was laid on the surface of nutrient agar previously seeded with sp. bacteria whose growth was inhibited by the antibiotics. The agar plate revealed zones of growth inhibition which served to characterize the various antibiotics (and their amts.) in the original mixt.

4943. WOIWOD, A. J. **Microestimation of amino nitrogen and its application to paper-partition chromatography.** *Nature* **161**, 169 (1948).—*C.A.* 42, 3287*d*.

The amino acids could be detd. on the paper chromatograms after their location on trial strips. Instead of using trial strips, it was possible to locate glycine, valine, and possibly other amino acids with ninhydrin under conditions which did not destroy the amino N appreciably.

4944. AGREN, GUNNAR AND NILSSON, TAGE. **Paper chromatographic analysis of amino acids and other ninhydrin-reacting substances in deproteinized human plasma.** *Acta Chem. Scand.* 3, 525-38 (1949).—*C.A.* 43, 8429*c*.

Combination of one- and two-dimensional chromatograms showed 21 compds. present, with 1-ml samples of deproteinized human plasma. When strict duplicate chromatograms were run simultaneously in the same chamber, differences in R_F values did not exceed 4%.

4945. ALBANESE, ANTHONY A. AND LEIN, MARILYN. **The chromatographic estimation of lysine and some applications of the method.** *Science* **110**, 163-4 (1949).—*C.A.* 43, 9126*f*.

Cu salts of amino acids were partitioned on paper strips in an aq. phenol atm. for 6 hrs by the capillary ascent method. After drying in air the strips were developed with a freshly prepd. 10% soln. of iron ferrocyanide. Relative amts. of the individual acids could be judged by the intensity of the pink color.

4946. ARDEN, T. V.; BURSTALL, F. H., AND LINSTEAD, R. P. **A new method for the detection and determination of uranium.** *J. Chem. Soc.* 1949, S311-13.—*C.A.* 44, 8820*f*.

A chromatographic method employing org. solvents in conjunction with strips or sheets of absorbant paper was described for the sepn. of U from other metals in soln. U as $UO_2(NO_3)_2$ in soln. moved with the solvent front as diffusion of the solvent in the absorbant paper proceeded. Most other metals remained stationary or moved only slowly in comparison with U. Detection was accomplished with $K_3Fe(CN)_6$.

4947. ARONOFF, S. **Separation of the ionic species of lysine by means of partition chromatography.** *Science* **110**, 590-1 (1949).—*C.A.* **44**, 3332*i*.

Paper partition chromatography of lysine in a satd. phenol-water system may result in a plurality of spots, the no. and position of these spots depending on the pH of the aq. soln. of the lysine. The relative intensities of the spots were in rough accord with the distribution of ionic species for the different pH values as calcd. from ionization consts.

4948. BACH, RICARDO O. **Experiments in inorganic chromatography. III. A variation of the Gutzeit test for arsenic.** *Anales Asoc. quím. argentina* 37, 247-8 (1949).—*C.A.* **45**, 2361*e*.

From 0.5 to 500 γ As was detd. with the conventional Gutzeit app. except that the tube contg. sensitized paper was replaced by a tube 2 mm in diam. filled with diatomaceous earth impregnated with 1-5% $HgBr_2$.

4949. BAILEY, A. **Adsorption chromatography of lignin.** *Paper Ind. and Paper World* **31**, 205-9 (1949).—*C.A.* 43, 5590*a*.

The adsorption of various lignin prepns. on cellulose (filter paper) was shown to be a general phenomenon which occurred with unrelated lignins and formed a variety of solvents. All prepns. were sepd. into zones which were chromatographically hetergeneous, the no. of such zones varying with the lignin prepn. and the solvent used. The prepns. were allowed to dry on the filter paper and the best chromatographic differentations were obtained with the following solvents: for BuOH-NaOH lignin MeOH, EtOH, $PhNH_2$, $PhCH_2OH$, BzH, quinoline, Ph cellosolve, and furfural.

4950. BENTLEY, H. R. AND WHITEHEAD, J. K. **Use of furan derivatives in paper chromatography.** *Nature* **164**, 182-3 (1949).—*C.A.* **43**, 8299*a*.

Furfuryl alc., freshly distd., and tetrahydrofurfuryl alc., contg. 10 to 30% water, gave good sepns. of amino acids on paper chromatograms. The inclusion of urea (0.5%), pyridine (8%), or furoic acid (5%) as stabilizers sharpened the outlines of the spots and reduced their size.

4951. BERRY, HELEN KIRBY AND CAIN, LOUISE. **Biochemical individuality. IV. Paper chromatographic technique for determining excretion of amino acids in the presence of interfering substances.** *Arch. Biochem.* **24**, 179-89 (1949).—*C.A.* **44**, 2062*g*.

The solvent was prepd. by mixing 100 g phenol with 20 ml of a soln. contg. 6.3% Na citrate, 3.7% KH_2PO_4, and 0.5% ascorbic acid, allowing to stand until soln. occurred, and then using the upper layer within 48-72 hrs. The chromatogram was developed by the ascending technique for 12-16 hrs, after which the solvent was removed by blowing air at 85°C over the sheets for 8-10 min. Amino acids were detected by spraying the sheets with 0.2% ninhydrin in H_2O-satd. BuOH.

4952. Block, Richard J. **Quantitative paper chromatography; a simplified procedure.** *Proc. Soc. Exptl. Biol. Med.* **72**, 337-41 (1949).—*C.A.* **44**, 2587*e*.

Some improvements were described in existing techniques of estg. amino acids by one- and two-dimensional paper chromatography.

4953. Brante, Gunnar. **Iodine as a means of development in paper chromatography.** *Nature* **163**, 651-2 (1949).—*C.A.* **43**, 5336*e*.

Iodine sublimed or sprayed in EtOH soln. on to paper aided identification of spots caused by amines, amino acids, amine alcs., quanidines, purines, and pyrimidines.

4954. Brimley, Robert C. **Quantitative paper chromatography.** *Nature* **163**, 215-16 (1949).—*C.A.* **43**, 5695*h*.

Equations developed from the theory of heat flow were applied to a theoretical consideration of the linear relationship which held between the area of the spots of test substance and the log of the concn., at which it was initially applied. Movement by diffusion was assumed.

4955. Burstall, F. H.; Davies, G. R.; Linstead, R. P., and Wells, R. A. **Inorganic chromatography on cellulose.** *Nature* **163**, 64 (1949).—*C.A.* **43**, 4595*g*.

Au, Pt, and Pd were sepd. from each other and from Ir or Rh by paper chromatography by using methyl propyl ketone contg. 30% (vol./vol.) of concd. HCl. Metals of the Cu and Sn groups were also sepd., with solns. of the chlorides and ethyl isopropyl ketone, contg. 10% (vol./vol.) of concd. HCl, for group IIa, and dry EtOAc previously shaken with 2% HCl, for group IIb. Columns of cellulose pulp have been used to sep. and est. Ni and Co in minerals and steels, and to sep. Sc from a large no. of metals, including the rare earths.

4956. Burstall, F. H.; Davies, G. R., and Wells, R. A. **Inorganic chromatography on cellulose. III. The use of columns of cellulose for the separation and determination of metals.** *Discussions Faraday Soc.* **1949**, No. 7, 179-83.—*C.A.* **45**, 60*e*.

Ni, Co, Cu, Fe, Hg, Bi, Cd (chlorides) could be sepd. by elution with appropriate org. solvents on a column of cellulose prepd. from paper pulp. The solvents used contained Me-Pr-CO, acetone, water, HCl, Me acetate, Na phosphate, Et ether, and HNO_3. The sepns. depended on the selectivity of the solvent, the partition of the salts between the org. solvent and the water in the cellulose, and the adsorbability of the metal ions.

4957. Calvin, M. and Benson, A. A. **The path of carbon in photosynthesis. IV. The identity and sequence of the intermediates in sucrose synthesis.** *Science* **109**, 140-42 (1949).

Fumarate buffer in distd. water was used since inorg. salts, especially phosphates, interfered with movement of compds. on the paper. Alc. extract of as much as 100 mm of algae was applied to the filter paper (Whatman No. 1). Development in water-satd. phenol was followed by thorough drying at room temp. The sec. solvent was freshly prepd. before use from equal vols. of 1,246 ml *n*-BuOH—84 ml water, and 620 ml propionic acid—790 ml water. Although the radioactive fixation products which were sepd. chromatographically may be eluted and their activity detd. accurately, the radiogram served as a semiquant. record of the activity fixed in each compd. The first free carbohydrate which appeared in these plants was sucrose.

4958. Cavallini, Doriano; Frontali, Nora, and Toschi, Giovanni. **Determination of keto acids by partition chromatography on filter paper.** *Nature* **163**, 568-9 (1949).—*C.A.* **43**, 5342*g*.

Only BuOH gave satisfactory results with Schleicher-Schull filter paper No. 597, in strips 2 × 50 cm. The dinitrophenylhydrazones, dissolved in 0.01 *M* phosphate buffer (pH 7.2), was placed on a mark, 7 cm from the end of the filter paper. The soln. was dried with warm air. The top of the paper was then placed in the solvent. Well-shaped and well-separated spots of the hydrazones were obtained.

4959. Chargaff, Erwin; Magasanik, Boris; Doniger, Ruth, and Vischer, Ernst. **The nucleotide composition of ribonucleic acids.** *J. Am. Chem. Soc.* **71**, 1513-14 (1949).—*C.A.* **43**, 5817*d*.

A method was developed for sepn. on filter paper and estn. by spectrophotometry of all ribonucleotides found in ribonucleic acids. The chromatograms were developed with isobutyric acid in an NH_3 atm. and the components shown by an indirect method or by direct inspection under a "Mineralight." Guanylic acid and uridylic acid had the same position on the chromatogram and were eluted together.

4960. Crumpler, H. R. and Dent, C. E. **Distinctive test for α-amino acids in paper chromatography.** *Nature* **164**, 441-2 (1949).—*C.A.* **44**, 75*d*.

The method was based on the ability of compds. which have the α-amino-carboxylic structure to form Cu complexes. The mixt. was applied to the paper for 2-dimensional chromatograms in duplicate. One paper was dusted lightly with finely powd. $[CuCO_3, Cu(OH)_2]$ in a streak along the path of the amino acids in phenol. The chromatograms were then run as usual with phenol and collidine-lutidine and were finally treated with ninhydrin. The untreated paper was for control. The Cu-dusted one showed only the substances not contg. an α-aminocarboxylic acid grouping in their mol.

4961. Datta, S. P.; Overell, B. G., and Stack-Dunne, M. **Chromatography on alumina-impregnated filter paper.** *Nature* **164**, 673-4 (1949).—*C.A.* **44**, 1778*e*.

Strips of Whatman No. 54 filter paper were dipped into aq. $Al_2(SO_4)_3$ (65g/liter, drained, and then dipped into 2 *N* NH_4OH to ppt. the $Al(OH)_3$. After being dried at about 140°C these were stored over H_2SO_4 or P_2O_5. Variations in Rf values (ratio of distance traveled by an ion to distance traveled by the liquid front) were obtained by storing over different concns. of H_2SO_4. Storing over P_2O_5 gave very strongly adsorbing papers.

4962. DOUGLASS, C. D. AND WENDER, SIMON H. **The use of multiple strips in one-dimensional paper chromatography.** *Proc. Okla. Acad. Sci.* **30**, 153-4 (1949) (Pub. 1951).—*C.A.* 46, 3445*f*.

Sixteen paper-strip chromatograms of a lemon-peel infusion, exhibiting 14 bands, when sectioned by bands, leached, and rechromatographed from a new solvent, gave enough material for identification studies.

4963. DRAPER, O. JANET AND POLLARD, ARTHUR L. **The purification of phenol for paper partition chromatography.** *Science* **109**, 448-9 (1949).—*C.A.* 43, 5758*d*.

Paper partition chromatography was used to identify amino acids in bacterial-culture filtrates, but the extraneous colors present on the developed chromatograms made the results uncertain. These colors, probably due to metal contaminants, could be eliminated by purification of the PhOH.

4964. ELBEIH, I. I. M.; MCOMIE, J. F. W., AND POLLARD, F. H. **The application to qualitative analysis of the separation of inorganic metallic compounds on filter paper by partition chromatography.** *Discussions Faraday Soc.* **1949**, No. 7, 183-90.—*C.A.* 45, 61*g*.

The sepn. of 24 cations by using aq. 1-butanol with and without complexing agents, and aq. collidine was studied. Sepns. with butanol solns. of benzoyl acetone were notable. The successive use of collidine and the butanol soln. at right angles to each other on the paper permitted sepns. which were otherwise difficult or impossible. The sepn. of As from large amts. of other ions was sensitive to 0.1γ.

4965. EVANS, R. A.; PARR, W. H., AND EVANS, W. C. **Paper partition chromatography of phenolic substances.** *Nature* **164**, 674-5 (1949).—*C.A.* 44, 2325*c*.

Phenolic acids were sepd. from their parent phenols and from each other in quantities of the order of 5γ. A one-dimensional, 15-hr development at room temp. on Whatman No. 44 filter paper gave a 30-cm solvent run, which was sufficient. The org. phase of a mixt. of one part butanol, one part pyridine, and 2 parts NaCl was the mobile liquid. Diazotized sulfanilic acid (Pauley's reagent) in 50% ethanol was the coloring agent.

4966. FINK, KAY AND FINK, R. M. **Application of filter paper partition chromatography to qualitative analysis of volatile and nonvolatile organic acids.** *Proc. Soc. Exptl. Biol. Med.* **70**, 654-6 (1949).—*C.A.* 43, 5695*i*.

The method was suitable for many org. acids with chain lengths of 1-8 C atoms. The hydroxamate derivs. obtained from about 10^{-6} mole of each of the esters were applied to the filter paper, the 2-dimensional chromatogram was developed with suitable solvents, and the paper was sprayed with dil. $FeCl_3$ to make the derivs. visible as purple spots on a yellow background. Isobutyric acid and phenol gave excellent results as solvents for 2-dimensional chromatograms of dicarboxylic acids.

4967. FLOOD, H. **Inorganic capillary analyses.** *Discussions Faraday Soc.* **1949**, No. 7, 190-5.—*C.A.* 45, 20*b*.

Thick blotting paper was impregnated with $Al(OH)_3$ by dipping in Na aluminate soln. and drying. The adsorption sequence on this paper was similar to that for Al_2O_3 columns. With cation mixt. the elongation of the chromatographic zone was a function of concn. ratios. Sepns. were effected by adding glycine as complexer.

4968. FOSDICK, L. S. AND BLACKWELL, R. Q. **Scanning instrument for quantitative one-dimensional paper partition chromatography.** *Science* **109**, 314-15 (1949).—*C.A.* 43, 4055*g*.

The paper strip developed with ninhydrin was passed between a light source and a photoelec. cell. From transmission values, R_f values and the quantity were detd. The accuracy varied from 5 to 15% depending on the amino acid.

4969. GOOD, P. M. AND JOHNSON, A. W. **Paper chromatography of pterins.** *Nature* **163**, 31 (1949).—*C.A.* 43, 3529*h*.

Individual butterfly wings were extd., and the pterins identified by paper chromatography of 0.1% solns. in 0.5 *N* NH_3, with a BuOH-AcOH solvent. After development of the chromatogram, the paper was viewed in ultraviolet light.

4970. GORDON, A. H. **Paper chromatography.** *Angew. Chem.* **61**, 367-9 (1949).—*C.A.* 44, 19*h*.

The procedures for unidimensional and two-dimensional paper chromatography were described on the basis of examples with amino acids.

4971. HAIS, I. M. AND PECÁKOVÁ, L. **Paper partition chromatography of riboflavin decomposition products.** *Nature* **163**, 768 (1949).—*C.A.* 43, 7073*f*.

The products of photolytic decompn. of riboflavin were studied by paper partition chromatography with 0.08-2.5γ riboflavin in BuOH 4, AcOH 1, and H_2O 5 parts or BuOH 3, $C_5H_5N_4$ 4 and H_2O 5 parts as the mobile phase and examg. the chromatogram in ultraviolet light. In addn. to riboflavin, lumiflavin and lumichrome, two other spots were observed at R_f 0.0 and 0.30 with BuOH, AcOH, H_2O developer.

4972. HAMER, D. AND WOODHOUSE, D. L. **Amino acid composition of salmine.** *Nature* **163**, 689-90 (1949).—*C.A.* 43, 7524*a*.

Analysis of hydrolyzed salmine by partition chromatography on paper was used. No other amino acids were detected by using one-or two-dimensional chromatograms when phenol with NH_3, collidine-lutidine mixt. 1:1 (vol./vol.), or BuOH-HOAc mixt. 4:1 (vol./vol.), were used as solvents.

4973. HANES, C. S. AND ISHERWOOD, F. A. **Separation of the phosphoric esters on the filter paper chromatogram.** *Nature* **164**, 1107-12 (1949).—*C.A.* 44, 3408*d*.

A procedure was given for the identification of phosphoric esters, based on characteristic diffusion rates in filter paper. Quant. data could be obtained by analysis of separate areas of the paper.

4974. HIRST, E. L.; HOUGH, L., AND JONES, J.K.N. **Quantitative analysis of mixtures of sugars by the method of partition chromatography. II. Separation and determination of methylated**

aldoses. *J. Chem. Soc.* **1949**, 928-33.—*C.A.* **44**, 486*c*.

With BuOH (40%), EtOH (10%), H_2O (49%), and NH_4OH (1%) as solvent the qual. chromatographic sepn. of 62 common and less common sugars and their methylated derivs. was discussed and the "R_G" values given. R_G was the ratio between the distance traveled from the starting line by a specific sugar (or its deriv.) and that traveled by the tetra-Me D-glucose. The NaIO micrometric method could be applied in the detn. of aldoses and their derivs. (after paper partition chromatographic sepn.) by H_2O extn. of the paper strips (as previously described). Satisfactory analyses of known sugar mixts. were given.

4975. Hirst, E. L. and Jones, J. K. N. **Quantitative analysis of sugars by means of partition chromatography. III. Determination of sugars by oxidation with sodium periodate.** *J. Chem. Soc.* **1949**, 1659-62.—*C.A.* **44**, 1364*i*.

The method depended on a micro-scale oxidation of sugars to HCOOH. Satisfactory recoveries of HCOOH (94-100% of theory) were obtained from ribose, arabinose, xylose, rhamnose, glucose, galactose, mannose, fructose, sorbose, galacturonic acid, glucosamine-HCl, and sucrose. In one mixt. the constituents were sepd. by paper chromatography and the sugars detd. by the above method. The results were satisfactory.

4976. Hirst, E. L. and Jones, J. K. N. **The application of partition chromatography to the separation of the sugars and their derivatives.** *Discussions Faraday Soc.* **1949**, No. 7, 268-74.—*C.A.* **45**, 1464*i*.

The method of sepn. by partitioning of γ quantities on strips of filter paper was described. R_G values (distance sugar has traveled/distance of travel of tetramethyl glucopyranose under like conditions) were given for sugars with the solvent system BuOH 50, EtOH 10, and H_2O 40 parts. Cellulose columns with solvents such as BuOH-H_2O, iso-PrOH-H_2O, acetone-H_2O, or ethanol as solvents were recommended where larger samples were required.

4977. Holiday, E. R. and Johnson, E. A. **Location of paper chromatogram spots of purine and pyrimidine derivatives in ultraviolet light.** *Nature* **163**, 216-17 (1949).—*C.A.* **43**, 5704*c*.

A low pressure Hg lamp equipped with a filter for 230-400 mμ was used to excite the fluorescence of the paper. Areas of concn. of the order of 0.5-1.0 γ/cm^2 appeared as dark patches against the background fluorescence. Either transmitted or reflected light may be used.

4978. Horrocks, R. H. **Paper partition chromatography of reducing sugars with benzidine as a spraying reagent.** *Nature* **164**, 444 (1949).—*C.A.* **44**, 185*f*.

The reagent was prepd. by combining benzidine 0.5 g, glacial AcOH 20 ml, and abs. EtOH 80 ml. When the sprayed chromatograms were heated at 100-105°C, pentoses produced a chocolate brown color in 5 min.; lactose, maltose, galactose, glucose, and levulose formed dark brown spots within 10 min.

4979. Lacourt, A.; Sommereyns, G.; Degeyndt, E.; Baruh, J., and Gillard, J. **The separatory power of organic solvents in quantitative chromatographic separations of inorganic compounds present in gamma quantities.** *Mikrochemie ver. Mikrochim. Acta* 34, 215-23 (1949).—*C.A.* 43, 6537*b*.

The tests were made with 0.01 ml of soln. applied 3.5 cm below the top of a strip of suitable paper. The process could be applied to the detn. of impurities, e.g., the content of Fe, Ti, Al, V, Ni, and Co in MeOH, EtOH, PrOH, iso-PrOH, and iso-AmOH. The inorg. cations could be sepd. from saline solns. and a soln. contg. Fe, Ti, and Al in 6 *N* HCl eluted with 6.5 *N* HCOOH could be analyzed and 10γ of each ion detd. within 2-3%.

4980. Lacourt, A.; Sommereyns, G.; Degeyndt, E.; Baruh, J., and Gillard, J. **Quantitative inorganic paper chromatography. Submicro separation and determination of aluminum, iron, and titanium.** *Metallurgia* 40, 181-2; *Nature* **163**, 999-1000 (1949).—*C.A.* 43, 7859*g*.

The soln., contg. 1-10γ of salt, was drawn directly from a horizontal capillary buret which delivered 0.01 cc. with an accuracy of ± 0.0002 cc. It was deposited 3.5 cm from the top of a strip of Whatman No. 1 filter paper. Only solvents miscible with H_2O gave satisfactory sepns. Acetone carried Fe along the liquid front. Acid salt solns. produced different chromatograms from the neutral solns., even if the soln. spot was dried before development. Chlorides were preferable to nitrates for sepns. Mixed solvents such as pyridine-acetone, pyridine-MeOH, pyridine-H_2O, in varying proportions were good developing agents for cations, giving sharp, well-defined spots in the sepn. of Fe from Ti, Al, and V.

4981. Lederer, Michael. **Separation of chloride-group anions by partition chromatography on paper.** *Science* **110**, 115-16 (1949).—*C.A.* **43**, 8972*h*.

The solvent was BuOH satd. with 1.5 *N* NH_4OH. Among the methods tried the most satisfactory procedure was first to spray with a soln. of $Fe(NO_3)_3$ and H_2O_2. This produced a red spot for CNS and a blue spot for I^-. The whole paper was then originally formed and pptd. the 4 anions. The paper was then washed twice with dil. HNO_3 to remove exceeds Ag, and then held over H_2S. Cl^- produced a brown spot (R_f 0.10-0.11) and Br^- a brown spot.

4982. Lederer, Michael. **Separation of the copper and tin groups by partition chromatography on paper.** *Anal. Chim. Acta* **3**, 476-80 (1949).—*C.A.* 44, 10579*d*.

The chromatographic sepn. on paper of elements of the Cu and Sn groups employed ascending development by BuOH satd. with *N* HCl and identification by means of H_2S. The sepn. of Cu and Cd, and and that of Sb, As, and Sn-(II) ions was recommended.

4983. Lederer, Michael. **The paper chromatography of inorganic anions.** *Australian J. Sci.* **11**, 174 (1949).—*C.A.* **43**, 6883*b*.

Paper chromatography, using butanol satd. with aq. 1.5 *N* NH_4OH, was useful for making the following sepns.: halides from most other ions; nitrite from bromate, iodate, and periodate; most univalent anions from mixts. with multivalent anions.

4984. Lederer, Michael. **Paper partition chromatography of organic anions.** *Australian J. Sci.* **11**, 208-9 (1949).—*C.A.* **44**, 976*h*.

The following acids were sepd. by paper chromatography, by using as solvent BuOH satd. with 5 *N* NH_4OH: *o*-, *m*-, and *p*-aminobenzoic acids ($R_f = 0.38$, 0.19, 0.12, resp.), *o*-, *m*-, and *p*-hydroxybenzoic acids (0.60, 0.27, 0.13), sulfanilic acid (0.13), *o*-, *m*- and *p*-nitrophenols (0.62, 0.72, 0.62), and α-, and β-naphthols (0.95, 0.97).

4985. Lederer, Michael. **Paper chromatography of some metals.** *Australian J. Sci.* **12**, 78 (1949).—*C.A.* **44**, 6332*g*.

R_f values for butanol satd. with *N* HCl, and color tests were given for the following ions: Tl^+ (0.0), Tl^{3+} (1.11), Zn^{2+} (0.77), Be^{2+} (0.33), In^{3+} (0.30), V^{4+} (0.17), Mg^{2+} (0.11), Ti^{4+}, Al^{3+}, and Cr^{3+} (0.07), Er^{3+} (0.05), Ce^{3+}, Y^{3+}, Th^{4+}, and Di (0.03). Tl^{3+} could be sepd. from all metal ions except Au and Hg.

4986. Lindberg, Olov and Hummel, J. P. **The measurement of radioactivity from chromatogram.** *Arkiv. Kemi* **1**, 17-19 (1949).—*C.A.* **43**, 4951*c*.

A method was described for the serial counting of segments of filter-paper strips. The procedure was used in an expt. which demonstrated the synthesis of adenosine triphosphate by rat kidney homogenate.

4987. Longenecker, William H. **Simplified partition chromatographic procedures—resolution of sulfonamides, sulfones, and their metabolic products from biological methods.** *Anal. Chem.* **21**, 1402-5 (1949).—*C.A.* **44**, 3065*e*.

Apply 0.003-0.01 ml aliquots of sulfonamide solns. or plasma to narrow strips of filter paper (3 mm × 34 cm). Suspend the strips from the top of 1-liter cylinder to below the surface of 100 ml of solvent (40 ml BuOH and 10 ml concd. NH_4OH dild. to 100 ml with water). For use with plasma, add 0.1 g nonaethyl-eneglycol monostearate to this soln. Hold the strips taut with attached weights. Provide a filter paper wick to carry solvent from a test tube at the top down into the cylinder to maintain a satd. atm. When the solvent, rising by capillary action, reaches the top, remove and dry the strips. Apply *p*-dimethylaminobenzaldehyde soln. (1 g in 100 ml of 3% HCl) to representative strips to locate the bands. To the other strips, add nitrite soln. (0.1 g $NaNO_2$ in 100 ml glacial HOAc + 1 drop HCl), dry, and add *N*-(1-naphthyl) ethylenediamine (0.1 g in 100 ml BuOH) to produce colored bands. Strings of plain or mercerized cotton, glass wool, or thin asbestos paper could be used.

4988. Ma, Roberta M. and Fontaine, Thomas D. **One- and two-dimensional paper-partition chromatographic apparatus.** *Science* **110**, 232-3 (1949).—*C.A.* **43**, 8747*e*.

A 1-liter graduated cylinder served as the chamber. The paper for the chromatogram was held in a stainless steel holder. A rubber stopper and adhesive cellophane tape sealed the top of the cylinder. The chromatograms were run on filter paper sheets 300-330 mm long and 230-280 mm wide.

4989. Malpress, F. H. and Morrison, A. B. **Use of pyridine in the deionization of solutions for paper chromatography.** *Nature* **164**, 963 (1949).—*C.A.* **44**, 3836*e*.

A procedure was given, based on the soly. of sugars and the insoly. of inorg. salts in pyridine, for consistent elimination of salt effects in chromatographic studies.

4990. Markham, Roy and Smith, John D. **Chromatography of nucleic acid derivatives.** *Nature* **163**, 250-1 (1949).—*C.A.* **43**, 4723*c*.

Chromatograms run in BuOH in an NH_3 atm. on filter paper were dried and pinned to a strip of Ilford Reflex Document Paper No. 50. On exposure to 2537 and 2650 A. light for 1.5 min., the absorbing substances (purine and pyrimidine derivs.) showed up as light areas on a black background. Extn. of these areas from the filter paper with H_2O was followed by spectrophotometric analysis.

4991. Markham, Roy and Smith, J. D. **Chromatographic studies of nucleic acids. I. Technique for the identification and estimation of purine and pyrimidine bases, nucleosides and related substances.** *Biochem. J.* **45**, 294-8 (1949).—*C.A.* **44**, 3066*i*.

Pyrimidines moved faster than corresponding purines (uracil faster than xanthine, or cytosine than guanine). In the presence of NH_4OH, the NH_2 derivs. moved much faster than the corresponding OH compds.; the difference was greatly decreased or actually reversed by changing to an acidic solvent. Increasing the no. of OH groups in the subst. decreased its rate of movement. Increasing methylation tended to increase the movement of the subst. in all solvents.

4992. Masuyama, Motosaburo and Takahashi, Mitsumasa. **Ionophoretic chromatography.** *Kagaku (Science)* **19**, 327 (1949).—*C.A.* **46**, 3366*i*.

Six dyes were used for testing the method. After a mixt. of 4 aq. dye solns., which was put on the lower end of vertically hung filter paper, was dried, 0.1 *N* NaCl soln. was sprayed to make the paper conducting. By use of carbon electrodes, a d.c. (0.05 ma.) was applied for 3 hrs. Application of the usual partition method with phenol, after the ionophoretic method, gave almost the same results as in 2 successive one-dimensional partition methods.

4993. Miettinen, J. K. **A new technique in descending paper chromatography.** *Abstracts Communs., 1st Intern. Congr. Biochem.* **1949**, 229.—*C.A.* **46**, 5930*f*.

The neutral amino acids could be completely sepd. from hydrolyzates in one-dimensional expts. In 2-3 weeks, leucine, isoleucine, phenylalanine, methionine, valine, tryptophan, tyrosine, and proline could be completely sepd. as individuals on a 50-cm chromatogram on Whatman No. 1 filter paper.

4994. Miettinen, Jorma K. and Virtanen, Atturi I. **A new technique in paper chromatography.** *Acta Chem. Scand.* **3**, 459-64 (1949).—*C.A.* **43**, 8298*i*.

A continuous developing technique was accomplished in descending paper chromatography by fastening a thick pad of cellulose at the foot of the filter paper and allowing solvent to be adsorbed until the fastest moving compd. nearly reached the pad. tert-AmOH showed the best resolving power; this and other alcs. were preferred, and caused less decompn. than collidine, isobutyric acid, and pytidine.

4995. MITCHELL, HERSCHEL K.; GORDON, MALCOLM, AND HASKINS, FRANCIS A. **Separation of enzymes on filter paper chromatopile.** *J. Biol. Chem.* **180**, 1071-6 (1949).—*C.A.* 44, 2592*g*.

The method was based on salting-out adsorption and adsorption displacement of enzymes on a filter paper pile. The soln. of enzymes was taken up on filter paper disks, dried, and then placed near the head of an enclosed column of filter paper disks. Sepn. of the enzymes occurred when $(NH_4)_2SO_4$ solns. of varying strengths were passed through the column.

4996. MITCHELL, HERSCHEL K. AND HASKINS, FRANCIS A. **A filter paper "Chromatopile".** *Science*, **110**, 278-9 (1949).—*C.A.* 44, 75*f*.

A pile of filter paper disks clamped tightly was used as an absorbing column. It was connected by a siphon of rubber tubing to a flask contg. the solvent and the flask adjusted so the level of the solvent was even with the top of the paper pile. In a test run on 50 mg each of adenine, tryptophan, phenylalanine, *p*-aminocinnamic acid, and anthranilic acid, the compds. sepd. on different groups of paper disks and 233 mg of the original 250 mg was recovered.

4997. MÜLLER, RALPH H. AND CLEGG, DORIS L. **Automatic paper chromatography.** *Anal. Chem.* **21**, 1123-5 (1949).—*C.A.* 43, 8776*i*.

Paraffin barriers were placed on filter paper to form 2 plane reservoirs connected by a narrow channel. With the paper vertical, the sample and an appropriate eluting liquid were placed in the lower reservoir. The progress of the elution was followed automatically by an optical arrangement. With MeOH as elutant, 1γ each of aniline orange and malachite green were sepd. in approx. 1 min.

4998. MÜLLER, RALPH H. AND CLEGG, DORIS L. **Kinetics of paper-chromatogram development.** *Anal. Chem.* **21**, 1429-30 (1949).—*C.A.* 44, 2325*e*.

The square of the radius (r) of a colored zone on a paper-disk chromatogram was proportional to the development time (t) for a given solvent or a solute. Thus $r^2 = at$, or $R_f = r_{11}/r_1 = (a_1/a_{11})^{1/2}$. The values of a_1 and a_{11} could be detd. precisely from a plot of square-law data.

4999. NICHOLSON, D. E. **Modified technique for the development of paper chromatograms.** *Nature* **163**, 954 (1949).

In the sepn. of amino acids by partition chromatography, use of the BuOH in the spray was obviated by the following procedure: carry out the two dimensional chromatography in PhOH as usual, then at right angles with a 0.1% soln. of ninhydrin in collidine or BuOH-AcOH; heat the paper; and remove the solvent in a current of air. The warming was sufficient to develop the colors of the amino acids.

5000. NORRIS, FLORA C. AND CAMPBELL, JACK J. R. **Intermediate metabolism of Pseudomonas aeruginosa. III. Application of paper chromatography to the identification of gluconic and 2-ketogluconic acids.** *Can. J. Research* **27C**, 253-61 (1949).—*C.A.* 44, 3567*c*.

The use of paper chromatography for the detection of gluconic, 2-ketogluconic, and α-ketoglutaric acids was described. The R_f values obtained were found to vary markedly with the water content of the solvent. Salts of acids or free acids were always found to give identical R_f. MeOH and EtOH, separate or in combination, were found to be suitable solvents for this work.

5001. OSBORN, G. H. AND JEWSBURY, A. **Inorganic paper chromatography; Qualitative separation of aluminum and beryllium.** *Nature*, **164**, 443-4 (1949).—*C.A.* 44, 75*c*.

Al scarcely moved from its starting point but Be moved a considerable distance down the paper. The technique of development by fluorescence was used. The chloride spots were eluted with a solvent contg. 80% by vol. *n*-butanol and 20% concd. HCl and then sprayed with an alc. soln. of 8-hydroxyquinoline.

5002. PACSU, E.; MORA, T. P., AND KENT, P. W. **General method for paper chromatographic analysis of reducing and nonreducing carbohydrates and derivatives.** *Science* **110**, 446-47 (1949).—*C.A.* 44, 2417*b*.

An improved method for the detection of carbohydrates and their derivs. after sepn. on paper chromatograms consisted in spraying the dried chromatograms with a 1% aq. soln. of $KMnO_4$ contg. 2% Na_2CO_3. Yellow zones on a purple background changed to gray zones on a brown background after drying. Elution with H_2O in place of BuOH gave some sepn. of higher sugars and trisaccharides, but with considerable widening of the bands. Streptomycin migrated readily with H_2O. R_f values detd. on Whatman No. 1 paper with downward elution with BuOH were given.

5003. PARTRIDGE, S. M. **Aniline hydrogen phthalate as a spraying reagent for chromatography of sugars.** *Nature*, **164**, 443 (1949).—*C.A.* 44, 487*a*.

This reagent was much more selective for sugars than ammoniacal $AgNO_3$ and was extremely sensitive to aldo-pentoses and aldo-hexoses. Since it may be dissolved in moist butanol, migration of the sugar spots during the spraying process could be avoided. To prep. the reagent add aniline 0.93 g and phthalic acid 1.66 g to 100 ml of water-satd. butanol. After spraying, the chromatogram was heated for 5 min. at 105°C to develop the color.

5004. PATTON, A. R. AND FOREMAN, E. M. **Glycine reagent for paper chromatograms.** *Science* **109**, 339 (1949).—*C.A.* 43, 4978*a*.

Glycine could be identified on a paper chromatogram as a Hellebore green spot, chocolate brown under radiation at 3650 A., by spraying with a soln. of *o*-phthalaldehyde. The most suitable solvent for dispersing interfering substances found in protein hydrolyzates was 77% EtOH. Use of *o*-phthalaldehyde also permitted detection of NH_4^+ (dark grey), and histidine and tryptophan (sep. spots with intense yellow fluorescence at 3650 A.).

5005. PATTON, A. R.; FOREMAN, ELSIE M., AND WILSON, PATRICIA C. **Do amino acids fluoresce on paper-grams?** *Science* **110**, 593-4 (1949).—*C.A.* 44, 3361*a*.

Spots formed by drying solns. of amino acids on filter paper fluoresce under the ultraviolet light, possibly as a result of a reaction between the amino acid and the cellulose. All amino acids produced similar results.

5006. POLLARD, F. H.; MCOMIE, J. F. W., AND ELBEIH, I. I. M. **Inorganic paper chromatography and detection of cations by fluorescence.** *Nature* **163**, 292 (1949).—*C.A.* 43, 5702*b*.

The relative R_F values were given for two solvents: (1) 50 BuOH, 10 HOAc, 5 acetoacetic ester, 35% water; and (2) 50 collidine with 50% water. The dried strips were sprayed with kojic acid, *o*-aminobenxoic acid, morin, 1-naphthylamine-8-sulfonic acid, 2-naphthylamine-1-sulfonic acid, or 8-hydroxyquinoline and examd. under ultraviolet to locate the cations.

5007. PORTER, W. L. AND FENSKE, CHARLES S. JR. **Determination of glucose, galactose, and rhamnose in mixtures.** *J. Assoc. Offic. Agr. Chemists* **32**, 714-17 (1949).—*C.A.* 44, 486*h*.

The method involved hydrolysis, identification of the sugars by paper chromatography, and detn. of reducing sugars before and after fermentation by two yeasts capable of selective destruction of glucose, and of glucose and galactose, resp. When the chromatogram indicated only rhamnose, fermentation was unnecessary.

5008. RENARD, MARCEL. **Paper chromatography of α-chlorinated acids. A new, simple, and rapid method to establish the structure of dipeptides.** *Bull. soc. chim. Belges* **58**, 301-9 (1949).—*C.A.* 44, 3409*i*.

Paper chromatography of chloroacetic acid and α-chloropropionic acid was studied. The mixt. of acids was displaced by dichloroethylene in a moist atm. and the acid zone detected with methyl orange. The ratio R (distance covered by the acid zone divided by distance covered by the solvent zone) depended on the amt. of acid present. The presence of either compd. in an unknown mixt. was detected by addn. of a known amt. of chloroacetic acid or α-chloropropionic acid. Appearance of a single acid zone indicated identity. The application of this method for detg. the structure of dipeptides was shown with alanylglycine.

5009. ROCKLAND, LOUIS B. AND DUNN, MAX S. **Capillary-ascent test-tube method for separating amino acids by filter-paper chromatography.** *Science* **109**, 539-40 (1949).—*C.A.* 43, 8777*f*.

A spot of a 0.03 *M* amino acid soln., 1.5 mm in diam. or less, was placed about 6 mm from the small end of a strip of No. 1 Whatman filter paper, 13.5 × 1.8 × 1.0 cm. This was developed in a stoppered 6-in. test tube contg. about 0.4 cc. of a water-satd. phenol soln. R_f values (the ratio of the distance traveled by an ion to that traveled by the liquid front) were detd. for 17 amino acids.

5010. ROCKLAND, LOUIS B. AND DUNN, MAX S. **Quantitative determination of amino acids on filter paper chromatograms by direct photometry.** *J. Am. Chem. Soc.* **71**, 4121-2 (1949).—*C.A.* 44, 3072*a*.

Alanine and glycine were detd. in silk fibroin by a rapid, direct photometric analysis of color intensities of filter paper chromatograms stained with ninhydrin.

5011. ROTH, LLOYD J.; LEIFER, EDGAR; HOGNESS, JOHN R., AND LANGHAM, WRIGHT H. **Metabolism of radioactive pentobarbital in mice.** *J. Biol. Chem.* **178**, 963-5 (1949).—*C.A.* 43, 6306*h*.

When Na pentobarbital, labelled with C^{14}, was injected intraperitoneally into mice, 80% of the radioactivity was recovered: 78% in the urine, 2% in the feces, and none in expired CO_2. Filter paper chromatograms of the urine indicated the presence of 5 radioactive metabolites.

5012. RUTTER, L. **Streaming potential in paper chromatography.** *Nature* **163**, 487 (1949).—*C.A.* 43, 6040*b*.

The potential developed by the resultant flow of solvent through the capillary channels of paper was studied.

5013. SLUYTERMAN, L. A. A. E. AND VEENENDAAL, H. J. **A method for the detection of amphoteric substances in paper chromatography.** *Rec. trav. chim.* **68**, 717-20 (1949).—*C.A.* 44, 4363*i*.

Amino acids with a tertiary amino group, or aminobenzoic acids which did not react with ninhydrin, were chromatographed on paper and, after drying, the paper treated with a soln. of 15 mg tropeolin 00 in 100 ml $EtOH$-Et_2O (1:2) or other suitable acid-base indicator. After drying, the paper was held in HCl vapor in such a way that all parts absorbed the same amt. of acid. Through their buffering action, the spots with amino acids held the pH higher than the surrounding unbuffered parts of the paper and thus formed yellow spots on a red background if the correct amt. of HCl was absorbed.

5014. SUNDMAN, JACOBUS; SAARNIO, JOUKO, AND GUSTAFSSON, CHARLEY. **Investigation of the carbohydrate composition of some kinds of wood by paper chromatography.** *Finnish Paper Timber J.* **31**, 467-71 (1949).—*C.A.* 45, 2199*b*.

One g powd. and dried wood sample was treated with 10 ml 72% H_2SO_4 at room temp. for 4 hrs, 320 ml H_2O added, and the soln. boiled for 6 hrs. The acid was removed by filtering through an anion exchanger, thus avoiding epimerization. The soln. was then adjusted to pH 4-5 with AcOH and evapd. to a small vol. The chromatograms were developed with a 1:1 mixt. of *N* $AgNO_3$ and 5 *N* NH_4OH applied with a brush. In some parallel expts. the hexoses were removed by fermentation before chromatographing to bring out the pentoses more clearly.

5015. TAUROG, ALVIN; CHAIKOFF, I. L., AND TONG, W. **Occurrence of monoiodotyrosine in the thyroid gland.** *J. Biol. Chem.* **178**, 997-8 (1949).—*C.A.* 43, 6714*c*.

Two-dimensional filter paper chromatograms were prepd. with aliquots of the filtered hydrolyzate with $BuOH$-$AcOH$-H_2O and collidine-H_2O as the developing agents. Two of the radioactive spots corresponded exactly to the positions taken by added diiodo-DL-tyrosine and monoiodo-DL-tyrosine.

5016. Urbach, Karl F. **Deposition and simultaneous concentration of dilute solutions in paper partition chromatography.** *Science* **109**, 259-60 (1949).—*C.A.* **43**, 4183*a*.

A device was described which allowed the concn. on a small spot on paper strips of 3-5 ml soln. instead of the customary 0.01-0.1 ml. Histamine soln. in BuOH was added to paper strips at a rate of 1 ml per hr through specially constructed capillary pipets. The strips were mounted over a hot plate in such a way that the liquid evapd. as it was applied.

5017. Wender, Simon H. and Gage, Thomas B. **Paper chromatography of flavonoid pigments.** *Science* **109**, 287-9 (1949).—*C.A.* **43**, 6285*b*.

The sepn. of mixts. contg. 4 to 6 of these pigments and the use of color developing sprays to locate and identify the pigment zones were presented. Mixts. of 4 to 6 pigments were sepd. on a one-dimensional chromatogram strip by selecting the solvent giving the greatest differences in R_F values for the particular pigments. The color of the pigment zones in ultraviolet light was an aid in identifying the respective pigments on the developed chromatogram.

5018. Wieland, Theodor and Fischer, Edgar. **Paper chromatography of α-keto acids.** *Naturwissenschaften* **36**, 219 (1949).—*C.A.* **44**, 5757*d*.

Fresh soln. of *o*-phenylenediamine (0.05%) in 10% aq. CCl_3CO_2H was sprayed on filter paper and dried for 2 min. at 100°C to a moist, yellow condition. α-Keto acids were dissolved in either of 2 solvents: PWB, 5:7: 10 vol. ratio of propionic acid, water, and butanol, or WDB, 3:4:6 ratio of water, α-(dimethylamino) isobutyronitrile, and butanol, keto acid concn, in either 1%. The R_F values obtained by chromatography of such solns. on the paper described (yellow-green fluorescence at the locations of the keto acid) were 0.29 for pyruvic acid, 0.60 for dimethylpyruvic acid, 0.75 for cinnamoylformic acid, 0.21 for α-keto-glutaric acid, and 0.16 for oxalacetic acid with PWB solns. For WDB solns. the values were 0.46, 0.78, 0.95, 0.07, and 0.04, resp.

5019. Woiwod, A. J. **A technique for examining large numbers of bacterial culture filtrates by partition chromatography.** *J. Gen. Microbiol.* **3**, 312-18 (1949).—*C.A.* **44**, 3550*g*.

A special app. was designed for making paper chromatograms. Whatman No. 4 paper (22 1/2 × 18 1/4 in.) and BuOH + AcOH mixt. were chosen as the best paper and solvent. Phenol was used for 2-dimensional chromatography.

5020. Wolfson, W. Q.; Cohn, C., and Devaney, W. A. **An improved apparatus and procedure for ascending paper chromatography on large-size filter-paper sheets.** *Science* **109**, 541-3 (1949).—*C.A.* **43**, 8806*f*.

The stainless steel chromatography tank was cylindrical, 16 in. internal diam., 24 in. high and constructed with a 3/4-in. flange at the top for sealing. The lid was fitted with an eccentrically placed 1-in. hole for pressure reduction or the addn. or removal of material. The filter sheets (Whatman No. 1, 18 in. × 23 in. or S & S No. 604, 23 in. × 23 in.) were folded back 1 in. on 3 edges, stapled, and the sheet fastened in the form of a cylinder with adhesive tape.

5021. Wynn, Victor. **Peptidelike contaminant of filter paper.** *Nature* **164**, 445 (1949).—*C.A.* **44**, 185*g*.

A contaminant in Whatman nos. 1, 2, and 4 filter papers was studied. Each paper was set up as for a chromatogram with distd. water as the solvent. The water was allowed to run off for 5 days into a receiving vessel. Each 24-hr collection was filtered and evapd. to dryness. The first two 24-hr samples contained appreciable amts. of solid material, the other 3 negligible amts. The material from the first 2 days was mixed and the 4 specimens were hydrolyzed (6 *N* HCl, 105°C, 24 hrs) and subjected to 2-dimensional chromatography.

5022. Zaffaroni, Alejandro; Burton, Robert B., and Keutmann, E. Henry. **The application of paper partition chromatography to steroid analysis. I. Ketosteroids.** *J. Biol. Chem.* **177**, 109-16 (1949).—*C.A.* **43**, 3872*f*.

Ketosteroids were transformed into water-sol. hydrazones by means of trimethylacetohydrazideammonium chloride which were sepd. on paper strips and developed with BuOH or a mixt. of BuOH and *tert*-BuOH, satd. with H_2O. After development of the chromatogram the hydrazones were made visible with K_2PtI_6 or iodobismuthate.

5023. Zocher, H. and Torok, C. **Relations between fluorescence and adsorption.** *Anais assoc. quim. Brasil* **8**, 5-19 (1949).—*C.A.* **45**, 40*i*.

A fluorescence exhibited by a drop of soln. allowed to spread on S. & S. No. 589 filter paper was studied (Hg-vapor lamp with NiO glass filter). The threshold concn. for observable fluorescence in H_2O, expressed as the neg. log of the wt fraction, was 7 for a drop of fluorescein soln., and 6 if adsorbed onto paper. For mercurochrome the values were 6.5 and 5.5, resp., but for eosin 7 and 8, the increased sensitivity on paper being due to stronger adsorption because of higher mol. wt.

5024. Acher, Roger; Fromageot, Claude, and Jutisz, Marian. **Chromatographic separation of amino acids and peptides. V. The amino acids of insulin with a note on the determination of proline.** *Biochim. et Biophys. Acta* **5**, 81-8 (1950)(in French).—*C.A.* **46**, 11288*h*.

The chromatographic sepn. method of amino acids into 4 groups (basic, acid, neutral aromatic, and neutral nonaromatic) was applied to the constituent amino acids of insulin.

5025. Anderson, J. R. A. and Lederer, M. **Quantitative paper chromatography. I. Separation and gravimetric determination of thallium.** *Anal. Chim. Acta* **4**, 513-16 (1950) (in English).—*C.A.* **45**, 3282*f*.

Tl [III] could be sepd. quantitatively from Fe, Cu, Ni, and Co by using butanol satd. with *N* HCl soln. as solvent. Strips of paper pulp 150 × 25 × 6 mm capable of adsorbing 1-2 ml of soln. on a spot 25 mm in diam were used. Up to 50 mg of metallic ion could be sepd.

5026. Aronoff, S. and Vernon, L. **$C^{14}O_2$ assimilation by soybean leaves.** *Arch. Biochem.* **27**, 239-40 (1950).—*C.A.* **44**, 10812*c*.

The primary chromatographic product of CO_2 fixation in 5 to 90 sec. exposure was glyceric acid. Next are alanine, serine, and glycine. The first free sugars were the trioses and glucose, followed by fructose, and later by sucrose, raffinose, and mannose.

5027. Atkinson, R. O.; Stuart, R. G., and Stuckey, R. E. **Colors developed in the paper chromatography of amino acids.** *Analyst* **75**, 447 (1950).—*C.A.* **44**, 10602*e*.

Many amino acids gave a reddish color after irrigation with acid solns. and a bluish color after irrigation with basic solns. Elution with a mixt. of 60% 2,4-lutidine and 40% water, or with 20% pyridine and 80% water, caused the color to change from red to blue and the blue was readily washed away. The blue color was unstable in the presence of alkali hydroxide and NH_3 and vigorous shaking with pyridine sometime peptized the filter paper giving a transparent colloidal suspension. Glycine, asparagine, tyrosine, phenylalanine, histidine, and tryptophan gave anamolous results. By irrigation with phenol in the presence of NH_4OH, drying and spraying with ninhydrin gave brown or orange spots with the 6 acids mentioned.

5028. Bailey, A. **Chromatographic behavior of lignins.** *Paper Ind.* **32**, 395-8 (1950).—*C.A.* **44**, 8106*h*.

Lignin was extd. (1 hr) from aspen, birch, white oak, white spruce, and jack pine by means of aq. BuOH (50% by vol.) at 160°C. The filtered liquors were pptd. by aq. HCl, and the washed, air-dried lignin dissolved in dioxane (4% soln.) which was applied slowly to the center of a filter paper and after adsorption, AcOBu was applied as solvent. The preferential lignin absorption was followed alternately in ultraviolet and visible light, the appearances of the various zones being noted both wet and dry.

5029. Beerstecher, Ernest, Jr. **Micromethod for estimation of potassium by paper chromatography.** *Anal. Chem.* **22**, 1200-02 (1950).—*C.A.* **45**, 495*d*.

K was sepd. from interferring substances by paper chromatography; a soln. of 80 parts of EtOH and 20 parts of 0.1 *N* HCl was used as a solvent. K was developed as a green spot at $R_f = 0.4$ upon spraying with $NaPbCo(NO_2)_6$. Planimetry of the spots measured the K present.

5030. Biserte, Gérard and Osteux, Roger. **Separation of amino acids and polypeptides as dinitrophenyl derivatives.** *Compt. rend.* **230**, 1404-5 (1950); *Bull. soc. chim. biol.* **33**, 50-63 (1951).—*C.A.* **44**, 7374*f*.

The fixation of dinitrophenyl by the action of fluorodinitrobenzene on amino groups was a precise method for detg. terminal amino groups in polypeptides. In applying this method to paper chromatography, the following solvents were used: (1) ammoniacal $PhOH$-iso-$AmOH$-H_2O, 1:1:1, (2) toluene-$ClCH_2CH_2OH$-C_5H_5N-NH_4OH, 5:3:1:3, and (3) C_5H_5N-iso-$AmOH$-dil. NH_4OH, 6:14:20. The resolution was satisfactory when there were a small no. of different (dinitrophenyl) amino acids and particularly for the identification of the terminal groups of simple polypeptides.

5031. Bland, D. E.; Ho, G., and Cohen, W. E. **Aromatic aldehydes from the oxidation of some Australian woods and their chromatographic Separation.** *Australian J. Sci. Research* **3A**, 642-8 (1950).—*C.A.* **45**, 4442*i*.

The wood (5 g sawdust) was oxidized with $PhNO_2$ (3 ml) and 2 *N* NaOH (100 ml) in a steel bomb at 150°C for 3 hrs, and the product filtered. p-OHC_6H_4CHO was isolated from certain exts. by the "chromatopile." Paper chromatograms showed it to be present in traces in all cases.

5032. Block, Richard J. **Paper chromatograms spot amino acids.** *Food Inds.* **22**, 824-7, 951-3 (1950).—*C.A.* **45**, 983*e*.

The sepn. and identification of amino acids from protein hydrolyzates by 2-dimensional chromatographic analysis were described. Identification should not rest solely on the R_f values. The position of the spot relative to other amino acids, movement in a variety of solvent mixts., and color reactions should also be used.

5033. Block, Richard J. **Estimation of amino acids and amines on paper chromatograms.** *Anal. Chem.* **22**, 1327-32 (1950); **23**, 298 (1951).—*C.A.* **45**, 8585*a*.

Quant. detn. of amino acids from protein hydrolyzates was accomplished by prepg. one- and two-dimensional chromatograms. Known mixts. were run on the same sheet with unknowns. For two-dimensional chromatograms, it was therefore necessary to cut the first chromatogram into horizontal strips, ext. the groups of amino acids, and make new chromatograms from each group.

5034. Boggs, L.; Cuendet, L. S.; Ehrenthal, I.; Koch, R., and Smith, F. **Separation and identification of sugars using paper chromatography.** *Nature* **166**, 520-1 (1950).—*C.A.* **45**, 1840*a*.

Blackening of the paper in the chromatography of sugars with a $PhOH$-H_2O mixt. and ammonical $AgNO_3$ as a developer could be avoided if the paper was extd. with Et_2O before developing. Another method was to use malonic or propionic acid together with BuOH and H_2O as solvents.

5035. Boissonnas, R. A. **Chromatographic studies. I. Rapid separation of amino acids by ascending two-dimensional paper chromatography.** *Helv. Chim. Acta* **33**, 1966-71 (1950) (in French).—*C.A.* **45**, 418*b*.

Two chromatograms were run. Leucine, isoleucine, valine, methionine, phenylalanine, tyrosine, and tryptophan were sepd. by the solvent systems *tert*-$BuOH:MeCOEt:H_2O$ (4:4:2) and *tert*-$BuOH:MeOH:H_2O$ (4:5:1), whereas all the other amino acids were sepd. on another sheet with $C_6H_5OH:H_2O$ (7:3) and $PrOH:H_2O$ (7:3). Whatman No. 1 paper was used. The solvents were removed by an air current or *in vacuo* at 60°C.

5036. Boissonnas, R. A. **Chromatographic studies. II. Punctiform color development of amino acids, polypeptides, and sugars.** *Helv. Chim. Acta* **33**, 1972-4 (1950) (in French).—*C.A.* **45**, 418*d*.

Ninhydrin (3 g) in a mixt. of 50 ml *tert*-BuOH, 40 ml glycerol, and 10 ml H_2O was applied to paper chromatograms in small points of 0.5 mm diam. at distances of 7 mm with the aid of a stamp equipped with fine metal needles. The viscosity of the reagent prevented its spreading on the paper. Exposure of the spotted paper to infrared rays for 10 sec developed the color and outlined the amino acid spots.

5037. BONINO, GIOV. BATTISTA AND CARASSITI, V. **Separation of optical antipodes of *dl*-1(2-hydroxy) naphthylbenzylamine by means of chromatography on paper.** *Atti accad. nazl. Lincei. Rend., Classe sci., fis., mat. and nat.* 9, 229-31 (1950).—*C.A.* 45, 8489*e*.

dl-2,1-$HOC_{10}H_6CH(Ph)NH_2$, was resolved by forming the *d*-tartarate and chromatographing the salt on filter paper which had been impregnated with PhOH.

5038. BOURSNELL, J. C. **A radioactivity scanning device for paper chromatograms with phosphorus^{32}.** *Nature* 165, 399 (1950).—*C.A.* 44, 8170*g*.

An app. for counting radioactive P in PO_4^{3-} esters after sepn. on filter paper chromatograms consisted of a brass plate within which an exact 1-cm square hole had been cut. A Geiger-Müller counter with a 2-in. "Dural" end window was mounted below the hole, and the filter paper was pressed against the brass by a glass plate and a Pb wt.

5039. BRADFIELD, A. E. AND SMITH, E. C. BATE. **Chromatographic behavior and chemical structure. II. The tea catechins.** *Biochim. et Biophys. Acta* 4, 441-4, (1950).—*C.A.* 44, 5677*e*.

Paper chromatography at 20°C in BuOH-AcOH-H_2O (4:1:5) was performed on the components of the "white tannin" of green tea leaves. Spots were developed by spraying with ammoniacal $AgNO_3$. Certain regularities in these results, as well as similar ones obtained from optical rotation suggested that the l-gallocatechol of tea would be more suitably designated as l-epigallocatechol.

5040. BRODA, E. AND SCHONFELD, T. **Exchange adsorption of radioactive ions on paper.** *Monatsh.* 81, 459-62 (1950).—*C.A.* 44, 8262*b*.

The pH dependence pointed to an ion-exchange mechanism. Th-B and Rb^{86} were used. On the assumption that the active centers were carboxyls, the no. of glucose units per carboxyl group in cellulose was calcd. to be 125. Adsorption capacities for 10^{-7} *M* RbCl increase in the order H-paper 3.1%, Ca-paper 7.7%, K-paper 16.1%, and Li-paper 38%.

5041. BROWN, F. AND HALL, L. P. **The separation of carboxylate ions on the paper chromatogram.** *Nature* 166, 66-7 (1950).—*C.A.* 44, 9868*c*.

Fatty acids could be sepd. and identified by paper chromatography of the Na salts with BuOH satd. with 1.5 *N* NH_4OH as solvent. Bromocresol green and bromothymol blue revealed the anions as yellow spots, the cations as blue spots. The Na ion moved separately and more slowly than its anion, its R_f increasing as the anion R_f increased. The acids tested were: formic ($R_f = 0.09$), AcOH 0.10, propionic 0.19, butyric 0.33, valeric 0.45, caproic 0.61, caprylic 0.74, benzoic 0.39, salicylic 0.50, B-phenylpropionic 0.52, lactic 0.07, oxalic 0, tartaric 0, adipic 0, and citric 0.

5042. BRUMBERG, E. M. **Apparatus for chromatography and analysis in ultraviolet (ultrachemiscope).** *Doklady Akad. Nauk S.S.S.R.* 72, 885-8 (1950).—*C.A.* 44, 9745*i*.

A strip of filter paper was placed between a glass light-filter plate transmitting only ultraviolet, mainly 253 mμ, and a fluorescent screen with 3 fluorescent layers, the outermost (facing the filter paper) excitable by wave lengths shorter than 270, the intermediate by 320-270, the innermost by 400-320 mμ, and omitting, resp., red, green, and blue fluorescence. The nature of the substances present in the filter paper, depending on their adsorption in the ultraviolet, detd. characteristic shadows on the fluorescent screen.

5043. BUCHANAN, J. G.; DEKKER, C. A., AND LONG, A. G. **Detection of glycosides and nonreducing carbohydrate derivatives in paper-partition chromatography.** *J. Chem. Soc.* 1950, 3162-7.—*C.A.* 45, 3753*g*.

Nonreducing sugar derivs. and 1,2-glycols could be detected by methods depending on their specific reactions with $NaIO_4$ or with $Pb(OAc)_4$. After oxidation, $NaIO_4$ and $NaIO_3$ were reduced by SO_2, and the aldehydes detected by Schiff's reagent. Dialdehydes thus formed gave stable blue or purple stains, monoaldehydes reacted more feebly and precautions to prevent aerial oxidation were required. The method gave pos. results with every 1,2-glycol tested (18 of which were listed) in quantities of 10γ or less.

5044. BURMA, D. P. AND BANERJEE, B. **The role of cellulose in filter-paper chromatography.** *Science and Culture* 15, 363-4 (1950).—*C.A.* 45, 3753*b*.

Cellulose may not play a completely passive role in paper chromatography. The effect of partition was precluded by using pure H_2O as a solvent for 15 α-amino acids and 7 sugars in runs employing the usual ascending and descending techniques. Const. and reproducible R_f values in the range 0.80-0.95 were obtained for all compds. tested (except tryptophan, 0.57), indicating a weak but definite adsorption.

5045. BURMISTROV, S. I. **Chromatographic analysis on paper applied to mixtures of primary arylamines.** *Zhur. Anal. Khim.* 5, 39-43 (1950).—*C.A.* 44, 4373*h*.

This method was particularly suitable for identification of arylamines obtained after reduction of azo dyes. A strip of filter paper was exposed for a predetd. time to the vapors of HCl, formic acid, AcOH, or pyridine. A little of the amine soln. in a volatile solvent was transferred onto the paper with the aid of a capillary and the identification was carried out.

5046. BURSTALL, F. H.; DAVIES, G. R.; LINSTEAD, R. P. AND WELLS, R. A. **Inorganic chromatography on cellulose. II. The separation and detection of metals and acid radicals on strips of absorbant paper.** *J. Chem. Soc.* 1950, 516-28.—*C.A.* 44, 7182*g*.

Successful sepns. of the following were achieved by chromatography on paper strips by using the indicated solvents: Pb^{2+}, Cu^{2+}, Bi^{3+}, Cd^{2+}, Hg^{2+}—BuOH satd. with 3 *N* HCl; As^{3+}, Sb^{3+}, Sn^{2+}—acetylacetone satd. with H_2O, contg. 0.5% HCl (d. = 1.18) and 25% acetone; Fe^{3+}, Al^{3+}, Cr^{3+}—glacial AcOH contg. 25% CH_3OH; Ni^{2+}, Co^{2+}, Mn^{2+}, Zn^{2+}—acetone contg. 5% H_2O and 8% HCl; Ca, Sr, Ba—pyridine contg. 20% H_2O and 1% KCNS; Li, Na, K—CH_3OH; Pt, Pd, Rh, Ir, Ru, Os, Au chlorides, or chloro salts—Me Et ketone contg. 30% HCl; Au from Pt metals—Et_2O contg. 2% dry HCl and 7.5% dry Me-(OH).

5047. Bush, I. E. **Chromatography of steroids on alumina-impregnated filter paper.** *Nature* **166**, 445-6 (1950).—*C.A.* **45**, 986*b*.

The paper was prepd. by soaking Whatman 54 paper in a soln. of ammonium alum (200 g/liter) at 60°C, hanging for 15 min. in a closed glass vessel, then adding a liberal vol. of concd. NH_4OH to the vessel and leaving overnight, removing the paper, and washing in running H_2O for 6 hrs before drying. After complete removal of traces of solvents, drying, and neutralization of acids by a short exposure to NH_3 gas, the chromatogram was dipped for a few sec in a fresh, satd. soln. of I_2 in petr. ether, b. 60-80°C, heated to 40°C on a water bath. To make the spots more permanent and clear, the chromatogram could be sprayed with concd. starch soln. after all the background I_2 had disappeared.

5048. Cacioppo, F. and Grutta, G. La. **Partition chromatography on paper of certain thiazoles.** *Boll. soc. ital. biol. sper.* **26**, 1011-12 (1950).—*C.A.* **46**, 558*a*.

By descending chromatography with BuOH satd. with water and AcOH, it was possible to show in tissue homogenates the presence of 4-methyl-5-(2-hydroxyethyl) thiazole (R_f 0.53). Equal parts of 0.066 *M* KI soln. and 0.0033 *M* chloroplatinic acid with 6 vols. doubly distd. water was used as spot test.

5049. Carter, C. E. **Paper chromatography of purine and pyrimidine derivatives of yeast ribonucleic acid.** *J. Am. Chem. Soc.* **72**, 1466-71 (1950).—*C.A.* **44**, 5953*h*.

Solvent systems for paper chromatography of purine and pyrimidine derivs. of yeast nucleic acid were described and use of the method for analysis of complex mixts. of these compds. by two-dimensional chromatography was reported. Location of compds. on the paper chromatogram was achieved by ultraviolet fluorescence.

5050. Csobán, Gyorgy. **Paper chromatography.** *Magyar Kém. Folyóirat* **56**, 449-51 (1950).—*C.A.* **46**, 1384*g*.

A relatively simple method was worked out for the sepn. of spots which were located too close to each other on one-dimensional paper chromatograms. The principle of the method was to repeat the run 2 or 3 times with the same solvent. The procedure was suitable for increasing the distance between spots having R_f values of 0 to 0.5 by about 50%.

5051. Dalgliesh, C. E. **Permanganate as a spraying reagent for amino acids on paper chromatograms.** *Nature* **166**, 1076 (1950).—*C.A.* **45**, 3753*e*.

If a paper chromatogram was lightly sprayed with a 1% soln. of $KMnO_4$ contg. 2% Na_2CO_3, methionine, tryptophan, tyrosine, and (more weakly) proline and histidine immediately appeared as yellow spots on a red background. Cysteine, which did not normally occur on a paper chromatogram, also gave a spot as does threonine, hydroxyproline, lysine, and glycine upon standing for a few min.

5052. Datta, S. P.; Dent, C. E., and Harris, H. **An apparatus for the simultaneous production of many two-dimensional paper chromatograms.** *Science* **112**, 621-3 (1950).—*C.A.* **45**, 1824*h*.

An app. was described which allowed the simultaneous running of 12 paper chromatograms on sheets of 20 cm^2.

5053. Decker, Peter and Riffart, Wolfgagn. **Paper chromatography with water-miscible solvents.** *Chem.-Ztg.* **74**, 261 (1950).—*C.A.* **45**, 6528*d*.

R_f values were given for amino acids in such solvents as 60 vol. % α-picoline, 90% MeOH, 80% iso-PrOH, water-satd. PhOH, and collidine, and a mixt. of pyridine 50, acetic acid 35, H_2O 15%.

5054. Duff, R. B. and Eastwood, D. J. **Use of the arsenomolybdate-Somogyi reagent in quantitative paper chromatography, and its application to the study of sucrose utilization by a fungus.** *Nature* **165**, 848-9 (1950).—*C.A.* **44**, 8816*e*.

A method was described for the estn. of micro quantities of sucrose by using chromatographic sepn. on paper, extn., and colorimetric assay with a modified Somogyi Cu reagent and arsenomolybdate reagent. Ten to 350 γ of sugar could be detd. accurately.

5055. Durrum, E. L. **A microelectrophoretic and microionophoretic technique.** *J. Am. Chem. Soc.* **72**, 2943-8 (1950).—*C.A.* **44**, 8737*f*.

The technique consisted in applying an elec. potential across the ends of strips of filter paper satd. with electrolyte soln. At some intermediate position of these strips, the mixt. to be sepd. was applied. The course of sepns. was followed in the case of amino acids and peptides by ninhydrin treatment; in the case of protein sepns. by coagulation and selective dyeing *in situ* and in the case of radioactive components by autoradiography.

5056. Fowden, L. and Penney, J. R. **Elimination of losses in the estimation of amino acids by paper chromatography.** *Nature* **165**, 846-7 (1950).—*C.A.* **44**, 8826*e*.

Recovery of amino acids after chromatographic sepn. on paper strips with PhOH-NH_4OH as solvent, drying at 75-100°C and colorimetric detn. with ninhydrin was usually 75-80%. Recovery with BuOH-AcOH solvent was somewhat higher. Expts. showed that drying the paper at high temp. in the presence of solvent caused the losses of amino acids. Removal of the solvent with Et_2O, drying at room temp. and subsequent color development resulted in 98 to 101% recovery of alanine, phenylalanine, and glutamic acid.

5057. FRIERSON, W. JOE AND AMMONS, MARY JO. **The separation of inorganic ions by paper partition chromatography.** *J. Chem. Education* 27, 37-8 (1950).—*C.A.* 46, 2962*c*.

A procedure for the sepn. of inorg. ions from Groups I, II, and III by paper partition chromatography was described. No. 1 Whatman filter paper was used, acidified *n*-butanol as the solvent, and H_2S as the developer.

5058. FUČÍK, K. AND PROCHÁZKA, Ž. **Simple devices for paper chromatography.** *Chem. Listy* 44, 165 (1950).—*C.A.* 45, 5460*i*.

An Erlenmeyer flask and a test tube were used for paper chromatography. The strip of paper was hung from the stopper. One phase was placed in the vessel, the other soaked in absorbent cotton or filter paper and fastened to the stopper.

5059. GAGE, THOMAS B. AND WENDER, SIMON H. **Determination of certain flavonol-3-glycosides by paper partition chromatography.** *Anal.Chem.* 22, 708-11 (1950).—*C.A.* 44, 7189*a*.

Binary mixts. of rutin, quercitrin, isoquercitrin, robinin, and xanthorhamnin and ternary mixts. of rutin, quercitrin, and isoquercitrin have been sepd. quantitatively by paper partition chromatography. The mixts., contg. 10-40 γ of each pigment, were chromatographed on filter paper with BuOH-AcOH-H_2O. Blank filter strips were carried through the chromatographic procedure.

5060. GRASSMANN, W. AND HANNIG, K. **Simple process for continuous separation of mixtures on filter paper by electrophoresis.** *Naturwissenchaften* 37, 397 (1950).—*C.A.* 45, 2363*c*.

Inside of a 22 × 26 × 7 cm glass cuvette a vertical sheet of filter paper (S & S 589g or 602h) was suspended between 2 vertical Pt electrodes. A continuous downward stream of buffer soln. was maintained through the paper (2-6 hrs flow period) and at a location in the middle of the paper slightly below the top the test soln. was continuously fed. The electrodes carried 110 v. and 20 to 30 ma. The electrophoresis would cause the components of the soln. to spread out sidewise in a downward direction and they could be collected at the bottom of the paper sheet in sep. containers.

5061. GRAY, IRVING; IKEDA, SABURO; BENSON, ANDREW A., AND KRITCHEVSKY, DAVID. **Detection of tritiated compounds in paper chromatography.** *Rev. Sci. Instruments* 21, 1022 (1950).—*C.A.* 45, 4100*i*.

Constructional details of a windowless tube which could be used to detect tritium activity on paper, glass, or Al were given. The tube was of glass with a nichrome anode and a copper sulfide-coated Cu cathode, and utilized a stream of alc.-satd. He.

5062. HARASAWA, SHIRO. **Inorganic paper chromatography. I. The chromatograms of cadmium salts obtained by means of the developers containing hydrochloric acid as active component.** *J. Chem. Soc. Japan, Pure Chem. Sec.*, 71, 636-9 (1950).—*C.A.* 45, 6456*e*.

With developers contg. HCl as active component, $Cd(NO_3)_2$, $CdSO_4$, $Cd(C_2H_3O_2)_2$, $CdCl_2$, $CdBr_2$, and CdI_2 were chromatographed.

5063. HISCOX, E. R. AND BERRIDGE, N. J. **Use of paper partition chromatography in the identification of volatile fatty acids.** *Nature* 166, 522 (1950).—*C.A.* 45, 1901*h*.

The acids were neutralized by NH_3 or $C_2H_5NH_2$ vapor; BuOH and H_2O were used as solvents, and 2% bromocresol green was used as indicator. Blue spots on a yellow background were obtained, whose area was a rough indication of the amts. of acid present.

5064. HOUGH, LESLIE. **Application of paper partition chromatography to the separation of the polyhydric alcohols.** *Nature* 165, 400 (1950).—*C.A.* 44, 8284*i*.

Trimethylene glycol, ethylene glycol, glycerol, sorbitol, dulcitol, inositol, α-methylgalactoside, α-methylmannoside, β-methylmaltoside, and sucrose gave brown spots on filter paper chromatograms when sprayed with 5% ammoniacal $AgNO_3$ and heated. The polyhydric alcs. gave no color with aniline trichloroacetate and hence could be distinguished from reducing sugars and methylglucosides.

5065. HOUGH, L.; JONES, J. K. N., AND WADMAN, W. H. **Quantitative analysis of mixtures of sugars by the method of partition chromatography. V. Improved methods for the separation and detection of their methylated derivatives on the paper chromatogram.** *J. Chem. Soc.* 1950, 1702-6.—*C.A.* 45, 70*b*.

New spray reagents served for detecting and identifying sugars and their derivs. on paper chromatograms.

5066. ISHII, SHIN'ICHI AND ANDŌ, TOSHIO. **The effect of hydrochloric acid on the paper chromatogram of amino acids.** *Science* (Japan) 20, 424-5 (1950).—*C.A.* 45, 10141*c*.

The apparent R_f values of DL-alanine, DL-valine and L-leucine were affected by the presence of HCl, when BuOH was used as the solvent. Isovaleric acid used as the solvent decreased the R_f.

5067. ISHII, SHIN-ICHI AND ANDŌ, TOSHIO. **Effects of hydrochloric acid on the paper chromatography of amino acids.** *Bull, Chem. Soc. Japan*, 23, 172-6 (1950) (in English).—*C.A.* 46, 3906*a*.

With butanol as solvent, an increase in HCl concn. increased the R_f values of amino acids. With isovaleric acid, the R_f values decreased; with phenol only those acids of low R_f values were affected.

5068. JONES, TUDOR S. G. **Paper chromatography. I. General considerations.** *Chemist & Druggist* 153, 247-9 (1950).—*C.A.* 44, 4306*b*.

5069. KAKITA, YACHIYO AND GOTŌ, HIDEHIRO. **Fluorescence analysis. XIV. Application of chromatography with filter paper.** *Science Repts. Research Insts. Tohoku Univ.* **Ser. A, 2,** 837-41 (1950).—*C.A.* 46, 4947*d*.

Filter paper prepd. with an Al_2O_3 absorbent gave chromatographic sepns. from solns. contg. ions of any 3 of the following: Pb, Cu, Cd, Zn, Ni, Co, Mn, or Fe when developed by oxine, cochineal, or Rhodamine B and observed under ultraviolet light.

5070. Kelemen, E.; Tanos, B., and Halmagyi, D. **Separation of *p*-aminobenzoic acid derivatives by paper chromatography.** *Biochem. J.* **47**, 138-9 (1950).—*C.A.* **45**, 699*g*.

2.5-20 microliters of urine were applied to paper using H_2O satd. butanol as solvent. Ehrlich's reagent (2 g *p*-dimethylaminobenzaldehyde in 100 ml 20% wt/vol. HCl) served as a color reagent, and ocher-yellow spots developed on spraying. Each compd. could be detected in 1 γ quantity.

5071. Kennedy, Richard H. **Use of the paper-column separation in the estimation of microgram quantities of uranium.** *U. S. Atomic Energy Comm., Tech. Inform. Service* **AECD-3187** (1950).—*C.A.* **46**, 2957*e*.

For detg. U (U_3O_8) at low concns. (1 p.p.m.) and in the presence of quenching ions, an accurate and rapid method was given combining paper-column chromatography with a fluorometric final detn. In the paper chromatography, the U in aq. soln. contg. free HNO_3 was adsorbed on partially nitrated cellulose packed in a glass column. The adsorbed U was then selectively extd. from the column with Et_2O contg. HNO_3.

5072. Keston, Albert S.; Udenfriend, Sidney, and Levy, Milton. **Determination of organic compounds as isotopic derivatives. II. Amino acids by paper chromatographic and indicator techniques.** *J. Am. Chem. Soc.* **72**, 748-53 (1950).—*C.A.* **45**, 1464*e*.

Paper chromatography was applied to the sepn. of the *p* iodobenzenesulfonic acid derivs. formed from the protein hydrolyzate products with a reagent contg. I^{131}. The recovery was measured by the use of indicators consisting of known *p*-iodobenzenesulfonyl derivs. contg. S^{35} which were added in known amts. immediately after forming the I^{131} derivs. of the amino acids.

5073. Koštíř, J. V. and Slavík, K. **Partition chromatography between two organic solvents. I. Separation of dinitrophenylhydrazones of the carbonyl fission products of sugars.** *Collection Czecholov. Chem. Communs.* **15**, 17-25 (1950).—*C.A.* **44**, 8817*e*.

The carrier for the stationary phase was acetylated filter paper. The stationary phase was octanol, $CHCl_3$, trichloroethylene, or $PhCH_2OH$, the mobile phase EtOH (85%) or mixts. of petr. ether-benzene or petr. ether-pyridine. The H_2O-insol. dinitrophenylhydrazones of HCHO, CH_3CHO, $COMe_2$, $AcCH_2CO_2H$, $AcCO_2H$, $HO_2C.CO.\ CH_2CO_2H$, $HO_2C.CO\text{-}(CH_2)_2CO_2H$, and the osazones of $(CHO)_2$, CH_3COCHO and $(HOCH_2)_2CO$ could be sepd. by one or two dimensional chromatograms. The spots were detected by spraying with 10% NaOH.

5074. Kowkabany, George N. and Cassidy, Harold G. **Paper-strip chromatography.** *Anal. Chem.* **22**, 817-19 (1950).—*C.A.* **44**, 8817*h*.

Twenty-two filter papers of qualitative and quant. grade from various manufacturers were examd. for their suitability in the chromatographic sepn. of amino acid mixts., with the descending method and 5 different mixed solvent systems.

5075. Kraus, Kurt A. and Smith, Gilbert W. **Electromigration on filter paper.** *J. Am. Chem. Soc.* **72**, 4329-30 (1950).—*C.A.* **45**, 2754*d*.

The filter paper electromigration method was used to det. the charge of complex ions of Hg(II). The technique consisted of moistening a strip of filter paper with the supporting electrolyte, placing a no. of 1-microliter aliquots of solns. of the unknown near the center of the paper and measuring the displacement caused by the application of a known d.c. voltage to nonpolarizable electrodes.

5076. Kressman, T. R. E. **Ion-exchange resin membranes and resin-impregnated filter paper.** *Nature* **165**, 568 (1950).—*C.A.* **44**, 9086*a*.

Ion-exchange resins were prepd. in the form of membranes, rods, tubes, and thimbles. The membranes consisted of cross-linked resin polymers identical in compn. to the granular ion-exchange resins and were insol. in all aq. and nonaq. liquids. The SO_3H and COOH resins could be converted to any cationic form by treating them with a soln. of a salt of the appropriate cation; the anion-exchange membranes could be converted by treating them with the appropriate acid or base.

5077. Lacourt, A.; Gillard, J. and Walle, M. van der. **Chromatographic separation and absorptiometric determination of nickel and cobalt present in micromilligram quantities.** *Mikrochemie ver. Mikrochim. Acta.* **35**, 262-5 (1950); *Nature* **166**, 225-6 (1950).—*C.A.* **44**, 7711*f*; **45**, 7466*f*.

Details were given for getting the Ni and Co on filter paper, developing the chromatograms with Me_2CO, eluting separately with HCl, and detg. the Ni with dimethylglyoxime on paper and the Co with nitroso-R-salt. Excellent results were obtained in the analysis of samples contg. 2-10 γ of Ni and 2-19.7 γ of Co.

5078. Lacourt, A.; Sommereyns, G.; Degeyndt, Ed.; Gillard, J., and Baruh, J. **The separating power of organic solvents in inorganic paper (adsorption) chromatography.** *Mededel. Vlaam. Chem. Ver.* **12**, 76-84 (1950).—*C.A.* **44**, 10572*i*.

The effectiveness of various org. solvents and mixts. of solvents in developing paper chromatograms of mixts. (in HCl soln.) of Fe(III), Ti, Al, and V, and of Ni and Co was components. The sepn. of Co from Ni was best accomplished by developing with acetone contg. 1.4% EtOH and 1% HCl gas.

5079. Lacourt, A.; Sommereyns, G., and Degeyndt E. **Two observations in connection with inorganic paper chromatography.** *Mededel. Vlaam, Chem, Ver.* **12**, 91-4 (1950).—*C.A.* **44**, 10572*g*.

Sometimes 1,4-dioxane developed paper chromatograms of Fe(III) very sharply; at other times the spots were very diffuse. The difference was due to H_2O_2 and AcH produced by hydrolysis and oxidation of the solvent. Chromatograms developed in sunlight with this solvent were always diffuse. The humidity of the atm. during the drying of the paper affected the positions of Fe and Al in chromatograms of HCO_2H solns. of these 2 ions.

5080. Laidlaw, R. A. and Reid, S. G. **Filter paper chromatography. Extraction of sugars from the paper at room temperature.** *Nature* **166**, 476-7 (1950).—*C.A.* **45**, 2814*d*.

The paper strip was held between two glass rods whose interior surfaces were ground flat. H_2O was introduced to the top of the paper by means of a capillary dropping tube, (capacity 10 cc., dropping rate, 1 drop/10 secs.) which rested on the top of the paper between the two support rods. One cc. H_2O was allowed to flow down until the paper was completely wet; all the sugar was then at the foot of the strip. The dropper was then filled to the top and the flow continued for 0.5 hr. collecting about 5 cc.

5081. Lederer, Michael. **Inorganic paper chromatography.** *Roy. Australian Chem. Inst. J. & Proc.* **17**, 308-26 (1950).—*C.A.* **45**, 3222*c*.

The mechanism of chromatographic sepn. and the techniques used were reviewed. Published data on solvents tried for sepg. various cation and anion mixts. in inorg. analysis were discussed.

5082. Lederer, Michael. **Paper chromatography of some acridines.** *Nature* **165**, 529-30 (1950).—*C.A.* **44**, 7489*g*.

By development with H_2O or HCl good sepn. of pairs of the chemotherapeutic dyes atebrin, acrifavine, and monacrin (9-aminoacridine-HCl) were made. In partition chromatography, as distinguished from paper chromatography, no sepns. were obtained since all the dyes traveled with the solvent front.

5083. Lederer, Michael. **Paper chromatography of pH indicators.** *Science* **112**, 504-5 (1950).—*C.A.* **45**, 2742*e*.

The R_F values of 16 of the more common indicators were detd. with iso-PrOH, BuOH, and AmOH as solvents. The general trend appeared to be that the R_F values decreased with an increase in the no. of C atoms in the alc.

5084. Lederer, Michael. **The paper chromatography of inorganic cations.** *Anal. Chim. Acta* **4**, 629-34 (1950) (in English).—*C.A.* **45**, 3282*f*.

The R_f values of a no. of cations in several solvents were given. The values were influenced by the solvent in those cases where complexes between the cation and the acid contained in the solvent were formed.

5085. Lemmon, R. M.; Tarpey, Winifred, and Scott, Kenneth G. **Paper chromatography in synthetic organic chemistry. Microgram scale syntheses of labeled monoiodotyrosine, diiodotyrosine, and thyroxine.** *J. Am. Chem. Soc.* **72**, 758-61 (1950).—*C.A.* **45**, 1457*f*.

Syntheses of I^{131}-labeled monoiodotyrosine, 3,5-diiodo-L-tyrosine (m.p. 202°C with decompn.), and thyroxine of high sp. activity were carried out on a γ scale. The products were sepd. from their reaction mixts. and identified through the use of paper chromatography.

5086. Leone, E. and Guerritore, D. **Chromatographic analysis of 3-hydroxyanthranilic acid.** *Boll. soc. ital. biol. sper.* **26**, 608-9 (1950).—*C.A.* **45**, 6971*e*.

Paper chromatography with isoamyl alc. and the descending technique for 8-14 hrs gave R_f values for anthranilic acid 0.70 and 3-hydroxyanthranilic acid 0.63. After localizing the spots by ultraviolet photography, a microdetn. could be made by clipping the spots, extg. with water or *N* HCl, and detg. with the Beckman spectrophotometer.

5087. Lindstedt, Gösta. **Constituents of pine heartwood. XX. Separation of phenolic heartwood constituents by paper-partition chromatography.** *Acta Chem. Scand.* **4**, 448-55 (1950) (in English).—*C.A.* **45**, 2482*g*.

Paper-partition chromatography was used to sep. and identify 9 phenolic constituents of pine heartwood exts. Two-dimensional chromatograms were also prepared. Best results were obtained by using standard solvent in 1 direction and $CHCl_3$-MeOH-ligroin (2:1:7 + 5 H_2O) in the other.

5088. Loeb, C. and Lichtenberger, J. **Partition chromatography on paper of several hydroxy acids.** *Bull. soc. chim. France* **1950**, 362-3.—*C.A.* **44**, 7619*d*.

Chromatography was used to study the partition of some hydroxy acids between butanol and water. Each acid was characterized by a definite measurable partition coeff. Results were reported for tartaric, citric, malic, α-hydroxyisobutyric, glycolic, and lactic acids. Com. lactic acid gave 3 distinct coeffs.; these were interpreted as indicating the presence of 3 compds.: free lactic acid, lactyllactic acid, and a polylactyllactic acid.

5089. Magasanik, Boris and Umbarger, H. Edwin. **Separation and identification of keto acids by filter paper chromatography.** *J. Am. Chem. Soc.* **72**, 2308-9 (1950).—*C.A.* **44**, 8827*d*.

Traces of keto acids were sepd. by unidimensional ascending partition chromatography on filter paper and made visible by converting to semicarbazide hydrochloride and NaOAc and viewed under ultraviolet light.

5090. Munier, Roger and Pénasse, Lucien. **Chromatographic separation on paper of the dinitrophenylamino acids.** *Compt. rend.* **230**, 1176-7 (1950).—*C.A.* **44**, 7189*c*.

The dinitrophenyl derivs. of amino acids was sepd. by adsorption on filter paper through the use of these 3 solvent mixts. (1) $CHCl_3$, iso-PrOH, and 0.05 *M* K benzoate soln. in 45:49:6 ratio, (2) C_6H_{12}, iso-PrOH and 0.05 *M* K benzoate soln. in 60:36:4 ratio, and (3) CCl_4, iso-PrOH and 0.05 *M* K benzoate soln. in 56:40:4 ratio. These solvents prevented diffusion and elongation of spots and reduced the n_f values to suitable values.

5091. Munier, Roger and Macheboeuf, Michel. **Separation of nitrogen-containing bases through microchromatography in acid media.** *Compt. rend.* **230**, 1177-9 (1950).—*C.A.* **44**, 8054*i*.

Alkaloid mixts. contg. bases whose dissocn. consts. lie between 10^{-3} and 10^{-10} formed diffused and elongated spots in paper-adsorption sepns. with neutral solvents. Small addns. to the solvent of acids whose dissocn. consts. were close to those of the bases to be sepd., round the spots. For the sepn. of scopolamine, atropine, and hyoscyamine (dissocn. const. 10^{-5}), a solvent contg. 100 ml BuOH, 14 ml AcOH, and sufficient water for satn. was used.

5092. Opieńska-Blauth, Janina; Saklawska-Szymonowa, Olga, and Kański, Marek. **Partition paper chromatography of some organic acids.** *Ann. Univ. Mariae Curie-Sklodowska, Lublin-Polonia*, Sect. D, **5**, 221-75 (1950) (English summary); *Nature* **168**, 511-12 (1951).—*C.A.* 46, 5930*a*.

Phenol satd. with water was used as a developer, and water satd. with phenol was used as stationary phase. To prevent ionization of org. acids, the atm. of the chromatographic chamber was satd. with HCOOH vapor. A 0.04% alc. soln. of bromophenol blue gave the best results as regards the stability of revealed spots, although bromothymol blue seemed to be more sensitive. Although the size and intensity of the spots seemed to be proportional to the concn. of acids present, some acids formed more intense and larger spots than would be expected from their concn.

5093. Procházka, Ž. **Potassium permanganate as a nonspecific detection reagent in paper chromatography.** *Chem. Listy* 44, 43 (1950).—*C.A.* 45, 5561*c*.

Paper chromatograms of org. compds. could be developed with 0.03-0.15 *N* $KMnO_4$ acidified with 0.06-0.3 *N* H_2SO_4. White or light yellow spots revealed the presence of org. compds.

5094. Procházka, Ž. **Treatment of paper for paper chromatography.** *Chem. Listy* 44, 158-9(1950).—*C.A.* 45, 9334*g*.

Both filter paper and ordinary writing paper gave better results and quicker movement of the front after digestion with 5-24% HCl. Et bis-(4-hydroxycoumaryl-3)-acetate and glycine were used as test substances.

5095. Quevauviller, André. **Salts of quinine: paper chromatography.** *Rev. paludisme et méd. trop.* **8**, 281-90 (1950).—*C.A.* 45, 7301*i*.

Papergrams of aq. solns. of different quinine salts failed to show any consistent correlation between phys., chem., or physiol. properties and R_f values. Strips of Durieux (fine) filter paper 10 × 300 mm were suspended from the perimeter of a 20 cm cork disk at such a height that each ended 2 mm from the bottom of a crystg. dish 50 mm high and 27 mm in diam. Each paper was dipped in 5 cc. of the desired salt soln. in the crystg. dish for 30 sec., allowed to develop 2 hrs at 16-18° C under a bell jar contg. an atmosphere satd. with H_2O, and redipped in the soln. as above. The distance of H_2O migration was measured directly, that of the quinine salt after immersing the strips in *N*/100 iodide soln. to develop a brown color with the alkaloid.

5096. Rao, N. R.; Shah, K. H., and Venkataraman, K. **Chromatographic separation of dyes.** *Current Sci.* 19, 149-50 (1950).—*C.A.* 45, 9154*g*.

Various chromatographic sepns. of mixts. of acid dyes, basic dyes, and direct dyes by means of filter paper, cellulose acetate, nylon, or vinyon fabric, with water, pyridine, or methyl cellosolve acetate as solvents were described.

5097. Reguera, Rose M. and Asimov, Isaac. **Use of silver nitrate and sodium dichromate in the detection of purines by paper partition chromatography.** *J. Am. Chem. Soc.* 72, 5781-2 (1950).—*C.A.* 45, 2814*e*.

After resolution of the purines and pyrimidines with H_2O-satd. BuOH, the dried chromatogram was treated with 2% $AgNO_3$ followed by 0.5% $Na_2Cr_2O_7$. The chromatogram was then immersed in 0.5 *N* HNO_3 to leach out Ag_2CrO_4 not bound in purine complexes. The procedure was more sensitive than the sulfide-spot technique.

5098. Renard, Marcel. **Paper chromatography of α-chlorinated acids. II. Chloracetic and α-chloropropionic acids and their mixtures.** *Bull. soc. chim. belges* 59, 34-9 (1950).—*C.A.* 44, 7186*b*.

The method previously described, with methyl orange as indicator, was sensitive to 10-30 γ/4 mm^3. By using paper treated with bromocresol green for the chromatograph, drying the paper and subjecting it to vapors from a methyl orange soln., the positions of the 2 acids were more clearly marked and smaller quantities were detected. The ratio R (distance covered by the acid zone divided by the distance covered by the solvent zone) depended on the amt. of acid present.

5099. Riley, Richard F. **Paper partition chromatography of some simple phenols.** *J. Am. Chem. Soc.* 72, 5782-3 (1950).—*C.A.* 45, 2742*f*.

Phenols were sepd. by one-dimensional descending paper chromatography. The best solvent systems were: amyl alc. satd. with H_2O; BuOH:C_6H_6:H_2O 1:9:10; BuOH:C_6H_6:H_2O 1:19:20. The last solvent resolved hydroquinone (R_f, 0.078), resorcinol 0.13, catechol 0.38, toluhydroquinone 0.23, phloroglucinol 0.00, pyrogallol 0.025. α- and β-Naphthol fell at 0.83 and 0.85, resp. The spots were developed by spraying with 2% aq. phosphomolybdic acid and exposing to NH_3 vapor.

5100. Roche, Jean; Justisz, Marian; Lissitzky, Serge, and Michel, Raymond. **Quantitative chromatographic analysis of iodinated amino acids from the thyroid globulin.** *Compt. rend.* **231**, 723-5 (1950).—*C.A.* 45, 3017*i*.

The iodinated amino acids were extd. from the hydrolyzate with butanol at pH 1. The butanol was distd. off, the residue was dissolved in NH_4ONH_2 and then poured on Whatman paper No. 1. The chromatograph was developed with a mixt. of 68% butanol, 5% AcOH, and 27% H_2O. The amino acids were revealed by a 0.2% ninhydrin soln. in 2% AcOH.

5101. Rockland, Louis B. and Dunn, Max S. **Partogrid, proportional divider for use in paper chromatography (partography).** *Science* **111**, 332-3 (1950).—*C.A.* 44, 5677*g*.

The device was prepd. by drawing double- and triple-thickness lines at 2.5- and 5-cm intervals with India ink on a 50-cm × 50 cm sheet of millimeter paper, marking the intervals in steps of 0.1 unit from 0 to 1, photographing and making prints of 3 sizes (5.5,7, and 10 in. hypotenuses). The prints were mounted on an etched, lighted glass window and swabbed with a 25% alcoholic carbowax soln. for greater transparency. By inserting a pin through the initial spot of a paper strip chromatogram and the zero point of the partogrid and rotating the strip until the solvent front coincided with 1.0, the R_f of all spots could be accurately detd.

5102. Rutter, L. **Some applications of a modified technique in paper chromatography.** *Analyst* 75, 37-42 (1950). —*C.A.* 44, 3396*c*.

New methods were described for detecting colorless adsorbates and examples given of the application of the new technique in the analysis of dyes, biol. materials, and inorg. samples. The possible importance of soly. relations as a guide in the choice of developers was discussed. The phys. factors affecting chromatographic sepns. on paper were polarity of the solvent surface tension, activation of paper, and possible elec. effects.

5103. Rutter, L. **Treatment of paper for chromatography of some colloidal electrolytes.** *Nature* 166, 273 (1950). —*C.A.* 45, 6456*h*.

Papers treated with dil. cetyltrimethylammonium bromide have a net pos. charge in contact with water permitting their use for chromatography of colloidal electrolytes such as acid dyes and anionic detergents.

5104. Sarma, Byomkes. **Separation of uranium and thorium by partition chromatography on filter paper.** *Science and Culture* 16, 165-6 (1950).—*C.A.* 45, 3682*i*.

UO_2^{++} and Th^{4+} were best sepd. by paper chromatography using BuOH satd.with 3 *N*, or 4 *N* HCl. The UO_2 spot was developed with $K_4Fe(CN)_6$. After marking with a pencil, the strip was satd. with NH_3 for 7-10 min. and then sprayed with a 1% soln. of alizarin in EtOH; Th gave a bluish violet color.

5105. Schönfeld, T. and Broda, E. **Adsorption on paper as an indication of the presence of radiocolloids.** *Montash.* 81, 1153-5 (1950).—*C.A.* 45, 2742*c*.

Adsorption due to ion exchange occurred when 10^{-15} *M* Pb soln. (thorium B) was brought into contact with paper or glass. If the soln. was satd. with H_2S, radiocolloids were formed which were adsorbed by paper by a different mechanism; whereas when ion-exchange adsorption was occurring, the addn. of electrolyte decreased the amt. adsorbed.

5106. Shibata, Shoji; Takito, Michio, and Tanaka, Osamu. **Paper chromatography of anthraquinone pigments.** *J. Am. Chem. Soc.* 72, 2789-90 (1950).—*C.A.* 44, 8286*c*.

The solvent was gasoline (b.p. 45-70 °C) satd. at 19 °C with 97% MeOH. The paper was Toyo-Filter Paper No. 2 in 2 × 40 cm strips. Acetone solns. of the pigments were spotted on the strips and the solvent was allowed to ascend 5-6 hrs at 24-5 °C. The spots were developed by spraying with 0.5% $Mg(OAc)_2$ in MeOH and heating at 90 °C for 5 min. The colors appeared to depend upon the positions of the OH groups in the 18 natural and synthetic hydroxyanthraquinones.

5107. Smith, E. C. Bate and Westall, R. G. **Chromatographic behavior and chemical structure. I. Some naturally occurring phenolic substances.** *Biochim. et. Biophys. Acta* 4, 427-40 (1950).—*C.A.* 44, 5677*a*.

R_F values (movement of band of substance/movement of the advancing front of liquid) were detd. for naturally occurring flavones, anthocyanins, and related compds., as well as for OH, MeO, and COOH derivs. of C_6H_6; BuOH-AcOH and m-cresol-AcOH mixts. were used as solvents, resp., with results reproducible to ± 0.02. When the function $\log [(1 - R_F) - 1] = R_M$ was plotted against the no. of substituent groups of any kind, a straight line was obtained in most cases. Some irregularities were observed attributable to constitutional factors.

5108. Svendsen, Anders B. **Paper chromatography as a qualitative procedure for the phytochemical analysis of organic acids.** *Pharm. Acta Helv.* 25, 230-6 (1950).—*C.A.* 45, 1724*a*.

A procedure for the detection of org. acids in the roots of *Angelica archangelica* by paper chromatograms was outlined. Fairly large amts. of oxalic, citric, malic, and aconitinic acids and smaller amts. of succinic, chlorogenic, caffeic, and quinic acids were identified.

5109. Takahashi, Kosei. **Distribution of solvents in filter-paper chromatography.** *Science* 20, 41-2 (1950).—*C.A.* 45, 10005*i*.

The quantity of the solvent soaking into the filter paper was a complex function of the distance from the surface of the solvent, Y and of the time elapsed, t. For BuOH and PhOH, a linear relation between Y^2 and t was found.

5110. Trevelyan, W. E.; Procter, D. P. and Harrison, J. S. **Detection of sugars on paper chromatograms.** *Nature* 166, 444-5 (1950).—*C.A.* 45, 986*f*.

The dried, developed paper chromatogram strip was passed rapidly through a soln. (0.1 ml satd. aq. soln. $AgNO_3$ dild. to 20 ml with acetone and H_2O added dropwise with shaking until the sepd. $AgNO_3$ redissolved). The dry paper was sprayed with a 0.5 *N* aq.-EtOH soln. of NaOH. Brown Ag_2O was immediately produced. . Reducing sugars formed dense black spots. Excess Ag_2O was dissolved by immersion of the strip in 6 *N* NH_4OH, the paper was washed for 1 hr in running H_2O and dried in an oven. Black or dark brown spots on a white background were obtained. The spots could be made jet black by momentary exposure to H_2S.

5111. Turba, F. and Enenkel, H. J. **Electrophoresis of proteins in filter paper.** *Naturwissenschaften* 37, 93 (1950).—*C.A.* 44, 8407*h*.

A strip of filter paper (Whatman No. 1 or 4, Schleicher and Schüll No. 598g, etc.) 5 × 25 cm was stretched out in a moist chamber, soaked in buffer soln. and the ends dipped in the same. In the middle 1 to 3 drops (0.03 to 0.1 cc.) of a protein soln. were deposited and 110 v. d. c. applied. The proteins sepd. electrophoretically as shown by placing the strip in a dye soln. (50% aq. MeOH, 10% AcOH, cold satd. with azocarmine) for 10 min., then 5 min. in MeOH and 5 min. in 10% AcOH. The protein spots became intensive red to deep purple.

5112. Walker, W. R. **Paper chromatography of nitrogen bases.** *Australian J. Sci.* 13, 26, 84 (1950).—*C.A.* 45, 1912*g*; 3146*d*.

Pyridine, quinoline, isoquinoline, and collidine were sepd. by ascending development with a solvent prepd. by shaking 200 ml BuOH with 200 ml 2 N HCl, discarding the aq. layer and adding 0.5 g methyl red. The presence of pyridine, 2-picoline, 2,6-lutidine, and 2,4,6-collidine was shown in "crude pyridine oil."

5113. Wallenfels, Kurt. **Detection of reducing sugars in paper chromatogram and quantitative evaluation.** *Naturwissenschaften* 37, 491-2 (1950).—*C.A.* 45, 4604*a*.

Sugar spots on a paper chromatogram could be made visible by spraying the dry paper with a fresh mixt. of aq. 2% triphenyltetrazolium chloride soln. and 1 N NaOH and exposing for 20 min. to a water-satd. atm. at 40°C. The excess was then carefully washed out with water and the paper dried at 25°C. Reducing sugars showed up as bright-red spots. Quantities down to 5 γ could be detd. by cutting out the spot, extg. with a solvent like pyridine with 10% HCl.

5114. Yanofsky, Charles; Wasserman, Elga, and Bonner, David M. **Large-scale paper chromatography.** *Science* **111**, 61-2 (1950).—*C.A.* 44, 8279*f*.

The difficulty of applying relatively large samples in straight, narrow bands for paper chromatography was overcome by the application of the soln. through a capillary onto a cylinder of heavy filter paper mounted on a rotating kymograph. Several ml of soln. could be used satisfactorily. Schleicher and Schuell paper No. 470-A was most satisfactory.

5115. Zaffaroni, Alenjandró; Burton, Robert B., and Keutmann, E. Henry. **Adrenal cortical hormones: analysis by paper partition chromatography and occurrence in the urine of normal persons.** *Science* **111**, 6-8 (1950).—*C.A.* 44, 4059*e*.

Paper partition chromatography, modified by the use of non-aq. solvent systems, was suited to the microanalysis of adrenal cortical hormones. It was necessary to impregnate the strips with the glycol or formamide prior to chromatography. The samples were then applied and chromatograms developed, papers dried, and positions of the steroids revealed with alk. $AgNO_3$.

5116. Abdel-Akher, M. and Smith, F. **Detection of carbohydrate esters and lactones after separation by paper chromatography.** *J. Am. Chem. Soc.* 73, 5859-60 (1951).—*C.A.* 46, 11041*c*.

The dried paper was sprayed with a soln. of N MeOH-$H_2NOH.HCl$ (1 vol.) and 1.1 N MeOH-KOH (1 vol.), air dried 10 min., and sprayed with 1-2% $FeCl_3$ contg. 1% HCl, yielding a blue or mauve color in areas contg. the esters, lactones, or ester lactones.

5117. Allouf, Raymond and Macheboeuf, Michel. **Principle of microfractionation by separation between two liquid phases acting simultaneously in the midst of a sheet of paper.** *Compt. rend.* **232**, 2440-2 (1951).—*C.A.* 45, 8848*e*.

The aq. phase studied was an M/15 phosphate soln. of pH 5.3; the org. phase was iso-AmOH, each phase satd. with the other. When the bottom of a piece of filter paper was dipped into both phases, one over the other, the wet line rose in the paper less rapidly than it did when the paper was dipped in either phase alone. With 2 phases, the org. phase rose first but after a time (an hr or so) a second wet line of the org. phase remained stationary, whereas that of the aq. phase continued to rise.

5118. Anderson, J. R. A. and Lederer, M. **Quantitative paper chromatography. II. Separation and gravimetric estimation of gold. III. Separation and gravimetric determination of copper.** *Anal. Chim. Acta* 5, 321-4, 396-400 (1951) (in English).—*C.A.* 46, 850*f*.

Up to 50 mg of Au could be sepd. quantitatively from Pt and Pd with ether satd. with HCl as solvent. Strips of paper pulp measuring approx. 250 mm long, 25 mm wide, and 6 mm thick, capable of absorbing 2 ml of soln. on a spot 25 mm in diam., were employed. Up to 50 mg of Cu could be sepd. from similar quantities of Ag, Au, Pt, Rh, Hg, and Bi with butanol satd. with both 2 N NH_4OH and dimethylglyoxime as solvent.

5119. Ando, Toshio and Ishii, Shin-ichi. **Identification of halogens in organic compounds by means of paper chromatography.** *Rept. Inst. Sci Technol., Univ. Tokyo* 5, 217-21 (1951).—*C.A.* 46, 6037*c*.

Paper chromatograms of NaCl, NaBr, and NaI in water or in aq. NaOH solns. of various concns. were studied with BuOH-picoline, BuOH-PrOH, and BuOH-NH_3 as a developing solvents. After developing the soln., the spots of halides were made visible by spraying 0.2 N $AgNO_3$ soln., washing out the excess $AgNO_3$ with 0.1 N HNO_3 soln., and then spraying 0.2 N soln. of Na_2S or exposing the paper to H_2S gas. Iodide was identified by the iodo-starch reaction.

5120. Asquith, R. S. **Paper chromatography of the pyrogallol tannins.** *Nature* **168**, 738-9 (1951).—*C.A.* 46, 3462*h*.

Two new solvents (phenol-acetic acid-water and phenoltrichloroacetic acid-water) were used to sep mixts. of complex phenols into well-defined spots. The R_F values of the different tannins varied considerably with temp.

5121. Bandurski, Robert S. and Axelrod, Bernard. **Chromatographic identification of some biologically important esters.** *J. Biol. Chem.* **193**, 405-10 (1951).—*C.A.* 46, 2613*h*.

A 2-dimensional chromatographic method was described for identification of some phosphate esters. An improved method of color development involving ultraviolet light permitted hydrolysis of resistant esters and minimization of background color.

5122. Bartlett, J. K.; Hough, L., and Jones, J. K. N. **The colorimetric determination of methylated sugars: an improved micromethod of end-group assay.** *Chemistry & Industry* **1951**, 76.—*C.A.* 46, 64*e*.

Beer's Law was found to be obeyed by the colors formed with a variety of methylated sugars. Scission products of methylated glycogen were sepd. on a paper chromatogram and detd. colorimetrically to within 10-15% on γ quantities.

5123. Bishop, J. R. and Liebmann, H. **Quantitative separation of small amounts of zinc from other metals by chromatography on cellulose columns.** *Nature* **167**, 524 (1951).—*C.A.* **45**, 6121g.

The possibility of sepg. Sn, Al, Ni, Pb, Mn, Bi, Co, Zn, Cu, and Fe was shown by paper chromatography with butanol-HCl as eluent. The same sequence of sepn. was found with cellulose columns. Solns. contg. approx. 500 γ of each of the metals were applied to the top of the column and were eluted with a mixt. of water-satd. butanol and concd. HCl in the vol. ratio 92 to 8. The sepn. of the Zn was very good.

5124. Blackburn, S. and Lowther, A. G. **Separation of *N*-2,4-dinitrophenyl amino acids on paper chromatograms.** *Biochem. J.* **48**, 126-8 (1951).—*C.A.* **45**, 5220f.

The *N*-2,4-dinitrophenyl (DNP) derivs. of amino acids ran successfully on paper in solvents where the mobile phase contained much H_2O, like a benzyl alc.-water system. On adding EtOH the DNP amino acids formed spots more compact in shape.

5125. Brattsten, Inger and Nilsson, Anna. **Continuous zone electrophoresis in filter paper.** *Arkiv Kemi* **3**, 337-45 (1951) (in English).—*C.A.* **46**, 373f.

An app. for small scale fractionation by continuous zone electrophoresis was described. The sepn. occurred in sheets of filter paper between glass plates which were cooled by circulating water. A mixt. of glycine, alanine, and glycylglycine in acid soln. and a mixt. of serum albumin and γ-globulin in neutral soln. were used.

5126. Bremner, J. M. and Kenten, R. H. **Paper chromatography of amines.** *Biochem. J.* **49**, 651-5 (1951).—*C.A.* **46**, 1085b.

In spite of the question as to the specificity of the ninhydrin reaction, this reagent was very effective for the detection of primary aliphatic amines. Some secondary aliphatic amino groups seemed to give the ninhydrin reaction, but none of the tertiary groups. The chances of confusing amino acids with amines seemed to depend largely upon the solvents used for chromatography.

5127. Brown, F. **Application of paper chromatography to the separation of nonvolatile carboxylic acids.** *Nature* **167**, 441 (1951).—*C.A.* **45**, 6956c.

The sepn. by paper chromatography of fatty acids contg. more than one carboxyl group was described. EtOH-NH_3 was used as the mobile phase. The R_f values became greater with increased water in the solvent so that the sepn. of acids with similar values could be improved by adding water. Chlorophenol red and ammoniacal silver nitrate soln. were used as indicators for the anions.

5128. Bryant, F. and Overell, B. T. **Paper chromatography solvent for amino acids.** *Nature* **168**, 167-8 (1951).—*C.A.* **46**, 4603a.

Values (R_f) were given for 20 amino acids sepd. by paper chromatography from a medium contg. 1 vol. each of mesityl oxide and 85% formic acid and 2 vols. H_2O. Values were spread conveniently and ranged from 0.81 for tryptophan to 0.06 for cystine.

5129. Buchanan, J. G. **Detection of deoxyribonucleosides on paper chromatograms.** *Nature* **168**, 1091 (1951).—*C.A.* **46**, 11042g.

Deoxyribonucleosides showed pink spots on the chromatogram with the reagent cysteine-HCl in H_2SO_4. Deoxyribonucleosides 10-20 γ could be detected in this way.

5130. Burma, D. P. and Banerjee, B. **The role of water contained in the solvent used in filter paper chromatography. I.** *J. Indian Chem. Soc.* **28**, 135-40 (1951).—*C.A.* **45**, 10120f.

The R_f values of amino acids with iso-PrOH-H_2O mixts. increased with increase in H_2O of the solvent. Iso-PrOH-H_2O contg. 30% H_2O was a useful 2nd solvent in 2-dimensional paper chromatography of amino acids.

5131. Burma, D. P. **Role of water contained in the solvent used in filter-paper chromatography. II.** *J. Indian Chem. Soc.* **28**, 555-60 (1951).—*C.A.* **46**, 6542h.

R_f values of amino acids with BuOH-HOAc-H_2O, amyl alc.-HOAc-H_2O, and benzyl alc.-HOAc-H_2O as the solvents were recorded. The following compns. of alc.-HOAc-H_2O were recommended for 2nd solvents in 2-dimensional chromatography: 4:1:1 for BuOH, 25:10:8.75 for amyl alc., and 25:5:6.5 for benzyl alc.

5132. Burma, D. P. **Effect of temperature on the R_f values of the amino acids during paper chromatography with solvents completely miscible with water.** *Nature* **168**, 565-6 (1951).—*C.A.* **46**, 6922h.

The change in phase-compn. of developing solvents which were not completely miscible with H_2O was responsible for observed variations in R_f values of amino acids with increasing temp. R_f values were recorded for aspartic acid, glycine, proline, and phenylalanine at 10°, 15°, 20°, 25°, and 30°C.

5133. Burma, D. P. **R_f values and the distance of the starting point from the source of solvent in filter-paper chromatography.** *J. Indian Chem. Soc.* **28**, 631-7 (1951).—*C.A.* **46**, 6548d.

In both descending and ascending paper chromatography, the R_f values of amino acids decreased gradually when the distance between the point of their application and the source of the solvent was increased. This was attributed to a change in solvent compn. owing to the adsorption of water by the cellulose of the filter paper.

5134. Burstall, F. H. and Wells, R. A. **Inorganic chromatography on cellulose. V. Use of columns of cellulose in combination with organic solvent extraction for the separation of uranium from other metals.** *Analyst* **76**, 396-410 (1951).—*C.A.* **45**, 8393e.

UO_2^{++} was sepd. from other ions by the extn. of $UO_2(NO_3)_2$ with ether contg. 5% HNO_3 by vol. in the presence of cellulose. A soln. of the sample in HNO_3 was prepd., the acid soln. was transferred to the top of a column of cellulose in a glass tube, and 10-ml portions of Et_2O were added until 150 ml of solvent eluent was obtained, to which 75 ml of water was added and the ether removed by evapn.

5135. Chakrabarti, S. and Burma, D. P. **Separation of the alkali metals as chlorides by paper chromatography.** *Science and Culture* **16**, 485-6 (1951).—*C.A.* **46**, 380*b*.

The chlorides of Li, Na, and K were sepd. by paper chromatography; abs. MeOH; EtOH:H_2O, 8:2 (vol.); and Me_2CO:H_2O, 8:2 were used in solvents.

5136. Cheftel, Rose Irene; Munier, Roger, and Macheboeuf, Michel. **Partition microchromatography on paper of nonvolatile, water-soluble aliphatic acids.** *Bull, soc. chim. biol.* **33**, 840-5 (1951).—*C.A.* **46**, 3460*a*.

Expts. were made with BuOH, iso-BuOH, *sec*-BuOH, *tert*-BuOH, iso-AmOH, $PhCH_2OH$; cyclohexanol, PrOH, iso-PrOH, eucalyptole (cineole), EtOAc, $MeOB_z$, and EtOBz as solvents. A mixt. of PrOH 50, eucalyptole 50, HCOOH 20, satd. with H_2O, gave excellent sepn. of a mixt. contg. oxalic, tartaric, citric, malic, maleic, malonic, lactic, succinic, and fumaric acids.

5137. Counsell, J. N.; Hough, L. and Wadman, W.H. **Partition chromatography at elevated temperatures.** *Research* **4**, 143-4 (1951).—*C.A.* **45**, 6007*b*.

Chromatography at high temps. in the case of sugars and amino acids showed an increased rate of flow of the mobile phase. A higher concn. of materials could be handled and with precise temp. control and care in establishing equil., the degree of sepn. was improved. Whatman No. 1 filter paper and phenol/water contg. a trace of acetic acid was used.

5138. Decker, Peter. **Preparative paper chromatography.** *Naturwissenschaften* **38**, 287-8 (1951).—*C.A.* **46**, 2442*c*.

Details were given of a method for concg. small amts. of material on chromatographic paper by transporting it with water to one end of the paper strip which had been reduced in width. Overnight, water was admitted to the wide end and evapd. at the narrow end.

5139. Decker, Peter; Riffart, Wolfgang, and Oberneder, Gertrud. **Multidimensional paper Chromatography.** *Naturwissenschaften* **38**, 288 (1951).—*C.A.* **46**, 2442*d*.

Two-dimensional chromatography used 2 solvents in two perpendicular directions. With amino acids a suggested set of 3 solvents was: *(A)* 30% liquid phenol D.A.B. 6, 70% liquid phenol, water satd. in NH_3 and HCN atm., *(B)* 70% α-picoline, 2% concd. NH_3 soln., 28% water, *(C)* 70% iso-PrOH, 20% AcOH, 10% water.

5140. DeLoach, Will S. and Drinkard, Charles. **Separation of anions by paper partition chromatography.** *J. Chem. Education* **28**, 461 (1951).—*C.A.* **46**, 5936*h*.

The 6 anions that appeared on the filter-paper strips from top to bottom were in the order: $Fe(CN)_6{}^{4-}$, $Fe(CN)_6{}^{3-}$, S^{2-}, $AsO_4{}^{3-}$, $PO_4{}^{3-}$; and I. Flow of developer (a mixt. of, 40% BuOH, 40% of 95% EtOH, and 20% H_2O by vol.) was restricted by notching the 25 x 2-cm strips 1-2 cm from one end.

5141. DeVay, James E.; Chang, Wen-Hua, and Hossfeld, Ralph L. **Identification of histidine and tyrosine by partition chromatography of their azo dyes.** *J. Am. Chem. Soc.* **73**, 4977-8 (1951).—*C.A.* **46**, 8180*d*.

The method afforded a pos. identification of histidine and tyrosine. The azo dyes from diazotized p-$O_2NC_6H_4NH_2$ and histidine could be resolved into 3 differently colored spots, while the dye from p-$O_2NC_6H_4NH_2$ and tyrosine gave a colored spot with an R_f value greater than any of the spots of histidine. The spots were developed with aq. *sec*-BuOH (1:1).

5142. De Whalley, H. C. S. **Raffinose in raw beet sugars. Further results by the chromatographic method.** *Intern. Sugar J.* **53**, 247 (1951).—*C.A.* **45**, 10629*g*.

The analyses of numerous samples of beet sugars by the chromatographic method were reported.

5143. Dubois, M.; Giles, K.; Hamilton, J. K.; Rebers, P. A., and Smith, F. **Determination of sugars.** *Nature* **168**, 167 (1951).—*C.A.* **46**, 2448*i*.

A quant. method was outlined for sugars sepd. by paper chromatography involving phenol. The potential reducing group of an aldose or ketose was necessary. The area contg. the sugar was extd. with H_2O at room temp. and the color developed with H_2SC_4

5144. Ebel, Jean Pierre and Volmar, Yves. **Paper chromatography of ortho-, pyro-, meta-, and poly-phosphates.** *Compt. rend.* **233**, 415-17 (1951).—*C.A.* **46**, 1841*d*.

Mineral phosphates could be completely sepd. by 2-dimensional paper chromatography with an acidic and a basic solvent. The following phosphates were tested: Na_2HPO_4, $(NaPO_3)_3$, $(NaPO_3)_4$, $Na_4P_2O_7$, $Na_5P_3O_{10}$, and $(NaPO_3)_6$. Whatman No. 1 and No. 4 filter papers were satisfactory but must be previously washed with dil. HCl or alc. oxine for use with basic and acidic solvents, resp. The solvents used and R_f values obtained were given.

5145. Edström, Jan Erik. **Determination of nucleic acid components by paper partition chromatography.** *Nature* **168**, 876-7 (1951).—*C.A.* **47**, 7950*g*.

Hydrolysis, sepn., optical equipment, and results were discussed. Sensitivity in γ per cm^2 was for adenine 0.35, guanine 0.55, cytosine 0.75, uracil 0.45, and thymine 0.60.

5146. Erlenmeyer, H.; Hahn, H. v., and Sorkin, E. **Paper chromatographic separation and determination of alkali and alkaline-earth ions.** *Helv. Chim. Acta* **34**, 1419-21 (1951) (in German).—*C.A.* **46**, 858*c*.

Whatman's No. 1 filter paper, 0.1 *M* solns. of acetates, and development with a solvent consisting of 80% by vol. EtOH (96%) and 20% by vol. 2 *N* AcOH to height of 30 cm (about 24 hrs) followed by color development with *violuric acid* (5-isonitrosobarbituric acid) were used. R_f values and characteristic colors of the violurates were obtained.

5147. FEWSTER, MONA E. AND HALL, DAVID A. **Application of buffered solvent systems to the detection of aromatic acids by paper partition chromatography.** *Nature* **168**, 78-9 (1951).—*C.A.* **46**, 373*d*.

Good sepns. of aromatic acids, with little or no tailing, were obtained when butanol satd. with an NH_3-$(NH_4)_2CO_3$ buffer (1.5 *N* with respect to each) was used to develop the chromatogram. The R_f values increased when EtOH was added to the system and decreased when benzene was added. The chromatograms were run with Whatman No. 4 paper at 15°C.

5148. FOWDEN, L. **Quantitative recovery and colorimetric estimation of amino acids separated by paper chromatography.** *Biochem. J.* **48**, 327-33 (1951).—*C.A.* **45**, 5073*d*.

The reagent ninhydrin was used satd. with hydrindantin, which was prepd. from ninhydrin by treatment with H_2S and recrystn. from acetone. With this slightly modified reagent 1-30 γ of α-amino N could be detd. in amino acids. Ammonia gave false values and was removed.

5149. FOWLER, H. D. **Quantitative paper chromatography.** *Nature* **168**, 1123-4 (1951).

With more than 100-250 μg of sucrose, the linear relation between spot length and logarithm of spot-content broke down. A much truer representation was the linear relation of the logarithm of spot-content to the logarithm of spot-length. Increase of temp. decreased absolute stain-length while increase in the time of running of the chromatogram had the opposite effect.

5150. FRIERSON, W. JOE AND JONES, JOHN W. **Radioactive tracers in paper partition chromatography of inorganic ions.** *Anal. Chem.* **23**, 1447-52 (1951).—*C.A.* **46**, 850*i*.

Sepns. on paper were established by autoradiography, counting techniques, and chem. tests. The solvent systems used were: for Fe and Co, a mixt. of pyridine, BuOH, and *N* HCl; for Fe, Co, Ni, Mn, and Zn, a mixt. of BuOH and pyridine contg. diphenylamine. The R_f values were Fe, 0: Co, 0.5; Mn, 0.1: Ni, 0.6: Zn, 0.8. Also BuOH-Me iso-Pr ketone (40-25) plus 30 mg Ph_2NH/ml gave the same R_f values.

5151. GAGE, THOMAS B.; DOUGLASS, CARL D., AND WENDER, SIMON H. **Identification of flavonoid compounds by filter paper chromatography.** *Anal. Chem.* **23**, 1582-5 (1951).—*C.A.* **46**, 2449*c*.

The behavior of 38 flavonoids in 11 solvents was studied. Color development was given by 8 chromogenic sprays (alc. $AlCl_3$, $ThCl_4$, $FeCl_3$, each 1%; aq. basic Pb acetate, $Pb(OAc)_2$, Na_2CO_3, each 1%; ammoniacal $AgNO_3$, and Benedict's soln.) or spots were located under ultraviolet light before spraying.

5152. GORE, D. NEVILLE. **The detection of acids on paper-partition chromatograms.** *Chemistry & Industry* **1951**, 479.—*C.A.* **46**, 3459*i*.

Org. acids could be detected on paper chromatograms by spraying with a reducing soln. (1% dextrose), then with ammoniacal $AgNO_3$. A soln. (0.002 ml) contg. 1% tartaric, citric, and lactic acids was sprayed on Whatman No. 1 paper then the solvent was evapd. The paper was then heated in air at 105°C. The white spots corresponded to the position of the acids.

5153. GRAICHEN, CHARLES. **Paper chromatography of fluorescein and the halogenated fluoresceins.** *J. Assoc. Offic. Agr. Chemists* **34**, 795-9 (1951).—*C.A.* **46**, 2875*g*.

Two solvent systems were used for the sepn. of fluorescein dyes by 2-dimensional paper chromatography: (1) NH_4OH (1+99) satd. with isoamyl alc. and (2) a mixt. of 200 ml butanol, 88 ml water, 2 ml concd. NH_4OH, and 40 ml alc. Results were most satisfactory when (1) was used for the initial development.

5154. GUSTAFSSON, CHARLEY; SUNDMAN, JACOBUS, AND LINDH, THORSTEN. **Determination of carbohydrates by means of paper partition chromatography.** *Paper and Timber* (Finland) **33**, 1-3 (1951) (in English).—*C.A.* **45**, 4175*e*.

A photometric method was developed to evaluate quantitatively the paper chromatographic sepn. of glucose, mannose, xylose, galactose, and arabinose from wood hydrolyzates. Preferably 100-500 γ of the sugar mixt. was chromatographed on Whatman's no. 1 filter paper strips accompanied by two known mixts., one above and one below the concn. of each sugar in the unknown. For detg. all 5 sugars, 2 sep. runs must be made, one for 8 days with BuOH satd. with H_2O as eluent for detn. of glucose, galactose, and xylose; the other for 16 days with the upper layer of a mixt. of H_2O 50, AmOH 40, and AcOH 10 (by vol.) for detg. mannose, arabinose, and xylose. The developer consisted of phthalic acid and aniline.

5155. HAHN, H. V.; SORKIN, E., AND ERLENMEYER, H. **Simultaneous detection of cupric and cobaltic ions by paper chromatography.** *Experientia* **7**, 358 (1951) (in German).—*C.A.* **46**, 1391*g*.

Sepn. was accomplished as acetates employing as the nonaqueous phase a mixt. of 100 cc BuOH, 50 cc AcOH, 20 cc $AcCH_2COOEt$, and 150 cc H_2O. The chromatogram was developed with violuric acid. As little as 0.3 γ could be detected.

5156. HARASAWA, SHIRO. **Paper chromatography. II. Chromatograms of cadmium salts treated with several developers. III. Separation of copper, bismuth, and cadmium salts.** *J. Chem. Soc. Japan, Pure Chem. Sect.*, **72**, 107-10, 110-13 (1951).—*C.A.* **46**, 3449*d*.

Developers contg. BuOH and HNO_3, org. acids, or pyridine were studied. Pyridine was found excellent in some cases owing to its complex-forming property. BuOH-HCl developer was suitable for the sepn. of chlorides, sulfates, and nitrates of Cu, Bi, and Cd. The most suitable compn. of developer was BuOH 100 parts, concd. HCl 20 parts, and water 30 parts by vol.

5157. HARASAWA, SHIRO. **Inorganic paper chromatography. IV. Separation and identification of the copper group. V. Separation and detection of lead and silver salts. VI. Separation and detection of the first group metals.** *J. Chem. Soc. Japan, Pure Chem. Sect.*, **72**, 236-9, 295-8, 352-6 (1951).—*C.A.* **46**, 850*c*.

Chlorides or nitrates of Cu, Cd, Bi, Hg, and Pb were sepd. from other metals in the usual way and were subjected to paper chromatography. With a mixt. of BuOH 100, pyridine 10-20, and water

20 parts by vol. as the developer, Ag advanced rapidly, its R_f value being 0.5-0.9, while Pb showed a broad band continuous from its original line, and its R_f was far less than that of Ag. Hg(I) salt remained in the original position by the treatment of pyridine-butanol developer, and produced a dark-brown band without any fixing operations.

5158. HARASAWA, SHIRO. **Studies on inorganic paper chromatography. VII. Separation of tin and antimony and the application to the analysis of metals of the tin group.** *J. Chem. Soc. Japan*, Pure Chem. Sect. **72**, 423-6 (1951).—*C.A.* **46**, 1917*d*.

Sb^{5+} and Sn^{4+} could be completely sepd. by treating with the developer contg. 100 vols. BuOH, 4-7 vols. HCl, and 20 vols. water, while sepn. of Sb^{3+} and Sn^{2+} was incomplete. Therefore, the soln. to be analyzed should be oxidized and for that purpose 20 vols. of water in the developer was replaced with the same vol. of 3% H_2O_2 soln.

5159. HARASAWA, SHIRO. **Studies on inorganic chromatography. VIII. Separation of iron, chromium, and manganese with butanol-hydrochloric acid developers. IX. X.** *J. Chem. Soc. Japan, Pure Chem. Sect.*, **72**, 614-16, 660-3, 776-8 (1951).—*C.A.* **46**, 6033*b*.

Suitable compns. of the developer were: BuOH 100, concd. HCl 30-40, and water 0-20 vols. Fe^{3+} was fixed by $K_4Fe(CN)_6$ soln. Dil. NaOH soln. was sprayed on both Cr and Mn bands which were then oxidized with Br_2 vapor. Mn^{+2} was oxidized to H_2MnO_3 and fixed as a dark brown band. Cr^{3+} was oxidized to CrO_4^{--}. Al was first sepd. from other cations as AlO_2^- in the usual way, and then Fe, Cr, and Mn were sepd. chromatographically by the acetone-HCl developer: 100 parts acetone + 20-40 parts concd. HCl by vol. With 100 vols. of acetone and 5-6 vols. of concd. HCl, Zn advanced almost to the front line and Fe, Co, Mn, and Ni followed in this order. Zn was fixed by spraying with a CCl_4 solution of dithizone. Ni, Mn, and Co were fixed by spraying with an alc. soln. of dimethylglyoxime and exposing them to NH_3 gas.

5160. HARASAWA, SHIRO AND SAKAMOTO, TAKASHI. **Inorganic paper chromatography. XI. Behaviors of aluminum and its separation from iron.** *J. Chem. Soc. Japan*, Pure Chem. Sect., **72**, 897-900 (1951).—*C.A.* **46**, 6460*b*.

The suitable developers were acetone-HCl and acetone-AcOEt-HCl series contg. about 10% HCl by vol. Chromatograms of Al and Fe were sprayed with an alc. soln. of hydroxyquinoline and then with a mixed soln. of AcOH and AcONa (buffer soln.). Al was fixed as a pale-yellow band and Fe as a grayish black one.

5161. HARASAWA, SHIRO AND SAKAMOTO, TAKASHI **Inorganic paper chromatography. XII. Chromatographic behavior of chromium(IV) compounds and systematic analysis of metals of third group.** *J. Chem. Soc. Japan*, Pure Chem. Sect., **72**, 1033-6 (1951).—*C.A.* **46**, 7927*c*.

Sepn. of Cr(III) from Al or Al-Fe(III) was difficult, but detection of these elements in the mixt. was possible. R_f values of Cr(IV) compds. such as dichromate depended on the pH of the developer contg. org. solvents. Sepn. of Al, Fe(III), and Cr(IV) was complete, but during the development Cr(III) was formed by reduction and its band partly overlapped that of Al.

5162. HEFTMANN, ERICH. **Paper chromatography in the separation of 17 α-estradiol from 17 β-estradiol and of equilin from equilenin.** *J. Am. Chem. Soc.* **73**, 851-2 (1951).—*C.A.* **45**, 5707*i*.

The solvent mixt. was prepd. by equilibration of 200 cc. petr. ether (b. p. 35-60 °C), 100 cc. PhMe, 10 cc. EtOH, and 90 cc. distd. H_2O.

5163. HOSSFELD, RALPH L. **Paper partition chromatography of simple phenols.** *J. Am. Chem. Soc.* **73**, 852-4 (1951).—*C.A.* **45**, 5651*g*.

The phenols were coupled with diazotized sulfanilic acid and the Na salts developed on carbonate-treated paper with EtAc-H_2O. The sepn. of dye mixts. was observed both by superimposed spotting of the individual dyes at a single location on the paper and by spotting the mixed dye resulting from the coupling of a mixt. of phenols with $HO_3SC_6H_4N_2Cl$.

5164. HOYER, H. **Hydrogen-bridge bonding and the separation of isomers by electrochematography.** *Kolloid-Z.* **122**, 164 (1951).—*C.A.* **45**, 8848*b*.

The sepn. of 1- and 2-naphthol orange was undertaken under the following conditions: S. & S. No. 602h paper, 10.1 v./cm, 0.005 to 0.008 amp. for 1 hr.

5165. HUEBNER, CHARLES F. **Paper chromatography of pyridine derivatives.** *Nature* **167**, 119-20 (1951).—*C.A.* **45**, 4605*i*.

The solvent used for the development of these compds. was butyl alc. satd. with 1.5 *N* NH_3. After evapn. of the solvent at room temp., the dry paper was placed for 15 min. in a closed glass cylinder contg. a few crystals of CNBr. The paper was then sprayed with 0.25% soln. of benzidine in 50% EtOH. As little as 5γ could be detected.

5166. ISHERWOOD, F. A. AND JERMYN, M. A. **Relationship between the structure of the simple sugars and their behavior on the paper chromatogram.** *Biochem. J.* **48**, 515-24 (1951).—*C.A.* **45**, 10204*e*.

A definite relation between R_F value (movement of sugar on paper chromatogram) and the molar fraction of H_2O (N) in the solvent was established empirically, and the log $[(1/R_F) - 1]$ plotted against $-\log N$ was a straight line for each sugar. Members of each homomorphous series revealed a closely similar behavior.

5167. JEANES, ALLENE; WISE, C. S., AND DIMLER, R. J. **Improved techniques in paper chromatography of carbohydrates.** *Anal. Chem.* **23**, 415-20 (1951).—*C.A.* **45**, 5072*e*.

Glucose, fructose, galactose, mannose, arabinose, xylose, maltose, lactose, cellobiose, isomaltose, gentiobiose, melibiose, and a mixt. of oligosaccharides (homologous polyglucoses of up to 10 units) from the α-amylase hydrolysis of amylose could be sepd. by paper chromatography and detected with 3,5-dinitrosalicylic acid reagent. R_f values for several sugars in 16 solvents were given.

5168. JERCHEL, DIETRICH AND MÜLLER, RUTH. **Paper-chromatography of 3-indoleacetic acid.** *Naturwissenschaften* **38**, 561-2 (1951).—*C.A.* **46**, 11294*f*.

An aq. soln. (0.5 cc.) with at least 5 γ indoleacetic acid was placed on a width of 6 cm of 8 × 60 cm Whatman IV filter paper. After room drying it was treated with a mixt. of 60 PrOH, 30 concd. NH_4OH and 10 parts H_2O in the downward direction for 6 hrs. The acid traveled with R_f 0.82-0.84.

5169. KARIYONE, TATSUO AND HASHIMOTO, YOHEI. **Paper-partition chromatography of some organic bases by the method of *N*-methylation.** *Nature* **168**, 739 (1951).—*C.A.* **46**, 3460*h*.

Basic substances not reacting readily with Dragendorff's reagent were chromatographed. The paper strip was then treated with K_2CO_3 and Me_2SO_4. The positions occupied by basic substances with quaternary N atoms were revealed.

5170. KARIYONE, TATSUO; HASHIMOTO, YOHEI, AND KIMURA, MUTSUO. **Paper-partition chromatography of alcohols with the potassium xanthogenates.** *Nature* **168**, 511 (1951).—*C.A.* **46**, 3459*b*.

A method for prepg. and chromatographing K xanthogenates of alcs. was given. By this method, 0.1% of MeOH in EtOH was easily detected. The R_f value for 10 alcs. was given.

5171. KAWAMURA, ICHIJI AND HIGUCHI, TAKAAKI. **Relation between lignin and carbohydrates in wood. III. Paper chromatography of dioxane lignin.** *J. Soc. Textile Cellulose Ind.* (Japan) **7**, 39-41 (1951).—*C.A.* **46**, 6380*c*.

Dioxane lignin could be sepd. from monosaccharides (xylose, glucose, and rhamnose) by paper chromatography and the latter converted to 2-furaldehyde with 12% HCl.

5172. KAWERAU, E. **A bridge unit for filter-paper chromatography.** *Biochem. J.* **48**, 281-3 (1951).—*C.A.* **45**, 4494*d*.

An app. was described for accurate identification of urinary sugars, etc., by filter-paper chromatography.

5173. KEMBER, N. F. AND WELLS, R. A. **Inorganic chromatography on cellulose. VI. Extraction and determination of gold.** *Analyst* **76**, 579-87 (1951).—*C.A.* **46**, 376*a*.

EtOAc contg. 5% H_2O and 10% concd. HNO_3 by vol. ext. Au efficiently from the ions of many other metals. The most satisfactory solvent, however, proved to contain 3% H_2O and 2% concd. HNO_3. The Au was removed from the paper with the aid of this solvent and 1-2 γ of Au detd. with *p*-dimethylbenzylidinerhodamine. The Au could be recovered from the solvent, prepd. in nitrate-free chloride soln. by electrodeposition on Pt. Many important details were given and the results of numerous expts. shown.

5174. KENNEDY, E. P. AND BARKER, H. A. **Paper chromatography of volatile acids.** *Anal. Chem.* **23**, 1033-4 (1951).—*C.A.* **45**, 10140*i*.

Unidimensional chromatograms made by the "ascending method" at room temp. over a period of 6-8 hrs were made of various volatile acids. One-tenth ml of an aq. soln. contg. 1.5 micromoles of each acid as an NH_4 salt was applied to pre-washed Whatman No. 1 filter paper. Chromatograms were developed in solvents contg. free NH_3 such as EtOH-NH_3 soln. or aq. acetone-soln. Location of the spots after development was accomplished by spraying dried paper with bromophenol blue indicator made acid with a little citric acid.

5175. KNIGHT, C. A. **Paper chromatography of some lower peptides.** *J. Biol. Chem.* **190**, 753-6 (1951).—*C.A.* **45**, 8076*d*.

R_f values in PhOH-water and in pyridine-iso-AmOH were detd. for some common amino acids and for 34 peptides contg. 2-8 amino acids. The spread was greater with PhOH-water.

5176. KRITCHEVSKY, THEODORE K. AND TISELIUS, ARNE. **Reversed phase partition chromatography by steroids on silicone-treated paper.** *Science* **114**, 299-300 (1951).—*C.A.* **46**, 1612*c*.

Filter paper (Munktell 20, 150G) strips were drawn through a 5% soln. of Dow Corning Silicone No. 1107 in cyclohexane, blotted between sheets of absorbent paper and dried at 110 °C for 1 hr. The treated paper was hydrophobic and held the nonpolar solvent as a stationary phase. The upper layer of a mixt. of 6 vols. H_2O, 10 EtOH, and 10 $CHCl_3$ was used as the mobile phase. At the end of the run, strips were dried at 110 °C and colored spots developed with a freshly prepd. mixt. of equal vols. of 2% *m*-$(NO_2)_2C_6H_4$ in EtOH and 2.5 *N* KOH in EtOH.

5177. LACOURT, A.; SOMMEREYNS, GH., AND CLARET, M. **Chromatographic separation on paper and determination of microgram quantities of anions.** *Mikrochemie ver. Mikrochim. Acta* **38**, 444-55 (1951).—*C.A.* **46**, 2447*f*.

Si, B, and Mo was detd. in 1 hr. For developing the spots produced from Na silicate, Na borate, and Na molybdate, a mixt. of 5% by vol. of concd. HCl and acetone in an atm. which was satd. with 5% concd. HCl in 2-butanone.

5178. LACOURT, A.; SOMMEREYNS, GH., AND DEGEYNDT, E. **New chromatographic separation of microgram quantities of iron, titanium, and aluminum.** *Mikrochemie ver. Mikrochim. Acta* **36/37**, 312-21 (1951).—*C.A.* **45**, 5062*e*.

The cations (10 γ) were present as chlorides in 6 *N* HCl. For the test, 0.01 ml of soln. was dropped on Whatman no. 1 paper (1 cm × 25 cm) and the paper was then dried. Chromatograms were developed with org. solvents or with a mixt. of these. A usable chromatogram, for qual. and quant. purposes, was obtained by a mixt. of AmOH, benzene, and HCl.

5179. LACOURT, A.; SOMMEREYNS, GH.; DEGEYNDT, ED., AND JACQUET, O. **New chromatographic method for separating cations (on paper) with the aid of organic solvents.** *Mikrochemie ver. Mikrochim. Acta* **36/37**, 117-32 (1951).—*C.A.* **45**, 5057*e*.

Solns. contg. chlorides of Fe, Ti, Al, V, Ni, Co, or Cu could be chromatographed by downward development on Whatman No. 1 or 4 paper with the aid of org. solvents. The time required to establish chromatographic equil. was appreciably less for inorg. cations than for org. substances. Sepns. were obtained of Fe from Ti and from Al, Ni from Cu, Co from Cu, and Ni from Co.

5180. Lacourt, A.; Sommereyns, Gh.; Jacquet, O., and Wantier, G. **Paper chromatographic behavior of copper, nickel, and cobalt; qualitative and quantitative separations.** *Bull. soc. chim. France* **1951**, 873-80.—*C.A.* **46**, 6544*f*.

New solvents and new development techniques were tried. Ni and Cu could be detd. by depositing on paper, developing with Me_2CO contg. 10% $CHCl_3$ or dioxane with 10% AcOH, eluting with HCl, and detg. the Ni with dimethylglyoxime and the Cu with diethyldithiocarbamate.

5181. Lacourt, A.; Sommereyns, Gh., and Soete, J. **Chromatographic separation of microgram inorganic samples on paper. Aluminum, uranium, iron.** *Mikrochemie ver. Mikrochim. Acta* **38**, 348-57 (1951).—*C.A.* **46**, 2444*d*.

The sepn. of Al and Fe was studied. For development, a 5% soln. of HCl in acetone satd. with benzene proved excellent. Fifty γ of U could be detd. in 75-175 min. within 4% of the truth.

5182. Lacourt, A.; Sommereyns, Ghislaine, and Wantier, Georges. **Inorganic chromatography on paper. Separating ability of organic solvents for saturating and developing.** *Compt. rend.* **232**, 2426-8 (1951).—*C.A.* **45**, 8848c.

One org. solvent was used for satg. the enclosure contg. the chromatographic paper and another solvent for the development. Quant. sepns. of the order of micrograms were obtained for B from Si and Mo; U from Fe and Al; Ni and Cu from Co and Fe; U from Pb, Zn, and Cd; and Al, Ti, and V from Fe, Cr, and Mo.

5183. Landua, Alton J.; Fuerst, Robert, and Awapara, Jorge. **Paper chromatography of amino acids.** *Anal. Chem.* **23**, 162-8 (1951).—*C.A.* **45**, 3447*d*.

The effect of pH on various amino acids was demonstrated. The graphs showed the position of a compd. on a chromatogram at a particular pH of the applied soln., and the pH of the applied soln. for which the spot had a min. area. Phenol, 2,4-lutidine and 1-butanol were used as solvents. Buffers were not used owing to the effect of inorg. salts on chromatograms.

5184. Laskowski, Donald E. and McCrone, W. C. **Filter-paper chromatography of inorganic cations with 8-quinolinol.** *Anal. Chem.* **23**, 1579-82 (1951).—*C.A.* **46**, 2442*g*.

Paper impregnated with 8-quinolinol was used with various solvents (e.g. dioxane, pyridine, $CHCl_3$, Me_2CO, and several alcs.) in the sepn. of Al^{3+}, Sb^{3+}, Ba^{++}, Cd^{++}, Ca^{++}, Co^{++}, Cu^{++}, Fe^{3+}, Pb^{++}, Mg^{++}, and Ni^{++}. Spots were located by observation under white and ultraviolet light.

5185. Lederer, Michael. **Inorganic analysis by paper ionophoresis.** *Nature* **167**, 864-5 (1951).—*C.A.* **45**, 8321*h*.

The sepn. of the Cu-group metals occurred in the same order as for a paper chromatogram with butanol contg. HCl. Likewise, the ionophoretic sepn. of Co and Ni by the formation of the Co thiocyanate complex was analogous to that obtained in paper chromatography with butanol contg. HCNS.

5186. Lederer, Michael. **Paper chromatography of inorganic cations. II.** *Anal. Chim. Acta* **5**, 185-90 (1951) (in English).—*C.A.* **46**, 4319*f*.

The R_F values of some 40 metallic ions were measured in Et, isopropyl, Bu, and Am alcs., contg. some HCl. Specific sepns. were obtained for Tl and Zr.

5187. Lewis, J. A. and Griffiths, J. M. **Inorganic chromatography on cellulose. IV. Determination of inorganic compounds by paper-strip separation and polarography.** *Analyst* **76**, 388-95 (1951).—*C.A.* **45**, 8393*c*.

The sepns. were of 3 kinds: (1) one cation from other cations, (2) a group of ions into individual salts, and (3) a large group into smaller groups of salts. The first kind of sepn. was illustrated by the sepn. of UO_2^{++} from about 52 other cations. The second type of sepn. was illustrated with a soln. contg. chlorides of Ni, Mn, Co, Cu, and Fe.

5188. Liberman, L.A.; Zaffaroni, Alejandro, and Stotz, Elmer. **Paper chromatography of hydroxy and keto acids.** *J. Am. Chem. Soc.* **73**, 1387-8 (1951).—*C.A.* **45**, 6540*e*.

Toluene-acetic acid-water provided an excellent system for the chromatographic analysis of hydroxy and keto acids.

5189. Marchal, J. G. and Mittwer, T. **A modification of the technique of chromatography on paper; chromatography in arcs of a circle.** *Compt. rend. soc. biol.* **145**, 417-21 (1951); *Proc. Koninkl. Nederland Acad. Wetenschap.* **54C**, 391-2 (1951).—*C.A.* **46**, 318*i*, 2442*e*.

A strip of filter paper 8-10 cm wide was trimmed at one end so that a tab 2 cm wide and 4 cm long was left attached to the main portion by a section 10-15 mm long and only 2 mm wide. The mixt. to be sepd. was placed on the tab, and the paper hung vertically with the lower end of the tab dipping in the developing soln. The substances traveled up the 2-mm-wide section and spread out in the wide portion of the paper in a series of concentric semicircular arcs. The application to the sepn. of amino acids was described.

5190. Martin, E. C. **The use of thocyanic acid in paper partition chromatography. I. The R_f values of some common cations.** *Anal. Chim. Acta* **5**, 511-12 (1951) (in English).—*C.A.* **46**, 7471*f*.

The prepn. and use of HCNS in butanol-water mixts. were described. The R_f values of 12 common cations found by using this reagent were given.

5191. McFarren, Earl F. **Buffered filter paper chromatography of the amino acids.** *Anal. Chem.* **23**, 168-74 (1951).—*C.A.* **45**, 3447*e*.

By employing several solvents buffered at pH values between 1.0 and 12.0 it was possible to sep. and identify each amino acid from all the others by the use of one dimensional chromatography. Data were given on variation of R_f values of amino acids with pH of buffer using *o*-, *m*-, and *p*-cresols, phenol, collidine, benzyl alc., 2,4-lutidine, BuOH, and benzyl and butyl acl. 1 to 1, as solvents. Twenty different amino acids were studied.

5192. Michl, H. **Quantitative measurement of electrophoresis diagrams on filter paper.** *Monatsh.* **82**, 944-5 (1951); **83**, 210-20 (1952).—*C.A.* **46**, 8465*i*.

The strip of filter paper with a dyed electrophoresis diagram extending along its length was made transparent with 1-bromonaphthalene and was placed in an app. in which light was passed through the filter paper, then through a cylindrical lens and a gray wedge onto sensitized paper. The concn. of a given component in the mixt. subjected to electrophoresis was then proportional to the area of the resp. hump of the pattern appearing on the sensitized paper. The minimizing of adsorption of dye or protein on the filter paper, and a means of quickly detg. the optimum pH for electrophoresis were discussed.

5193. Miettinen, Jorma K. and Virtanen, Artturi I. **Rapid method for determination of fatty acids and ammonia in silage by means of paper chromatography.** *Ann. Acad. Sci. Fennicae*, Series A, II, No. 41, 9pp. (1951) (in English).—*C.A.* **46**, 11500*d*.

Acetic, propionic, butyric, valeric, and caproic (?) acids were found. NH_3 was detd. (±30%) by developing the paper chromatograms with BuOH satd. with 6 *N* HCl. The NH_3 spots were located with Nessler reagent.

5194. Miličevic, B. **Inorganic single-phase paper chromatography.** *Bull. soc. chim. Belgrade* **16**, 101-3 (1951) (English summary).—*C.A.* **46**, 4319*g*.

The sepn. of the following cations and anions (in groups of 3 or 4) was accomplished by use of H_2O for developing the chromatograms: (in increasing R_F order) Fe^{3+}, UO_2^{++}, Pb^{++}, Hg^{++}, Cu^{++}, Ag^+, Cd^{++}, Co^{++}, Ni^{++}, and MnO_4^-, $Cr_2O_7^{--}$, I^-, Br^-.

5195. Miller, Christina C. and Magee, Robert J. **Separations by partition chromatography on paper. (1) Strontium from barium, calcium and magnesium. (2) Potassium, rubidium, and cesium. (3) Sodium and lithium.** *J. Chem. Soc.* **1951**, 3183-7.—*C.A.* **46**, 3453*h*.

A mixt. of 5% BuOH and 95% concd. HCl (by vol.) satd. with BuCl was used to sep. $SrCl_2$ from Ba, Ca, and Mg chlorides. From 2.5 to 500 γ of Sr could be detected and estd. with Na rhodizonate. A total wt of up to 1 mg of K, Rb, and Cs as chlorides could be sepd. by a mixt. of 55% concd. HCl, 35% MeOH, 5% BuOH, and 5% iso-butyl Me ketone. Complex Pb-Co hexanitrites were used for the estn. and detection of 5 to 1000 γ of K, Rb, or Cs.

5196. Miyaki, Komei; Satake, Kazuo, and Hayashi, Makoto. **Quantitative paper chromatography.** *J. Pharm. Soc. Japan* **71**, 249-56 (1951) (in English).—*C.A.* **45**, 7909*i*.

A known vol. of sample taken in a capillary pipet was placed at the end of a filter paper cut into 7 mm × 40 cm pieces. A set of these strips contg. unknown and various known concns. were chromatographed. Exptl. data on histamine, antibiotics, lower peptides, and amino acids from protein hydrolysis were given.

5197. Momose, Tsutomu and Yamada, Atsushi. **Organic qualitative analysis. II. Qualitative analysis of alcohols by paper-partition chromatography.** *J. Pharm. Soc. Japan* **71**, 980-1 (1951).—*C.A.* **46**, 1921*e*.

Dissolve 0.1-1 g of sample in 0.1-0.2 ml of dry pyridine, add 3,6-$(NO_2)_2C_6H_2(CO)_2O$ in excess, heat at 50°C (lower alcs.) or at 100°C (higher or polyhydric alcs.), decomp. the excess 3,6-$(NO_2)_2C_6H_2(CO)_2O$ by adding 1 drop water, add 2-3 ml ether, remove pyridine by extg. with 2-3 ml 5% HCl, take the residue from ether in BuOH. A drop of BuOH soln. was placed on a filter paper developed by BuOH-AcOH, sprayed with 1 *N* NaOH and $AcCH_2CO_2Et$ to get an orange-red spot.

5198. Moynihan, P. and O'Colla, Proinsias. **Application of paper chromatography to the analysis of chlorinated organic insecticides.** *Chemistry & Industry* **1951**, 407.—*C.A.* **45**, 10205*b*.

The isomers in crude hexachloro- and heptachlorocyclohexane might have been sepd. on paper impregnated with Ac_2O.

5199. Müller, Ralph H. and Clegg, Doris L. **Paper chromatography. Instruments and techniques. Physical and geometric factors.** *Anal. Chem.* **23**, 396-403, 403-8 (1951).—*C.A.* **45**, 4997*e*.

The app. and techniques used in a study of the fundamental factors involved in paper chromatography were described. Flow rates depended on the dimensions of the paper at the solvent surface and above the solvent, and variations in dimensions could be used to speed up chromatographic sepns.

5200. Müller, Ralph H. and Clegg, Doris L. **Automatic paper chromatography.** *Ann. N.Y. Acad. Sci.* **53**, 1108-18 (1951).—*C.A.* **46**, 3807*g*.

App. was described for automatic scanning of paper chromatograms during and after their development.

5201. Müller, Ralph H. and Wise, Edward N. **Use of β-ray densitometry in paper chromatography.** *Anal. Chem.* **23**, 207-8 (1951).—*C.A.* **45**, 3753*d*.

Equipment was described for the rapid analysis of paper chromatograms of substances contg. tracers. This technique was used to study metabolic products resulting from the administration of C^{14} labeled compds. The chromatogram was drawn across a fine lead slit in front of an ionization chamber at a uniform rate and in exact conformity to chart motion of a recorder.

5202. Nakano, Shoichi. **Separation and detection of twenty-four common ions by means of paper chromatography. Practical applications to the analysis of alloys. I.** *J. Chem. Soc. Japan*, Pure Chem. Sect. **72**, 962-7 (1951).—*C.A.* **46**, 6996*f*.

Paper chromatography of the following 24 ions were studied: Ag, Pb, Hg(I), Hg(II), Cd, Bi, Cu, Sn(IV), Sb(III), Sb(IV), As(III), As(V), Zn, Fe(III), Cr(III), Al, Mn(II), Co, Ni, Mg, Ca, Sr, Ba, K. Nitrate and chloride were used with the addn. of HNO_3 and HCl, resp. The solvents used were HCl, AcOH, BuOH, iso-AmOH, acetone, ether, and their mixts.

5203. NEHER, R. AND WETTSTEIN, A. **Steroids. CVII. Color reactions with steroids, especially corticosteroids in a paper chromatogram.** *Helv. Chim. Acta* 34, 2278-85 (1951) (in German).—*C.A.* 46, 3110*d*.

The finished and dried chromatogram was drawn quickly through a 15% soln. of H_3PO_4, heated to 90°C for 20 min. and observed under the ultraviolet lamp. Characteristic fluorescent spots were seen. The fluorescence persisted for several hrs, then faded away. H_3PO_3 gave a similar but less sensitive reaction.

5204. NICHOLAS, RACHEL E. H. AND RIMINGTON, C. **Paper chromatography of porphyrins: some hitherto unrecognized porphyrins and further notes on the method.** *Biochem. J.* 48, 306-9 (1951).—*C.A.* 45, 5221*e*.

A lutidine-water system (lutidine is a mixt. of 2,4- and 2,5-dimethylpyridines which becomes completely miscible with H_2O at temps. of 17°C or below) was employed for the sepn. of porphyrins by paper chromatography. The R_f values of free porphyrins were inversely proportional to the no. of -COOH groups in the mol.

5205. OHARA, MASAMI AND SUZUKI, YUKIMASA. **The behavior of lactic acid in paper chromatography.** *Science (Japan)* 21, 362-3 (1951).—*C.A.* 45, 10286*h*.

In the paper partition chromatography of nonvolatile org. acids, lactic acid often gave 2 spots, one of which corresponded to lactyllactic acid produced by the dehydration of lactic acid. The R_f value of lactyllactic acid resembled closely that of levulinic acid.

5206. OKA, YOSHINAGA AND MURATA, AKIRA. **Inorganic chromatography. I. Chromatography on filter paper impregnated with aluminum hydroxide.** *J. Chem. Soc. Japan, Pure Chem. Sect.* 72, 657-60 (1951); *Sci. Repts. Research Inst. Tohoku Univ.* 3A, No. 1, 82-90 (1951) (in English).—*C.A.* 46, 6030*b*; 47, 66*g*.

With strips of paper impregnated with $Al(OH)_3$, fundamental studies were made on the detn. of H_2SO_4 and sulfates of Mn, Co, Ni, Cu, Cd, and Zn. The width of absorption zone, or sensitivity, depended upon the amt. of $Al(OH)_3$. Decreasing order of adsorption on the paper were H > Cu > Zn > Cd > Ni, Co > Mn.

5207. OKA, YOSHINAGA AND MURATA, AKIRA. **Inorganic chromatography. II. Determination of copper in zinc.** *J. Chem. Soc. Japan, Pure Chem. Sect.* 73, 494-6 (1951); *Science Repts. Research Inst. Tohoku Univ.*, **Ser. A, 3,** 707-10 (1951).—*C.A.* 47, 2631*f*, 4242*d*.

Dissolve Zn contg. Cu in HNO_3 and develop on filter paper impregnated with $Al(CH)_3$. Measure the width of the Cu band fixed with H_2S and det. its amt.; 1 part of Cu in 50 parts of Zn could be detd.

5208. OKA, YOSHINAGA AND MURATA, AKIRA. **Inorganic chromatography. III. Determination of zinc in cadmium.** *J. Chem. Soc. Japan, Pure Chem. Sect.* 73, 496-8 (1951); *Science Repts. Research Inst. Tohoku Univ.*, **Ser. A, 3,** 711-15 (1951).—*C.A.* 47, 2631*f*, 4242*d*.

Sepn. of Cd from Zn on filter paper impregnated with $Al(OH)_3$ was possible with the addn. of KI to the soln. of their nitrates. KI soln. was used as the developer.

5209. PAPASTAMATIS, S. C. AND WILKINSON, J. F. **Paper chromatography of proteins.** *Nature* **167,** 724-5 (1951).—*C.A.* 45, 9102*c*.

One-dimensional ascending chromatography was carried out at 5°C. Buffers and salt solns. were used as developing solns. The filter strip was dried in air and sprayed with the indicator (0.1% soln. of the Na salt). The dye gave a blue-violet color throughout, the area occupied by the proteins being just discernible. The strip was air-dried and passed smoothly through 0.2 *N* AcOH, becoming a pale yellow color except in the spot occupied by the protein which persisted violet-blue, or green with very small quantities.

5210. PARDEE, ARTHUR B. **Calculations on paper chromatography of peptides.** *J. Biol. Chem.* **190,** 757-62 (1951).—*C.A.* 45, 8076*e*.

A relation between the R_F values on paper chromatograms of peptides and the amino acids of which they were composed was established. From the R_F values of the amino acids and 2 general, experimentally detd. consts., the R_F value of any desired peptide could be calcd. with an av. accuracy of ±0.05.

5211. POLLARD, F. H.; MCOMIE, J. F. W., AND ELBEIH, I. I. M. **Analysis of inorganic compounds by paper chromatography. I. Movement of cations with complex-forming solvent mixtures.** *J. Chem. Soc.* **1951,** 466-70.—*C.A.* 45, 5559*c*.

The chromatographic behavior of Ag, Hg^+, Pb, Hg^{2+}, Bi, Cu, Cd, As, Sb, Sn^{2+}, Sn^{4+}, Al, Cr, Fe^{3+}, Zn, Mn, Co, Ni, Ca, Sr, Ba, Mg, K, Na in a number of different solvent mixts., alone and with complex-forming reagents, was studied and the R_f values detd.

5212. POLLARD, F. H.; MCOMIE, J. F. W., AND ELBEIH, I. I. M. **Analysis of inorganic compounds by paper chromatography. II. Analysis of cations and anions.** *J. Chem. Soc.* **1951,** 470-4.—*C.A.* 45, 5559*d*.

The qual. analysis of mixts. of cations by paper chromatography with various combinations of 3 solvent mixts. was outlined for the sepn. of Cd and Zn; Th and U; K, Ti, V, Mo, and Fe were also reported. The R_f values for the movement of anions in butanol-pyridine-ammonia were recorded for chloride, bromide, iodide, chlorate, bromate, iodate, nitrite, nitrate, arsenite, arsenate, carbonate, phosphate, chromate, thiocyanate, and sulfate.

5213. POLLARD, F. H.; MCOMIE, J. F. W., AND STEVENS, H. M. **Analysis of inorganic compounds by paper chromatography. III. A scheme for the qualitative analyses of an unknown mixture of cations. IV. An extended scheme for the qualitative analyses of an unknown mixture of cations.** *J. Chem. Soc.* **1951,** 771-4, 1863-5.—*C.A.* 45, 5559*f*, 10120*e*.

A procedure was described for the qual. analysis of unknown mixts. of the following cations, on a series of paper chromatograms prepd. with butanol-benzoylacetone as the mobile phase: Pb, Ag, Hg, As, Sb, Cr, Mn, Cu, Co, Ni, Bi, Fe, Sn, Sr, Ba, Cd, Zn, Al, Mg, Ca, Na, K. The scheme of analysis included Ce, Li, Mo, Tl, Ti, U, V, and W.

5214. Polson, A.; Van Rooy, P. J., and Marais, E. J. **A photometric method for quantitative paper-partition chromatography of amino acids.** *Onderstepoort J. Vet. Research* **25**, 31-8 (1951).—*C.A.* 46, 3905*g*.

The concn. of the unknown must lie within the limits of the known. Close control of the temp. of the chromatographic tank was important. To insure an even application of the ninhydrin the strip of paper was drawn through a tray of the reagent. Reagent stains were removed by washing the paper in the chromatographic tank overnight in pure BuOH before the ninhydrin treatment.

5215. Porath, J. and Flodin, P. **New method for detecting amino acids, peptides, proteins, and other buffering substances on paper.** *Nature* **168**, 202-3 (1951).—*C.A.* 46, 3460*g*.

A chromatogram of several amino acid spots was sprayed with dil. acid. Hydrolysis of the cellulose occurred only in regions not occupied by the spots. After drying, the paper was treated with orcinol and the spots appeared white against a red-violet background. The method was suitable for detg. amino acids.

5216. Porter, W. L. **Multiple-paper chromatogram.** *Anal. Chem.* **23**, 412-13 (1951).—*C.A.* 45, 4971*e*.

The "chromatopack," devised to separate mg amts. of material, consisted of 100 to 200 strips (2 × 18 in.) of filter paper compressed between 2 stainless steel plates. Each strip was spotted separately with 0.05 ml of soln. and dried. The assembled strips were then placed in a closed cylinder and the solvent was allowed to ascend nearly to the top. Strips removed from the middle and ends of the pack were sprayed to locate the zones and served as guides for cutting and eluting the rest of the strips.

5217. Reeves, Wilson A. and Crumpler, Thomas B. **Paper-partition chromatography of cations.** *Anal. Chem.* **23**, 1576-8 (1951).—*C.A.* 46, 2442*i*.

BuOH contg. 20% of 12 *N* HCl was used as a solvent to resolve the 8-quinolinolates of Al^{3+}, Bi^{3+}, Cd^{2+}, Co^{2+}, Cu^{2+}, Fe^{3+}, Hg^{2+}, Ni^{2+}, and Zn^{2+}. This solvent decompd. the org. complexes and the metals moved as chloro complexes. Spots were visualized by spraying with 8-quinolinol, diphenylcarbazone.

5218. Reid, R. L. and Lederer, M. **Separation and estimation of saturated C_2-C_7 fatty acids by paper-partition chromatography.** *Biochem. J.* **50**, 60-7 (1951).—*C.A.* 46, 1923*a*.

The ascending development was for 20-24 hrs and used BuOH satd. with aq. 1.5 *N* NH_4OH as solvent; the fatty acids were used as their NH_4 salts; after air-drying the paper was sprayed with a soln. of bromocresol purple in EtOH contg. HCHO. The latter promoted the formation of well-defined yellow spots on a purple background.

5219. Rice, Randall G.; Keller, George J., and Kirchner, Justus G. **Separation and identification of 2,4-dinitrophenylhydrazones of aldehydes and ketones, and 3,5-dinitrobenzoates of alcohol by filter-paper chromatography.** *Anal. Chem.* **23**, 194-5 (1951).—*C.A.* 45, 3295*d*.

The filter paper, capillary ascent test tube method for sepg. γ quantities of amino acids was used. $CHCl_3$ was a more suitable solvent and no drying was necessary. For 3,5-dinitrobenzoates, the procedure used a 0.5% soln. of 1-naphthylamine in EtOH as the chromatogenic agent. In many cases the colored spot produced could be intensified by spraying with 10% KOH soln.

5220. Rockland, Louis B.; Blatt, Jeremiah L., and Dunn, Max S. **Small-scale filter-paper chromatography.** *Anal. Chem.* **23**, 1142-6 (1951).—*C.A.* 45, 10001*a*.

Ratings were given for 13 types of filter paper on the basis of characteristics important in chromatography. The R_f values for 18 amino acids with phenol as a solvent were given; they showed some variation (greatest for the acidic and basic amino acids) but in general the resolution sequence was the same for all papers. The effect on R_f of the H_2O content of 8 H_2O-miscible solvents was shown for the papers.

5221. Rose, Irwin A. and Schweigert, B. S. **Use of borate in the paper chromatography of ribosides.** *J. Am. Chem. Soc.* **73**, 5903 (1951).—*C.A.* 46, 11049*c*.

A mixt. of nucleic acid constituents was resolved by chromatography in aq. BuOH and the strip dried. When the paper was rerun in BuOH-borate the ribosides did not migrate and the area occupied by them was freed of contaminants.

5222. Roux, D. G. **Color reagents for the paper chromatography of di- and trihydroxyphenols.** *Nature* **168**, 1041-2 (1951).—*C.A.* 46, 5488*c*.

A new spray reagent was described for the identification of di- and trihydroxyphenols in paper chromatography. The reagent, prepd. by shaking 2.0 g of sucrose with 10 ml HCl and 90 ml abs. alc., was lightly sprayed on the paper chromatogram which was then heated for 40-60 sec. at 85°-95°C to give various colors under both visible and ultra-violet light.

5223. Sakaguchi, Takeichi and Yasuda, Hitoshi. **Inorganic paper chromatography. I. Paper chromatographic analysis of Group V and its mechanism.** *J. Pharm. Soc. Japan* **71**, 1469-74 (1951).—*C.A.* 46, 3452*i*.

Paper-partition chromatography of inorg. cations was carried out with chlorides of K, Na, NH_4^+, Mg, and Li in neutral solns. of PrOH contg. 10% by vol. of MeOH. After evapn. of the solvent the strip was sprayed with 5% $AgNO_3$, exposed to diffused light, and washed with water. A good sepn. of all 5 metals was always obtained.

5224. Sarma, Byomkes. **Inorganic separation by paper chromatography. II. Separation of uranium, thorium, and rare earth by partition chromatography on filter paper.** *Science and Culture* **17**, 139-41 (1951).—*C.A.* 47, 6217*i*.

Difficulties in sepg. U, Th, and the rare earths by one-dimensional chromatography led to an investigation of solvent mixts. that would bring about sepn. of the constituents into distinct zones. Five of the successful mixts., and the R_f values obtained, were discussed.

5225. Schneider, F. and Erlemann, G. A. **Developing reagents for sugars in paper chromatography. The rearrangement of fructose and glucose.** The

problem of glucose. *Zucker-Beihefte* No. 3, 40-1; 41-3 (1951).—*C.A.* 46, 381*d*.

Müller's alk. Cu reagent identified reducing sugars in paper chromatography. The ZnCl$_2$ double salt of *p*-aminodimethylaniline (0.3% alc. soln.) could be used as a general reagent for sugars. Different shades were obtained with aldose and ketose sugars, but a clearer distinction could be made with hypoiodate soln. On heating fructose or glucose solns. at pH 7.5 and 90°C for a long time, 3 outstanding chromatograms were obtained in each case.

5226. SCHÖNFELD, T. AND BRODA, E. **Adsorption of ions on paper and glass surfaces.** *Mikrochemie ver. Mikrochim. Acta* **36/37**, 537-52 (1951).—*C.A.* 45, 5070*c*.

The taking up of cations by surfaces of paper and of glass was studied with the aid of radioactive traces (Pb and Rb). The adsorption appeared to be caused by ion exchange. Carboxyl groups were responsible in the case of paper and silicic acid in the case of glass. Anions (PO$_4^{---}$) were not adsorbed. The adsorption of Pb and Rb by paper was reversible but equil. was not obtained in the adsorption or desorption of Pb on glass. Adsorption on paper and glass has not always been taken into consideration in microchem. work.

5227. SHIBATA, MURAJI AND UEMURA, TAKU. **Inorganic paper chromatography. IV.** *J. Chem. Soc. Japan,* Pure Chem. Sect. 72, 541-4 (1951).—*C.A.* 46, 3458*d*.

Sepn. of Hg^{2+}, Cd^{2+}, Bi^{3+}, and Cu^{2+} was achieved by using BuOH satd. with 3-4 *N* HCl. Acetone contg. HCl in 6-8 vol. % could be recommended for the sepn. of Zn^{2+}, Co^{2+}, Mn^{2+}, and Ni^{2+}. Paper strips on which ZnS was deposited could be successfully applied to the detection of Cu in Al, Cr, Fe, Mn, Cd, Co, Ni, Zn, and alk.-earth and alkali metals.

5228. SHIBATA, MURAJI AND UEMURA, TAKU. **Inorganic chromatography. V.** *J. Chem. Soc. Japan.* Pure Chem. Sect., 72, 757-8 (1951).—*C.A.* 46, 6030*b*.

The sepn. of noble metals, Au, Pt, Pd, and Rh, was studied by means of the paper chromatography. MeOH, EtOH, PrOH, BuOH, AmOH, ether, acetone, or methyl ethyl ketone mixed with HCl were used as solvents. Ether, mixts. of BuOH or AmOH, and HCl showed the best results for the sepn. Au was at the top with solvent, followed by Pt, Pd, and then Rh.

5229. SHIBATANI, ATUHIRO AND FUKUDA, MICHIO. **Importance of controlling the water content of solvents for paper chromatography.** *J. Biochem. (Japan)* 38, 181-98 (1951).—*C.A.* 45, 8933*e*.

The influences of the developing solvents upon R_f values of 23 amino acids was studied with solvents varying in water contents. On a filter paper 10-30 γ of amino acid were placed, developed by ascending chromatography, dried at room temp., colored by ninhydrin, and the R_f values measured. With increased water, the R_f was generally increased. Solvents in a homologous series gave similar patterns of R_f values which were decreased with increase of mol. wt as well as b.p.: e.g. pyridine > picoline > lutidine.

5230. SHIBATANI, ATUHIRO AND FUKUDA, MICHIO. **The effect of water content in the solvent for paper chromatography.** *Science (Japan)* 21, 468 (1951).—*C.A.* 46, 54*h*.

The relation between the R_f values and the H$_2$O content of the solvent was discussed for several org. substances.

5231. SINGER, ARNOLD J. AND KENNER, LEONARD. **Versatile paper partition chromatographic apparatus.** *Anal. Chem.* 23, 387-8 (1951).—*C.A.* 45, 4100*h*.

Details were given for the construction of an app. for ascending strip chromatography which contained sufficient vapor space to minimize effects of temp. fluctuations and which provided rigid support at both ends for 50 strips.

5232. SINGH, M. M. AND GUPTA, J. **Inorganic partition chromatography by complexing elution.** *J. Sci. Ind. Research* (India) **10B**, 289-90 (1951).—*C.A.* 46, 5477*d*.

Bi was sepd. from Cu and Pb by chromatography on filter paper, with acetone, contg. 5% v./v. HNO$_3$, as eluant and diallyldithiocarbamidohydrazine as complexing reagent. The order of sepn was Pb→Cu→Bi. The orange-yellow Bi complex sepd. almost at the solvent front. Pb and Cu were developed by spraying solns. of KI and rubeanic acid, resp.

5233. SMELLIE, R. M. S. AND DAVIDSON, J. N. **The separation of nucleosides by ionophoresis.** *Proc. Biochem. Soc.* 49, XV (1951).

Paper as the transport media was proved more satisfactory than agar gel. The nucleosides sepd. in the order uridylic acid, guanylic acid, adenylic acid and cytidylic acid in decreasing order of mobility, and their positions after sepn. could easily be located in ultraviolet light.

5234. SOBUE, HIROSHI AND HATANO, AKIRA. **Chromatographic studies. I. Chromatographic determination of saccharides in pulp.** *J. Chem. Soc. Japan,* Ind. Chem. Sect. 54, 460-2 (1951).—*C.A.* 47, 6133*f*.

Various sugars obtained on hydrolysis of pulp were sepd. by means of partition paper chromatography, and the R_f value of each sugar was detd. The detectable amts. of aldohexose and aldopentose were about 10 γ.

5235. STARK, J. B.; GOODBAN, A. E., AND OWENS, H. S. **Paper chromatography of organic acids.** *Anal. Chem.* 23, 413-15 (1951).—*C.A.* 45, 5072*h*.

Solvents were found for the ascending chromatographic sepn. of citric, glycolic, lactic, malic, oxalic, pyrrolidone-carboxylic, succinic, aconitic, adipic, fumaric, glutaric, levulinic, maleic, malonic, methylenebis-*N*-pyrrolidone-carboxylic, syringic, tricarballyic, and trihydroxyglutaric acids. The occurrence of the first 7 in *sugar-beet processing liquor* was confirmed.

5236. STEEL, ALAN E. **Identification of sulfonamides on paper chromatograms.** *Nature* **168**, 877 (1951).—*C.A.* 47, 7951*f*.

BuOH-AcOH solvent was found the most satisfactory of many solvents tested (BuOH, AcOH, and water 50-15-35 by vol.). Nitrous acid soln. was sprayed on the dried paper, followed after 1 min.

by a 1% soln. of dimethyl-α-naphthylamine. The sulfonamides showed as red or pink spots of the azo color; one γ was easily detected.

5237. Strain, Harold H. and Sullivan, James C. **Analysis by electromigration plus chromotography.** *Anal. Chem.* **23**, 816-23 (1951).—*C.A.* **45**, 8391*e*.

A cell, which combined electromigration and paper chromatography, could be used for a discontinuous sepn. of ions or for the continuous collection of effluent fractions. One to several sheets of paper (up to 60 cm^2) were compressed between glass plates having 2 Pt wire electrodes in grooves along opposite sides. The top edge was fitted with a wick for addn. of solvent. The bottom edge was provided with a series of wicks for collecting effluent.

5238. Suzuki, Sakaru. **Paper chromatographic resolution of basic amino acids.** *Igaku to Seibutsugaku* (*Med. and Biol.*) **20**, 64-5 (1951).—*C.A.* **45**, 10290*i*.

A soln. of a basic amino acid was spotted on the paper as in the usual way, and 1 cm beneath it a soln. of 10% cholestenonesulfonic acid in EtOH was spotted in a line of suitable length in the rectangular direction of the development. After drying, the paper was developed in the usual ascending method; a mixt. of BuOH and EtOH (or MeOH or Me_2CO might have been used) contg. 35% H_2O was used as the solvent. The color was developed with ninhydrin, and 2 spots were found to be sepd. on the paper. No further resolution of these spots was obtained in the 2-dimensional chromatography.

5239. Svendsen, Anders Baerheim. **Paper chromatography in phytochemical analyses. II. Occurrence of chlorogenic and caffeic acids in the Umbelliferae.** *Pharm. Acta Helv.* **26**, 253-8 · (1951).—*C.A.* **46**, 1220*a*.

The tests and procedures for extg. the plant and chromatographing the exts. were described.

5240. Taira, Tomotsune; Yamatodani, Saburo, and Fujii, Shigehiro. **Paper chromatography with salt solution and its application.** *J. Agr. Chem. Soc. Japan* **25**, 121-3 (1951-52).—*C.A.* **47**, 6302*e*.

Amino acids, pigments, and vitamins were chromatographed on filter paper with 3% NaCl soln. as the developing agent. R_f values of most amino acids were about 0.9, and it was difficult to identify an individual amino acid by this method.

5241. Takeda, Sumi and Shibatani, Atuhiro. **The significance of water content in the solvent for paper chromatography.** *Science* (Japan) **21**, 92 (1951).—*C.A.* **46**, 54*f*.

The R_f values of amino acids often fluctuate when rutidine or collidine was used as the developing solvent. This was due to the difficulty with which these solvents were obtained in a pure state. A mixt. of rutidine-collidine contg. 35 vol. % of H_2O was shown to give satisfactory results. A mixt. of BuOH-AcOH-H_2O giving good results contained also 35% of H_2O.

5242. Takeda, Sumi and Shibatani, Atuhiro. **An attempt to apply paper chromatography to quantitative reaction.** *Science* (*Japan*) **21**, 136-7 (1951).—*C.A.* **46**, 54*g*.

Solns. of pure amino acids of varying concns. were chromatographed in 1 or 2 dimensions, with PhOH (contg. 0.1% NH_3 and 5% H_2O), and rutidine-collidine (contg. 35% H_2O), and detected with ninhydrin. The sample contg. various amino acids was chromatographed in the same manner.

5243. Tennent, David M.; Whitla, John B, and Florey, Klaus. **Two techniques in paper chromatography [application to ketosteroids].** *Anal. Chem.* **23**, 1748-9 (1951).—*C.A.* **46**, 2952*i*.

The different zones of constituents that absorbed either visible or ultraviolet light was detd. by means of an adapter for paper chromatograms to be used in the Beckman spectrophotometer, model DU. Another procedure for ascending chromatography utilized long lengths of glass tubing as supports for the paper chromatograms.

5244. Thompson, Adrienne R. **Separation of saturated monohydroxamic acids by partition chromatography on paper.** *Australian J. Sci. Research* **B4**, 180-6 (1951).—*C.A.* **46**, 427*f*.

Simple satd. hydroxamic acids with 1-9 C atoms were sepd. by paper chromatography by an ascending technique. The ranges of useful sepn. with various mobile phases were: BuOH or AmOH, 1-5 C atoms; octanol, 2-6; C_6H_6-HOAc, 3-9; benzene-HCO_2H, 4-9 and sometimes 10; C_6H_6-octanol-HCO_2H, 2-7. Acids were added to the solvents to suppress ionization of the hydroxamic acids and prevent "tailing." Efficient humidification of the system was essential when C_6H_6 was used.

5245. Toennies, Gerrit and Kolb, Joseph J. **Techniques and reagents for paper chromatography.** *Anal. Chem.* **23**, 823-6, 1095 (1951).—*C.A.* **45**, 8392*i*.

Emphasis was put on the importance of conditioning, i.e., allowing the attainment of equil. between the paper and the atm. within the vessel before beginning a run. HCOOH (50 or 100%) as a solvent for amino acids gave compact spots initially and after running. SS589 Green Ribbon was satisfactory. Color-developing reagents were applied by dipping (e.g. 0.25%, ninhydrin in anhyd. Me_2CO) with the consequent advantage of more intense and stable color. Sulfhydryl groups were detected by dipping in ammoniacal methanolic $Na_2(NO)Fe(CN)_5$.

5246. Udenfriend, Sidney and Velick, Sidney F. **The isotope derivative method of protein amino end-group analysis.** *J. Biol. Chem.* **190**, 733-40 (1951).—*C.A.* **45**, 8066*f*.

With the aid of S^{35}-labeled indicator derivs. and paper chromatography the derivs. of the terminal amino acids could be identified and detd.

5247. Ukai, Teiji and Ohashi, Tsutomu. **Paper chromatography of the salts of organic bases. II.** *Pharm. Soc. Japan* **71**, 1393-3 (1951).—*C.A.* **46**, 3896*h*.

Paper chromatograms of HI salts of org. bases obtained by developing with BuOH with those of the quarternary ammonium iodides. On the latter either a spot of iodine could be observed which coincided with the spot of the base colored by Dragendorff's reagent, or 2 spots of iodine, one of which coincided with that of the base while the spot of iodine of the former did not coincide at all.

5248. Wachtmeister, Carl Axel. **Paper chromatography on borate-impregnated paper.** *Acta Chem. Scand.* 5, 976-8 (1951) (in English).—*C.A.* 46, 8565*a*.

Parallel chromatograms were run with borate-impregnated paper and phosphate-treated paper. When phenols and phenolic aldehydes contained 2 adjacent OH groups R_f values on the former were far lower than the corresponding values on the latter. However, compds. with nonvicinal OH groups (or *o*-hydroxy aldehydes) moved, resp., at approx. the same rates on both.

5249. Walker, W. R. and Lederer, M. **Paper chromatography of inorganic cations. III.** *Anal. Chim. Acta* 5, 191-4 (1951) (in English).—*C.A.* 46, 4319*f*.

Mixts. of aliphatic alcs., contg. HCl were examd. as solvents in the paper chromatography of cations. A mixt. of 2 solvents gave lower R_F values than the mean of the 2 components. However, a mixt. of Et and isopropyl alcs. gave lower R_F values than did either component.

5250. Weil, H. and Williams, Trevor I. **Autoradiochromatography.** *Angew. Chem.* 63, 457-60 (1951).—*C.A.* 46, 804*d*.

The use of radioactive tracers in conjunction with paper chromatography permitted photographic recording. The technique and some results were described.

5251. Weiting, G. C. **Paper chromatography of flax fiber polyuronide hemicellulose.** *Nature* 168, 833-4 (1951).—*C.A.* 46, 3284*d*.

Purified flax fiber was freed of pectic substances by $(NH_4)_2C_2O_4$ extn. and the resulting polyuronide hemicellulose was dissolved in 4% NaOH and pptd. with EtCH. A H_2SO_4 hydrolyzate contained galactose, glucose, arabinose, mannose, xylose, rhamnose, an unknown uronic acid, and traces of 2 other sugar-like compds.

5252. Weller, G. Lewis Jr. **Vector-like patterns in chromatography with parallel rows of adsorbent on filter paper.** *Chromatography Bull.* 1, No. 4, 13-16 (1951).—*C.A.* 46, 373*b*.

Rows of adsorbent (talc, sulfur, and alumina), 2-3 mm wide, were spread on a strip of filter paper 2 × 15 cm, 2-3 cm apart, and parallel to the strip length. This was supported between two strips of glass. A crystal of Giemsa stain was placed at one end of the strip and developed with a 1:1 mixt. of xylene and MeOH. A definite pattern was formed for each color component in the stain.

5253. Westman, A. E. R. and Scott, A. E. **Chromatographic evidence for the tetraphosphate ion.** *Nature* 168, 740 (1951).—*C.A.* 46, 3365*f*.

The alk. hydrolyzate of Na tetrametaphosphate was chromatographed with other pure phosphate anions. A strong spot, which by colorimetric analysis accounted for 60% of the hydrolyzate, appeared in a position where the tetraphosphate might logically be expected. A sepn. of orthophosphate, pyrophosphate, and triphosphate anions was obtained.

5254. Wieland, Th. and Wirth, Liselotte. **Retention analysis. IV. Determination of amino acids with improved retention technique.** *Angew. Chem.* 63, 171-2 (1951).—*C.A.* 45, 6126*g*.

The accuracy of the retentiometric detn. could be improved by using stripwise deposition of the test substance, prior to the paper-chromatography and ionophoresis.

5255. Wieland, Theodor and Feld, Ursula. **Retention analysis. V. Paper chromatography and ionophoresis of hydroxycarboxylic acids and their determination.** *Angew. Chem.* 63, 258-9 (1951).—*C.A.* 45, 7909*c*.

Hydroxyacids forming complexes with Cu^{++} could be detd. by the Cu acetate-tetrahydrofuran method. Data were given for tartaric, citric, malic, and citramalic acids.

5256. Winteringham, F. P. W.; Harrison, A., and Bridges, R. G. **Radioactive tracer-paper chromatography techniques.** *Analyst* 77, 19-28 (1951).—*C.A.* 46, 2443*b*.

The uses and potentialities of combined radiochem. and paper chromatography techniques were discussed. One or more radioactive isotopes were assocd. with 1 or more substances on a paper chromatogram. Labelled substances could then be located and estd.

5257. Wollish, E. G.; Schmall, Morton, and Shafer, E. G. E. **Determination of small quantities of niacin in presence of niacinamide. Separation by paper partition chromatography.** *Anal. Chem.* 23, 768-71 (1951).—*C.A.* 45, 8409*b*.

Niacin was sepd. from niacinamide by paper partition chromatography, by means of EtOAc satd. with H_2O as the carrier.

5258. Zahn, H. **Paper chromatography of dyes.** *Textil-Praxis* 6, 127-30 (1951).—*C.A.* 45, 8251c; 47, 4085*g*.

The sepn. of mixts. of dyes by paper chromatography was described. For the sepn. of wool dyes, 80% isobutyric acid, 80% glycol, 80% EtOH, and an isobutanol-glycol-HOAc-H_2O mixt. were found to be suitable. Mixts. of Cellitone dyes were sepd. with 60% glycol. Developed chromatograms were shown, and R_f values were tabulated.

5259. Zahn, H. and Wolf H. **Analysis of polyamides and polyurethan by papyrography [paper chromatography].** *Melliand Textilber.* 32, 317-21 (1951).—*C.A.* 45, 6847*i*.

The analysis for polyamides, such as Perlon L, Nylon 66 and Nylon 610, or polyurethan (Perlon U) could be carried out by chromatographic sepn. of the amino and dicarboxylic acid components in the HCl hydrolyzate of the fibers. For the ϵ-aminocaproic acid and hexamethylenediamine a mixt. of 75 parts *sec*-BuOH, 15 parts HCOOH (88%), and 10 parts H_2O was suitable. ϵ-aminocaproic acid migrated 4 times as far as hexamethylenediamine.

5260. Zimmermann, G. and Nehring, K. **Ring paper chromatography by the drop method. I.** *Angew. Chem.* 63, 556 (1951).—*C.A.* 46, 2952*i*.

The prepn. of circular chromatograms on filter paper was described.

5261. AIRAN, A. W. **Application of circular chromatography to inorganic analysis.** *Science & Culture* (India) **18**, 89-90 (1952).—*C.A.* 47, 2625*g*.

Butanol-acetic acid-water was used to irrigate the chromatogram; and after developing, the paper was sprayed with 0.1% rubeanic acid in 75% alc. Cu, Co, and Ni were sepd. from a soln. of mixed chlorides (up to 0.03% of each).

5262. AMES, BRUCE N. AND MITCHELL, H. K. **Paper chromatography of imidazoles.** *J. Am. Chem. Soc.* 74, 252 (1952).—*C.A.* 47, 1546*d*.

Air-dried chromatograms were sprayed lightly with diazosulfanilic acid reagent, and the color was developed with a light spray of 5% Na_2CO_3. R_f values were given for 3:1 PrOH-0.2 *N* NH_3 and 3:1 PrOH-*N* AcOH.

5263. ANDERSON, J. R. A. AND LEDERER, M. **Quantitative analysis by electrochromatography on paper. I. Separation and gravimetric determination of copper.** *Anal. Chim. Acta* 6, 472-5 (1952)(in English).—*C.A*, 46, 7926*h*.

Up to 20 mg of Cu could be quantitatively sepd. from small quantities of Au, Pt, and Pd by ionophoresis on strips of paper pulp 6 mm thick by 25 mm wide by 250 mm long.

5264. ANT-WUORINEN, OLLI AND VISAPÄÄ, ASKO. **The effect of the cation-exchange capacity of glass material on the carboxyl-group titration values of cellulose.** *Valtion Tek. Tutkimuslaitos Rept.* **107**, 5-9 (1952) (in English).—*C.A.* 47, 3557*h*.

The surface of the glass funnel in which exchange occurred between the carboxyl H and Na^+ could also exchange with Na^+ and release H^+. Blanks should be run without cellulose to det. the total exchange capacity of the glass. The specific exchange capacity of Pyrex and Jena Geräte was equiv. to 0.035 ml of 0.001 *N* NaOH/cm².

5265. BAUDET, JEANNINE. **Paper chromatography of copper complexes of picolines and lutidines.** *Compt. rend.* **234**, 2454-6 (1952).—*C.A.* 46, 9473*f*.

Filter paper after immersion in a mixt. of 5 g of $CuCl_2$, 20 cc. of glycerol, and 100 cc. of H_2O was pressed free of liquid and dried in air. Mixts. were chromatographed with Et_2O in an atm. satd. with Et_2O and the components identified by color as follows: Picolines: α, green; β, orange; γ, blue. Lutidines: 2-6, mauve; 2-3, yellowish; 2-4, very pale blue which became violet in air; 2-5, pale blue.

5266. BERLINGOZZI, S. AND SERCHI, G. **Distribution chromatography on the disk. Some modification of the method.** *Sperimentale, Sez. chim. biol.* 3, 1-5 (1952).—*C.A.* 46, 10039*f*.

A filter-paper disk was placed over a Petri dish, touching the center of the tip of a cone of filter paper, with the open side resting in a smaller dish in the center of the Petri dish contg. the soln. to be chromatographed. The whole was covered with a watch glass with a perforated center, through which a pipet passed that ended above the point of contact of both filter papers. It served to drop solvent on the paper.

5267. BERNSTEIN, S. AND MCGILVERY, R. W. **The enzymatic conjugation of *m*-aminophenol.** *J. Biol. Chem.* **198**, 195-203 (1952).—*C.A.* 47, 650*a*.

Products of the enzymatic conjugation of *m*-aminophenol were sepd. and identified by a combination of ion exchange and paper chromatography. Using the analytical grade of a weakly basic anion exchange resin, conditions were developed for the sepn. of known samples of *m*-aminophenylsulfuric acid from samples of the glucuronide and the free phenol. The column, after washing with hydrochloric acid followed by distd. water, ammonium hydroxide, and distd. water again, was regenerated with sodium hydroxide.

5268. BERSIN, TH. AND MÜLLER, A. **Circular paper chromatography of sugars.** *Helv. Chim. Acta* **35**, 475-8 (1952) (in German).—*C.A.* 46, 6549*h*.

Place 3 drops of the sugar soln. in the center of a circular Whatman 1 paper and chromatograph in a BuOH-AcOH-H_2O (4:1:5) mixt. at room temp. Air and solvent-satd. atm. gave identical results. The R_f values parallel the R_f values in one-dimensional chromatograms. By using selective developers and different sections of the paper, compds. with the same or very similar R_f values could be identified.

5269. BEVENUE, ARTHUR AND WILLIAMS, KENNETH T. **Color reaction of certain aldehydes with orcinol.** *Chemist Analyst* **41**, 5-7 (1952).—*C.A.* 46, 9018*f*.

By dissolving 0.5 g of orcinol and 15 g of CCl_3COOH in 100 ml of water-satd. 1-butanol, a reagent was obtained which gave characteristic colors with vanillin and at least 13 other common aldehydes on paper chromatograms.

5270. BONNIN, ANDRÉ AND SÜE, PIERRE. **Separation of phosphates, phosphites, and hypophosphites by paper chromatography.** *Compt. rend.* **234**, 960-1 (1952).—*C.A.* 46, 6038*c*.

A paper chromatogram prepd. with a solvent contg. equal vols. of BuOH, dioxane, and *N* NH_3 gave bands of phosphate, phosphite, and hypophosphite (in order of increasing distance from the soln.-paper boundary) which could be identified by molybdate-H_2S method.

5271. BOSE, R. K. AND BURMA, D. P. **Paper chromatography in the study of sugar constituents of jute hemicellulose.** *Science and Culture* (India) **18**, 39-40 (1952).—*C.A.* 47, 3557*c*.

A pyridine ext. of polyuronide hemicellulose was used for chromatography. One-way descending chromatography was carried out with phenol-H_2O, BuOH-AcOH-H_2O, and $PhCH_2OH$-AcOH-H_2O. Aniline hydrogen phthalate and benzidine were used as spraying agents.

5272. BUCH, M. L.; MONTGOMERY, REX, AND PORTER, W. L. **Identification of organic acids on paper chromatograms.** *Anal. Chem.* **24**, 489-91 (1952).—*C.A.* 46, 6039*f*.

The identification of acids of similar mobilities was assisted by the use of $AgNO_3$-NH_4OH, Ac_2O-pyridine, $(NH_4)VO_3$, and ceric ammonium nitrate as spray materials to produce color reactions that permitted the differentiation of certain groups of these acids. This procedure, in conjunction with the R value, aided in the identification of individual org. acids.

5273. Burma, D. P. **Chromatographic separation of a mixture of the hydroxides of lithium, sodium, and potassium.** *Analyst* 77, 382-3 (1952).—*C.A.* 46, 9469*g*.

From a column filled with ashless filter paper powder, different portions of the eluate were tested with phenol red or bromothymol blue. The top band in the column contained LiOH, the middle one KOH, and the lowest NaOH. With paper chromatography continuous development was used by the descending method with EtOH contg. 15% water. For indication, the dried paper was sprayed with phenolphthalein, phenol red, or bromothymol blue. After 24-hr.development, the alkali hydroxides were barely sepd. LiOH moved a little, KOH a little more, and NaOH the most.

5274. Campani, M.; Arezio, G., and Cameroni, R. **Chromatographic identification of acetylglucosamine.** *Atti soc. lombarda sci. med. e biol.* 7, 113-15 (1952).—*C.A.* 47, 5310*h*.

A 0.5 *N* Na_2CO_3 soln. was used as a solvent for paper chromatography with Whatman paper No. 1 or 4. The paper was dried at 105 to 110°C and the acetylglucosamine was identified by the violet color developed by spraying with *p*-dimethylaminobenzaldehyde.

5275. Cassidy, Harold G. **Investigation of paper chromatography.** *Anal. Chem.* 24, 1415-21 (1952).—*C.A.* 47, 4689*c*.

Important properties of the paper were porosity, chem. nature, impurities, and uniformity of these three. Properties of the fluid were type of flow, inertia, and chem. structure in terms of d., viscosity, and surface tension.

5276. Consden, R. and Stanier, Winifred M. **Ionophoresis of sugars on paper and some applications to the analysis of protein polysaccharide complexes.** *Nature* 169, 783-5 (1952).—*C.A.* 47, 664*h*.

In buffers contg. borate, sugars moved toward the anode when a voltage was applied. This ionophoresis was carried out on Whatman No. 1 paper satd. with buffer laid in a dish. The ends of the paper extended over the edge of the dish into troughs contg. buffer soln. and the electrodes. The sugars were placed on the paper 12 cm from the cathode, the dish was filled with chlorobenzene to cover the paper, and a potential of about 310 v. was applied for about 2 hrs.

5277. Consden, R. and Stanier, Winifred M. **Paper electrophoresis apparatus.** *Nature* 170, 1069-70 (1952).—*C.A.* 47, 3626*h*.

Basically, the app. was composed of 2 end trays each contg. 1 electrode plus electrolyte and a center tray bearing an org. liquid and glass-rod frame. The paper extended from the 1st to the 3rd tray, and subsequent chromatography after sepn. was possible by adjustments.

5278. Dalgliesh, C. E. **Optical resolution of aromatic amino acids on paper chromatograms.** *J. Chem. Soc.* 1952, 3940-2.—*C.A.* 47, 2013*b*.

Chromatograms run with an org. phase of BuOH-AcOH-H_2O on Whatman No. 4 paper permitted the resolution of 2,3-$(HO)_2C_6H_3CH_2CH(NH_2)CO_2H$ [not of the 3,4-isomer or its 5-Me deriv.], the 2,5-dihydroxy isomer and 2,3,4-Me$(HO)_2C_6H_2CH_2CH(NH_2)$-CO_2H; the ratio of the R_F value of the 2 optical isomers were about 0.9, which suggested that a common mechanism was operative in all cases.

5279. Das, D. B.; Choudhury, P. K. Roy, and Wareham, J. F. **The constitution of jute [as determined] by paper chromatography.** *Science and Culture* (India) 18, 197 (1952).—*C.A.* 47, 2980*b*.

Jute chlorite holocellulose was hydrolyzed with 90-95% HCOOH, the hydrolyzate (free of HCOOH) spotted on Whatman No. 1 filter paper and the following sugars were found: glucuronic acid, xylose, arabinose, and rhamnose. The developing systems used were phenol-H_2O, and *n*-BuOH-H_2O; the spray reagent was aniline oxalate.

5280. Das, D. B.; Mitra, M. K., and Wareham, J. F. **Association of xylan with α-cellulose in jute by partition chromatography.** *Science and Culture* 18, 249-50 (1952).—*C.A.* 47, 2980*d*.

α-Cellulose of jute prepd. by the chlorite method was shown by the formic acid method invariably to contain considerable amts. of xylan. The unknown sugar traveled much faster than xylose in moist phenol and BuOH and developed a brown color when sprayed with aniline oxalate.

5281. Diller, H. and Rex, O. **Chromatographic detection of thallium on paper in toxicological analysis.** *Z. anal. Chem.* 137, 241-4 (1952).—*C.A.* 47, 1537*h*.

KI was an excellent reagent for detecting Tl. As little as 0.03 γ could be detected at a diln. of 1:330,000 by the formation of yellow TlI. Thionalide, thioglycolic 2-aminonaphthalide, also gave an insol. yellow complex compd. which would serve to detect 0.5 γ of Tl.

5282. Durant, J. A. **A one-dimensional paper chromatographic technique for the separation of phenols, phenolic acids, and their derivatives.** *Nature* 169, 1062-3 (1952).—*C.A.* 46, 9473*d*.

Phenols, phenolic acids, and their derivs. have been sepd. by paper chromatography with Whatman No. 4 filter paper buffered at pH 8.0, BuOH satd. with aq. satd. $NaHCO_3$ as the solvent, and Millon's reagent as the developer.

5283. Ebel, Jean Pierre. **Application of paper chromatography to the study of some meta- and polyphosphates of disputed existence and constitution.** *Compt. rend.* 234, 621-3 (1952).—*C.A.* 46, 5486*g*.

Of the various metaphosphates previously reported, only the tri- and tetrametaphosphate ions could be characterized by paper chromatography; if mono- and di-metaphosphate ions existed in soln., they were too unstable to be isolated by this method.

5284. Ebel, Jean P. **Chromatographic and potentiometric study of the acid derived from Graham's salt.** *Compt. rend.* 234, 732-3 (1952).—*C.A.* 46, 4884*c*.

A freshly prepd. soln. of Graham's salt, the acid obtained by passage through Amberlite IR-100 H, the same acid, 24 hrs later, and the acid prepd. by treating the Pb salt with H_2S were examined by paper chromatography.

5285. EDWARD, J. T. AND WALDRON, DEIRDRE M. **Detection of deoxy sugars, glycals, and methyl pentoses in paper partition chromatography.** *J. Chem. Soc.* **1952**, 3631-4.—*C.A.* 47, 1009*h*.
Methylpentoses, deoxy sugars, and glycals on paper, sprayed lightly with aq. $NaIO_4$ and, after 10 min. with 1 vol. Na nitroprusside, 3 vols. H_2O, and 20 vols. EtOH satd. with piperazine gave blue zones in 5-10 min. (piperidine and Et_2NH could be used in place of piperazine). Deoxy sugars and glycals could be distinguished from methyl pentoses by the deep yellow zone which they gave when the chromatogram was sprayed with an acidic soln. of p-$O_2NC_6H_4NH_2$ after $NaIO_4$ oxidation.

5286. FREEMAN, J. H. **Separation and identification of polymethylol phenols by paper chromatography.** *Anal. Chem.* **24**, 955-9 (1952).—*C.A.* 46, 9017*h*.
Descending chromatography with BuOH and concd. NH_4OH (4:1 by vol.) sepd. the products formed in the initial reaction of PhOH and HCHO. The indicator reagent was 1% *p*-nitrobenzene-diazonium fluoroborate in Me_2CO.

5287. FREEMAN, J. H. **Determination of methylolphenols by paper chromatography.** *Anal. Chem.* **24**, 2001-2 (1952).—*C.A.* 47, 3187*a*.
Mono- and polymethylolphenols were detd. quantitatively by cutting out the spots on a paper chromatogram and weighing them. A straight line curve was obtained by plotting spot wt *vs.* the log of concn. To avoid errors due to variations in temp., time, distance traveled, and paper compn., the curve must be established for each chromatogram.

5288. FUJITA, HIROSHI. **The distribution of liquid ascending in a filter paper.** *J. Phys. Chem.* **56**, 625-9 (1952).—*C.A.* 46, 8461*a*.
Exptl. data indicated that the distribution of liquid ascending or descending in a filter paper was not always uniform. An equation was developed for the amt. of liquid contained in a unit area of filter paper in terms of the satn. values of the amts. of liquids contained as capillary flow and as surface flow per unit area of filter paper.

5289. GIRI, K. V.; KRISHNAMURTHY, K., AND VENKATASUBRAMANIAN, T. A. **Determination of amino acids separated by circular paper chromatography.** *Current Sci.* (India) **21**, 44-5 (1952).—*C.A.* 46, 10051*d*.
A simple quant. paper chromatographic procedure for detg. amino acids was described. It consisted in extg. the color of nindhydrin stained spots with 75% alc. and photometrically comparing the color of the exts. with those obtained from known amino acids chromatographed at the same time.

5290. GIRI, K. V. AND RAO, N. A. N. **Circular paper chromatography. I. A technique for the separation and identification of amino acids.** *J. Indian Inst. Sci.* **34**, 95-105 (1952); *Nature* **169**, 923-4 (1952).—*C.A.* 46, 9019*f*, 11290*b*.

5291. GORBACH, G. **A capillary colorimeter which is particularly suited for quantitative paper chromatography.** *Mikrochemi ver. Mikrochim. Acta* **39**, 204-8 (1952).—*C.A.* 46, 6438*g*.
After causing traces of material to be deposited on paper, the desired substance could be obtained by elution and a suitable colorimetric test applied. Expts. in detg. 0.2 mg of valine, alanine, leucine, phenylalanine, tyrosine, tryptophan, lycine, asparaginic acid, etc., alone and in mixts. with one another, showed that the percentage error may be 5%.

5292. HARASAWA, SHIRO. **Inorganic paper chromatography. XIII. Detection and separation of titanium, zirconium, iron, and chromium and the application to the systematic analysis.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 73, 59-63 (1952).—*C.A.* 46, 8570*d*.
Developers composed of a mixt. of BuOH and Me_2CO as the main component and HCl as an active component were excellent for Ti. For example, to 100 parts of BuOH-Me_2CO mixt. (1:1), 60 parts of HCl was added. Fe salts advanced near to the front line and Ti moved almost half way from the original line. Cr followed Ti and Zr moved scarcely from the original line.

5293. HARASAWA, SHIRO. **Inorganic paper chromatography. XIV. Separation and detection of calcium, strontium, and barium.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 73, 207-10 (1952).—*C.A.* 46, 11012*f*.
For the sepn. of Sr and Ba 20-30% NH_4CNS soln. was found most suitable and alcs. such as MeOH or EtOH were most useful as the main component of the developer. The bands of Sr and Ba were fixed by spraying solns. of sodium rhodizonate and dil. AcOH. The color of the former band was reddish orange and that of the latter was violet-pink.

5294. HARASAWA, SHIRO. **Inorganic paper chromatography. XV. Separation of alkaline earth metals and the application to systematic analysis.** *J. Chem. Soc. Japan, Pure Chem. Sect.* 73, 210-14 (1952).—*C.A.* 46, 11012*g*.
Ca, Sr. and Ba were sepd. by the developer contg. NH_4CNS and alcs. by the descending method with good results. The compns. of the suitable developer were EtOH 100 + 30% NH_4SCN soln. 10, BuOH 100 + 30% NH_4SCN 25, and BuOH 100 + pyridine 10 + 30% NH_4SCN 30 parts.

5295. HARASAWA, SHIRO AND SAKAMOTO, TAKASHI. **Inorganic paper chromatography. XVI. Behavior of mercury and iron in oxidized and reduced forms.** *J. Chem. Soc. Japan, Pure Chem. Sect.* 73, 240-3 (1952).—*C.A.* 46, 11012*h*.
Hg^{+}-Hg^{2+} and Fe^{2+}-Fe^{3+} could be sepd. by paper chromatography. Although expts. were carried out in an atm. of coal gas from which CO_2 and O_2 were removed, partial oxidation or reduction during the analysis occurred. For Hg the mixt. of EtOH and EtOEt (1:1) contg. HCl and for Fe, BuOH or a mixt. of BuOH and AcOEt (1:1) contg. HCl were found suitable.

5296. HARASAWA, SHIRO AND SAKAMOTO, TAKASHI. **Inorganic paper chromatography. XVII. Chromatographic behavior of copper salts in oxidized and reduced states.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 73, 300-3 (1952).—*C.A.* 47, 2621*a*.
CuCl and $CuCl_2$ could be sepd. by the following developers: acetone-HCl, acetone-AcOH, MeOH, EtOH, BuOH, BuOH satd. with NH_4CNS with or without addn. of HCl. Cuprous and cupric salts were fixed by solns. $K_3Fe(CN)_6$ and $K_4Fe(CN)_6$, resp.

5297. Harasawa, Shiro and Sakamoto, Takashi. **Inorganic paper chromatography. XVIII. Separation of arsenic in oxidized and reduced forms. XIX. Separation of potassium, sodium, magnesium, and lithium.** *J. Chem. Soc. Japan, Pure Chem. Sect.* 73, 611-14, 614-18 (1952).—*C.A.* 47, 3752*e*.

Sepn. of H_3AsO_3 and H_3AsO_4 was possible by MeOH or AcOH. Developers consisting of Me_2CO, or MeOH with AcOH or HCl, or $Me_2CO.H_3PO_4$, Me_2CO-EtOAc-H_3PO_4 gave good results. The position of the Na band on filter paper was recognized by gently heating it on the elec. heater (carbonization method). Developers contg. mixts. of BuOH, EtOH, MeOH, and 10% of AcOH caused good sepn. of these metals.

5298. Hashimoto, Yohei and Mori, Itsuhiko. **High-frequency papyrography, an apparatus for detecting substances on a filter paper by means of high-frequency oscillators.** *J. Pharm. Soc. Japan* 72, 1532 (1952).—*C.A.* 47, 1434*e*.

The finished paper obtained by chromatography or electrophoresis was passed through the guide of a high-frequency oscillator, consisting of 2 metal plates held closely, and the variations in grid current produced by the sample substances on the filter paper were plotted, or recorded by an automatic recorder. In this way R_f values were calcd. readily for semiquant. purposes.

5299. Hashimoto, Yohei and Mori, Itsuhiko. **Ultraviolet papyrography: an automatic analytical apparatus using filter paper without a color reagent.** *Nature* 170, 1024-5 (1952).—*C.A.* 47, 3049*d*.

The app. used light in 4 methods: (1) densitometry of finished filter papers prepd. by paper chromatography or electromigration; (2) automatic paper chromatography; (3) automatic paper electromigration; (4) automatic paper electrochromatography.

5300. Horner, Leopold; Emrich, Walter, and Kirschner, Adolf. **Experimental contribution to the mechanism of paper chromatography.** *Z. Elektrochem.* 56, 987-95 (1952).—*C.A.* 47, 5837*i*.

The interaction of cellulose with solvents was examd. by detg. refractometrically the compn. of the solvent after percolation through a paper strip. Water was preferentially taken up from 9.3%, 80.7%, and 90% aq. BuOH, 75.8% aq. PhOH, 15-60% aq. α-picoline, and 25-80% aq. iso-PrOH. From 8.1% aq. PhOH, PhOH was preferentially taken up. Oven-dried papers imbibed more H_2O than air-dried ones. The addn. of amino acids or KI increased the binding of H_2O. When a PhOH-H_2O equil. mixt. was allowed to rise in a paper strip, the PhOH content, detd. iodometrically after cutting the paper into segments, increased toward the top.

5301. Jaenicke, L. **Paper electrophoresis of sugars and sugar derivatives.** *Naturwissenschaften* 39, 86 (1952).—*C.A.* 47, 941*h*.

Sugar mixts. in electrophoresis arranged themselves from start to anode in the order maltose, xylose, ribose, glucose with fructose, arabinose, and galactose. A strip of S and S 2043b filter paper, 30 cm long, 2 to 5 cm wide was laid over a glass support, both ends hanging in electrolyte dishes; voltage 220; vacuum. The test material was added on top and 0.1 *M* borate buffer sprayed over the strip, pH 9.2. Electrophoresis was continued for 6 to 9 hrs.

5302. Jones, J. K. N. and Wise, Louis E. **The hemicelluloses present in aspen wood** *(Populus tremuloides)*. **II.** *J. Chem. Soc.* **1952**, 3389-93.—*C.A.* 47, 306*i*.

4-Methyl-*D*-glucuronic acid, galacturonic acid, and 2-α-(4-methyl-*D*-glucuronosyl)-α-*D*-xylose were identified definitely, and paper chromatographic sepns. indicated that at least 5 other (unidentified) acids of higher mol. wt were also present. The acids were sepd. first on charcoal columns and then by elution from cellulose columns. Various R_g values of the sugars and their derivs. were given with a series of solvents; these showed the relative positions of sugars on chromatograms.

5303. Kickhöfen, Botho and Westphal, Otto. **A simple combination of paper electrophoresis and paper chromatography.** *Z. Naturforsch.* **7b**, 659-60 (1952).—*C.A.* 47, 5761*c*.

Paper electrophoresis followed by paper chromatography on the same sheet of Whatman No. 1 paper was accomplished by cutting the filter paper in cross form with the lateral part approx. 1/5 or less of the diam. of the main beam. The electrophoresis of amino acids proceeded along the lateral part for 200 min. using 2800 v. (70 v./cm), the rest of the paper being rolled in. After electrophoresis the side flaps were cut off and the chromatography proceeded along the main beam.

5304. Kingsbury, G. W. J. and Temple, R. B. F. **Inorganic chromatography on cellulose. X. Spectrographic determination of micro quantities of thorium separated by chromatography from minerals and ores.** *Analyst* 77, 307-12 (1952).—*C.A.* 46, 7471*d*.

A simple spectrochem. procedure was described for detg. traces of Th that had been sepd. by chromatographic methods. In the ext., Th was copptd. with La which formed the matrix and acted as internal standard in the spectrographic analysis.

5305. Kowkabany, George N. and Cassedy, Harold G. **Investigation of paper chromatography. Factors that may affect R_F values in paper chromatography.** *Anal. Chem.* 24, 643-9 (1952).--*C.A.* 46, 11012*a*.

R_F values in ascending paper chromatography were detd. with amino acids as solutes. The increase of the amt. of amino acid slightly decreased the R_F value, and it was not affected by rate of flow of developer. Greater reproducibility of the R_F value was obtained, the further the distance the solvent moved.

5306. Krishnamurthy, K.; Venkatasubramanian, T. A., and Giri, K. V. **Preservation of paper chromatograms.** *Current Sci.* (India) **21**, 252 (1952).—*C.A.* 47, 2013*a*.

Paper chromatograms of amino acids, stained with ninhydrin, were kept in a vacuum desiccator for 2 months without fading. Preservation in dry N_2 or at low temp. in a closed container was effective.

5307. Lacourt, A.; Sommereyns, Gh., and Wantier, G. **Inorganic chromatography on paper. Power of separating and developing of organic solvents.** *Mikrochemie ver. Mikrochim. Acta* 39, 396-403 (1952).—*C.A.* 46, 11012*i*.

An org. developing soln. different from that of the satn. media was used. It was tested on solns. contg. Ni, Co, Cu, Fe, Al, Ti, Pb, U, Cd, Si, B, Mo, W, and Cr. In 17 tests with solns. contg. 10γ each of B in the presence of Mo and Si the quant. results averaged within 2.5% of the truth and in 12 tests with solns. contg. $50\ \gamma$ of U the results averaged within 4% of the truth in the presence of Fe and Al.

5308. Lacourt, A.; Sommereyns, Gh., and Wantier, G. **Quantitative inorganic paper chromatography.** *Analyst* 77, 943-54 (1952).—*C.A.* 47, 1529*h*.

Although a quant. chromatographic sepn. of Al was accomplished, the Fe and Ti spots were not completely resolved. Al was detd. with aluminon, Ti and Fe with Tiron. About 9.5γ of each ion was deposited on a paper strip, dried, and the chromatogram developed in an air-tight vessel. The soln. was then eluted from the spot. Al was removed with 0.2% aluminon and 1 ml of NH_4OAc soln. of pH 4 with the absorption measured at 5600 A.

5309. Lederer, Michael. **Electrochromatography inside filter paper. II. Diffusion and its effect on electrophoretic separations.** *Anal. Chim. Acta* 6, 521-5 (1952) (in English).—*C.A.* 46, 7927*a*.

The increase in the areas of spots of solns. on moistened filter paper was measured, and the results were used to calc. the feasibility of sepns. by paper electrophoresis.

5310. Lederer, Michael. **Paper chromatography of inorganic ions. IV.** *Anal. Chim. Acta* 7, 458-61 (1952) (in English).—*C.A.* 47, 4792*d*.

Filter paper impregnated with salts (KNO_3, NH_4NO_3, $NaNO_3$, NaCl) had been used for paper chromatography of many inorg. cations (Ag^+, Pb^{2+}, Hg^{2+}, Cu^{2+}, Cd^{2+}, Bi^{3+}, Sb^{3+}, Fe^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, $MoO_4{}^{2-}$, Ti^{4+}, V^{5+}, $UO_2{}^{2+}$, Ba^{2+}, Rh^{3+}, Pd^{2+}, Pt^{4+}, Ru^{6+}, Au^{3+}). The R_f values of a no. of cations on such paper differed considerably from those on untreated paper, and in some cases better sepns. were possible.

5311. Lederer, M. and Ward, F. L. **Paper electrochromatography of inorganic substances.** *Anal. Chim. Acta* 6, 355-62 (1952) (in English).—*C.A.* 46, 7452*i*.

Electro-migration on filter paper was influenced by the movement of the solvent on the paper, adsorption on the paper, and the potential applied. Details of the sepn. of the Cu group, and Fe, Ni and Co, were described. The Cu group could be sepd. in 15 min. by the application of high potentials.

5312. Leech, John G. **Acetolysis products of slash pine α-cellulose studied by chromatographic methods.** *Tappi* 35, 249-53 (1952).—*C.A.* 47, 306*b*.

No uronic acid or arabinose and only very slight traces of xylose could be found in the hydrolyzate of α-cellulose by paper partition chromatography. A soln. of the acetalyzated product was stabilized by filtration through Magnesol. A portion was chromatographed on Magnesol (5 parts)-Celite (1 part), and the chromatogram developed with benzene-EtOH.

5313. Lüderitz, Otto and Westphal, Otto. **Chromatography with circular filter paper.** *Z. Naturforsch.* 7b, 136-8 (1952).—*C.A.* 46, 6542*i*.

Discrete spots in a circle about the center were used rather than as a single spot at the origin. This permitted a variety of substances to be compared on one sheet.

5314. Makisumi, Satoru. **Paper chromatography of guanidine compounds.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 73, 737-9 (1952).—*C.A.* 47, 5848*d*.

By using BuOH:AcOH:C_5H_5N:H_2O (4:1:1:2) and BuOH:$6N$ HCl (7:3) as the solvent on Toyo filter paper 5 B and Sakaguchi's reaction, $Na_2Fe(CN)_5NO$ + $K_3Fe(CN)_6$, and Jaffe's reaction as detecting agents, R_f values of guanidine compds. were measured by a one-dimensional descending method.

5315. McFarren, Earl F. and Mills, James A. **Determination of amino acids on filter paper chromatograms by direct photometry.** *Anal. Chem.* 24, 650-3 (1952).—*C.A.* 46, 11039*h*.

Before chromatographic sepn., tryptophan was hydrolyzed with 14% $Ba(OH)_2$, cystine with a 1:1 mixt. of 6 N HCl and 90% formic acid, and all the other amino acids with 6 N HCl. The amino acid compn. of β-lactoglobulin was detd. by this procedure.

5316. Meigh, D. F. **Separation of the 3,5-dinitrobenzoates of volatile alcohols by paper chromatography.** *Nature* 169, 706-7 (1952).—*C.A.* 46, 9017*f*.

The paper-chromatographic sepn. of the 3,5-dinitrobenzoates of volatile aliphatic alcs. was carried out with MeOH and heptane as the solvents and Whatman No. 1 paper, previously soaked in a MeOH soln. of Rhodamine, 20 mg/liter, and dried at 100°C to give a yellow fluorescent background for the dark benzoate spots under ultraviolet light.

5317. Micheel, Fritz and Kamp, Franz Peter van de. **Separation of sugar mixtures by combined electrophoresis and paper chromatography.** *Angew. Chem.* 64, 607-8 (1952).—*C.A.* 47, 1545*h*.

The mixts. were used as H_3BO_3 complexes. Electrophoresis was carried out during the downflow of the soln. in filter paper. Fractions were collected and then chromatographed separately.

5318. Mills, J. S. and Werner, A. E. A. **Paper chromatography of natural resins.** *Nature* 169, 1064 (1952).—*C.A.* 46, 10639*e*.

Natural resins were sepd. by the application of paper partition chromatography, with Whatman No. 1 as the paper support, aq. isopropanol satd. with odorless kerosine (b. 180-200°C) as the solvent system, and 50% (wt/vol.) phenol in CCl_4 with exposure to Br_2 vapor as the developing agent. The procedure was applied to the following resins, dammar, mastic, sandarac, rosin, elemi, and copal.

5319. Miyaki, Komei; Momiyama, Hamako, and Hayashi, Makoto. **Quantitative paper chromatography. II. Determination of thiamine by paper chromatography.** *J. Pharm. Soc. Japan* **72**, 688-92 (1952).—*C.A.* **46**, 9147*d*.

A paper strip 8 mm wide and 40 cm long and a developing soln. consisting of 10% KCl and 95% EtOH (3:2) was used. Thiamine solns. contg. 50, 100, 250, 500, and 1000 γ/ml were submitted to chromatographic detn. The relation was found: log (spot length) = α log (amt.) + β, where α and β were const.

5320. Miyaki, Komei and Hayashi, Makoto. **Quantitative paper chromatography. III. Determination of *p*-aminosalicylic acid by paper chromatography.** *J. Pharm. Soc. Japan* **72**, 842-3 (1952) (in English).—*C.A.* **47**, 6815*e*.

The estn. of $2,4\text{-}HO(H_2N)C_6H_3CO_2H$ was given.

5321. Moura Goncalves, J. and Hasson, Aida. **Chromatographic analysis of the products evolved from glucose in an alkaline solution.** *Anais acad. brasil. cienc.* **24**, 221-3 (1952).—*C.A.* **47**, 2647*h*.

When an alk. soln. of glucose was heated in the absence of air, 8 spots (pink and white) appeared in a paper chromatogram developed with Tillman reagent with BuOH-AcOH as solvent. Besides reductone (R_f 0.63), 2 other dienols (R_f 0.34 and 0.90) were present. Two acid spots were congruent with pyruvic and lactic acids.

5322. Mukherjee, S. and Srivastava, H. C. **A spray reagent for the detection of sugars.** *Nature* **169**, 330 (1952).—*C.A.* **46**, 7000*d*.

Sugars on paper chromatograms were detected by spraying with the filtrate from a mixt. of 0.5 g $p\text{-}MeOC_6H_4NH_2$ and 2 ml 90% H_3PO_4 in 50 ml alc. soln The following colors developed after heating at 95°C for 3-5 min.: aldopentoses—dark brown, rhamnose—pinkish brown, fructose—lemon yellow, sucrose—brown yellow, aldohexases—light brown, lactose—dull yellow, maltose—faint brownish yellow, glucuronic acid—pink.

5323. Müller, Doris Clegg. **Instrumental approaches to paper chromatography.** *Analyst* **77**, 933-42 (1952).—*C.A.* **47**, 1529*g*.

An improved optical scanner for examg. chromatograms proved satisfactory for indicating the shape of a band and for evaluating R_F values more closely. Practical chromatographic sepns. depend on the distribution of solutes between 2 solvents or on selective adsorption on paper fibers, which was controlled by the compn. of the binary solvent.

5324. Nakano, Shoichi. **Analysis of cations by electrochromatography.** *J. Chem. Soc. Japan,* Pure Chem. Sect. **73**, 912-15 (1952).—*C.A.* **47**, 6308*h*.

Pt electrodes were placed at the ends of a filter-paper strip held between 2 glass plates, with one end of the paper dipping in the soln. tested. As solvent, 5*N* NH_4OH with or without citric acid, and mixts. of BuOH and AcOH were used. Uni-, bi-, and trivalent metal ions were studied with less satisfactory results than by ordinary paper chromatography.

5325. Nayar, M. R. and Rao, V. K. Mohan. **Papyrography of inorganic cations.** *J. Sci. Ind. Research* (India) **11B**, 78-9 (1952).—*C.A.* **47**, 6217*h*.

R_f values were reported for Ag, Hg, Pb, Cu, Cd and Bi in H_2SO_4, HOAc, HCl, and NH_3 solns. The sepn. of these ions by paper chromatography were discussed.

5326. Novellie, L. **A simple application technique for paper chromatography.** *Nature* **169**, 672 (1952).—*C.A.* **46**, 11011*i*.

To quickly and simply apply relatively large quantities of material to paper for use in paper chromatography, draw a line parallel to and 2 in. from the edge of the sheet of filter paper, fold the paper along the line, and dip the edge of the fold into the soln. to be chromatographed.

5327. Ohara, Eiichi and Nagai, Hideo. **Analysis of inorganic cations by simplified electropaper chromatography.** *J. Chem. Soc. Japan,* Pure Chem. Sect. **73**, 924-5 (1952).—*C.A.* **47**, 6308*i*.

A filter paper of fanlike shape was used. The soln. of the sample was put on the rivet, and electrodes were set on both sides of the fan. Results of application of Ag + Pb + Hg, Cu + Cd + Pb + Bi + Hg, As + Sb + Sn, Al + Fe + Ni + Co, Sr + Ba, etc. were given.

5328. Ohtsu, Takawo and Mizuno, Den'ichi. **Quanitative paper chromatographic estimation of various amino acids.. A modification of Fisher's method.** *Japan J. Med. Sci. and Biol.* **5**, 37-44 (1953).—*C.A.* **46**, 10051*c*.

A linear relationship was found between the area plotted on a linear scale and the quantity of the amino acid plotted on a logarithmic scale for 0.2-5.0 γ aspartic and glutamic acids chromatographed with phenol as solvent, and 0.6-5.0 γ glycine and alanine with *n*-BuOH. The error was ± 10%.

5329. Okáč, Arnošt and Černeý, Pavel. **Application of capillary chromatography in separation and determination of some metals.** *Chem. Listy* **46**, 14-15 (1952).—*C.A.* **46**, 3896*i*.

Impregnate filter paper with a soln. contg. Bi^{3+}, Sb^{3+}, and Sn^{2+} ions, treat with $(NH_4)_2S$ and then $(NH_4)_2S_2$. The thio salts formed concentric rings: black Bi_2S_3, barely visible SnS_2, and orange Sb_2S_3. The SnS_2 ring was developed, after drying, with a soln. of $K_2Hg(CNS)_4$ with which it formed a black ppt. of Hg. To detect Cd in the presence of Cu, treat the soln. to be tested with alkali and excess KCN and add to filter paper impregnated with $(NH_4)_2S$. A yellow spot of CdS was formed.

5330. Onoe, Keigo. **The separation and identification of aliphatic aldehyde 2,4-dinitrophenylhydrazones by the chromatostrip method.** *J. Chem. Soc. Japan,* Pure Chem. Sect. **73**, 337-9 (1952).—*C.A.* **47**, 3757*e*.

The prep. strips: triturate silica gel (23 g, 200 mesh) and 30 cc. 2.5% polyvinyl alc. to a homogeneous paste with addn. of a few drops of alc. to prevent foaming, spread over a strip of glass (1.5 × 25 cm) to a thickness of 0.6 mm, air-dry, and finally dry 1 hr at 60°C. C_6H_6 satd. with H_2O was the best solvent. The R_f value was very sensitive to variation in the water content of the strip; therefore, the extent of desiccation of the strip must be carefully controlled. The R_f value of CH_2O 2,4-dinitrophenylhydrazone was steady and could be used for the identification of the phenylhydrazones.

5331. Overell, B. T. **Quantitative and two-dimensional paper chromatography of organic acids.** *Australian J. Sci.* **15**, 28-9 (1952).—*C.A.* 46, 10039*h*.

Citric, malic, malonic, succinic, and oxalic acids, when present singly in concns. 2-10 mg/ml, were estd. (±4%) by measuring the lengths of the trails or comets on chromatograms. Careful control of pH and temp. (preferably below 10°C) were necessary and the use of const. development time and const. initial spot size. With mixts. of acids, interference was avoided by selecting solvents and pH so that 1 or 2 acids migrated while the others remained stationary.

5332. Paladini, Alejandro C. and Leloir, Luis F. **Detection of ultraviolet-absorbing substances on paper chromatograms.** *Anal. Chem.* **24**, 1024-5 (1952).—*C.A.* 46, 9011*a*.

After chromatography the paper was impregnated with paraffin oil to overcome any difficulty due to opaqueness of the paper. After spectrometric readings the paraffin oil could be removed with ether and the paper used for other chem. tests.

5333. Pollard, F. H.; McOmie, J. F. W., and Stevens, H. M. **The analysis of inorganic compounds by paper chromatography. V. The separation and detection of certain lanthanons.** *J. Chem. Soc.* **1952**, 4730-4.—*C.A.* 47, 5293*i*.

The chromatographic behavior of Y, La, Ce, Pr, Nd, Er, and Yb in a complex-forming solvent mixt. was investigated. Both filter-paper and cellulose columns were used and the solvent was BuOH-AcOH contg. 8-quinolinol.

5334. Rachinskiĭ, V. V. and Knyazyatova, E. I. **Sugar analysis by paper-partition chromatography.** *Doklady Akad. Nauk. S.S.S.R.* **85**, 1119-22 (1952).—*C.A.* 47, 448*c*.

For sensitivity about 20γ, the ammoniacal $AgNO_3$ reagent was satisfactory (1:1 mixt. of 0.1 N $AgNO_3$ and 5 N NH_4OH) for development of reducing sugars followed by drying at 105°C; the location of sugars was shown by dark-brown spots on a light-brown field. The 1:1 soln. of 1% alc. resorcinol and 0.2 N HCl gave various colors and sensitivities. EtOH soln. of 1:10 mixt. of 15% EtOH soln. of 1-$C_{10}H_7OH$ with 0.01 N H_2SO_4 served as a developer by giving violet spots for raffinose, sucrose, and fructose, with sensitivity about 10γ; other sugars showed very little sensitivity (500γ).

5335. Rachinskiĭ, V. V.; Knyazyatova, E. I. and Kravtsova, B. E. **Preparation and qualitative analysis of filter paper chromatograms of sugars.** *Biokhimiya* **17**, 551-6 (1952).—*C.A.* 47, 3758*f*.

Russian filter papers were employed. The best mobile solvent was C_6H_5OH satd. with H_2O. A mixt. of butanol, butyric acid, and water was used in the sepn. of glucose, fructose, and sucrose. The best developer for reducing sugars was an NH_4OH soln. of $AgNO_3$. Resorcinol was an effective developer for both reducing and nonreducing sugars; it was the universal developer for sugars.

5336. Redfield, Robert R. and Guzman Barron, R.S. **Quantitative determination of amino acids in protein hydrolyzates by paper chromatography.** *Arch. Biochem. Biophys.* **35**, 443-61 (1952).—*C.A.* 46, 5656*c*.

Complete sepn. of amino acids in simple protein hydrolyzates was achieved by one-dimensional paper chromatography with a no. of alcs. Direct photometric scanning of the chromatograms subjected to a modification of the ninhydrin reaction (or isatin for proline) was the basis of the assay.

5337. Rockland, Louis B.; Lieberman, José and Dunn, Max S. **Automatic determination of radioactivity on filter paper chromatograms.** *Anal. Chem.* **24**, 778-82 (1952).—*C.A.* 47, 3*b*.

An automatic sample changer utilized two types of recording counters and other standard app. for the detn. of radioactivity. Examples were given of radioactive counts made of glycine-2-C^{14} spotted at five concns. on Whatman No. 1 filter paper and of a typical phenol-developed test tube chromatogram of glycine-2-C^{14}. The av. recovery of radioactivity in glycine-2-C^{14} spotted at the origin was 85 ± 6%.

5338. Sattler, Louis and Zerban, F. W. **New spray reagents for paper chromatography of reducing sugars.** *Anal. Chem.* **24**,1862 (1952).—*C.A.* 47, 1543*d*.

Common hexoses and pentoses gave orange spots on a light background when the chromatogram was sprayed with a 0.3% alc. soln. of *p*-aminohippuric acid and heated to 140°C for 8 min. A spray reagent contg. 3% phthalic acid revealed 0.25 γ of glucose and 1 γ of fructose under ultraviolet light; 4 or 5 times these amts. of sugar gave orange-red spots visible in ordinary light.

5339. Schönfeld, T. and Reinharz, M. **Ion exchange capacity and dielectric strength of paper.** *Monatsh.* **83**, 753-7 (1952).—*C.A.* 46, 11013*h*.

Lignin-free cellulose was ground and washed, part was treated with 0.001 N HCl, another with 0.05 N NaCl, a 3rd with 0.05 N $CaCl_2$, and a 4th with distd. water. The dielec. strength was detd. After correcting for the thickness and d. of the sheet, it was found by statistical test that the breakdown voltage varied with the samples. The ion-exchange capacity of paper was attributed to the presence of about one COOH group per 100 glucose residues.

5340. Seiler, H.; Sorkin, E., and Erlemeyer, H. **Detection and determination of metallic ions separated by paper chromatography.** *Helv. Chim.*

Acta **35**, 120-8 (1952) (in German).—*C.A.* **46**, 8327*c*.

Tap water, mineral waters and solns. of plant ash (tobacco) were tested for Li, Zn, Mg, Cu, Ca, Na, K, and Fe with violuric acid. The solns. tested were not stronger than 0.05*N* and were first passed through a column contg. Amberlite 410 to change the chlorides, sulfates, etc., to acetates. The soln. was then evapd. to dryness in a vacuum, taken up in as little H_2O, as possible and made into a chromatogram on Whatman paper, with violuric acid. For the detns., blue, white, and red light was used to define the edges of the stains and the areas then detd. by a planimeter.

5341. SHIBATA, MURAJI AND UEMURA, TAKU. **Inorganic chromatography. VI. Mechanism of paper chromatographic separation.** *J. Chem. Soc. Japan*, Pure Chem. Sect. **73**, 176-9 (1952).—*C.A.* **46**, 11012*d*.

The mechanism of paper chromatographic sepn. was studied by the countercurrent method. Water was used as the stationary phase and BuOH satd. with dil. HCl as the mobile phase. The mechanism of chromatographic sepns., was explained by the partition mechanism which depended upon the nature of the paper cellulose.

5342. SOBUE, HIROSHI; MATSUZAKI, KEI; HATANO, AKIRA, AND ARISAWA, YUKIO. **Chromatography. III. Pentosan in wood cellulose and some high-grade rayon pulps for the cellulose ester.** *J. Soc. Textile Cellulose Ind.* (Japan) **8**, 79-81 (1952) (English summary).—*C.A.* 46, 8851*h*.

Red-pine and beechwood pulps were hydrolyzed with 4 *N* HCl, and the insol. residue at each stage of hydrolysis was further hydrolyzed with dil. H_2SO_4 to det. the polysaccharide content. Chromatographically compared, Japanese high-grade rayon pulps contained slightly more pentosan than did U. S. Rayacetal.

5343. SOLOWAY, SIDNEY; RENNIE, FRANK J., AND STETTEN, DEWITT, JR. **Automatic scanner for paper radio chromatograms.** *Nucleonics* **10**, No. 4, 52-3 (1952).—*C.A.* **46**, 9435*h*.

The paper strip moved continously under a thin-mica-window Geiger counter shielded with 2 in. of Pb. By means of an electronic circuit, an elec. pulse was produced once each min., the strength of the pulse being proportional to the no. of counts picked up by the counter.

5344. SPITERI, JOSEPH AND NUNEZ, GIACOMO. **Partition chromatography of fat-soluble substances.** *Compt. rend.* **234**, 2603-4 (1952).—*C.A.* **47**, 941*f*.

Sepn. of higher fatty acids, chlorophylls, carotenes, vitamins, sterols, terpenes, higher alcs. hydrocarbons, etc., was done by impregnating filter paper with triglycerides and using as a carrier MeOH, EtOH, or PrOH; the latter was found to be the one of choice. The position of the different components was revealed by treating the paper with ammoniacal Ag soln.; the fixed Ag was transformed into AgCl and finally into black stains of Ag_2S.

5345. STOLL, A. AND RÜEGGER, A. **Separation and estimation of sugars by paper chromatography of their *p*-nitrophenylhydrazones.** *Helv. Physiol. et Pharmacol. Acta* **10**, 385-94 (1952) (in German).—*C.A.* **47**, 448*f*.

After conversion of the sugars to the hydrazones the mixt. could be transferred directly to the filter-paper strip, dried, and developed with an ester or one of the higher alcs. R_f values for 11 sugars with 9 different org. solvents were detd.

5346. STRAIN, HAROLD H. **Qualitative separations by two-way and three-way electrochromatography.** *Anal. Chem.* **24**, 356-60 (1952).—*C.A.* **46**, 4947*e*.

Differential elec. migration in paper moistened with one solvent followed by transverse electromigration after variation of the solvent was tested as a qual. analytical method for sepn. of the cations of the common qual. groups. This method, employed with various solvents and absorptive phases, served for the sepn. of very small quantities of the mixts.

5347. TAMURA, ZENZO. **Inorganic paper chromatography. II. Total analysis of cations by paper chromatography.** *Japan Analyst* **1**, 117-22 (1952). (1952).—*C.A.* **47**, 4792*g*.

The soln. to be tested (in dil. HNO_3 or HCl) was developed on filter paper by the descending method with the following developing solvents: Hg(0.85), Sn, Sb, Bi, As, Zn, and Cd(0.3) (in decreasing R_f value order) were sepd. by BuOH satd. with a mixt. of 2.5*N* HNO_3 and 1.5*N* HCl, other cations were fixed near the original point. Fe (1.0), Cu (0.85), Co, Pb, Mn, Cr, and Ni (0.06) were sepd. by the mixt. of 10 vols. Me_2CO and 1 vol. 35% HCl; alkali and alk. earths were fixed and Hg Sn, Sb, Bi, As, Zn, and Cd moved beyond R_f 0.9. Li (0.83), Al, Mg, NH_4, Ca (0.38), Na, Sr, K, and Ba (0.05) were sepd. by a mixt. of 10 vols. MeOH and 3 vols. 35% HCl, others moved beyond R_f 0.5.

5348. THIES, H.; SOUCI, S. W., AND KALLINICH, G. **Colorimetric determination of ketohexoses.** *Z. Lebensm.-Untersuch. u. -Forsch.* **94**, 240-5 (1952).—*C.A.* 46, 7475*h*.

The colored materials formed in the color test for fructose as well as fructose-contg. carbohydrates and diphenylamine were studied by solvent and chromatographic sepns. and spectral analysis of fractions. Four colored reaction products were sepd.

5349. TISELIUS, ARNE. **Some recent advances in chromatography.** *Endeavor* **11**, 5-16 (1952).—*C.A.* **46**, 11011*a*.

Underlying principles were discussed, especially methods for developing chromatograms. The techniques of chromatographic columns, of partition and paper chromatography and of ion-exchange chromatography were compared.

5350. ULTÉE, A. J., JR. **Chromatography, limiting the area of solution spots.** *Chem. Weekblad* **48**, 821 (1952).—*C.A.* **47**, 4239*i*.

In 2-dimensional paper chromatography results were improved by limiting the area of the spot. Best results were obtained by the use of 52.5%

$CCl_3.CCl_3$ and 47.5% $C_{10}H_8$ to produce a limiting ring. The mixt. was applied with the fire-polished end of a glass tube of 1 cm diam.

5351. VANYARKHO, L. G. AND GARANINA, V. A. **Preparation and use of chromatographic paper in chemical analysis.** *Aptechnoe Delo* **1952**, No. 3, 22-5.—*C.A.* **47**, 439*h*.

Filter paper treated with hydroxides of Al, Cr, Si, etc., was useful for adsorption analysis. The $Al(OH)_3$ paper treated with 8-quinolinol showed clear ring zones on drop tests with cation mixts. Use of 5% oxine and 10% AcOH gave very clear demarcation. Sepns. of Fe-Cu, Co-Mo, Cu-Co, Fe-Mo, Cu-Mo-Ni, Cr-Mn-Mo, and Cr-Mn-Cu could be readily made.

5352. VAVRUCH, IVAN. **Chromatographic study on beet seeds and sugar beet. I. Sugars and amino acids.** *Chem. Listy* **46**, 453-7 (1952).—*C.A.* **46**, 11728*d*.

Paper chromatography was used to study the content and movement of sugars, amino acids, and their amides in various parts of beets during various periods of their life. During germination the sugar content in seeds decreased and the amino acids and their amides increased, whereas the order was reversed during vegetation.

5353. VENTURELLO, G. AND GHE, A. M. **Qualitative and quantitative paper chromatography of inorganic ions.** *Anal. Chim. Acta* **7**, 261-7, 268-73 (1952).—*C.A.* **47**, 4792*e*.

The detection and detns. of one or more inorg. ions (Cu^{2+}, Fe^{2+}, Fe^{3+}, Ni^{2+}, Zn^{2+}, and Pb^{2+}) when present together in mixts. was made by means of filter-paper chromatography; standard diagrams obtained from titrated solns. were used. The same method was also employed with the addn. of Mn^{2+}, in Al alloys.

5354. VOLMAR, YVES; EBEL, JEAN PIERRE, AND YACOUB, FAWZI BASSILI. **Paper chromatography of the oxyacids and phosphorus and arsenic.** *Compt. rend.* **235**, 372-3 (1952).—*C.A.* **47**, 2568*f*.

The sepn. of the following salts was studied by 2-dimensional paper chromatography with Whatman No. 4 paper washed with dil. HCl and 8-hydroxyquinoline: NaH_2PO_2, NaH_2PO_3, $Na_2H_2P_2O_5$, $Na_2H_2P_2O_6$, Na_2HPO_4, and $Na_2P_2O_7$, and Na arsenate, and Na arsenite. The solvents used and the R_f values obtained for the compds. in the above order were: acidic solvent (iso-PrOH 75 cc., CCl_3COOH, 5 g, H_2O 25 cc., and concd. NH_4OH 0.3 cc.), 0.84, 0.86, 0.86, 0.48, 0.82, 0.61, 0.68, and 0.83; basic solvent (EtOH 30 cc., iso-BuOH 30 cc., H_2O 39 cc., concd. NH_4OH 1 cc), 0.75, 0.49, 0.66, 0.21, 0.39, 0.28, 0.40-0.49, 0.40.

5355. WANKMÜLLER, ARMIN. **Paper chromatography of aromatic amines.** *Naturwissenschaften* **39**, 133-4 (1952).—*C.A.* **47**, 1335*c*.

For sepn. of sulfonamides a mixt. of 32 parts MeOH, 8 H_2O, 15 AmOH, and 45 C_6H_6 was used, on S. and S.2043b filter paper, with rising chromatography in fiber direction. The strips were sprayed with 0.1 *N* HCl contg. 0.1% $NaNO_2$ and a second time with aq. Na 2-naphtholate. A max. of 150 γ should be used for good sepn., a difference of 0.05 to 0.07 in R_f value was adequate for sepn.

5356. WHITTAKER, V. P. AND WIJESUNDERA, S. **Separation of esters by filter-paper chromatography.** *Biochem. J.* **51**, 348-57 (1952).—*C.A.* **46**, 7940*g*.

Choline esters could be sepd. by paper chromatography by using alcs. freely sol. in H_2O as solvents. Propanol- and butanol-water mixts. (with or without benzyl alc. or HCOOH as a third component) gave the best sepn.

5357. WIELAND, THEODOR AND BERG, A. **Chromatography on carboxyl paper.** *Angew. Chem.* **64**, 418-19 (1952).—*C.A.* **46**, 10039*e*.

Paper with a carboxyl content of 1 to 4% gave promising results with amino acids, amines, and inorg. ions. Some data were given.

5358. YODA, ATSUNOBU. **A paper chromatographic method for the detection of nonreducing sugars and polyhydric alcohols.** *J. Chem. Soc. Japan*, Pure Chem. Sect. **73**, 18-19 (1952).—*C.A.* **47**, 3185*c*.

Chromatograms were run with BuOH, EtOH, and water (4:1:5) 20 hrs at 20°C, dried at room temp., and sprayed with 0.5% KIO_4 and then after 1 to 5 min. with a mixt. of equal amts. of 15% aq. $MnSO_4$ and a satd. soln. of $(p\text{-}Me_2NC_6H_4)_2CH_2$ in 2 *N* AcOH. White spots on a blue background indicated locations of α-glycols.

5359. AIRAN, J. W.; JOSHI, J. V.; BARNABAS, J., AND MASTER, R. W. P. **Identification of organic acids by circular paper chromatography.** *Anal. Chem.* **25**, 659-60 (1953).—*C.A.* **47**, 6309*f*.

Tartaric, citric, malic, malonic, and citric acids were sepd. on Whatman's No. 1 paper with 1-pentanol and 5*M* aq. HCOOH. The chromatograms were sprayed with bromophenol blue or a 0.1% soln. of Mercurochrome in neutral alc. and examd. under ultraviolet light.

5360. BURMA, D. P. **Partition mechanism of paper chromatography.** *Anal. Chem.* **25**, 549-53 (1953).—*C.A.* **47**, 6735*f*.

Exptl. evidence was advanced which indicated that adsorption of the solute by the cellulose played a minor role in sepns.

5361. CAMPBELL, H. AND SIMPSON, J.A. **Spectrophotometric attachment for use in paper chromatography.** *Chemistry & Industry* **1953**, 342-3.—*C.A.* **47**, 6706*g*.

After a substance had been sepd. by chromatography or electrophoresis, the quantity present could be detd. by measuring the amt. of light absorbed by the substance. No sepn. or removal from the filter paper was necessary. As small as 10^{-6} g of colored compd. could be detd.

5362. CASTIGLIONI, ANGELO AND NIVOLI, MARIA. **Paper chromatographic separation of piperazine with hexamethylenetetramine.** *Z. Anal. Chem.* **138**, 187-8 (1953).—*C.A.* **47**, 5848*a*.

With Whatman Paper no. 1 excellent sepns. could be obtained with a (5:4:1) mixt. of water, BuOH, and AcOH as solvent or a 50% mixt. of BuOH and water. In some cases KCN was added in the stationary phase and in other cases HCl and AcOH. The migration speed of the amino acids was retarded by adding AcOH. The chromatograms were developed with I_2 vapors which gave with piperazine a brownish red spot and with urotropine a brownish yellow one.

5363. Giri, K. V.; Murthy, D. V. Krishna and Rao, P. L. Narasimha. **Circular paper chromatography. IV. Separation of organic acids.** *J. Indian Inst. Sci.* **35A**, 93-8 (1953).—*C.A.* **47**, 4248*i*.

Of 6 solvents tested, an *n*-butanol-formic acid water mixt. (15:10:15 vol./vol.) was found to be optimum for detn. of R_f values of oxalic, tartaric, citric, malic, malonic, succinic, and adipic acids in a mixt.

5364. Jones, A. Russell; Dowling, E. J., and Skraba, W. J. **Identification of some organic acids by paper chromatography.** *Anal. Chem.* **25**, 394-6 (1953).—*C.A.* **47**, 6309*g*.

To assist in the study of acidic products formed by the action of γ-rays from Co^{60} in aq. AcOH soln., the R_f values for a no. of common acids were detd. in several solvent combinations. A new acidic solvent combination for resolving nonvolatile acids and a new basic solvent combination for increasing the sensitivity of the paper chromatographic method for volatile acids were developed.

5365. Lacourt, A.; Sommereyns, Gh.; Stadler-Denis, A., and Wantier, G. **Paper chromatography of molybdates. Direct titration of chromatographic molybdenum spots and separation of chromium and of vanadium.** *Mikrochemie ver. Mikrochim. Acta* **40**, 268-84 (1953).—*C.A.* **47**, 5307*h*.

Under prescribed conditions Mo could be chromatographed on Whatman paper no. 4 and detd. within about 1% by absorption or the test spot could be cut out, the Mo dissolved, and titrated with $Pb(NO_3)_2$. After all the Mo had been converted into $PbMoO_4$ the next drop of the titrant gave a red color with diphenylcarbazide which was added as an indicator.

5366. Lindqvist, Börje and Storgårds, Torsten. **Paper chromatographic separation of volatile fatty acids. A study of a number of factors involved.** *Acta Chem. Scand.* 7, 87-96 (1953) (in English).—*C.A.* **47**, 5627*i*.

$EtNH_2$ soln. (33% $EtNH_2$ dild. to 0.025 *N* with BuOH-satd. H_2O) was placed in the bottom of the tank to a depth of 2 cm, the lid replaced, the papers were cut and lined (Whatman No. 1 for *B* and Munktell OB for *A*), a pad of filter paper (5 times the wt of the chromatogram) attached to the lower edge of the sheet and folded together tightly, and approx. 3 microliters of the sample was spotted on the paper and the position marked, the 2 outer positions being used for 0.050 and 0.025 *N* standard solns. The paper was hung in the trough, the H_2O-satd. BuOH run in, the paper removed after 16-32 hrs, the pad sepd., the paper allowed to dry in the air for 1 hr and sprayed evenly with indicator soln. prepd. from 2.5 g bromocresol green in 500 cc. EtOH and 500 cc. BuOH, the acid spots were marked, and the paper was sprayed with fresh Ag reagent, prepd. from 50 cc. 0.1 *N* $AgNO_3$ and 50 cc. 5 *N* NH_4OH, the paper heated 1-2 hrs at 100-25°C, the indicator and excess Ag reagent were removed by washing with distd. H_2O, and the paper was dried as usual.

5367. Nakano, Shoichi. **Analysis of anions by paper chromatography.** *J. Chem. Soc. Japan*, Pure Chem. Sect. **74**, 56-8 (1953).—*C.A.* **47**, 6821*b*.

Developers contg., ammonia such as ammonia 4 + acetone 13 + BuOH 3 parts were suitable for anions. R_f values of anions in the increasing order were MnO_4^-, CrO_4^{--}, SO_4^{--}, $S_2O_3^{--}$, CO_3^{--}, CN^-, Cl^-, Br^-, I^-, CNS^-. In most cases anions were fixed by spraying with $AgNO_3$ or $Pb(NO_3)_2$ solns.

5368. Ogawa, Shuntaro. **Fluoresent reaction of vitamin C. III. Its application to filter-paper chromatography. 1. IV. Its application to filter-paper chromatography. 2.** *J. Pharm. Soc. Japan* **73**, 59-63, 94-9 (1953).—*C.A.* **47**, 4042*c*, 4042*d*.

The specificity and sensitivity of the fluoresence reactions that occurred between dehydroasorbic acid, oxidation-type reductone, or α-keto acid, with o-$C_6H_4(NH_2)_2$ were utilized for detection in paper chromatography. Chromatograms of asorbic acid, its allied compds., and of α-keto acid were prepd. and their R_f values detd. Paper chromatograms of various pH were prepd. to obtain characteristic developed images.

5369. Roberts, E. A. H. and Wood, D. J. **Separation of polyphenols on paper chromatograms.** *Biochem. J.* **53**, 332-6 (1953).—*C.A.* **47**, 3757*g*.

Paper chromatograms were prepd. with H_2O as the mobile solvent. By this procedure sepn. of optical antipodes of cathecol, epicathecol, gallocathecol, and epigallocatechol had been apparently achieved. A list of the spots corresponding to the various polyphenols was given.

5370. Sato, Takuya R.; Kisieleski, Walter E.; Norris, William P., and Strain, Harold H. **Electrochromatographic separations of calcium and phosphate ions. Factors influencing separations.** *Anal. Chem.* **25**, 438-46 (1953).—*C.A.* **47**, 6303*h*.

This investigation was concerned with procedures for detection, sepn., purification, and estn. of Ca^{2+} and PO_4^{3-}, particularly radioactive prepns. employed as tracers and radioactive species encountered in neutron activation analyses. Differential elec. migration from a narrow zone of the mixt. in an electrolytic soln. supported in paper was found to have many desirable features. The sepns. were affected by the dimensions of the paper, the electrolytic soln., its concn., the vol. and concn. of the mixt. to be resolved, the presence of salts and of mineral acids in this mixt., the elec. potential, the electrode reactions, and the distance of migration.

5371. Schlögl, K. and Siegel, A. **Paper chromatographic separation and identification of monatomic phenols as aryl hydroxyacetic acids.** *Mikrochemie ver. Mikrochim. Acta* **40**, 202-11 (1953).—*C.A.* **47**, 5309*g*.

Advantage was taken of the pH dependence of the fluorescence of an umbelliferone soln. whereby the acids appeared in the ultraviolet region as black flecks on a light green luminous background.

5372. SCHUTE, J. B. **The mechanism of paper chromatography.** *Mededel. Vlaam. Chem. Ver.* **15**, 1-12 (1953) (in English).—*C.A.* **47**, 6218*a*.

R_f values of greater magnitude were found if the paper was not thoroughly equilibrated with H_2O. With water-miscible solvents, a sepn. may take place by a partition between water of the solvent and water imbibed by the cellulose. Concn., ionization, and assocn. of the solute may cause aberration. Ion exchange may take place between the cations held by the paper and bound to carboxyl groups and silicates and the H^+ of an acid being chromatographed. The H^+ was bound irreversibly by the paper, and the salt of the acid was sepd. from the acid spot. If the paper first was washed with HCl and then H_2O, the cations would be replaced by H^+. On such H^+-paper ion exchange was impossible and acids may be chromatographed.

5373. SCHWARZ, V. **The "Chromatocoil." A space-saving device for paper chromatograms.** *Chemistry & Industry* **1953**, 102.—*C.A.* **47**, 4660*g*.

A compact device 10 cm × 10 cm which could be used for paper chromatograms 1 cm wide and up to 70 cm long at any temp. was described in detail. Quant. chromatography of adreno-cortical steroids gave reproducible R_f values.

5374. SJÖQUIST, JOHN. **Paper-strip identification of phenyl thiohydantoins.** *Acta Chem. Scand.* **7**, 447-8 (1953) (in English).—*C.A.* **47**, 6822*c*.

A no. of naturally occurring amino acids were identified as the phenyl thiohydantoins by paper chromatography. Whatman No. 1 filter paper was soaked in a 0.5% soln. of starch (extd. with 2.5% 8-quinolinol in EtOH and then with EtOH) and dried 1 hr at 40-50°C. Three solvents were used. The paper was brought into equil. with a satd. atm. of the solvent. After the descending chromatograms were run, the paper was dried 5-10 min. at 90-100°C and sprayed with a reagent made up of equal vols. of an iodine soln. (0.01 *M* I_2 and 0.5 *M* KI in H_2O) and an azide soln. (0.5 *M* NaN_3 in H_2O).

5375. SMITH, IVOR. **Color reactions on paper chromatograms by a dipping technique.** *Nature* **171**, 43-4 (1953).—*C.A.* **47**, 3751*f*.

Instead of the usual spraying for color development, the dried paper chromatogram was dipped or drawn through a 0.2% isatin or ninhydrin in Me_2CO or 1% *p*-dimethylaminobenzaldehyde in Me_2CO: concd. HCl (9:1).

5376. SURAK, JOHN G.; LEFFLER, NORMAN, AND MARTINOVICH, ROBERT. **Inorganic paper chromatography. II. Separation of groups III, IV, and V.** *J. Chem. Educ.* **30**, 20-1 (1953).—*C.A.* **47**, 4781*c*.

Brush the soln. onto a strip of filter paper and dry. After the development of the chromatogram with the proper solvents and subsequent drying, locate the bands by treating the paper with the individual identifying reagents required. These were given for groups IIIa, IIIb, IV and V.

5377. TISELIUS, ARNE. **Zone electrophoresis in filter paper and other media.** *Discussions Faraday Soc.* **1953**, No. 13, 29-33.—*C.A.* **47**, 6218*e*.

The use of zone electrophoresis in immobilized media (filter paper strips or powder, glass beads, starch, gels) as a sepn. method was surveyed and compared with free electrophoresis. Application was made to the analysis of human serum.

II-11. Organic Solids With Various Solutions

5378. HEDGES, J. J. **The absorption of water by colloidal fibers.** *Trans. Faraday Soc.* **22**, 179-93 (1926).—*C.A.* **21**, 1389.

The heat of complete wetting of the dried material was detd. Extreme care was used in the washing and weighing of the wool. After wetting a dried sample in a calorimeter, reading the increase of temp. and time, a current was passed through a heating unit in the stirrer of the calorimeter, so that a similar increase in temp. took place in about the same time. The moisture contents at different relative humidities, and for temps. from 17°-29°C were detd. by careful weighening of dried samples of wool in closed bottles containing H_2SO_4 at various concns.

5379. HEDGES, J. J. **Moisture relations of colloidal fibers.** *J. Textile Inst.* **18**, 350-9T (1927).—*C.A.* **22**, 2062.

Curves for the variation of moisture content of chemically pure wool with atm. R. H. were of the usual sigmoid character given by other hygroscopic colloids. The heat of wetting of dry wool was considerable, being 24.1 g-cal/g. Wool and its absorbed water might be considered as a two-phase system in which a little water was adsorbed by the colloid particles, while the bulk was held in a system of pores.

5380. CHAMPETIER, GEORGES AND VIALLARD, RODOLPHE. **Penetration of water into the cellulose lattice. Interchange of H and D between cellulose and heavy water.** *Compt. rend.* **205**, 1387-8 (1937).—*C.A.* **32**, 1543^4.

Dry cellulose was placed in 99% D_2O, and the progress of the interchange H→D followed by detn. of the d. of the mixed H_2O and D_2O collected by evapn. The interchange was at the rate of 3D per glucose group. The results indicated that absorption of H_2O by cellulose occurred uniformly throughout the whole mass, and was not confined to a surface layer.

5381. MAASS, O, AND CAMPBELL, W. BOYD. **Studies in cellulose—moisture phenomena.** *Pulp Paper Mag. Can.* **40**, 108-14 (1939).—*C.A.* **33**, 4017^1.

The cryst. nature of cellulose lay in the regular spacing of the C_6 groups rather than in the arrangement of the long mols., though some degree of regularity in the arrangement of the chains must follow. Results of expts. on the sorption of water and org. liquids by cellulose, heat of wetting, d. or specific vol., dielec. const. and specific heat of cellulose, were discussed.

5382. Porai-Koshits, A. E.; Veller, E. A., and Sokolova, N. V. **The theory of the dyeing process. XI. The dyeing of animal fibers by acid anthraquinone dyes and other acid dyes.** *J. Applied Chem.* (U.S.S.R.) **12**, 1191-9 (in German) (1939).—*C.A.* **34**, 4913^1.

With respect to wool all dyes were classified as: (1) those having a normal limit of the satn. of wool equal to 0.80-0.83 mg equiv./g of wool and (2) those having an "anomalous" limit, equal to 0.60-0.67 mg equiv./g of wool. The main process in dyeing of wool or silk fibers with dyes followed the stoichiometric reaction between basic groups of fiber and acid of the dye, with salt formation. Adsorption and coagulation processes very probably accompanied the process of salt formation.

5383. Bresler, S. **Adsorption of acetylene on selective adsorbents.** *Acta Physicochim. U.R.S.S.* **12**, 783-5 (1940).—*C.A.* **35**, 949^2.

Highly disperse amphoteric methylpentadecyl ketone and cycloheptadecanone adsorbents were prepd. by addn. of H_2O to an alc. soln., coagulation with acid or alkali, and drying in vacuo. Around 600 mm and room temp. C_2H_4 was strongly adsorbed on the ketone, but equil. was attained only after 10 hrs. Acetylene was adsorbed by the enol form, and the rate of the enol-ketone isomerization was given by the change in the adsorptive capacity.

5384. Jong, H. G. B. de and Bank, O. **Mechanisms of dye absorption. II. Storage, polar linkage, and extractability of dyes.** *Protoplasma* **34**, 1-21 (1940).—*C.A.* **37**, 1146^1.

Small spheres of agar and gelatin were suspended in solutions to study adsorption of dyes on colloids. Basic dyes were adsorbed on agar more strongly the higher the pH and the lower the salt concentration. Exceptions were Rhodamine B, Prune Pure, and Congo Rubin which did not stain agar. Of the acid dyes tested, only eosin and erythrosin stained agar. Gelatin was stained by acid but not by basic dyes at pH 3; at higher pH values this relation was reversed. The failure of a dye to stain a given structure was not necessarily due to an impermeability of the cells for the dye; the cells were incapable of effecting a certain ionic exchange.

5385. Kleinert, Theodor. **The adsorption of phenol by wood tissues and their chief constituents.** *Cellulosechem.* **18**, 115-18 (1940).—*C.A.* **35**, 6441^1.

Samples of spruce-wood meal, coniferous lignins and coniferous cellulose (filter paper) were satd. with aq. phenol of various concns. at room temp. The absorption was only slightly affected by temp. The absorption process obeyed the equation of Freundlich up to an absorption of about 353 millimoles of phenol per 100 g H_2O-free lignin.

5386. Kline, G. M.; Martin, A. R., and Crouse, W. A. **Sorption of water by plastics.** *Modern Plastics* **18**, No. 2, 119-23, 152, 154 (1940).—*C.A.* **35**, 534^5.

Part of the results of an exploratory investigation of the water absorption and desorption characteristics of 17 plastics were given.

5387. Kurbatov, V. Ya, and Moiseev, A. S. **The dependence of the adsorption of dyes by wool and cotton on pH.** *Trudy Leningrad. Krasnoznamen. Khim.-Tekhnol Inst. im. Leningrad. Soveta* **9**, 88-112 (1940).—*C.A.* **37**, 3607^8.

Expts. with acid, basic and substantive dyes showed that for dyes contg. strong ionogen groups (SO_3) the max. of adsorption lay at very low pH values; dyes with many cation groups showed a max. at intermediate pH values, and this latter max. became more and more marked with increasing numbers of cations. Dyes contg. anion groups other than SO_3 reached their max. adsorption at intermediate pH values, and this max. became greater the stronger the anion groups and the greater the number of these groups in the dye.

5388. Rao, K. S. **Elasticity of organo-gells in relation to hysteresis in sorption.** *Current Sci.* **9**, 19-21 (1940).—*C.A.* **34**, 2680^2.

The prepn. of Ca arabate was described. This material was taken through 4 cycles of sorption and desorption of water. On a weight-of-water vs. pressure diagram, a hysteresis occurred, which decreased and eventually disappeared on the fourth cycle. The cavities in the Ca arabate had rigid walls which "trapped" and retained water during desorption. With repeated cycles the gum swelled and the walls of the cavities became more elastic. After sufficient use they no longer "trapped" water, and the hysteresis effect disappeared. Similar results were obtained with rice and with the grain of *Cajanus indicus*.

5389. Smirnov, L. V. **The effect of impurities on crystal habit during crystallization from solution.** *Acta Univ. Voronegiensis* (U.S.S.R.) **5-6**, 38-44 (1940); *Khim. Referat. Zhur.* **4**, No. **4**, 13 (1941).—*C.A.* **37**, 4508^1.

The crystn. of herapathite (quinine iodosulfate) from solns. in various alcs. and in their mixts. was studied. The characteristics of crystals obtained from solns. in MeOH, EtOH, iso-BuOH and iso-AmOH and of crystals obtained from solns. in the mixts. MeOH-EtOH, EtOH-AmOH and EtOH-H_2O were studied. The largest crystals were obtained from EtOH-H_2O.

5390. Sponsler, O. L.; Bath, Jean D., and Ellis, J. W. **Water bound to gelatin as shown by molecular-structure studies.** *J. Phys. Chem.* **44**, 996-1006 (1940).—*C.A.* **35**, 2053^2.

Gelatin hydration was discussed from different points of view. Agreement was shown between the possible no. of H_2O mols. bound to the protein in a water-gelatin mixt. contg. 35% H_2O and the amt. calcd. to be present. Infrared absorption studies make it plausible that the water was bound to the gelatin by means of H-bridges.

5391. Steinhardt, Jacinto and Harris, Milton. **Combination of wool protein with acid and base: hydrochloric acid and potassium hydroxide.** *J. Research Natl. Bur. Standards* **24**, 335-67 (1940).—*C.A.* **34**, 3153^1.

The titration curve of wool protein with HCl and KOH at 0° and 25°C, and the effect on the curve of the maintenance of a wide range of constant ionic strengths by addns. of KCl were reported in detail. The max. acid-binding capacity (independent of ionic strength) was about 0.82 millimols./g; the max. base-binding capacity was greater than 0.78 millimols/g. In the absence of salt, no appreciable binding of acid or base occurred in the pH interval 5 to 10, but the amt. bound increased sharply as these limits were exceeded. With salt present, the course of combination was more gradual; over the 200-fold range of ionic strengths between 0.005 and 1.0, the point of zero combination was sharply defined and was near pH 6.4.

5392. VEITH, HANS. **The absorption of water by technical rubber products.** *Wiss. Veroffent. Siemens-Werken* **1940**, 318-33.—*C.A.* **38**, 1910^{6}.

Expts. on the water absorption of rubber products which are described in the literature and which are of importance in the manuf. of rubber-insulated wire and cables are reviewed, and new expts. in the same field are described. The extraordinarily long time required to reach the satn. value of water absorption, which may extend to decades (sq. root law by storage in air of 100% humidity), as a characteristic of this process.

5393. WEIDINGER, A. AND PELSER, H. **The mechanism of water adsorption in gelatin gel.** *Rec. trav. chim.* **59**, 64-72 (1940).—*C.A.* **34**, 2233^{2}.

The different colors of gelatin gels contg. $CoCl_2$ were observed. The colors were typical of different amts. of adsorbed water and allowed a distinction to be made between bound (intramicellar) and free (intermicellar) water. Small amts. of $CoCl_2$ did not interfere with intramicellar adsorption of water, but with high salt content the salt seemed to intrude into the micelles.

5394. BIKERMAN, J. J. **Measuring contact angles.** *Ind. Eng. Chem., Anal. Ed.* **13**, 443-4 (1941).—*C.A.* **35**, 5010^{4}.

An equation was suggested for detg. the contact angle (between air, liquid and solid) based upon measuring the vol. and diam. Calcns. might be made accurate to ± 0.2°.

5395. CALVET, E. AND IZAC, H. **Calorimetric study of the adsorption of acetone by the nitrocelluloses.** *Compt. rend.* **212**, 542-4 (1941).—*C.A.* **36**, 6073^{4}.

The curve for the heat evolved as function of time for the adsorption of acetone on dry 14%-N nitrocellulose was similar to that obtained for the adsorption of H_2O on urea. The amt. of acetone adsorbed reached 3.7 moles acetone per C_6 group (2.95 NO_2 groups) after 150 hrs; the relation of the heat evolved to the amt. of acetone adsorbed was a straight line without any irregularities at the equiv. ratio points. The heat of adsorption was 67.5 cal/g or 3,900 cal/mole of acetone adsorbed.

5396. CALVET, EDOUARD. **Thermal effects produced during the adsorption of acetone by nitrocelluloses.** *Compt. rend.* **213**, 126-28 (1941).—*C.A.* **36**, 6073^{6}.

The quantity of heat given off was proportional to the amt. of adsorbed acetone. The thermal effect was 3900 g cal/g mol. adsorbed acetone. The expts. had to be interrupted after the adsorption of 3.27 g mol. acetone per C_6 chain owing to the fact that the adsorption had become too slow for a convenient estn. of the heat produced.

5397. GIACANELLI, EUGENIO. **The adsorption power of gluten as a measure of the baking quality.** *Ann. chim. applicata* **31**, 449-53 (1941).—*C.A.* **37**, 3315^{1}.

The amount of water absorbed was 64-69% of the moist gluten. The baking quality improved with increased water content. Values of 68-71% water in the gluten were obtained by this method, and they might be used for judging the baking quality.

5398. IRANY, ERNEST P. **Water absorption of resins.** *Ind. Eng. Chem.* **33**, 1551-4 (1941).—*C.A.* **36**, 1109^{9}.

The rate of penetration and the max. absorption for infinite exposure are characteristic of the material and must be known in order to describe its absorption behavior completely. Exptl. absorption curves for polyvinyl acetate and polyvinyl acetal corresponded closely with the theory. For polyvinyl alc., however, no fixed value for the max. absorption was found and the absorption per unit area increased almost linearly until the resin disintegrated.

5399. KRÜGER, D. **The sorption of basic dyes by cellulose.** *Melliand Textilber.* **22**, 428-31 (1941).—*C.A.* **37**, 2579^{9}.

Comparison of the absorption spectra of basic dyes in aqueous solution and dyed onto cellulose films showed that the absorption maxima in the dyed films were shifted toward the longer wave lengths. Significant differences in the shapes of the absorption curves were also noted. The dye existed in the cellulose film as a polymeric rather than as a simple ion.

5400. KRÜGER, DEODATA AND OBERLIES, FRIDEL. **Catalytic oxidations at the surface of cellulose fibers.** *Ber.* **74B**, 663-70 (1941).—*C.A.* **35**, 6244^{2}.

The acid groups (lignosulfonic and carboxylic) in cellulose materials could, by virtue of the H ions which they produced, exert certain catalytic effects, as in sulfite digestion and in the acetylation of purified cellulose materials. These acid groups gave rise to a reaction which was not specific for lignosulfonic and carboxylic acid groups but also occurred in the presence of other absorbents with acid complexes, such as silicate complexes.

5401. MARTIN, H. AND KUHN, W. **A multiplication process for separating racemates.** *Z. Elektrochem.* **47**, 216-20 (1941).—*C.A.* **35**, 5102^{9}.

If an optically active insol. adsorption medium was distributed throughout a liquid racemic system, unequal adsorption of the optical isomers would be accompanied by different heats of adsorption and different temp. coeffs. of adsorbability for the resp. isomers. Using wool as the insol. optically active adsorbent (in the form of an endless belt) and a soln. of inactive mandelic acid as the racemate and maintaining one surface of the system at 100°C while a parallel surface was kept at room temp., for 2 different speeds of motion of the wool strip at the end of 2 days $[\alpha]_D$ of -0.25° and -0.35° were obtained at one end of the app. and +0.00° and +1.00°, resp., at the other end.

5402. NEALE, S. M. AND STRINGFELLOW, W. A. **The primary sorption of water by cotton.** *Trans. Faraday Soc.* **37**, 525-32 (1941).—*C.A.* **36**, 1228^1.

The expts. covered sorptions up to 1.5 mg H_2O/g cotton. The adsorption by the glass walls was corrected. The plot of log p vs. 1/T was linear and from the slope the differential heat of sorption was 15.7 kg-cal/g mol. This value was accounted for by each H_2O mol. directly linking in this stage of primary adsorption to a pair of suitably placed cellulose OH groups.

5403. NISHI, TETSUNOSUKE. **Permeability of membranes to dyes. VI. The dependence of the velocity of the dialysis of the dyes on temperature. VII. The relation between the dialysis constant and particle size.** *J. Soc. Chem. Ind., Japan* **44**, Suppl. binding 233-8 (1941).—*C.A.* **44**, 8198*e*.

Values for the velocity of dialysis k of Orange GG, acid Ponceau E, double Brilliant Scarlet 3R, and Scarlet 4R were detd. at 50°, 60°, and 70°C. The concns. of the solns. were detd. from the extinction coeff. In general, k increased linearly with temp., following the empirical relation of Arrhenius.

5404. RAO, KITTUR SUBBA. **Hysteresis in sorption. VI. Disappearance of the hysteresis loop. The role of elasticity of organic gels in hysteresis in sorption. Sorption of water on some cereals.** *J. Phys. Chem.*, **45**, 531-9 (1941).—*C.A.* **35**, 3138^8.

Sorption of H_2O on activated rice and dal grains exhibited a unique disappearance of a hysteresis loop initially present. The disappearance was explained on a basis of the elasticity of org. gels which swelled on the imbibition of H_2O. On rice, CCl_4 exhibited a reproducible and permanent hysteresis; the adsorption of CCl_4 was only one-twentieth as great as that of H_2O.

5405. SCHRAMEK, W. **Swelling in water and in alkalies of cellulose fibers regenerated from viscose.** *Monatschr. Textil-Ind.* **56**, 101-9 (1941); *Chimie & industrie* **47**, 239-40 (1942).—*C.A.* **40**, 7610^4.

Measurements were made of the mean length and diam. of the unswollen fibers and of fibers swollen in various media, so as to obtain the swelling both parallel and perpendicular to the fiber axis. By considering both the greatest and least diam. of a transverse section, the area of the latter was calcd. by means of the equation for the ellipse, and from the difference in fiber length before and after swelling the vol. of the swollen fiber was calcd.

5406. SEMBA, TAKESHI; YASUNAGA, EIJI, AND YAMADA, TEIKICHI. **Sorption of sulfuric acid dissolved in glacial acetic acid by cellulose.** *J. Soc. Chem. Ind. Japan* **44**, 748-9 (1941).—*C.A.* **42**, 2425*f*.

Cotton linters were dipped in glacial AcOH contg. 0.5-4.0% H_2SO_4 at 15°-55°C, and the amt. of H_2SO_4 absorbed by the cellulose in each case was detd. from the decrease in concn. of H_2SO_4 in the soln. As the duration of dipping increased, the amt. of H_2SO_4 absorbed per g of cellulose, x/m, reached a max. and then decreased gradually to an equil. value. The value of x/m decreased linearly as the temp. was raised $x/m = kC^n$, where C was the concn. of H_2SO_4.

5407. SOLLNER, KARL; ABRAMS, IRVING, AND CARR, CHARLES W. **Structure of the collodion membrane and its electrical behavior. II. The activated collodion membrane.** *J. Gen. Physiol.* **25**, 7-27 (1941).—*C.A.* **36**, 5695^6.

Acidic impurities detd. the possible charge d. of the collodion; this charge d. was probably identical with the base-exchange capacity of the interfaces. Crude collodion, because of its impurities, showed considerable electrochem. activity. Inactive com. collodion prepns., either as membranes or in bulk, could be activated by oxidation whereby the no. of carboxyl groups was increased.

5408. VIEWEG, R. AND SCHNEIDER, W. G. **The water sorption and swelling of synthetic resins.** *Kunststoffe* **31**, 417-21 (1941).—*C.A.* **37**, 4156^4.

The swelling phenomena were observed by viewing the transparent cast phenolic resin in polarized light. Test disks 30 mm diam. by 3 mm thick were first oven-dried 5 hrs at varying temps., then immersed in distd. water at room temp. Curing took place for a given time in a relatively narrow temp. range and resulted in greatly reduced water absorption capacity.

5409. ARAKI, TSUNAO. **XVI. Ion interchange of the cellulose sulfoacetate.** *J. Soc. Chem. Ind. Japan* **45**, 416-18 (1942).—*C.A.* **43**, 2432*f*.

The relation between the interchange velocity and the interchange conditions in the water washing or in the treatment with salts soln. was tabulated. The ion interchange was carried out under almost the same condition as that of other materials having the ion-interchange property.

5410. BOUTARIC, AUGUSTIN AND FABRY, SIMONE. **Capillary activity of starch-I_2 complex on filter paper.** *Bull. Soc. chim. biol.* **24**, 108-16 (1942); *Chem. Zentr.* **1943, II**, 2290.—*C.A.* **38**, 5708^9.

The starch-I_2 complex behaved like a colored colloidal substance and was adsorbed in filter paper and glass. The significance of this fact and the formation of the complex under various exptl. conditions were discussed.

5411. BOUTARIC, AUGUSTIN AND FABRY, SIMONE. **Studies on the adsorption of iodine on cellulose by a capillary rise method.** *Bull. soc. chim.* **9**, 835-40 (1942).—*C.A.* **38**, 3125^1.

Capillary rise measurements were made with ashless filter paper strips which permitted the study of I_2 sorption by cellulose. There was a rapid rise of the colorless solvent to height H and a slower rise of the I_2 to height h as shown by the formation of a reproducible blue zone. H and h were measured at various time intervals and H/h remained nearly const. The Freundlich adsorption isotherm was approximated in all cases.

5412. FRÖMEL, W. **Humus and humic acids. A comparative method based on adsorption studies and measurements of light absorption.** *Landw. Jahrb.* **92**, 94-154 (1942).—*C.A.* **38**, 4494^9.

The adsorption curves with humic acid, methylene blue and methyl violet followed the Freundlich equation in the medium concn. range. Light absorption of humic acid in the range of 5000 to about 2300 A. demonstrated the validity of Beer's law.

5413. HENK, HANS. J. **The change in textiles and dyes caused by higher air temperatures.** *Spinner u. Weber* **60**, No. 11, 22-3 (1942); *Chem. Zentr.* **1943, II**, 1685.—*C.A.* **38**, 3132^8.

Cotton withstands temps. up to 300°C for short periods of time, but it chars completely at 120°C after several months. At 80°C there is a decrease in elasticity and dye absorption; at 180°C the elasticity has dropped 50% and the dye absorption becomes nearly zero. Water absorption and fluorescence change similarly with heating. Wool is damaged by brief heating to 150°C and by prolonged heating to 50°C.

5414. HOLLAND, H. C. **The absorption of water by sole leather.** *J. Intern. Soc. Leather Trades' Chem.* **26**, 124-30 (1942).—*C.A.* **36**, 7348^2.

A method was described for differentiating the H_2O absorbed by leather at satn. into "free space" H_2O (i.e., the H_2O which just filled the capillary voids), and combined H_2O. A sample of leather, conditioned to const. wt at 60% relative humidity and 18°C, was immersed in kerosene for 1 hr. Dividing the percentage wt of kerosene absorbed by its sp gr. gave the percentage wt of capillary H_2O. Kerosene rapidly penetrated even heavily rolled leather. There was no combination, removal of H_2O-sol. matter or vol. change.

5415. HUBERT, E.; MATTHES, A., AND WEISBROD, K. **Gel structure of synthetic fibers from regenerated cellulose. I.** *Kolloid-Z.* **98**, 173-80 (1942).—*C.A.* **36**, 6793^5.

Detn. of the structure of synthetic fibers and regenerated cellulose was made with the aid of the centrifuge method, and various phenomena on swelling and shrinkage were investigated. The fiber (0.5g) was centrifuged to const. wt (800 X gravity). The swelling value q was detd. from the difference in wt between the centrifuged and abs. dry fiber, and $q = 100$ when the centrifuged fiber retained water equal to its own wt.

5416. JENSEN, JENS. **The dye adsorption in direct dyeing with several dyes.** *Kem Maanedsblad* **23**, 105-9 (1942).—*C.A.* **38**, 3132^6.

Expts. were described on the dyeing of cotton with mixts. of a slowly dyeing dye with great affinity for cellulose (Chicago Blue B) and a rapidly dyeing dye of low affinity (Chrysophenin G). At all concns. there was found a decrease in the amt. of Chicago Blue adsorbed on the addn. of Chrysophenin.

5417. LEHRMAN, LEO. **Nature of the fatty acids associated with starch. The adsorption of palmitic acid by potato and defatted corn and rice starches.** *J. Am. Chem. Soc.* **64**, 2144-6 (1942).—*C.A.* **36**, 6836^1.

Palmitic acid in MeOH was adsorbed by the starches by a typical Freundlich isotherm. Potato starch adsorbed only a very small amt. of palmitic acid compared with the defatted starches. Defatted rice starch, which in its original condition had a higher percentage of "fat by hydrolysis" than corn starch, adsorbed more palmitic acid than defatted corn starch.

5418. LENOIR, JACQUES. **A chromatographic adsorption method (on textile fibers) of dyes.** *Bull. soc. chim.* **9**, 475-83 (1942).—*C.A.* **37**, 3943^4.

A stack of 150-200 cotton fabric disks was boiled in 5% $Na_2SO_4 \cdot 10H_2O$ soln., and lowered into its adsorption tube, which was kept at 80-5°C by a water jacket. The dye soln. was run through, while the receptacle was changed regularly. The pile was then washed successively with 5%, 2% and 0.2-0.5% $Na_2SO_4 \cdot 10H_2O$ soln., and finally with H_2O; in each washing, 0.02% Na_2CO_3 might be added to prevent hydrolysis of the fixed dye. Viscose rayon and mercerized cotton act similarly to cotton, but wool in many cases held dyes too tenaciously to be useful in chromatography.

5419. MATTSON, SANTE. **Laws of ion exchange.** *Lantbruks Högskolans Ann.* **10**, 56-73 (1942).—*C.A.* **38**, 4855^1.

Demonstration expts. are described in which pieces of sponge are moistened with an electrolytic soln. ($CaCl_2$, NaCl), washed and then extd. with a soln. of another electrolyte or methylene blue. The ions first adsorbed on the surface of the sponge are exchanged for others and are found in the soln. after extn. The laws of this ion exchange are described in terms of the Debye-Huckel theory.

5420. NARASINGA, C. AND VENKATARAMANAYYA, S. **Absorption of mineral matter by sugar canes.** *Indian Sugar* **5**, 395-6 (1942).—*C.A.* **37**, 3626^3.

During the growth period selective absorption was evident. Co. 243 absorbed more sulfate and K_2O for the same amount of sugar produced; cultivation of this variety would result in rapid depletion of soil potash. Co. 313 was notably low in P_2O_5; Co. 419 contained the least amts. of CaO, MgO, SiO_2, Fe_2O_3 and Al_2O_3 and showed a good absorption of P_2O_5.

5421. NICKERSON, R. F. **Hydrolysis and catalytic oxidation of cellulosic materials. Hydrolysis of mercerized cotton.** *Ind. Eng. Chem.* **34**, 85-8 (1942).—*C.A.* **36**, 1186^4.

The rate of hydrolysis was detd. by re-fluxing 2-g samples with 150 cc. of HCl-$FeCl_3$ (2.45 *M* HCl and 0.6 *M* $FeCl_3$) and detg. the CO_2 evolved. The data indicated a parallelism between the entrance of H_2O vapor and hydrolytic liquid into the fiber and might have meant that hydrolytic attack involved mainly the surfaces and capillaries where moisture was adsorbed.

5422. PASYNSKII, A. G. AND ZOLOTAREVA, Z. **Investigations on electrochemistry of proteins. IX. Exchange adsorption of neutral salts on gelatin.** *J. Phys. Chem.* (U.S.S.R.) **16**, 27-37 (1942).—*C.A.* **37**, 2638^1.

By means of analytical and potentiometric methods, the exchange adsorption of Ag_2SO_4, $AgNO_3$, and $BaCl_2$ on gelatin was investigated. By superposition of the values for adsorption of the salt and the pH shift of the medium, it was shown that the apparent molecular adsorption of the salt in many cases represented the superimposition of exchange adsorption of the salt on the molecular adsorption of the acid.

5423. PASYNSKII, A. G.; ZOLOTAREVA, Z., AND MUKHINA, A. **Exchange adsorption of neutral**

salts on proteins. *Acta Physichochim. U.R.S.S.* **16**, 236-56 (1942).(in German).—*C.A.* **37**, 2393^4.

The adsorption of Ag_2SO_4, $AgNO_3$, and $BaCl_2$ on gelatin, of Ag_2SO_4, $BaCl_2$, and NH_4SCN on egg albumin, and of $CaCl_2$ on casein were detd. in dil. solns. The adsorption caused a change in pH of the solution, and the amount of acid or base which had to be added to the pure protein solution to cause the same change was compared with the amount of metal or CNS ion adsorbed. The ratio, α, represented the degree to which exchange adsorption occurred; α was unity for Ag solutions below 0.001 N, falling somewhat at higher concentrations; for the other solutions it ranged from 0.6 to 0.1.

5424. SCHRAMEK, W. **The swelling and dissolving of cellulose fibers.** *Deut. Textilwirt.* **9**, No. 1, 2-3 (1942).—*C.A.* **37**, 4243^5.

The typical swelling phenomena of wood fibers, ramie and cotton were discussed.

5425. SMIT, P. **A new adsorption medium and its possibilities.** *Chem. Weekblad* **39**, 375-7 (1942).—*C.A.* **38**, 2239^3.

Artificial resins could be used as purifying agents. A typical resin, called Asmit, was used for purifying molasses, fats and oils, or for adsorptive removal of alkaloids and vitamins from soln. The adsorptive power could be restored by filtering and washing the material.

5426. ABRAMS, IRVING AND SOLLNER, KARL. **The structure of the collodion membrane and its electrical behavior. VI. The protamine-collodion membrane, a new electropositive membrane.** *J. Gen. Physiol.* **26**, 369-79 (1943).—*C.A.* **37**, 2636^6.

By adsorbing salmine, a protamine, on porous collodion membranes strongly electropos. membranes were obtained that did not alter their charge for a long time. Between pH 1 and 10 these membranes were distinctly electropos.

5427. BAXTER, S. **Electrical conduction of textiles.** *Trans. Faraday Soc.* **39**, 207-14 (1943).—*C.A.* **38**, 646^6.

The elec. cond. of wool fibers was given with and without adsorbed water. The temp. coeff. at const. regain was detd. over a wide range of regains and was found independent of regain for values greater than 5%. Below 5% regain, polarization was shown, but this disappeared for higher regains and Ohm's law was obeyed. The cond. of wool with adsorbed MeOH, and for glass fibers with adsorbed water vapor, was found to be similar to the wool-water system.

5428. DAVIDSON, G. F. **The rate of change in the properties of cotton cellulose under the prolonged action of acids.** *J. Textile Inst.* **34**, T87-96 (1943).—*C.A.* **38**, 3123^6.

Purified cotton linters were steeped in solns. of HCl and H_2SO_4 for various times under conditions that did not lead to soln. The change from fibrous material to powder was gradual, but loss of tensile strength was practically complete when a fluidity of 44 was attained. The powders were observed under the microscope to be fragments of cotton fiber. The affinity for moisture of the various hydrocelluloses was expressed by the ratio of the amt. of moisture absorbed by the hydrocelluloses to that absorbed by the unmodified cotton under the same conditions of relative humidity and temp.

5429. DAYNES, H. A. **Absorption of water by soft rubber as affected by vulcanization in open steam.** *J. Rubber Research* **12**, 93-4 (1943).—*C.A.* **38**, 509^9.

The relatively great hygroscopicity of hard rubber vulcanized in open steam led to a study of soft rubber. Water-absorption tests were made by the standard method of exposing comminuted samples to humidities of 84.8 and 97.2% (relative). The difference in water absorption were not so great as with hard rubber, either because of the shorter time of vulcanization or low % S.

5430. DOUGLAS, H. W. **Electrophoretic behavior of certain hydrocarbons and the influence of temperature thereon.** *Trans. Faraday Soc.* **39**, 305-11 (1943).—*C.A.* **38**, 1159^5.

Detns. were made on emulsions of dodecane, paraffin wax and Δ^{1-2} - octadecene in aq. media in the presence of 0.01 N Na^+. The variations in the mobility of composite droplets contg. increasing mole fractions of each of the substances hexane, benzene, cyclohexane and decalin were detd. at pH 9 and 25°C using dodecane as the carrier. The affinity for OH^- of a hydrocarbon/water interface varied for different types of hydrocarbons.

5431. DYKYJ, JAROSLAV AND BENA, JAN. **The electrochemistry of starch particles. I. Cation exchange on potato-starch particles.** *Kolloid-Z.* **104**, 106-12 (1943).—*C.A.* **38**, 4494^2.

Potato starch contg. Ca was suspended in solns. 0.1 equiv. of $FeCl_3$, $CaCl_2$ or mixts. thereof and the exchange of ions detd. from analysis of the ash. Agreement was found for ion exchange on starch between exptl. values and values calcd. by the law of mass action in which activity coeffs. were used. Starch with $NH_4{}^+$ readily exchanged this ion for others, but Ca, Ba, or Fe^{III} ions were replaced by $NH_4{}^+$ with some difficulty.

5432. GOLOSOV, V. A. AND SMIRENSKIĬ, A. P. **Adsorption by vegetable fibers, dyed with sulfur dyes with dyes other than sulfur dyes.** *Tekstil. Prom.* **3**, No. 10, 11-14 (1943).—*C.A.* **38**, 3133^8.

In wool fabrics contg. cotton thread, the cotton was dyed with S dyes, then the fabric was dyed by methods used for wool with acid or with Cr dyes. The double dyeing produced an uneven color that was not fast to rubbing. This was attributed to absorption of the acid dyes by the previously dyed cotton as well as by the wool. Bleached cotton fabrics were dyed first with S dyes then washed and dried and treated with various acid, Cr and direct dyes.

5433. LIVITON, ABRAHAM. **Adsorption of riboflavin by lactose. Influence of concentration.** *Ind. Eng. Chem.* **35**, 589-93 (1943).—*C.A.* **37**, 4199^9.

In crystg. from concd. whey, lactose adsorbed riboflavin selectively. The phenomenon relating to this adsorption had been extensively investigated, and as a result the production of potent prepns. contg. pure adsorbed riboflavin had been placed on a practical basis. The relation between degree of adsorption and initial riboflavin concn. under conditions of complete crystn. was linear.

5434. Mason, Charles M. and Silcox, Herbert E. **Water adsorption by animal glue.** *Ind. Eng. Chem.* **35**, 726-9 (1943).—*C.A.* **37**, 3990^8.
Both adsorption and equil. moisture content were studied. The former obeys Freundlich's law and the latter was found to be greater than represented by the moisture adsorbed on the surface.

5435. McBain, James W. and Lee, Will Win. **Sorption of water vapor by soap curd.** *Ind. Eng. Chem.* **35**, 784-7 (1943).—*C.A.* **37**, 4920^6.
Anhyd. soap (pure or com.) took up 1 or 2% of H_2O according to a sorption mechanism of phys. type. Except for Na oleate, the curd or supercurd then suddenly formed a hemihydrate which again took up H_2O more rapidly, up to 10 or 12%, according to a sorption law until another phase formed. At low temps. these phases were higher hydrates.

5436. Neale, S. M. and Stringfellow, W. A. **The adsorption by cellulose of mixtures of direct cotton dyes.** *J. Soc. Dyers Colourists* **59**, 241-5 (1943).—*C.A.* **38**, 491^1.
Direct cotton dyes interact in aq. soln. When mixts. were used to dye cotton, the absorption of one component as compared to its absorption when dyed singly, was reduced markedly below the value to be anticipated merely from the competition of the 2 dyes for the available surface. The interference of 1 dye with the absorption of a 2nd dye increased as the temp. was lowered.

5437. Parks, L. R. and Barnes, C. R. **Some notes on the sorption of commercial tannic acid by hide powder and charcoal.** *J. Am. Leather Chem. Assoc.* **38**, 332-42 (1943).—*C.A.* **38**, 1903^3.
Neutral hide powder was prepd. by suspending com. hide powder in dil. NaOH soln. for 24 hrs., then passing CO_2 through for 15 min., filtering, washing, and drying at room temp. Com. hide powder showed min. adsorption at pH 4.69. Neutral hide powder and com. hide powder showed no min. point, and gave similar adsorptions. Deaminated neutral hide powder showed a min. at pH 3.55, deaminated com. hide powder at pH 3.96. Each adsorbed less tannic acid than com. hide powder.

5438. Poraĭ-Koshite, A. E.; Valler, E. A., and Sokolova, N. V. **Theory of dyeing. XII. The absorption by wool of acid dyes with different numbers of sulfo groups.** *J. Applied Chem.* (U.S.S.R.) **16**, 28-35 (1943) (English summary).—*C.A.* **38**, 3131^9.
Three dyestuffs (Acid Red Zh, Acid Red S, and Acid Orange Lightstable) were studied in respect to absorption on wool. Dyed in presence of H_2SO_4 at pH 2-2.5, the same satn. limit of 0.8 mg. equivs. per g. was found as the max. amt. of acid dyes chemically absorbable by wool. At pH 1.5, or less, a slight increase of absorption was found which may be due to partial hydrolysis of wool keratins.

5439. Powrie, A. and Speakman, J. B. **The adsorption of water by jute.** *J. Textile Inst.* **34**, T77-86 (1943).—*C.A.* **38**, 2826^9.
Adsorption and desorption isotherms were detd. at 25°C on powd. jute prepd. from the middle portions of six of the samples, selected so as to include 2 samples each of white jute of high and low quality, one sample of red jute, and a sample of Hibiscus cannabinus, a jute substitute. The samples for obtaining absorption data were dried for two weeks in vacuo over P_2O_5 at 25 ± 1°C. The adsorption isotherms were all sigmoid in shape, and there was considerable hysteresis between adsorption and desorption isotherms. The different kinds of jute differ considerably in their affinity for water.

5440. Aickin, R. G. **The adsorption of Na alkyl sulfates by wool and other fibers.** *J. Soc. Dyers Colourists* **60**, 60-5, 286-7 (1944).—*C.A.* **38**, 2498^8; **39**, 420^3.
The single long-chain alkyl sulfate ion reacted with the basic groups of wool and behaved as a colorless dye, in that the adsorbed ions could not be removed by a simple washing process. Under neutral conditions, up to 2.5% (on the wt of the fiber) on the Na alkyl sulfates were adsorbed. The extent of the adsorption increased with increasing pH, and the concn. of the Na alkyl sulfate was reduced to practically zero if there was less present initially than corresponded to the acid-combining capacity of the wool.

5441. Assaf, A. G.; Haas, R. H., and Purves, C. B. **Amorphous portion of dry, swollen cellulose by an improved thallous ethylate method.** *J. Am. Chem. Soc.* **66**, 59-65 (1944).—*C.A.* **38**, 1105^4.
Cotton linters, highly swollen in NaOH and dried through MeOH and benzene, were immersed in a large excess of 0.1 N thallous ethylate. The thallium cellulosate so formed was methylated with excess MeI in benzene. The methods were described in detail and could be used successfully only by avoiding many manipulative errors. The MeO content of the product was accepted as proportional to the percentage of the cellulose wetted by the particular liquid in which the thallous ethylate was dissolved.

5442. Assaf, A. G.; Haas, R. H., and Purves, C. B. **New interpretation of the cellulose-water adsorption isotherm and data concerning the effect of swelling and drying on the colloidal surface of cellulose.** *J. Am. Chem. Soc.* **66**, 66-73 (1944).—*C.A.* **38**, 1105^8.
Three highly swollen samples of cotton linters were immersed in solns. of thallous ethylate in normal ethers of different mol. vols. Methylation of the resulting thallium cellulosates gave products whose MeO contents were accepted as proportional to the penetration of the ether into the celluloses. The H_2O adsorption isotherms at 20° or 25°C of the same swollen samples were detd. The moisture content of the 1st region of inflection in the isotherm, occurring at a relative humidity of about 10%, was approx. 30% of the value at the 2nd inflection. The flat, intermediate portion of the isotherm represented the H_2O less strongly H-bonded to the sec. alc. groups, but its shape was influenced at the higher humidities by the effects of swelling and by capillary condensation.

5443. Assonov, V. A. **Adsorbent briquets for liquid-oxygen explosives.** *Kislorod* 1944, No. 3, 28-38.—*C.A.* **40**, 3605^6.
Premature explosions of liquid oxygen on adsorbents were attributed to small dust particles.

As the charge was dropped into the bore, small particles became detached from the adsorbent. These particles were carried upward by the O_2 vapors and became charged by friction. Potentials of the order of 15,000-20,000 v. were measured on these particles. A discharge of such potentials sufficed to set off the charge. Dust could be prevented by moistening the adsorbent with 20-25% of H_2O or by providing special capsules for the explosive.

5444. Austerweil, G. **Can rubber be transformed into an ion exchanger?** *Rev. gén. caoutchouc* **21**, 122-4 (1944).—*C.A.* **40**, 5944^6.

Four methods were tried: (1) introduction of a phenylamino group by the known reation of a reactive Me group and an NO group; (2) by a synesis reaction with N derivs., whereby double bonds were opened in both rubber and the N compd.; (3) fixation of an aromatic group from a NO_2 compd., with simultaneous reduction to NH_2; and (4) reaction with a quinoneimine, according to the method of Fisher. Only method (4), in modified form, gave promising results.

5445. Bersin, Th. and Meyer, Hans Georg. **Exchange adsorptions in nonaqueous solutions.** *Die Chemie* **57**, 117-18 (1944).—*C.A.* **40**, 4581^4.

Data were presented for lipoid-sol. compds., alkaloid bases, steroid hormones, oil-sol. vitamins, colchicine, piperine, acetanilide, and some aliphatic and aromatic amines. The exchange reaction was followed by means of displacement of p-dimethylaminoazobenzene on bolus adsorbate and carotene on vitellin adsorbate.

5446. Cassie, A. B. D. and Baxter, S. **Wettability of porous surfaces.** *Trans. Faraday Soc.* **40**, 546-51 (1944).—*C.A.* **39**, 2444^4.

Formulas were derived relating the apparent contact angles to the total areas of solid-liquid interface and of liquid-air interface. Exptl. confirmation was obtained when the formulas were applied to data obtained with a wire grating, the wires of which were coated with a thin film of paraffin wax. Water rolls off a duck's back owing to the structure of the feathers rather than to any exceptional proofing agent.

5447. Dykyj, J. **Electrochemistry of starch grain. I. Adsorption of dyes.** *Chem. Listy* **38**, 219-26 (1944).—*C.A.* **45**, 10630*g*.

Potato starch adsorbs cations. In the presence of a basic dye (fuchsin) in aq. suspension of the starch, the dye is adsorbed so that the soln. becomes more acidic. In the presence of a salt the adsorption of the dye is weaker. The cations decrease the sorption ability of the starch in the order: H < Na < K < NH < Rb < Cs << Ca < Sr < Ba.

5448. Gilbert, G. A. **The combination of fibrous proteins with acids. II. The adsorption of dye anions.** *Proc. Roy. Soc.* (London) **A183**, 167-81 (1944).—*C.A.* **39**, 1294^9.

Equations developed previously for the titration of fibrous proteins with acids were shown to accord with exptl. data for the adsorption of dyes in the presence of salt. Data were reported for 30 benzene dyes. Dyes of the same valency were equally affected by changes in the nonspecific force due to the fiber charge. Temp. coeffs. were detd. for a dye by use of adsorption on mohair and on human hair.

5449. Giles, C. H. **The determination of the absorption of members of the Brenthol or Naphthol AS series on cellulosic fibers.** *J. Soc. Dyers Colourists* **60**, 280-6 (1944).—*C.A.* **39**, 195^1.

Viscose rayon and cuprammonium rayon had almost identical affinity for the respective Brenthols, while mercerized cotton had lower affinity than viscose rayon but higher than linen or unmercerized cotton. Bleaching had very little effect on the affinity of either linen or cotton. Substantivity varied widely between different members of the Brenthol range and decreased with rise in temp.

5450. Holland, H. C. **The absorption of water by sole leather. II.** *J. Intern. Soc. Leather Trades' Chem.* **28**, 205-11 (1944).—*C.A.* **39**, 1560^6.

Pieces of limed hide were tanned with various vegetable tanning materials and the H_2O absorption of the resulting leathers detd. The H_2O absorption of leather was mainly influenced by the amt. of free spaces (detd. by Holland's kerosene method) and by the resistance to wetting. The free spaces decreased with increasing degree of tannage. Myrobalans leather was more resistant to H_2O than that of other vegetable tannins because of its high degree of tannage.

5451. Leviton, Abraham. **Adsorption of riboflavin by lactose. Influence of temperature.** *Ind. Eng. Chem.* **36**, 744-7 (1944).—*C.A.* **38**, 5447^3.

To obtain a higher concn. of riboflavin adsorbed on lactose crystals than was realized in the com. prepn. of lactose from whey, a two-stage crystn. was used. Conditions as to concn. of lactose and temp. were so controlled as to yield a min. of riboflavin in the first crystn. and a max. of riboflavin from the risidual liquor. The crit. concn. of riboflavin below which adsorption would not occur was a function of both concn. of lactose and temp.

5452. Liesegang, Raphael E. **Capillary phenomena with acid fuchsin.** *Kolloid-Z.* **109**, 16-18 (1944).—*C.A.* **41**, 2958*d*.

Since acid fuchsin (fuchsin S) did not combine with the cellulose fiber and thus traveled along the paper (ash-free filter paper) with the water by capillarity, it was possible to form a banded or rhythmic structure by the periodic addn. of drops of the dye. This was produced previously only by simultaneous chem. reaction.

5453. Liesegang, Raphael E. **Pseudo optics of capillary phenomena. III.** *Kolloid-Z.* **107**, 128-9 (1944).—*C.A.* **39**, 11^4.

The capillary action in blotting paper was discussed in which various dyes (malachite green, fuchsin S, trypan red and trypan blue) were used.

5454. Mitton, R. G. **The absorption of water by a vegetable-tanned sole leather.** *J. Intern. Soc. Leather Trades' Chem.* **28**, 201-5 (1944).—*C.A.* **39**, 1560^4.

Comparative expts. were described on the blotting and the whirling, methods of removing surplus H_2O from leather samples in detg. H_2O absorption.

The blotting method gave the most consistent results. Air trapped within the leather had only a slight influence on the wt of H_2O absorbed.

5455. PANKHURST, K. G. A. AND SMITH, R. C. M. **Adsorption of paraffin-chain salts to proteins. I. Some factors influencing the formation and separation of complexes between gelatin and dodecyl sodium sulfate.** *Trans. Faraday Soc.* **40**, 565-71 (1944).—*C.A.* **39**, 2442[9].

The adsorption of $C_{12}H_{25}SO_4Na$ on a high-grade com. hide gelatin in aq. solns. was studied as a function of concn. of NH_4NO_3 (0.35 to 4.0 N in 0.5% gelatin at pH 5.3 and 35°C), pH (in 1.0 N NH_4NO_3 at 35°C), concn. of gelatin (0.01% to 2.5% in the presence of 1.0 N NH_4NO_3 at pH 5.3 and 35°C), and temp. (35°, 50°, 65°C). The adsorption was continuous until a unimol. layer of the ions was formed. Further addn. of the $C_{12}H_{25}SO_4Na$ was considered to result in the formation of a reverse layer with polar groups outermost.

5456. SAIR, L. AND FETZER, W. R. **Water sorption by starches.** *Ind. Eng. Chem.* **36**, 205-8 (1944).—*C.A.* **38**, 6590[4].

Sorption isotherms were obtained for 7 com. varieties of starch. They fell into 3 groupings: tubers (white potato) > pitch or root starches (sago, arrowroot and sweet potato) > cereal starches (wheat, corn, rice). Up to 25-30% relative humidity the starches took up the same quantity of H_2O, which might be related to the quantity theoretically required to form a monohydrate.

5457. SAIR, L. AND FETZER, W. R. **Water sorption by cornstarch and commercial modifications of starch.** *Ind. Eng. Chem.* **36**, 316-19 (1944).—*C.A.* **38**, 3507[3].

Sorption isotherms of cornstarch and 10 of its com. modifications were detd. The sorption isotherm of a starch product was shown to be a sensitive method of measuring rearrangements occurring within the intact granule.

5458. SCHOCH, THOMAS J. AND WILLIAMS, CARL B. **Adsorption of fatty acid by the linear component of corn starch.** *J. Am. Chem. Soc.* **66**, 1232-3 (1944).—*C.A.* **38**, 4490[8].

Com. corn starch (contg. 0.65% natural fatty material) adsorbed 4.1-4.4% I_2; removal of the fatty acid with 81% aq. dioxane raised the value to 5.3%. A sample of recrystd. BuOH-pptd. fraction from com. corn starch adsorbed 18.7% I_2; addn. of 2, 5 and 10% palmitic acid reduced the value to 12.4, 3.5 and 0%, resp. The higher fatty acids likewise acted as selective precipitants for the linear-chain components of com. corn starch. Cereal starches must be exhaustively defatted before potentiometric evaluation of iodine affinity.

5459. SHEPPARD, S. E. **Amphipathic character of gelatin shown in its adsorption of polar surfaces.** *Science* **100**, 545 (1944).—*C.A.* **39**, 875[9].

Recent expts. on the retention of gelatin to AgBr, in which techniques developed in connection with the study of dye adsorption were used, have confirmed the hypothesis that a unimol. layer was actually present and that a secondary layer was attached to this by weaker forces. Whether molecularly stratified systems of still higher order could be built up on protein lamellae was discussed.

5460. WHEWELL, C. S. AND SELIM, A. **The action of halogens on Wool. I. Factors influencing the amount of halogen adsorbed from solutions in CCl_4.** *J. Soc. Chem. Ind.* **63**, 121-3 (1944).—*C.A.* **38**, 5413[3].

The adsorption of Cl_2 by wool from solns. of the dry gas in dry CCl_4 was affected by the duration of treatment, concn., temp., moisture content of fiber, the ratio of wool to soln., the type of wool and previous chem. treatment of the fiber.

5461. CASSIE, A. B. D. **Adsorption of water by wool.** *Trans. Faraday Soc.* **41**, 458-64 (1945).—*C.A.* **40**, 786[5].

An isotherm reduced to a common hydrostatic pressure showed excellent agreement with the theory of multimol. adsorption. There were 1.12 mols. of low-energy sites per 100 g of wool. This was close to the value (1.11 mol.) for the no. of CO groups per 100 g of wool, and it was suggested that the CO groups were primarily the water-attracting groups in wool. The heat of adsorption of water to these sites was 3500 cal per mol.

5462. KOLLMANN, F. **Sorption and swelling of wood.** *Naturwissenschaften* **32**, 121-38 (1945).—*C.A.* **40**, 2297[5].

Chemisorption of H_2O by wood was attributed to reactive OH groups of the cellulose chain and accounted for up to about 8% of the H_2O content. Additional H_2O was held by adsorption on interior surfaces and finally by condensation in capillaries. The H_2O content of wood in equil. with an atm. satd. with H_2O vapor varied from 24 to 35%. Sorption hysteresis, sorption energy, and swelling pressure were discussed, as well as the effect of different salt solns. on the swelling and means for the prevention of swelling.

5463. MONTGOMERY, E. A. V. AND WHITE, J. **Water relations of the yeast cell. II. Increase and decrease in the moisture content of the yeast cell by chemical means. Adsorption of albumin and peptone by yeast.** *J. Inst. Brewing* **51**, 285-9 (1945).—*C.A.* **40**, 3851[6].

The change in water content of the yeast cells was detd. by weighing the yeast cake obtained by a standard vacuum filtration method. Treatment with weak NH_4OH increased the yeast wt to a max. of 4.6% at pH 8.7. The yeast cells were destroyed rapidly at pH values lower than 1.8. Adsorption of albumin commenced at pH 4.85 and increased rapidly to a max. at pH 1.8; thereafter it decreased. Adsorption of peptone commenced at pH 4.4, increased to a max. at pH 2.1, then decreased to nil at pH 1.5.

5464. NATADZE, G. M. AND PEKHTEREVA, S. I. **A method for adsorbing resinous substances from conifer needles.** *Gigiena i Sanit.* **10**, No. 9, 53-4 (1945).—*C.A.* **41**, 2210c.

The conifer-needle exts. were important sources of vitamin C in Russia. Gumbrin, askanite, and gelatinized askanite were examd. as tar adsorbents. Askanite gave a turbid, green filtrate tasting almost like the untreated ext. Gelatinized askanite and gumbrin gave clear, transparent, and yellowish green filtrates, almost free from bitter flavor. Vitamin C activity of all the filtrates was 20-25% lower than that of the untreated ext.

5465. PALLMANN, H. AND DEUEL, H. **The water permeability of hydrogels.** *Experientia* **1**, 325-6 (1945) (in German).—*C.A.* **40**, 3670^5.

The permeability of different gels was detd. in terms of the permeability coefficient k of Darcy. Gels of gelatin and agar had very low k values. Water-glass gels varied markedly in k with the type and concn. of coagulant, temp., and when mixed with coarse sand. Ca silicate gels showed considerable reversibility in k when treated with $CaCl_2$ and eluted with H_2O..

5466. PAULING, LINUS. **The adsorption of water by proteins.** *J. Am. Chem. Soc.* **67**, 555-7 (1945).—*C.A.* **39**, 2240^9.

The initial process is the attachment of one water mol. to each polar amino acid side chain. Water is bound by carbonyl groups that are not coupled by H bonds with imido groups. In salmin, in which most of the amino-acid residues are polar, these polar residues cooperate to attach one water mol. jointly to 2 polar groups in the initial process of hydration.

5467. SKINNER, B. B. AND VICKERSTAFF, T. **The absorption of acid dyes by wool, silk, casein fiber, and nylon.** *J. Soc. Dyers Colourists* **61**, 193-201 (1945).—*C.A.* **39**, 4757^8.

Isotherms for the absorption of 3 acid dyes of different types on wool, silk, casein fiber, and nylon were detd. at several pH values. The results fitted the Langmuir adsorption equation at high concns. At high acidities, hydrolysis of wool occurred during dyeing, leading to increased dye absorption. The absorption isotherms of wool and casein fiber were almost identical. The observed differences in rate of dyeing and wet fastness must be attributed to differences in phys. structure. The dyeing mechanism with nylon appeared to be similar to that of wool.

5468. SOLLNER, KARL. **The physical chemistry of membranes with particular reference to the electrical behavior of membranes of porous character. I. The nature of physicochemical membranes-membranes as physicochemical machines; preparation and properties of membranes of highly pronounced electrical properties.** *J. Phys. Chem.* **49**, 47-67 (1945).—*C.A.* **39**, 3191^7.

Membranes with abs. permeability 3 to 4 times greater than that of previously described membranes of high ionic selectivity were made by improvements upon known methods. Such membranes were termed "megapermselective." The electroneg. membranes of this type were made by oxidation of collodion with NaOH and the electropos. by the adsorption of protamine on collodion.

5469. SOLLNER, KARL. **The physical chemistry of membranes with particular reference to the electrical behavior of membranes of porous character. II. The nature of the "dried" collodion membrane. Some current membrane theories and their limitation.** *J. Phys. Chem.* **49**, 171-9 (1945).—*C.A.* **39**, 3716^9.

With inorg. electrolytes and weakly-adsorbable org. compds., dried collodion membranes that were wet with water behaved as rigid nonswelling structures. The base-exchange capacity of collodion membranes was high for prepns. of great electrochem. activity, but might be medium to low for either active or inactive prepns. The high-base-exchange capacities observed were due to a more open structure.

5470. SOLLNER, KARL. **The physical chemistry of membranes with particular reference to the electrical behavior of membranes of porous character. III. The geometrical and electrical structure of membranes of porous character; some examples of the machine action of membranes.** *J. Phys. Chem.* **49**, 265-80 (1945).—*C.A.* **39**, 5153^2.

Membranes of porous character must be assumed in general to be heteroporous. It was postulated that the pore system consisted of a sequence of narrow channels and wider cavities that, interconnected at random, traverse the membrane. The penetration of the membrane by ions depended on the size of the pores and the elec. repelling forces resulting from like-charged ions fixed on the pore walls.

5471. STEIGMANN, A. **Experiments with a cationic wetting agent.** *J. Soc. Chem. Ind.* **64**, 88 (1945).—*C.A.* **39**, 3491^8.

Trimethyl-β-oleamidoethylammonium sulfate pptd. anionic colloid electrolytes, acid dyes, salts of org. acids or org. compds. with acidic groups. (SH, NO_2), polysulfides and polyiodides, nitroprussides, ferrocyanides, and thiocyanates. Techniques for impregnating filter papers for use in spot tests were described.

5472. VAN HOOK, ANDREW. **Kinetics of sucrose crystallization. Mechanism of reaction.** *Ind. Eng. Chem.* **37**, 782-5 (1945).—*C.A.* **39**, 4279^2.

Evidence was presented favoring the interpretation of the velocity of crystn. of sucrose from pure, and probably from impure solns. as an interfacial (homogeneous) rather than an interboundary (heterogeneous) reaction. Values of E, the activation energy, were calcd. for temps. from 10 to 80 °C from existing data on the crystn., diffusion, and viscosity of sucrose solns. at a const. super-satn. of 1.05 and other const. supersatns. The E values calcd. from the crystn. data were much higher than those calcd. from the diffusion and viscosity data.

5473. WIKLANDER, LAMBERT. **Partition of uni- and bivalent cations by adsorption on organolites.** *Svensk Kem. Tid.* **57**, 54-7 (1945).—*C.A.* **40**, 2711^4.

The relative adsorption from a soln. of NH_4Cl and KCl passing through an organolite did not differ much with diln., but when the ions were different in valence, it became very much different since they followed the Donnan equil. and differed by square roots. The adsorptions of NH_4Cl and KCl in N solns. passed over an organolite were 43.7 and 56.3%, a ratio of 0.74 which also held for 0.0001 N solns.

5474. BALAREV, D. **Periodic precipitation in gelatin.** *Annuaire univ. Sofia, Faculté phys. mat.* **43**, *Livre* 2, 115-17 (1946-1947).—*C.A.* **43**, 8237*e*.

The ppts. of $Ag_2Cr_2O_7$, $PbCrO_4$, and $Mg(OH)_2$ first adsorb $Cr_2O_7^{--}$, CrO_4^{--}, and OH^- until the ring becomes electronegatively charged and then adsorb Ag^+, Pb^{++}, and Mg^{++}. The outside of the ring is electroneg., the inside electropos., and the whole neutral. The adsorbed ions are firmly a part of the conglomerate of sol particles formed by coagulation.

5475. Darling, Robert C. and Belding, Harwood S. **Moisture adsorption of textile yarns at low temperatures.** *Ind. Eng. Chem.* **38**, 524-9 (1946).—*C.A.* **40**, 4220².

The moisture adsorption of wool, cotton, cellulose acetate, and viscose rayon yarns were measured at 40°, 0°, and -20°F and at several relative humidities above 50%. The equil. values obtained indicated that at const. relative humidity relative to satn. over liquid water there was a high point between 0° and 40°F. The equil. moisture content was nearly the same at 40° and 0°F, but somewhat lower at -20°F. The heat of adsorption on cotton yarn at a const. moisture content fell as the temp. fell, somewhat more rapidly than did the heat of condensation of water, until it equaled or fell below the latter at about 40°F. At a const. temp. the heat of adsorption on the yarn fell as the amt. of adsorbed water increased.

5476. Ewart, R. H.; Roe, C. P.; Debye, P., and McCartney, J. R. **The determination of polymeric molecular weights by light scattering in solvent-precipitant systems.** *J. Chem. Phys.* **14**, 687-95 (1946).—*C.A.* **41**, 1528*e*.

It was predicted by this theory and verified by expt. that correct values of mol. wt were obtained by the usual interpretation of turbidity measurements only if the solvent and precipitant had the same *n*. If the solvent and precipitant had different *n*s, scattering measurements gave information about the extent of selective absorption of solvent by the polymer.

5477. Lloyd, Dorothy J.; Dempsey, Mary, and Garrod, Marjorie. **Swelling of protein fibers in organic solvents.** *Trans. Faraday Soc.* **42B**, 228-44 (1946).—*C.A.* **42**, 6618*b*.

When all of the cross-bonds are of one type, a solvent opening this bond will dissolve the fiber; when the cross-bonds are of two or more types, a solvent that opens one type but leaves the others intact will lead to freeing of sections of the long backbone; but a solvent opening all types of links will lead to a soln. of the fiber.

5478. Neale, S. M. **Electrical double layer, the electro-kinetic potential, and the streaming current.** *Trans. Faraday Soc.* **42**, 473-8 (1946).—*C.A.* **40**, 6933⁴.

Equations were deduced that described the structure of the ionic atm. of an electrically charged surface in a uni-univalent electrolyte and that det. the potential at the surface. An equation was given for the streaming current carried by the stream through a cylindrical plug of charged fibers.

5479. Neale, S. M. and Peters, R. H. **Electrokinetic measurements with textile fibers and aqueous solutions.** *Trans. Faraday Soc.* **42**, 478-87 (1946).—*C.A.* **40**, 6933⁶.

An exptl. technique is proposed to det. the streaming current from which the surface potential (ψ_0) of fibrous nonconductors in aq. solns. is derived. Below pH = 6, ψ_0 for silk, wool, and nylon is a linear function of pH and changes sign at about pH 3. The adsorption of ions with specific affinity for the fibers causes marked changes in ψ_0 for wool and cotton.

5480. Sarkar, P. B.; Chatterjee, H.; Mazumdar, A. K., and Pal, K. B. **The relation between the acid values of jute fiber and its adsorption of methylene blue.** *Science and Culture* **12**, 108-10 (1946).—*C.A.* **41**, 2248*e*.

The affinity for basic dyes resulted from the presence of carboxyl groups in the halocellulose fraction of the jute. Acid values for raw, defatted, alkali-treated, and lignin-free jute as well as chlorite cellulose and α-cellulose were found to correspond fairly well with the dye-absorption values for carefully purified methylene blue at pH 7. Jute had been made substantially cation-free by treatment with 0.1 N HCl for 30 min. at room temp. As a result of this treatment, the color improved, but the dye-absorption and acid value were practically unchanged.

5481. Tai, An-Pang and Chu, Chi-Ming. **Calcium tartrate gels. II. Effect of salts on the time of set.** *J. Chinese Chem. Soc.* **14**, 1-6 (1946).—*C.A.* **43**, 6889*a*.

Ca tartrate dissolved in aq. NaOH through formation of a sol. complex, which subsequently gelled. Salts whose anions form insol. compds. with Ca exerted a much greater effect than those whose anions formed sol. salts. The order of effectiveness of anions for increasing the set time was $CO_3 > PO_4 >$ tartrate $>$ oxalate $> CrO_4 > SO_4 > Cl > NO_3 > OAc$. The relation of the concn. of each anion to the setting time could be expressed by an equation similar in form to the Langmuir adsorption isotherm.

5482. Van Hook, Andrew. **Kinetics of sucrose crystallization; sucrose-nonsucrose solutions.** *Ind. Eng. Chem.* **38**, 50-3 (1946).—*C.A.* **40**, 1053⁶.

The effects of both electrolytes and nonelectrolytes (especially those found in natural cane and beet juices; e.g., K_2SO_4, amino acid salts, aconitates, invert sugar, betaine, raffinose, pectins, etc.) on the crystn. velocity of sucrose from soln. were investigated refractometrically. Combinations of these contaminants depressed the normal crystn. value.

5483. Bhatnagar, Mahendra Swarup. **Organic adsorbents. I. Methods of preparation and activation, and the relative adsorptive powers of resins.** *J. Sci. Ind. Research* **6**, No. 1, B, 12-15 (1947).—*C.A.* **41**, 4952*i*.

Resins were prepd. from HCHO and phenol, resorcinol, catechol, and pyrogallol. Amino resins were prepd. from HCHO and *m*-phenylenediamine or aniline. Urea resins and protein resins from globulin were also made. Tests with aq. solns. of formic, acetic, and butyric acids showed that with HCl-condensed phenolic resins adsorption increased with increase in length of the hydrocarbon chain. The reverse held for NH_3-condensed phenolic resins, amino resins and if a less polar solvent was used, HCl-condensed resorcinol resins.

5484. BORDA, E. **Adsorption isotherm of a photographic emulsion for uranyl and lead ions.** *Nature* **160**, 231-2 (1947).—*C.A.* **41**, 7199*h*.

The adsorption isotherm of UO_2^{++} and of the Pb isotope, Th, B, dild. with inactive Pb^{++} on Ilford Concentrated Half-Tone Plates was detd. by counting the tracks formed in the emulsion after a definite length of time. The results fitted the Freundlich equation.

5485. BOSCOTT, R. J. **Solvent-treated cellulose acetate as the stationary phase in partition chromatography.** *Nature* **159**, 342 (1947).—*C.A.* **41**, 4999*d*.

Solvent-treated cellulose acetate was found to be a satisfactory stationary org. solvent phase for chromatography. The adsorbent was tested with an aq. soln. of cresol, BzH, and NaCl.

5486. CRANK, T. **An absorption isotherm for direct dyes.** *J. Soc. Dyers Colourists* **63**, 293-6 (1947).—*C.A.* **41**, 7755*f*.

Dyeing is an absorption process, on the surface and throughout the less-ordered regions of the cellulose. Cellulose is considered as a 3-dimensional network of more or less parallel mol. chains. When the structure is swollen by immersion in water, the mol. chains in the amorphous region move apart, forming capillaries or pores along which the dye mols. diffuse as dyeing proceeds.

5487. DE LOLLIS, NICHOLAS J. **Industrial adhesives.** *Product Eng.* **18**, No. 11, 117-22; No. 12, 137-42 (1947).—*C.A.* **42**, 4793*a*.

The effect of bond strength, of preparatory surface treatments, modulus of elasticity, coeff. of expansion, and new techniques such as high-frequency heating are discussed. Properties and uses of thermosetting resin adhesives, applications in wood, metal-to-wood, metal-to-metal, metal-to-glass, plastic and rubber bonding are renewed.

5488. GUTHRIE, J. D. **Introduction of amino groups into cotton fabric by use of 2-aminoethyl-sulfuric acid.** *Textile Research J.* **17**, 11 (1947)

Amino groups were introduced into the cellulose molecule in order to prepare a fabric that could be dyed with acid dyes, an acid-adsorbing property not possessed by ordinary cotton fabric. The aminized fabric also dyed well with chrome dye, showed increased affinity for direct cotton dyes, and behaved toward hydrochloric and phosphoric acid as an anion exchange resin.

5489. KING, G. **Electric polarization in keratin-water and keratin-methyl alcohol systems.** *Trans. Faraday Soc.* **43**, 601-11 (1947).—*C.A.* **42**, 2827*a*.

The increase in dielec. const. is unlikely to be a function of the absorbate alone. A comparison is drawn between the dielec. dispersion and the elastic properties of keratin-water systems. In both cases the bound water fraction breaks H bonds between the polypeptide chains, allowing increased freedom of rotation of polar groups in these chains.

5490. KING, G. AND MEDLEY, J. A. **Effect of polar vapors on the direct-current conductance of keratin and nylon.** *Nature* **160**, 438 (1947).—*C.A.* **42**, 1108*d*.

The d.-c. conds. of nylon-H_2O and of nylon-HCOOH were measured as a function of absorbate concn. The initially linear rate of increase fell away at an absorbate concn. of about 0.3 mol./100g. A similar turning point for wool-H_2O occurred at about 1.0 mol./100 g.

5491. MASON, S. G. **Specific surface and electrokinetic potentials of cellulose fibers.** *Pulp & Paper Mag. Can.* **48**, No. 10, 76-80 (1947).—*C.A.* **41**, 7747*h*.

Of the existing methods for measuring surface area, the permeability method is considered the most promising. Many of the phenomena involved in fiber flocculation, size pptn., filler retention, pitch control, etc., are often explained on the basis of changes in the zeta-potential.

5492. MELLON, EDWARD F.; KORN, ALFRED H., AND HOOVER, SAM R. **Water absorption of proteins. I. Effect of free amino groups in casein.** *J. Am. Chem. Soc.* **69**, 827-31 (1947).—*C.A.* **41**, 5364*b*.

The first step in the binding of water by the NH_2 groups was a sharing of one mol. of water between 2 NH_2 groups of relative humidities below 6%. However, treatment of the data by the B.E.T. theory of adsorption indicated a monolayer of one water mol. per NH_2 group. The 2nd step was a linear increase in absorbed water with increase in relative humidity. The 3rd step was a rapidly increasing amt. of absorption with increase of relative humidity and appeared to be a condensation of water on water mols. already attached to the NH_2 groups. Depending on the relative humidity, from 24-33% of the water absorbed was absorbed by the NH_2 groups.

5493. MONGAR, J. L. AND WASSERMANN, A. **Ionic exchange and fiber contractions.** *Nature* **159**, 746 (1947).—*C.A.* **41**, 6109*c*.

Ca alginate fibers when washed with Na_2CO_3 solns. first contracted and then elongated. The max. contraction (13%) occurred when 29% of the Ca had been converted to $CaCO_3$ with the simultaneous formation of Na alginate. This action was attributed to the formation of gel segments in the 3-dimensional network of Ca alginate.

5494. ODA, RYOHEI AND SHIMIZU, HIROSHI. **Cation-exchange resin from natural rubber. I. Preliminary experiments. II. Concentration of quantity of sulfuric acid for the preparation of cation exchangers. III. Temperature of resin formation. IV. Conditions of sulfonation. V. Conditions of resins drying.** *Chem. High Polymers* (Japan) **4**, 23-4; 24-6; 26-7; 27-8; 28-30 (1947).—*C.A.* **45**, 2706*c*.

A resin having cation-exchange capacity was obtained by the reaction of rubber with concd. H_2SO_4. The concn. of H_2SO_4 for resin formation must be above 95%, and 10 times as much H_2SO_4 as pale crepe must be used. The optimum temp. for resin formation was 140°C. The amt. of 60% oleum was 3 parts to 1 part dried resin, and the optimum reaction temp. was 40°C. The water content of resin after sulfonation was 33%. By heating first at a high temp. and then drying at a lower temp. after washing the liberation of acid could be avoided.

5495. PETITPAS, GENEVIEVE. **Absorption of Congo red by cellulose.** *Mem. services chim. etat* **33,** 83-9 (1947).—*C.A.* **43,** 4848*f*.

Dyeing of cotton linters, refined in a lab. beater for periods up to 27 hrs, in a bath contg. 6g Congo red, 2 g NaCl, and 10 g linters, in liter for 1 hr at 75°C showed a rapid and then a slower increase in the amount of Congo red absorbed, equil. finally being reached. The effect of washing was greater with beaten linters than with unbeaten. The treatment of 0.5 g of unbeaten linters, beaten linters, ramie, or spruce pulp in 10 cc. dist. H_2O (or MeOH contg. 0.5-2.0 g Congo red until equil. was reached at 20°C) showed little difference.

5496. RAO, G. N. SUBBA; RAO, E. SANJIVA, AND RAO, K. SUBBA. **Hysteresis in sorption. XV. Hysteresis in the sorption of water on casein, egg albumin, and gelatin.** *Proc. Indian Acad. Sci.* **25A,** 221-8 (1947).—*C.A.* **41,** 5359*b*.

Sorption-desorption cycles for H_2O at 30°C after degassing to 0.001 mm pressure showed that the hysteresis loop was diminished in the 2nd cycle and disappeared in the 3rd cycle for casein, denatured casein, and albumin. Denatured egg albumin and gelatin showed no hysteresis loop even on the first cycle. The disappearance of the hysteresis loop was related to the swelling property and solvation.

5497. SARKAR, P. B.; CHATTERJEE, H.; MAZUMDAR, A. K., AND PAL, K. B. **The acid number of vegetable fibers in relation to basic dye absorption.** *J. Soc. Dyers Colourists* **63,** 229-31, (1947).—*C.A.* **41,** 6052*d*.

Twelve vegetable fibers were analyzed for their lignin, CO_2, furfural, holocellulose, and other contents. Acid values and absorption of methylene blue were measured and showed a close relationship between them. Adsorption of basic dyes by these lignocelluloses was due to the presence of acidic constituents of the hemicelluloses, rather than the lignin.

5498. SCHRAMEK, W. AND STENZEL, ANNELIES. **The swelling and solution mechanism of xanthated sodium cellulose fiber.** *Melliand Textilber.* **28,** 420-7 (1947).—*C.A.* **43,** 9437*c*.

The breakdown of the aggregates in the native, cellulose structure and the recombination and orientation of these forms in the regenerated fiber were discussed.

5499. SHAH, NARHARI H. **Penetration means less depth of shade.** *Indian Textile J.* **57,** 458, 460 (1947).—*C.A.* **41,** 4312*i*.

Color penetrated cotton fiber better before mercerization. The increase in depth of shade of rayon over unmercerized cotton was due to a combination of 3 factors: (1) addnl. color absorbed, (2) differences in reflectance between cotton and rayon, and (3) difference in penetration.

5500. SIMPSON, J. E. AND HOWORTH, RUTH M. **A dynamic absorption method for determining water repellency.** *Textile Research J.* **17,** 497-503 (1947).—*C.A.* **41,** 7761*d*.

The method was claimed the most precise developed for: (a) detg. the max. hydrophobic level which any particular water-repellent was capable of producing on a fabric, (b) detg. the true degree of hydrophobicity of a fabric at any time, (c) ascertaining the efficiency of application of a repellent finish, and (d) quickly indicating the protective qualities of a finish during any given period until the repellency might become changed by wear.

5501. SUBRAHAMANYA, R. S.; DOSS, K. S. G., AND SANJIVA RAO, B. **Rubin numbers.** *Proc. Indian Acad. Sci.* **26A,** 197-202 (1947).—*C.A.* **42,** 2156*b*.

The rubin no. was defined as the no. of mg of the colloid that (when present in 10 cc. of a 0.002% Congo rubin soln. of pH 5.2 and electrolyte concn. of 0.02*N*) produced 26.5% blue color on the addn. of 10% NaCl soln. The rubin nos. of starch, gelatin, albumin, and casein were found to be 34.0, 3.5, 2.5, and 0.66, resp.

5502. SYSKOV, K. I. AND KUKHARENKO, T. A. **Sorption method of determination of constituent groups in coals and their components.** *Zavodskaya Lab.* **13,** 25-8 (1947).—*C.A.* **41,** 5702*d*.

The sum of phenolic OH and of COOH groups was detd. by the amt. of chemisorbed $Ba(OH)_2$. In many cases it was sufficient to derive the equil. E_1 from just one detn. with $Ba(OH)_2$ 0.03 N and only to check with a 0.06 N soln. The method was applicable to humic acids, lignins and residual coals. The COOH content was detd. in a similar way by the amt. E_2 of $Ca(AcO)_2$ chemisorbed in 4 days from 0.3 N and 0.4 N solns. Results were reliable when the two detns. did not differ by more than 0.2 mg equiv./g. The content of phenolic OH was found by the difference E_2-E_1.

5503. TAVERNIER, J. **Two curious cases of the formation of metallic sulfides.** *Bull. soc. Sci. Bretagne* **22,** 53-6 (1947).—*C.A.* **43,** 924*d*.

The brown color developed on exposure of white wool fabric to light and air was attributed to the reaction of S in the wool with Cu and Fe, probably introduced from a glycerinated bath used in finishing. A white creme de menthe occasionally developed an amber color after several months in bottles. This was due to the fact that at the end of each week, the sirup from incompletely purified sucrose (used in preg. the liqueur) remained in Cu containers from Saturday until Monday.

5504. TRAPEZNIKOV, A. A. AND LIPETS, M. E. **Conductometric study of the exchange adsorption of electrolytes on fatty acid crystals. III.** *J. Phys. Chem.* (U.S.S.R.) **21,** 109-18 (1947).—*C.A.* **41,** 6107*c*.

The elec. cond. κ of a $Ba(OH)_2$ soln. (0.036 M was used) was slightly lowered by palmitic acid crystals in the soln. as long as the temp. remained below 45°C. The κ of $Th(NO_3)_4$ solns. was slightly lowered by palmitic acid below 45°C and much raised between 45° and 59°C because of liberation of HNO_3; at 59°C (in 0.134 M $Th(NO_3)_4$) 0.5 g palmitic acid was quantitatively transformed into $Th(C_{16}H_{31}O_2)_4$.

5505. Zentner, Rene D. **Heat guard for the McBain-Bakr sorption balance.** *J. Phys. & Colloid Chem.* **51**, 972-4 (1947).—*C.A.* **41**, 6441*e*.

Heat radiation during the sealing and glass-blowing of the McBain-Bakr balance adversely affected the stability of certain substances such as dehydrated milk or Al soaps. This effect was prevented by shielding the sample or sorbent from radiation with a heat guard consisting of a no. of Cu disks sealed within an evacuated glass bulb.

5506. Angelescu, E. and Damian, D. **Comparative study of the adsorption on cellulose and on viscose rayon from cellulose. I. Adsorption of iodine.** *Bul. Inst. Natl. Cercetări Technol.* 3, 149-58 (1948) (in French).—*C.A.* **43**, 9438*g*.

Adsorption of I_2 from soln. in KI followed the relation $x/m = Kc^p$, x/m was mg I_2 adsorbed per g of adsorbent, c the equil. I_2 concn., and K and P consts. The adsorption on both cellulose and rayon was very weak compared with that on corn starch, and followed Henry's law $(p = 1)$, showing soln. of the I_2 rather than chem. combination as in the case of starch $(p = 0.166)$. No correlation was found between the development of blue color and adsorptive power for I_2.

5507. Berezin, B. I. and Deryagin, B. V. **Methods for the measurement of the absorptive capacity of paper. A new method for the measurement of the absorptive capacity of paper.** *Poligraf. Proizvodstvo* Sept., **1948**, 23-5; Oct., **1948**, 22-6.—*C.A.* **46**, 7767*a*.

The new method depended upon the measurement of the vol. of air displaced when the paper was satd. with paraffin oil or another liquid. Measurements could be made at normal pressure, reduced pressure or *in vacuo*. Equations were given for the calcn. of the specific pore surface and the specific paper surface from the results of the measurements described.

5508. Bréguet, André; Viatte, Robert, and Perra, H. **Absorption and fixation of sodium hydroxide by native cellulose.** *Compt. rend.* **226**, 1987-9 (1948).—*C.A.* **42**, 7524*a*.

Samples of linters (98-0% α-cellulose) were swollen at 20°C in aq..NaOH of various concns., then analyzed for percentage of NaOH and H_2O absorbed. The 1st part of the NaOH absorption curve, between 0 and 10.33% NaOH, was convex and represented swelling of amorphous cellulose, and was reversible. The 2nd part (up to 17.23% NaOH) was concave and represented transformation of cryst. areas, and was not reversible. The 3rd part (up to 27% NaOH) was a straight line and represented swelling of the converted cryst. areas and was reversible.

5509. Enders, C.; Tschapek, M., and Glawe, R. **Some colloidal properties of natural humic acids and synthetic melanoids.** *Kolloid-Z.* **110**, 240-4 (1948).—*C.A.* **43**, 5255*e*.

Comparative tests on the colloidal properties of humic acids and melanoids (formed by heating glucose with amino acids) showed similarities as well as some discrepancies between them. The hydrophilic properties of the humic acids and melanoids were similar; however, coalification of the melanoid, by heating to 300°C, reduced its hydrophilic capacity. The melanoids had less base-exchange capacity than the natural humic acids.

5510. Carbuzov, A. I. **Effect of electrolyte mixtures on the formation of periodic precipitates of calcium phosphate in agar gels.** *Kolloid. Zhur.* **10**, 265-7 (1948).—*C.A.* **43**, 7788*h*.

A 0.4 N Na_2HPO_4 soln. placed on a gel contg. 0.7% agar and 0.02 N $CaCl_2$ gave rise to 5-6 periodic ppts. Weaker solns. of citrate and tartrate had less effect, and K_2SO_4 lowered the no. of ppts. to 3 in a concn. as high as 0.3 M KSCN and KI, taken in excess (e.g. in M soln.), counteracted the action of citrate and tartrate.

5511. Geake, A. **Absorption of the two vat dyes Caledon Red BN and Caledon Jade Green by cotton.** *J. Textile Inst.* **40**, T57-T87 (1948).—*C.A.* **43**, 2776*g*.

Concn. of the dyes in the dyed cotton was detd. by extg. with pyridine and spectrophotmetric comparison with standards. Initial absorption was rapid but equil. was not reached within several days. Concn. of dye and of neutral electrolyte in solns. of const. concn. in NaOH were the chief variables considered.

5512. Haller, R. **Absorption of copper salts by vegetable and various artificial silk fibers.** *Melliland Textilber,* **19**, 168-9 (1948).—*C.A.* **44**, 8115*a*.

Absorption of Cu salts by cotton, viscose, Bemberg, and acetate rayon is described. Treatment with Fehling solution at 60-70°C results in absorption of the colloidal complex salt. of probable formula $Cu(OCH\text{-}CO_2K)_2$(?); on boiling, the complex salt is reduced to red Cu_2O by the hydro- or oxycelluloses present in the fibers. Treatment in presence of various oxidizing agents leads to absorption of various colored complex Cu salts.

5513. Harris, J. C. **Adsorption of surface-active agents by fibers.** *Textile Research J.* **18**, 669-78 (1948).—*C.A.* **43**, 1193*f*.

Cotton did not appear to preferentially absorb anionic or nonionic agents, the amts. adsorbed representing less than the quantities required for a regular closely packed monomol. film. Cationic agents were rapidly and tenaceously held, and com. practice and usage would indicate that cotton selectively adsorbed these agents. Adsorption by wool of anionic and cationic agents proceeded over a considerable period of time and in amts. exceeding those adsorbed by cotton. Cotton exhibited low adsorption of anionics because it did not possess the chemically reactive character of wool.

5514. Jurgens, J. F. **Phosphorylated Cotton Cellulose as a Cation-Exchange Material.** *Textile Research J.*, **18**, 1 (1948)

Phosphorylated cotton cellulose, made by the phosphoric acid-urea method, was investigated as a cation exchange material. Cotton linters and cotton fabric were tested for cation exchange capacity.

5515. Karnik, M. G. and Devadatta, S. C. **Swelling of cellulose.** *J. Univ. Bombay* **17A**, No. 24, 40-7 (1948).—*C.A.* **43**, 7679*i*.

The swelling and shrinkage of cellophane and of 2-fold yarn of 28s count of bleached Sakillaridis cotton were detd. in 21-71% H_2SO_4 and in 52-90% H_3PO_4 at 40°C. In H_2SO_4 the swelling and shrinkage increased to a max. and then decreased with increased acid concn.; the time to max. swelling and shrinkage decreased with increased acid concn. In H_3PO_4 the swelling and shrinkage increased with increase in concn. of acid up to 82.8% and then decreased; the time to max. swelling and shrinkage decreased with increased acid concn.

5516. KEYVAR, C. **The colloidal aspects of the theories of dyeing.** *Textile J. Australia* **22,** 872-4 (1948).—*C.A.* **43,** 6827*d*.

Dyeing theories as applicable to colloidal dye solns. were discussed. It was concluded that no single theory sufficed to explain all the phenomena which occurred in dyeing.

5517. KOSTRIKIN, YU. M. **Variants of use of chemisorbents for analytical purposes. I.** *Zavodskaya Lab.* **14,** 173-5 (1948).—*C.A.* **43,** 57*i*.

In using organolites for analytical purposes the soln. to be analyzed should be filtered through a layer of the sorbent in order to obtain complete absorption.

5518. LLARENA CHAVE, JOSE LUIS. **The adsorption of color on textile fibers.** *Afinidad* **25,** 498-503 (1948).—*C.A.* **43,** 2777*b*.

The Freundlich adsorption isotherm could be applied to exptl. data for the adsorption of Durazol Blue 3R-200 (an azo dye) on viscose rayon. A comparison of the effects of NaCl and Na_2CO_3 in the dyebath showed Na_2CO_3 to have the stronger flocculating action.

5519. LUR'E, YU YU. **Variants of use of chemisorbents for analytical purposes. II.** *Zavadskaya Lab.* **14,** 176-8 (1948).—*C.A.* **43,** 57*i*.

Mixing of the soln. with the organolite followed by extn. is preferred to filtration through a layer of sorbent followed by extn. for the following reasons: (1) In dealing with small concns. of material in soln., for which this method is intended, an extn. of 98-99% is quite satisfactory. (2) Time required for analysis is considerably shortened. (3) Smaller amts. of sorbent for adsorption and acid for extn. are required. (4) The pH required for specific adsorption can be easily maintained.

5520. McINTIRE, FLOYD C. AND SCHENCK, JAY R. **Polysaccharide acid esters as cation-exchange media.** *J. Am. Chem. Soc.* **70,** 1193-4 (1948).—*C.A.* **42,** 6968*c*.

Cotton was partially esterified with glutaric, maleic, phthalic, and succinic acids, and wood cellulose and starch with succinic acid. Shaking with excess 0.05 M Na_2CO_3 soln. showed Na-ion binding capacities in the range 0.8-4.9 milliequivs. per g at 4.8-52% esterification. The products did not gel in org. solvents or water and largely retained the original structure.

5521. MELLON, EDWARD F.; KORN, ALFRED H., AND HOOVER, SAM R. **Water absorption of proteins. II. Lack of dependence of hysteresis in casein on free amino groups.** *J. Am. Chem. Soc.* **70,** 1144-6 (1948).—*C.A.* **42,** 4818*g*.

In a series of benzoylated casein samples contg. different amts. of free amino groups, it was shown that the amino groups were responsible for the absorption of about 0.25 of the total amt. of water absorbed by casein, at all relative humidities (R.H.). The desorption expts. were all made at 30° ± 0.1°C and 51, 75, 84, and 93% R.H. by lowering the R.H. from the highest to the next lower level. Equil. was reached in 18 days, 3 times as long as required for absorption. A definite hysteresis in the sorption phenomena of about one half the absorption values at 6% R.H. and about one fifth at 50% R.H. was observed.

5522. NEUHAUS, A. **Partially isomorphous systems. X. Oriented separations on cane sugar.** *Z. Elektrochem.* **52,** 178-82 (1948).—*C.A.* **43,** 8238*f*.

The sepns. or growths of the following compds. on cane sugar as the "lattice carrier" were studied: anthraquinone, alizarin, 1-hydroxyanthracene, purpurin, and other naphthalene derivs.; C_6Cl_6, C_6Cl_5OH, p-benzoquinone, p-$O_2NC_6H_4OH$, and other benzene derivs.; β-succinic acid, isatin, and fluorescein.

5523. NORTH, F. **Some variables in the coloring of paper.** *Proc. Tech. Sect., Paper Makers' Assoc. Gt. Brit. & Ireland* **29,** 127-53, discussion 154-7 (1948).—*C.A.* **45,** 349*d*.

The dyeing of paper is believed to consist essentially of 2 stages: (1) adsorption of the dye from soln. by the cellulose before addn. of sizing agents; this adsorption is negligible with most acid dyes, small with basic dyes, and extensive with direct dyes; (2) after the addn. of sizing agents, a complex ppt. is produced and the retention of this ppt. by the fibers completes the dyeing process. From a practical viewpoint, the most important single variable in paper dyeing is that of pH.

5524. OOIWA, MASAYOSHI. **The capillary absorption of wood. III. Absorption of alcoholic solutions of phenolformaldehyde resin.** *J. chem. Soc. Japan, Ind. Chem. Sect.* **51,** 37-8 (1948).—*C.A.* **44,** 9215*a*.

After the pieces of beech wood were dipped into solns. of PhOH-HCHO resin (7.92, 17.88, and 38.61%) in 92% alc., both resin and absorbed soln. were detd. against time. Alc. was absorbed more quickly than resin, expecially at first.

5525. PETERS, R. H. AND VICKERSTAFF, T. **The adsorption of direct dyes on cellulose.** *Proc. Roy. Soc.* (London) **A192,** 292-308 (1948).—*C.A.* **43,** 8234*a*.

It was shown for Chlorazol Sky Blue FF on cotton and Chrysophenine G on cellophane that the concn. in the fiber of electrolytes other than the dye might not be neglected, and when this factor was taken into account, theory and expt. agreed well. Adsorption isotherms of a no. of direct dyes on viscose rayon were measured and relative affinities calcd. These affinities were found to vary somewhat with dye concn., but much more from dye to dye, and depended greatly on the salt concn. in the dye bath.

5526. PETITPAS, GEVEVIEVE AND PETITPAS, THERESE. **The role of water during the absorption of**

sodium hydroxide by cellulose. *Compt. rend.* **226,** 672-3 (1948).—*C.A.* **42,** 4744*a*.

In the absorption of aq. NaOH soln. by cellulose, the quantity of NaOH retained by the cellulose increased as the concn. of the aq. NaOH soln. increased, whereas the quantity of H_2O retained passed through a max. at a concn. of about 4 N (14%). When H_2O was replaced by MeOH, the retention was very small and only showed a slight indication of a max. When H_2O was added to the mixt. of NaOH-MeOH, the retention was larger and increased more rapidly in proportion to the concn.

5527. ROYER, G. L.; ZIMMERMAN, C. L.; WALTER, H. J., AND ROBINSON, R. D. **Dyeing studies at elevated temperatures—use of temperatures between 200 °F and 300 °F.** *Textile Research J.* **18,** 598-614 (1948).—*C.A.* **43,** 411*c*.

An app. was illustrated that was designed for dyeing textiles in the range of 200-300 °F. Fundamental dyeing data were obtained by using a wide variety of textile fibers. High-temp. technique was applicable in the dyeing of fibers requiring a long time for the diffusion of the dye into the individual fibers under normal dyeing conditions. A disadvantage of continuous dyeing at high temps. was the elevated temps. over a period of several hrs. The amt. of thermal decompn. of many acid and direct dyes in 0.5% concns. was detd.

5528. SARKAR, P. B. AND CHATTERJEE, H. **Studies on the absorption of methylene blue by jute fiber.** *J. Soc. Dyers Colourists* **64,** 218-21 (1948).—*C.A.* **42,** 6540*d*.

The dye absorption depends largely on the pH of the dye bath, but is practically independent of time, temp., and concn. The max. absorption agrees fairly well with the acid values of the fiber, both raw and treated. Cationic exchanges take place, apparently between polyuronic acids of the fiber and methylene blue.

5529. SCHOFIELD, R. K. AND TALIB-UDDEEN, O. **Measurement of internal surface by negative adsorption.** *Discussions Faraday Soc.* **1948,** No. 3, 51-6.—*C.A.* **43,** 1240*i*.

Measurements were made at pH 6 and pH 1.3 of the small increase in concn. occurring when samples of jute were shaken in chloride solns. from *N* to 0.0078*N*. At pH 1.3, the vol. of water taken by 100 g of dry jute was close to 11 cc. for concns. below 0.1*N*. This water was presumably taken into the fiber substance where chloride ions could not enter.

5530. SOKOLOVA, N. V. **Theory of dyeing. XIII. Effect of pH of the dye-bath on binding of acid and substantive dyes by wool keratin.** *J. Applied Chem.* (U.S.S.R.),**21,** 966-75 (1948).—*C.A.* **46,** 2806*g*.

Acid and substantive dyes are bound by wool at all pH values from 1 to 8, the amt. of dye fixed (mg.-equivs. per 100 g. of wool) increasing with diminishing pH; a satn. value of 80 is reached in 2-3 hrs. at pH 3-4 in the case of molecularly dispersed dyes, but not for colloidal dyes, which cannot penetrate into the interior of the fibers.

5531. TACHIBANA, TARO. **Surface chemical structures on biocolloids. I. Lubricating action of biocolloidal solution.** *J. Chem. Soc. Japan, Pure Chem. Sec.* **69,** 103-4 (1948).—*C.A.* **44,** 9212*b*.

The lubricating action of biocolloidal solns., such as those of sugar, gelatin, or albumin, between 2 solid surfaces was demonstrated experimentally. Comparisons were made of this action with the pptn. vol. in a soln. and the protective action of colloids, which were also manifestations of adsorption phenomena.

5532. THOMEN, E. W. **Dyeing wool with chromatable dyes in the presence of chromium salts.** *Textil-Rundschau* **3,** 367-76 (1948).—*C.A.* **43,** 2775*i*.

Differences of shades of wool tips and roots dyed with chrome dyes in neutral Cr salt solns. depended on the state of soln. of the dye-Cr salt complex preceding formation of the Cr lake. Wool tips, damaged by photochem. action of light rays, were in a loosened condition; wool roots were not damaged and more compact. Erio-chromal mordant TP was developed as a new assistant to neutral chrome dyeings, being capable of dispersing better the colloidal complexes so that the roots were penetrated as well as the tips.

5533. VIATTE, ROBERT AND PERRA, H. **Absorption and fixation of sodium hydroxide from solution by regenerated (viscose) cellulose.** *Compt. rend.* **227,** 204-6 (1948).—*C.A.* **42,** 7524*c*.

Regenerated cellulose swelled faster and absorbed more NaOH than native cellulose. The H_2O absorption reached a sharp max. at 9.3% NaOH. The curve of NaOH absorption had a 1st max. at 9.3%, a min. at 13.97%, and a 2nd max. at 21.9% NaOH.

5534. WEIR, C. E.; CARTER, J; NEWMAN, S. B., AND KANAGY, J. R. **Penetration of leather by water under dynamic conditions.** *J. Am. Leather Chemists' Assoc.* **43,** 69-95 (1948).—*C.A.* **42,** 2462*h*.

An app. was described for the detn. of the no. of flexes required for the penetration of water under essentially zero pressure through a leather specimen flexed through 60 cycles per min. during the test. Results were given for a large no. of com. leathers with and without various waterproofing treatments.

5535. ALBRINK, WILHELM S. AND FUOSS, RAYMOND M. **Electrical-properties of synthetic membranes.** *J. Gen. Physiol.* **32,** 453-60 (1949).—*C.A.* **43,** 4892*e*.

Strong water-insol. polyelectrolytes can be prepd. by addn. of butyl bromide to a 1:19 copolymer of 4-vinylpyridine. With a hydrocarbon plasticizer, flexible films can be made in which the Br are freely movable while the larger polycations are immobilized.

5536. ALEXANDER, P.; CARTER, D., AND EARLAND, C. **The application of organosilicon polymers to wool.** *J. Soc. Dyers Colourists* **65,** 107-15 (1949).—*C.A.* **43,** 4017*a*.

Organosilicon polymers are initially anchored to wool fibers, via -Si -NH—linkages. To obtain nonfelability with a deposit of less than 5%, the polymer must be produced from a monomer contg. a reactive grouping such as Si-Cl, and the polymer must be a hard solid.

5537. Arkhipov, M. I. and Kharitonova, V. P. **Effect of ammonia on the adsorption of copper by cellulose and its solubility in cuproammoniacal solutions.** *Zhur. Priklad, Khim. (J. Applied Chem.)* 22, 1030-6 (1949).—*C.A.* 44, 2233*e*.

The max. amt. of Cu absorbed by cellulose not only increased with the concn. of Cu but, at const. Cu content, varied strongly with the concn. of NH_3. In solns. incapable of dissolving the cellulose (Cu 6.28-36.2 millimoles/liter), absorption of Cu first decreased with increasing NH_3, passed through a min., and then increased with further increase in NH_3; with increasing Cu content, the min. shifted to increasingly higher NH_3 concn. Soln. of cellulose took place in 2 steps, absorption of Cu and solvation of the Cu-cellulose complex formed. NH_3 not only promoted absorption of Cu by cellulose but also was an effective solvating agent for the Cu-cellulose complex.

5538. Bellamy, L. J. and Watt, C. H. **Effect of rubber, polythene, and polyvinyl chloride tubing on penicillin.** *Chemistry & Industry* **1949**, 19-21.—*C.A.* 43, 4428*d*.

Rubber mixes, vulcanized without accelerator, when placed in contact with penicillin for 24 hrs. caused losses in potency up to 20%. Mixes vulcanized with accelerator deactivated up to 90% of pencillin on contact. The destructive activity was related to the quantity of accelerator in the vulcanized mixt. Polythene and polyvinyl chloride tubing had no effect on pencillin.

5539. Bréguet, André; Viatte, Robert, and Chareyron, Colette. **Absorption and fixation of sodium hydroxide by mercerized cellulose.** *Compt. rend.* **228**, 1499-1501 (1949).—*C.A.* 43, 7233*g*.

The swelling of mercerized cellulose in NaOH soln. plotted against the concn. of NaOH did not give a curve of 3 zones as was the case with native cellulose. Mercerized cellulose swelled in 0-35% NaOH by vol., then pressed, washed, neutralized, rewashed, and dried, swelled again in a weaker NaOH soln. as if it had not undergone the previous treatment.

5540. Bromberg, A. V. **Diffusion of pigments in gelatin gels. I. Measurement of diffusion by a microphotometric method.** *Kolloid. Zhur.* **11**, 211-20 (1949).—*C.A.* 44, 22*f*.

Dye soln. was placed on top of a gelatin gel., removed when less than 1 mm of the gel was tinted, and replaced by a gelatin soln. which at once solidified. Then the spread of the dye in both directions from the colored layer was detd. with a Se photocell. The 2 values of diffusion coeff. were almost identical for Direct Pink C, Benzopurpurin 4 B, and Chicago Blue B, but were in a ratio of 2 or 3 approx. for Saphrol and Thiocarmin R.

5541. Cassidy, Harold G. **Electron-exchange polymers.** I *J. Am. Chem. Soc.* 71, 402-6 (1949).—*C.A.* 43, 5263*c*.

The polymerized vinylhydroquinone was dissolved in glacial AcOH, buffered and suspended in the presence of albumin, and titrated under N with ceric sulfate; a bright Pt electrode referred to a satd. calomel electrode was used to measure the potentials. During the oxidation of the polymer, whether in soln. or in a dispersed solid form, a pink color developed which was interpreted to indicate the accumulation of semiquinoid residues.

5542. Cegarra, José. **Adsorption phenomena in the textile industry.** *Anales invest. textil.* (Barcelona) 1, 29-40, 99-100 (1949).—*C.A.* 44, 2247*e*.

The fixation of dye from a soln. contg. 25×10^{-5} g Dark Green BN/ml by cotton at 80 °C reached an equil. in 1 hr, but 4 hrs were required with Chlorantine Orange 2GL. Equil. (i.e., 1 hr) fixation of Dark Green BN, as g dye fixed/kg cotton, were detd. The dye fixation curve obtained at 60 °C with addn. of electrolyte followed the Freundlich adsorption equation closely. All the dye was taken up by a flock of silk from a soln. contg. 66×10^{-8} g of Brilliant Green/ml at 20 °C.

5543. Dickinson, H. O. **Use of dyes to determine the isoelectric point of gelatin.** *Nature* **163**, 485-6 (1949).—*C.A.* 43, 6884*d*.

Certain carbocyanide dyes showed a narrow and intense absorption band in the red region of the spectrum in dil. gelatin solns. if the pH was above the isoelec. point. Below this the absorption was similar to that of the aq. dye soln.

5544. Donovan, R. and Larose P. **The sorption of acids by wool.** *Can. J. Research* **27B**, 879-89 (1949).—*C.A.* 44, 4259*b*.

The effect of sodium sulfate on the sorption process was studied. Four solns. of H_2SO_4 ranging in strength from 0.0505 to 0.0101 *N* were used, but no significant effect of the salt was found. The adsorption isotherms were of the Langmuir type.

5545. Fischer, Roland; Seidenberg, S., and Weis, U. P. **Affinity of water-soluble substances to wool and their antibacterial activity.** *Helv. Chim. Acta.* 32, 8-17 (1949).—*C.A.* 43, 4017*e*.

Strips of plain wool (1 g.) were wet with warm water and placed for 1 min. at about 75 °C in 10 cc. of a soln. of gram stain (about 0.05 g gentian violet in 20 cc. of water), then throughly washed, and rinsed. The affinity for wool of wetting, detergent, mothproofing, and disinfecting agents was detd. from the increase in weight of wool strips (10 g ± 0.01) dyed in the presence of 2 g of the test substance in 500 cc. of water at 90 °C for 10 min., both neutral and acid soln.

5546. Fuoss, Raymond M. and Sadek, Hussein. **Mutual interaction of polyelectrolytes.** *Science* **110**, 552-4 (1949).—*C.A.* 44, 2824*c*.

Turbidimetric titrations of polyvinylbutylpyridonium bromide with Na polyacrylate were made with a Phoenix light-scattering photometer. Up to the equivalence point the turbidity increased linearly with the amt. of polyacrylate added, increased sharply to a ratio of 1.5, and decreased slowly upon further addn. of polyacrylate. Na polystyrene sulfonate and polypyridonium bromide were used in a second expt.

5547. Gardner, K. W. and Smith L. B. **The adsorptive capacity of cotton for sodium oleate.** *J. Am. Oil Chemists' Soc.* 26, 194-6 (1949).—*C.A.* 43, 4496*i*.

The adsorbate was shown to be an acid soap. The addn. of free NaOH repressed hydrolysis and reduced the adsorption. The acid soap could be removed from the fabric by repeated boiling distd. H_2O rinses, or the adsorptive capacity for fresh acid soap could be restored by converting the adsorbed material to lime soap by rinsing in hard H_2O.

5548. GRIGOROV, O. N. AND PRIKHID'KO, N. E. **Transference numbers of calcium ions (moving) through collodion membranes of various structures.** *Kolloid. Zhur.* **11**, 141-2 (1949).—*C.A.* **43**, 7290*g*.

Membranes of graded pore radius *r* were prepd. When *r* was 60 or 3 mμ, the transference no. *n* of Cl^- in 0.01 N KCl was 0.471 or 0.295. When *r* was 39 or 3 mμ, *n* in 0.01 N $CaCl_2$ was 0.559 or 0.506. The small relative accelration of Ca^{++} by neg. membranes was due to the great radius of Ca^{++}.

5549. GUASTALLA, LINA AND GUASTALLA, JEAN. **Physics of surfaces. Adhesion tension and bond energy.** *Compt. rend.* **228**, 1575-7 (1949).—*C.A.* **43**, 7777*b*.

Adhesion tention Γ was detd. by plunging a paraffined foil vertically into 0.001 N HCl soln. covered with a film of oleic acid or myristic acid and measuring the vertical force. As a first approxn. $W = \Gamma + A - p$, where W = energy liberated by the fixation of the fat acid film per cm² of paraffin surface, A = surface tension of pure water, and p = the film pressure.

5550. JAYME, GEORG AND MOHRBERG, WILHELM. **Swelling measurement with holocelluloses retaining lignin.** *Das Papier* **3**, 153-9 (1949).—*C.A.* **43**, 6407*e*.

Spruce holocelluloses and retaining, resp., 1.64% and 1.43% "Halse lignin" were extd. with varying concns. of aq. NaOH (ranging from 0.2% to 20%). Untreated samples retained their woody structures tenaciously and individual fibers could be obtained only by mild alk. or mech. treatments. As de-lignification increased, the H_2O-swelling capacity also increased (prior to any alk. treatments). When higher concns. of NaOH were used, the swelling capacity decreased because of the extn. of the hemicelluloses which were active swelling agents. A min. was reached after extn. with 6-8% aq. NaOH.

5551. KACSER, H. AND UBBELOHDE, A. R. **Thermodynamic conditions for the retention of solvents by crystals: the system brucine-benzene.** *Nature* **164**, 445-6 (1949).—*C.A.* **44**, 27*d*.

Brucine crystallized from C_6H_6 solns. with 1 mol of C_6H_6 per mol. of brucine. The C_6H_6 was held very tightly by the brucine, coming off only after a temp. of 140 °C was reached at ordinary pressure. The evolution of the C_6H_6 vapor could be almost explosive.

5552. KING, G. AND MEDLEY, J. A. **Direct-current conduction in swollen polar polymers. I. Electrolysis of the keratin-water system.** *J. Colloid Sci.* **4**, 1-7 (1949).—*C.A.* **43**, 3689*a*.

When a direct current was passed through a keratin film contg. at least 15% H_2O, the amt. of H_2 evolved was equiv., to the amt. predicted from the no. of coulombs passed. This indicated that d.-c. conduction in the keratin-H_2O system took place by ionic migration.

5553. KING, G. AND MEDLEY, J. A. **II. The influence of temperature and adsorbed salts on the direct-current conductivity of polar polymer-adsorbate systems.** *J. Colloid Sci.* **4**, 9-18 (1949).—*C.A.* **43**, 3689*b*.

Conds. at 25° and 40 °C were detd. as a function of H_2O sorption for keratin (undialyzed, dialyzed, or with 2% KCl or $MgSO_4$, added), dialyzed nylon, and dialyzed gelatin, and as a function of HCOOH sorption for dialyzed nylon and dialyzed keratin. Similar results were obtained with all systems. HCOOH was more effective than H_2O in increasing the cond. KCl increased the cond. of keratin markedly, whereas $MgSO_4$ had less effect.

5554. KITTELBERGER, W. W. **The diffusion of electrolytes through organic membranes. I. An equation for calculating diffusion rates. II. Experimental verification of calculated rates.** *J. Phys. & Colloid Chem.* **53**, 392-409 (1949).—*C.A.* **43**, 6489*i*.

The rates of diffusion were detd. of HCl, NaCl, and $CaCl_2$ through polyvinylbutyral resin films pigmented with SiO_2. The observed and computed rates were in agreement for HCl through membranes with 55 and 62% by vol. of SiO_2, for NaCl through membranes with 40, 55, and 62% SiO_2, and for $CaCl_2$ with 55% SiO_2 and 30% chrome yellow. Films with 70% SiO_2 were brittle and difficult to handle.

5555. KLEINERT, TH. **Adsorption process on lignin substances. III. The adsorption of sulfurous acid.** *Monatsh.* **80**, 135-9 (1949).—*C.A.* **43**, 5254*h*.

The adsorption of H_2SO_3 in dil. aq. soln. on sawdust (pine) and 2 lignins was measured at ordinary temp. One lignin was obtained from the digestion of pine shavings with dil. H_2SO_4 at elevated temp. and the other from treatment with concd. HCl at ordinary pressures. The adsorption followed the Freundlich isotherm.

5556. KLEINERT, TH. **Adsorption process on lignin substances. IV. The adsorption of aldehydes.** *Monatsh.* **80**, 140-3 (1949).—*C.A.* **43**, 5254*h*.

The adsorption of formaldehyde on the 2 types of lignin approximated Henry's law, while that of furfural followed the Freundlich adsorption isotherm.

5557. LIPETS, M. E. AND TRAPEZNIKOV, A. A. **Study of exchange adsorption of barium hydroxide by fatty acid crystals.** *Zhur. Fiz. Khim.* **23**, 981-92 (1949).—*C.A.* **44**, 19*a*.

The rate of decrease of elec. cond. of 6.3 g/liter $Ba(OH)_2$ on adding palmitic acid increased with temp. The apparent activation energy was 4300 cal/mole below 47 °C, 16,000 between 47° and 59 °C, and 227,000 between 59 and 60 °C. Two samples of stearic acids showed sudden changes of the rate of reaction with $Ba(OH)_2$ at 35°, 48°, and 60-65 °C.

5558. LISTER, G. H. **An investigation into the practical aspects of the adsorption of acid and chrome dyes by wool.** *J. Soc. Dyers Colourists* **65**, 97-106 (1949).—*C.A.* **43**, 4015*e*.

Under practical conditions of dye-bath concns. and materials the adsorption of acid and chrome dyes by wool agreed with the $\sqrt{t}$ for most of the dyeing period. To reach com. exhaustion of a dye bath 40-50% of the dye must be on the fiber in 5 min. The rate of dyeing was very sensitive to pH changes above the 50% exhaustion in 5 min.

5559. MACARTHUR, I.; MONGAR, L., AND WASSERMANN, A. **Ion exchange and fiber contraction.** *Nature* **164**, 110-11 (1949).—*C.A.* **43**, 8237*g*.

If fully swollen Ca alginate fibers of 0.4 mm were treated with a N soln. of Na_2CO_3 or Cl, the wt. of the axially contracted fibers increased up to 40%. In a test with NaCl soln. the contraction was relatively small (5-10%, depending on fiber diam.), but the vol. and length of the shortened fibers remained const. many hrs. Fully swollen fibers rinsed with 3 M dextrose or glycerol showed neither radial nor axial contraction; when treated with 5 N $CaCl_2$ the only changes were increase in stiffness, and linear coeff. of expansion (α) appeared small and pos.

5560. MACEWAN, D. M. C. AND TALIB-UDDEEN, O. II. **Artificial adsorbents.** *Bull. soc. chim. France* **1949**, D40-2.—*C.A.* **43**, 5255*i*.

The adsorption of water and 13 org. liquids, including alcs. and nitriles, on a complex of α-$Zn(OH)_2$ and Na 2,4-dinitro-1-naphthol-7-sulfonate were reported.

5561. MATSUNAGA, YOSHIAKI. **Adsorptive power of various fibers for aerosols.** *Bull. Nagoya Inst. Technol.* **1**, 260-70 (1949).—*C.A.* **44**, 8734*h*.

The adsorption on single fibers of silk, glass, and bamboo was measured for aerosols of benzidine, NH_4Cl, liquid paraffin, Boyle's oil, stearic acid, D-mannitol, and lanolin.

5562. MELLON, EDWARD F.; KORN, ALFRED H., AND HOOVER, SAM R. **Water absorption of proteins. IV. Effect of physical structure.** *J. Am. Chem. Soc.* **71**, 2761-4 (1949).—*C.A.* **43**, 7787*h*.

Sorption isotherms were measured on a series of wool, silk fibroin, and ovalbumin fibers treated to alter the internal phys. structure. Wool was dissolved in alk. thioglycolate and pptd. from soln. The product had essentially the same H_2O absorption as the control sample. Native ovalbumin was brought into a state of lateral order by denaturation, and the ordered regions were oriented by stretching the fibers. A slight but significant decrease in the absorption curve was produced by the increase in order, but this effect was much smaller on the succeeding desorption cycle.

5563. MONGAR, J. L. AND WASSERMANN, A. **Fully swollen alginate gels as "permutites"; kinetics of calcium sodium ion exchange.** *Discussion Faraday Soc.* **1949**, No. 7, 118-23.—*C.A.* **45**, 18*i*.

Fully swollen Ca-alginate fibers (diam. 0.24 to 1.2 mm) were suspended and rinsed with H_2O and then with NaCl soln. at the same temp. After known time intervals the flow of the NaCl soln. was interrupted and the fibers were again washed and analyzed for Ca^{++} and Cl . The diffusion of NaCl from the outside soln. into the gel was fast, compared with the rate of formation of $CaCl_2$ and the diffusion of $CaCl_2$ from the gel to the outside soln. was fast, compared with the rate of the reverse reaction.

5564. NEGISHI, MICHIHARU; FUKUDA, KAYOKO; MORI, HIDEKO; INAGAWA, KUNIKO, AND ARAI, YASUCHIKA. **Elasticity, tensile properties, and the mechanism of deformation of fiber. III. Tensile properties at natural cotton fibers in organic liquids.** *J. Soc. Textile Cellulose Ind.* **5**, 222-4 (1949).—*C.A.* **46**, 3756*h*.

The tensile strength and elongation of cotton fibers in satd. monohydric alcs., their esters, dioxane, C_6H_6, PhMe, and C_6H_{14} were similar to those alcs. and with a decrease of swelling.

5565. NEGISHI, MICHIHARU; FUKUDA, KAYOKO, AND MORI, HIDEKO. **Elasticity, tensile properties, and the mechanism of deformation of fibers. IV. Tensile properties of natural, hydrated, and water cellulose cotton fibers in water and caustic alkali solutions.** *J. Soc. Textile Cellulose Ind.* **5**, 266-8 (1949).—*C.A.* **46**, 3756*i*.

The tensile strength of natural cotton fibers in NaOH decreased with the concn. within the intermicellar swelling, but was const. with the value close to the dry strength within the intramicellar swelling. Hydrate and water cellulose fibers showed the same strength in water.

5566. NIKOLAEVA, M. A. AND PREIS, E. M. **Aggregative stability of metal organosols. II. Autocoagulation of organosols of some metals.** *Kolloid. Zhur.* **11**, 184-6 (1949).—*C.A.* **43**, 7292*a*.

The light absorption at 580 mμ of a slowly coagulating Zn sol in AcOEt (prepd. according to Svedberg) was detd. The coagulation was accelerated by KSCN. The dependence of the absorption on the wave length was measured for Zn in AcOEt and Au, Ag, and MnO_2 in H_2O.

5567. PERTI, S. L.; RANGANATHAN, S. K.; SUBRAMANIAN, T. S., AND SUD, L. R. **Metallic oxides as barrier treatments for prevention of attack by light on cellulose.** *Nature* **163**, 877-8 (1949).—*C.A.* **43**, 8133*i*.

Oxides of Cr, Cu, Fe, Mn, Sn, Ti, and Al were deposited by a double-bath process on Dosootie and Indian tenting fabric, in approx. 0.05, 0.5, and 1% concns. of the metal by wt of the fabric used. The treated fabrics and untreated congrol samples were exposed to sunshine at Kanpur for a total period of 2400 hrs, samples being withdrawn at periods of 400 hrs and tested for bursting strength. The results showed that Mn (0.56 and 1.3%) retarded actinic degradation markedly; Fe and Al showed some protective action but not to any useful extent.

5568. PETERS, L. AND SPEAKMAN, J. B. **The combination of wool with acids—a quantitative interpretation in terms of the Donnan theory of membrane equilibrium.** *J. Soc. Dyers Colourists* **65**, 63-71 (1949).—*C.A.* **43**, 3203*c*.

A quant. interpretation of the combination of HCl, H_2SO_4, and HCl in the presence of different concns. of KCl were given in terms of the Donnan theory of membrane equil. The course of combination was detd. by the pH inside the fiber, which could be calcd.

5569. Rosstovtzev, V. E. and Plaskin, S. A. **Sorption of sulfur dyes.** *Tekstil. Prom.* **9**, No. 1, 23-5 (1949).—*C.A.* **47**, 1936*c*.

Continuous dyeing with S dyes was improved on the lab. scale by quickly drawing the dye liquor through the fabric (with the help of a vacuum).

5570. Schwimmer, Sigmund and Balls, A. K. **Starches and their derivatives as adsorbents for malt α-amylase.** *J. Biol. Chem.* **180**, 883-94 (1949).—*C.A.* **43**, 9504*f*.

Adsorption was performed at 0°C in 40% EtOH and 0.5% CaCl$_2$ in a vol. of 20 cc. for a period of 2 min. In this system 5.1 g of wheat starch adsorbed half the α-amylase; the efficiencies of other adsorbents were compared with wheat starch. The following starches were tested: canna, potato, banana, smooth pea, wrinkled pea, corn, cassava, bean, waxy maize, sweet potato, oats, amylodextrin granules from wheat, rice and dasheen. Adsorption ranged from 0.2 (canna) to 8.0 (wrinkled pea), in general, in inverse order to the granule size which ranged from 85μ (canna) to 3μ (dasheen).

5571. Standing, G. H. A. and Warwicker, J. O. **Effect of the carboxy groups in viscose sheet on the equillibrium absorption of Chrysophenine** *J. Textile Inst.* **40**, T175-88 (1949).—*C.A.* **43**, 4015*h*.

Equil. absorption was found to depend on the ratio of the mass of sheet to the vol. of dye bath, especially if the concn. of NaCl in the bath was low, the effect being due to the presence of acidic carboxy groups in the viscose sheet which lowered the pH of the bath. In baths in which dye concn. and total cation concn. of inorg. electrolytes was kept const., the equil absorption increased with decrease of pH, and became fairly const. at pH 3 to pH 2.

5572. Subramanya, R. and Rao, M. R. Aswathanarayana. **The effect of electric field on the degree of depolarization of light scattering in colloidal solutions.** *Proc. Indian Acad. Sci.* **29A**, 442-57 (1949).—*C.A.* **44**, 2328*f*.

Light scattered by hydrosols of graphite, stearic acid, V$_2$O$_5$, and benzopurpurin was examd. while the sample was subjected to an elec. field. The depolarization factors were each detd. with the field in each of 3 orientations as follows: perpendicular to both the incident beam and the direction of observation (position A), perpendicular to the incident beam but parallel to the direction of observation (B), and parallel to the incident beam but perpendicular to the direction of observation.

5573. Willson, E.A.; Miller, J.R., and Rowe, E.H. **Adsorption areas in the soap titration of latex for particle-size measurement.** *J. Phys. and Colloid Chem.* **53**, 357-74 (1949).—*C.A.* **43**, 6041*g*.

By comparing soap adsorption values with electron microscope data on a series of copolymer latex particles, the adsorption area of an oleate mol. was calcd. to be 47 A.^{2}, and that of a myristate mol. 59 A^2. Correlations of the relative diams. from electron microscope measurements, adsorption data, and growth calcns. were shown.

5574. Wyk, A. J. A. van der and Studer, M. **The acidity of cellulose.** *Helv. Chim. Acta.* **32**, 1698-1712 (1949) (in French).—*C.A.* **43**, 9434*i*.

Cellulose suspended in 0.6 N NaCl soln. could be titrated as a sol. acid. Analysis of the titration curves obtained with native, purified, and regenerated (cuproammonium) celluloses provided dissocn. consts. having values of 10^{-7} to 10^{-6} for all samples studied. From the alkali consumed to attain the equivalence point the no. of glucose residues per equiv. was calcd. to be 690-770 for non-repptd.and 3100 for repptd. cellulose.

5575. Yarnold, G. D. and Mason, B. J. **The angle of contact between water and wax.** *Proc. Phys. Soc.* (London) **62B**, 125-8 (1949).—*C.A.* **44**, 901*g*.

The effects (a) of the velocity of the liquid surface, and (b) of the time of immersion, on the angle of contact between clean surfaces of $_2$O and wax were investigated by a dynamic method. Expts. with H$_2$O and a paraffin-wax coated steel sphere were described. A definite value could be assigned to the angle of contact of a liquid only if the exact conditions of observation were also specified.

5576. Zhukov, I. I. and Fridrikhsberg, D. A. **Changes of the transference numbers of ions in porous membranes.** *Kolloid. Zhur* **11**, 395-409 (1949).—*C.A.* **44**, 3338*d*.

The difference between the transference no. of cation in bulk (*n*) and in the membrane was detd.

5577. Zhuravleva, E. I. **The uptake of moisture by cornstarch from sugar solutions.** *Kolloid. Zhur.* **II**, 232-6 (1949).—*C.A.* **44**, 359*d*.

The amt. of H$_2$O adsorbed by 1 g of starch (0.21% ash) from sugar solns. was calcd. on the basis of the assumption that no sugar was adsorbed. It was greater when the sugar concn. *c* was less and was greater for sucrose than for fructose and glucose. Sugars could not be used for detg. the "solvation" of starch. The water adsorbed was detd. by the equil. between the osmotic pressure inside the starch grain and the osmotic pressure outside plus the elastic forces of the grain membrane.

5578. Zwolinski, Bruno J. ; Eyring, Henry, and Reese, Cecil E. **Diffusion and membrane permeability** *J. Phys. & Colloid Chem.* **53**, 1426-53 (1949).—*C.A.* **44**, 3333*i*.

Diffusion in membranes and their permeabilities were treated on the theory that mol. migration consists of a series of mol. jumps from one equil. position to another. The theory was applicable to the diffusion of electrolytes or nonelectrolytes in homogeneous or heterogeneous membranes and was applied to permeability data of H$_2$O, alcs., ethers, and amides through various animal and plant cells.

5579. Alexander, P.; Carter, D., and Earland, C. **Reaction of oxidizing agents with wool. II. The sorption of hydrogen peroxide.** *Biochem. J.* **47**, 251-4 (1950).—*C.A.* **45**, 864*i*.

H_2O_2 oxidized crystine in wool to cysteic acid and to cystine disulfoxide. Wool, silk, or nylon (*not* cotton) sorbed H_2O_2 from soln. The amt. sorbed was detd. directly on the treated fabric by titration with $KMnO_4$. The sorption within pH 2.5-9.0 was independent of pH, but decreased outside that range.

5580. ALEXANDER, P. AND KITCHENER, J. A. **The role of the electric double layer in the sorption of acids and dyes by wool.** *Textile Research J.* **20**, 203-14 (1950).—*C.A.* **44**, 5595*b*.

Dyes were taken up either as gegenions to the charged groupings within the fiber or as leading ions bound by non-coulombic forces and carrying inorg. gegenions with them into the fiber. The effect of salts and acids on dyeing equil. could be formulated by means of the law of mass action used in conjunction with the appropriate adsorption isotherm.

5581. ALEXANDER, P. AND HUDSON, R. F. **The kinetics of wool dyeing. I. Simple acid dyes.** *Textile Research J.* **20**, 481-91 (1950).—*C.A.* **44**, 8663*i*.

The rate controlling mechanism of dyeing wool with Acid Orange II could be diffusion through an unstirred film of liquid. At low concns., the diffusion of dye through an unstirred film of liquid was the slower of the two processes, whatever the degree of agitation. At higher concns. of dye, the rate-controlling step changed from diffusion through liquid film to diffusion through solid when the stirring of the liquid film was increased beyond the point at which the reaction became stirring-independent. At high concn. of dye, the diffusion of dye proceded from a satd. concn. on the fiber surface.

5582. ALEXANDER, P. AND CHARMAN, D. A. **The kinetics of wool dyeing. II. The adsorption of surface-active dyes by wool and other fibers.** *Textile Research J.* **20**, 761-70 (1950).—*C.A.* **45**, 864*e*.

The kinetic curves for the adsorption on textile fibers of a dye having a long hydrocarbon chain (Carbolan Crimson BS) indicated that there was an initial, rapid, but limited reaction, which was followed by a much slower reaction. The influence of electrolytes, dye concn., and temp. were studied and the magnitude of the initial adsorption was correlated with the surface activity of the soln. The dye taken up was on the fiber surface. The surface acitivity of the dye contributed substantially to its high anion affinity.

5583. BALAREV, D. **The structure of gels.** *Annuaire univ. Sofia, II, Fac. sci.*, Livre **2**, 153-8 (1950).—*C.A.* **46**, 10785*a*.

Pptn. of $Ag_2Cr_2O_7$ in gelatin gels forms 2 kinds of rings: primary or fine and secondary or coarse. Polar impurities are adsorbed on $Ag_2Cr_2O_7$ according to Paneth-Fajan's rule. Preaging of the gels coarsens the rings, while prestirring develops radial clear streaks through them.

5584. BENSON, BARBARA AND LAROSE, P. **The effect of sodium sulfate on the absorption of acid dyes by wool.** *Can. J. Research* **28F**, 238-56 (1950).—*C.A.* **44**, 10324*g*.

The sorption of Orange I on wool samples previously used in detg. the sorption of acids by wool was measured at the boil in the presence of salt (Na_2SO_4 or NaCl) and acid (H_2SO_4 or HCl). An empirical relation having the form of an adsorption isotherm expressed the results observed at any given acid and salt concn.

5585. BIGET, ANNE M. **A chemically inert gel.** *Ann. chim.* [12], **5**, 66-105 (1950).—*C.A.* **44**, 5186*a*.

Cellulose acetate gels, contg. as little as 2% of the acetate, could be obtained by use of strong $Mg(ClO_4)_2$ solns. These gels lose water progressively as the temp. exceeded 30°C, completely at 120°C. Strong solns. of lactic acid, phenol, acetamide, or pure alc., etc. caused dehydration, hardening, plasticizing, etc. Resorcinol and related compds. were especially destructive of the gel structure by virtue of their strong dehydrating power.

5586. BROMBERG, A. V. AND MAL'TSEVA, O. S. **Diffusion of dyes in gelatin gels. II. Effect of sorption on the rate of diffusion in gels.** *Kolloid. Zhur.* **12**, 9-16 (1950).—*C.A.* **44**, 3770*i*.

The diffusion in gel was slower than in H_2O not only because of mech. obstruction but also because the solute mols. might be for a time immobilized by adsorption on the "active centers" of the gel. The adsorption of Direct Pink by gelatin and its diffusion coeff. D were detd. in 7% gelatin gels. When pH increased from 3 to 8, the max. absorbed amt. decreased from 0.59 to 0.24 millimol./g.

5587. BROOKS, MARVIN C. AND BADGER, RICHARD M. **An adsorption system for the fractionation of nitrocellulose with respect to molecular weight.** *J. Am. Chem. Soc.* **72**, 4384-8 (1950).—*C.A.* **45**, 3682*g*.

The adsorption of nitrocellulose on starch from solns. of $(Me)_2CO$ admixted with several co-solvents was studied. The extent of adsorption increased with mol. wt, decreased with degree of nitration of the nitrocellulose, and decreased as the H-bonding character of the solvent mixt. was increased.

5588. BURTE, HARRIS, M. **A nondestructive mechanical test for animal fibers.** *J. Applied Phys.* **21**, 494-9 (1950).—*C.A.* **44**, 8114*d*.

The slope of the force-extension curve in the Hooke's law region could be measured nondestructively, for animal fibers, at 3- to 15-min. intervals. Data were presented on the interaction between concd. neutral salt solns. and wool fibers and indicated that 2 processes occurred: (a) relatively rapid hydration of the fiber until equil. with the activity of water in the salt soln. was attained; (b) relatively slow absorption of salt ions by the fiber.

5589. CARROLL, B. **Long range forces in solution.** *J. Am. Chem. Soc.* **72**, 2763-4 (1950).—*C.A.* **44**, 8734*i*.

Adsorption of 2×10^{-5} M Orange I on bovine, serum albumin (2 p.p.m. in 0.01 M HCl) proceeded in 2 steps: a rapid adsorption of 100-130 dye anions/protein mol. in 1 min., followed by a slower process requiring several weeks for the formation of an approx. unimol. layer (250 anions/mol.). An albumin mol. coated with fewer than 100 dye anions was easily attacked by pepsin.

5590. CHATTERJEE, H. **Role of the cationic ash of jute fiber in its acid-value determination.** *J. Textile Inst.* **41**, T243-8 (1950).—*C.A.* **44**, 9679*f*.

About 70% of the ash or raw jute was cationic and appeared to be mainly a salt or polyuronic acids, the remainder being mostly sol. SiO_2. HCl (0.1 N) removed almost all of the cationic ash derived from polyuronic acids. Blocking the —COOH groups of a fiber with a metallic radical could be done better by first blocking with Na and then replacing Na by double decompn.

5591. COULOMBRE, JANE AND MOORE, WALTER J. **The adsorption of sulfanilamide on silk fibroin.** *J. Phys. & Colloid Chem.* **54**, 661-4 (1950).—*C.A.* **44**, 7618*d*.

The adsorption of sulfanilamide on silk fibroin was measured in unbuffered solns. at pH = 6.0 and at 0.1, 16.3, and 34.4°C. The calcd. differential heat of adsorption remained practically const. at 4500 cal./mol. until an adsorption of 0.0058 mole of sulfanilamide per 100 g of protein was reached; thereafter it decreased rapidly. The arginine and lysine side chains in fibroin amounted to 0.0061 mole per 100 g of protein.

5592. COUPE, R. R. AND BANKS, W. H. **Adsorption of cobalt naphthenate by cellulose fibers.** *Research* (London) **3**, 528-30 (1950).—*C.A.* **45**, 2685*g*.

Co naphthenate was irreversibly adsorbed on acidified (HCl and H_2SO_4) filter paper from olive oil and linseed oil solns. and from olive oil solns. on nonacidified paper. The adsorption from linseed oil inhibited drying of the oil.

5593. DAVIDSON, G. F. **Acidic properties of cotton cellulose and derived oxycelluloses. VII. Ion-exchange reactions with basic dyes.** *J. Textile Inst.* **41**, T361-80 (1950).—*C.A.* **45**, 856*i*.

The affinity of the cations of a no. of basic dyes for the carbonyl group of acidic oxycelluloses was compared by measurements of absorption in competition with Na^+ or with another species of dye cation and by chromatographic investigation of the displacement of dye cations from oxycellulose by Na^+. The dyes varied widely but even the most weakly bound has a much greater affinity than Na^+. The xanthene dye Rhodamine B differed from the other basic dyes in its behavior. The adsorption showed a max. at pH 3.6.

5594. DOSS, K. S. G. AND GHOSH, S. K. **Kinetics of sucrose crystallization.** *Proc. Sugar Technol. Assoc. India* **19**, II, 183-91 (1950).—*C.A.* **46**, 7801*c*.

The rate of growth of a crystal of sucrose (between two parallel [100] faces), suspended and rotated in sirup of const. supersatn. at 35°C and at 75.5°C, was measured (with a screw gage). The addn. to the sirup of sufficient carboxymethylcellulose to increase the viscosity (η) ten-fold hardly affected the rate of growth, but caramel sufficient to increase η by 10% decreased the rate by 20%; impurities thus retarded growth far more effectively than a high η.

5595. EVANS, EVAN F. AND SPURLIN, HAROLD M. **Bound metal in ethycellulose effect on dilute-solution properties.** *J. Am. Chem. Soc.* **72**, 4750-6 (1950).—*C.A.* **45**, 3686*e*.

Neutralization of free carboxyls with metal ions caused an increase in the viscosity of solns. at finite concns. This increase was greatest in nonpolar solvents and least in solvents contg. appreciable H_2O or EtOH. Bound Ba^{++} decreased the slope of the reduced osmotic pressure-concn. curve. For polymers contg. bound metal ions it was recommended that solvents contg. H_2O, EtOH, or HOAc be used for the detn. of viscosity or osmotic pressure and that the values at infinite diln. be obtained by the extrapolation of exptly. detd. values.

5596. FOX, H. W. AND ZISMAN, W. A. **The spreading of liquids on low-energy surfaces. I. Polytetrafluoroethylene.** *J. Colloid Sci.* **5**, 514-31 (1950).—*C.A.* **45**, 4109*c*.

The contact angle (θ) on polytetrafluoroethylene was measured for a large no. of org. liquids. The cos θ was a linear function of the surface tension of the liquid for each homologous series. For each series there was a crit. surface tension, whose value varied from 17.5 to 20.5 dynes/cm, below which spreading coeffs. were neg. for most of the liquids studied.

5597. FRÖHLICH, H. G. **The behavior of protein fibers and of polyamides toward acids and bases. I. The absorption of hydrochloric acid.** *Deut. Textilgewerbe* **52**, 397-8 (1950).—*C.A.* **46**, 11691*f*.

The absorption of HCl by *Ardil*, *zein*, and *casein* fibers was investigated. The curves obtained for these fibers had the same form as those for silk and wool. Between pH 1.3 and 0.8 there was a region of const. acid fixation. Below pH 0.8 a rise in the absorption occurred, the steepness of which varied with the kind of fiber. The ability of the polypeptide groups to attract and bind protons with the formation of a salt was reduced with increasing HCHO content. The behavior of the polyamides toward HCl was analogous to that of the proteins. In this case, also, the absorption of HCl increased with decreasing pH and reached a satn. value at pH 2.2-2.6.

5598. HALLER, R. **Starch and metal salts.** *Melliand Textilber.* **31**, 49-50 (1950).—*C.A.* **47**, 898*e*.

Combinations of starch with metal salts are considered to be adsorption compds. rather than chem. compds. The effect of adsorbed metal oxides is discussed, expecially with respect to enzyme action.

5599. HEUSER, EMIL. **Factors which influence the kinetics of cellulose reactions.** *Textile Research J.* **20**, 828-37 (1950).—*C.A.* **45**, 2201*c*.

Either one or the other of 2 factors predominates, i.e., the phys. accessibility of the —OH groups, as dependent upon the cryst.-to-amorphous ratio, or their intrinsic chem. activity, as dependent upon the position of the —OH groups in the anhydroglucose units. Cellulose reactions could be grouped into 4 main "possibilities."

5600. Hirai, Nishio. **Solvation. I. Swelling velocity of starch and lyophilic property.** *Bull. Inst. Chem. Research, Kyoto Univ.* 23, 73-4 (1950) (in English).—*C.A.* 47, 2569*a*.

In swelling or soln. of raw starch, water mols. diffuse into the micelles, the micelle crystals grow loose, and chain mols. of starch begin to expand randomly. The substances capable of entering the helix and forming a complex with starch by their hydrophobic properties make easy the formation of the α form, the intermediate step of soln., and decrease the activation energy of swelling E by the energy of complex formation E_{xs}.

5601. Hoffpauir, Carroll L. and Guthrie, John D. **Ion-exchange characteristics of chemically modified cotton fabrics.** *Textile Research J.* 20, 617-20 (1950).—*C.A.* 44, 11104*a*.

Chemically modified fabrics exhibiting ion-exchange properties are produced by the introduction of a substituent group with basic or acidic properties into the cellulose mol. under such conditions that the fabric structure is retained. Phosphorylated cotton fabric behaves like a dibasic acid, with acid strength comparable to that of the first and second hydrogens of H_3PO_4. Partially sulfethoxylated cellulose is a strong-acid cation-exchanger.

5602. Inaba, Ayako. **Wettability of solid surfaces. IV. Wettability of palmitic acid surface by aqueous salt solutions.** *Bull. Chem. Soc. Japan* 23, 146-9 (1950).—*C.A.* 45, 6897*h*.

Minute impurities in the distd. water apparently controlled the wetting. The wetting of purified paraffin, crude paraffin, palmitic acid, and hexadecyl alc. by water and aq. solns. of KNO_3, $Ca(NO_3)_2$, $Al_2(SO_4)_3$, and $Th(NO_3)_4$ was detd. The effect of metallic soaps on the wettability was offered as an explanation of the results.

5603. Katz, Sidney M.; Kubu, Edward T., and Wakelin, James,H. **The chemical attack on polymeric materials as modified by diffusion.** *Textile Research J.* 20, 754-60 (1950).—*C.A.* 45, 897*e*.

The reaction of polymeric media with a chem. reagent generally involves the preliminary diffusion of the reagent through the polymer. The effect of a relatively rapid diffusion of a chem. reagent into a cylindrical fiber on the over-all rate of reaction and to the decay of stress therefore is derived.

5604. Kleinert, Theodor and Wincor, Wilhelm. **Bound calcium in rayon pulps and its behavior in the viscose process. I.** *Svensk Papperstidn.* 53, 638-43 (1950).(in German).—*C.A.* 45, 6839*b*.

The combining of Ca with cellulose from dil. aq. soln. of Ca salts was an ionic reaction involving carboxyl groups. Most of the Ca was bound to hemicelluloses in the pulps and, therefore, would diffuse out in the mercerizing process. The Ca remained combined with the hemicelluloses in the steeping liquor and was retained with the org. component in the dialysis process for purifying the liquor.

5605. Lambert, Joseph M. **Cationic adsorption and exchange as shown by radio-calcium tracer studies.** *Ind. Eng. Chem.* 42, 1394-8 (1950).—*C.A.* 44, 9210*c*.

The accessibility and acidic characteristics of cotton appeared to be of particular importance. The role of adsorption as an important factor in detergency was illustrated by exptl. adsorption data of surface-active agents on cotton. Radioisotope tracer methods were described for measuring the adsorption and exchange of Ca on cotton as it occurred in lab. wash test stimulating hard-water laundering. Data were obtained with several cotton detergents in multicycle wash test.

5606. Lindberg, Joel. **Rate of acid sorption by wool fibers.** *Textile Research J.* 20, 381-4 (1950).—*C.A.* 44, 8115*c*.

A method for measuring the diffusion rate of mineral acids in wool fibers consists mainly in dispersing short fibers in acid solns. and measuring the decrease in the concn. by means of a cond. cell. The diffusion const. is obtained by solving the diffusion equation for the conditions specified. Exptl. curves agree well with the theoretical ones. The importance of the epicuticle for the diffusion phenomena in wool fibers is proven.

5607. Manegold, E. **Capillaries, capillary systems, and capillarity XXII. 5. Significance of the Donnan-membrane barrier for corrosion protection by means of polar layers and for substantive dyeing.** *Kolloid-Z.* 116, 135-46 (1950).—*C.A.* 44, 9212*i*.

Covering layers may be anion-permeable, cation-permeable, or amphoteric (the type of ion passing through the layer depending on the isoelec. point and the pH), and unipolar, bipolar, or nonpolar. Presence of H_2O was necessary for corrosion and the ions available det. the type of corrosion. Substantive dyes entered pores of cellulose fibers when electrolytes supplied proper ions and in their absence remained within the fibers.

5608. Manegold, Erich and Hartel, Martin. **Capillaries, capillarity and capillary systems. XXV. 2. Forms of contraction in gelled cover- and bond-layers and the strength of the joint in three-layer bonds.** *Kolloid-Z.* 116, 80-8 (1950)

Phenomena of drying and shrinking in covering and bonding layers were described in relation to the nature of the surfaces of materials to which these layers were attached. Tensile strengths of bonding agents were listed.

5609. McGrew, Frank C. and Schneider, Allen K. **The sorption of acid dyes on nylon.** *J. Am. Chem. Soc.* 72, 2547-52 (1950).—*C.A.* 44, 8663*c*.

Evidence was presented to confirm the attachment of acid dyes to nylon at moderate pH levels by a salt-type linkage between the basic amine ends of the polymer chain and the sulfonic acid groups of the dye. The quant. measurement of affinity of dye was detd. The procedure was modified to permit its application to dyes with high affinity.

5610. McLaren, K. **The relation between detergency and adsorption by the fiber.** *J. Soc. Dyers Colourists* 66, 521-9 (1950).—*C.A.* 45, 362*d*.

A detailed study was made of the effect of temp., detergent, acid, and salt concn. on the wool-detergent properties of a specific nonionic surface-active compd. Increasing the temp. from the normal wool detergency temp. of 50 °C to 80-90 °C caused an increase in detergent efficiency. Adding acid to the detergent soln. increased its detergency, but at high temps., when a certain acid concn. was exceeded, the detergent efficiency was reduced. Both effects were accompanied by an increase in the adsorption by the substrate as acidity increased. NaCl improved the detergent efficiency up to a concn. where pptn. occurred; this concn. was lower, the higher the temp.

5611. MERRILL, REYNOLD C. AND SPENCER, ROBERT W. **Sorption of sodium silicate and silica sols by cellulose-fibers.** *Ind. Eng. Chem.* **42,** 744-7 (1950).—*C.A.* **44,** 6123*e*.

Sorption of both Na and SiO_2 from $Na_2O.3.37$ SiO_2, N-Sol A, and a H_2SO_4-treated SiO_2 sol were measured at 25 °C for bleached sulfite, soda, kraft, and mech. pulps. Similar data on NaOH were given for comparison. Both Na and SiO_2 were sorbed by the cellulose fibers but the quantity of the former sorbed was usually much greater than that of the latter.

5612. PARTRIDGE, S. M. AND SWAIN, T. **A reversed-phase partition chromatogram using chlorinated rubber.** *Nature* **166,** 272-3 (1950).—*C.A.* **45,** 6456*i*.

N-2,4-dinitrophenyl derivs. of various amino acids were sepd. by partition chromatography with 0.2 M citrate-phosphate buffer as the flowing solvent on columns prepd. by filtering a slurry of 10 g chlorinated rubber (Alloprene) in 4 cc. of a suspension of BuOH in buffer satd. with BuOH. Rates of movement depended on pH.

5613. REESE, CECIL E. AND EYRING, HENRY. **Mechanical properties and the structure of hair.** *Textile Research J.* **20,** 743-53 (1950).—*C.A.* **45,** 864*g*.

A simple quant. method for detg. the amt. of mech. strength contributed by the various types of bonds in hair fibers was developed. The effect of acids, bases, and oxidizing or reducing agents and hair fibers was first-order with respect to the bonds to be broken. Based on the theory of abs. reaction rates, the heats and entropies of activation for the reaction were calcd.

5614. REEVES, RICHARD E.; MAZZENO, LAURENCE W. JR., AND HOFFPAUIR, CARROLL L. **The heterogeneous methanolysis of native and mercerized cotton cellulose.** *J. Am. Chem. Soc.* **72,** 4773-7 (1950).—*C.A.* **45,** 2200*f*.

Methanolysis of native cotton cellulose and mercerized cellulose introduced acid-labile MeO groups into the insol. phase (representing cleavage of glucose-glucose bonds) and dissolved a portion of either cellulose. The methanolysis rate decreased in the region where 0.1-0.5% glucose unit had reacted. The data were explained in terms of reaction with an initially large cryst. surface, diminishing strongly as the surface was reduced by the coalescence of cryst. areas when internal tensions relax because of reaction within the fiber.

5615. REMINGTON, W. R. AND GLADDING, E. K. **Equilibria in the dyeing of nylon with acid dyes.** *J. Am. Chem. Soc.* **72,** 2553-9 (1950).—*C.A.* **44,** 8663*f*.

The dye absorption data yield a precise value for the amine-end content of the fiber, which was the practical upper limit for dyeing with acid dyes. The absorption of dye from solns. of low pH was accompanied by the hydrolytic rupture of principally nonterminal amide groups with the consequent production of addnl. dyeing sites. These phenomena were observed at pH's within the range of normal dyeing practice.

5616. RODMAN, CHARLES A. AND PANSEY, ALVIN W. **Use of a microscopic technique in studying the filtration characteristics of wool and cotton fibers.** *Textile Research J.* **20,** 873-9 (1950).—*C.A.* **45,** 2217*e*.

A microscopic technique was used to study the sorption mechanism of org. colloidal matter.

5617. SAMUELSON, OLOF; GÄRTNER, FRED, AND JOHANSSON, GEORG. **Ion exchange in alkali cellulose.** *Svensk Kem. Tid.* **62,** 211-14 (1950) (in English).—*C.A.* **45,** 4443*d*.

Any difference in reaction velocity between those Na ions which were bound in the amorphous parts of the cellulose and those bound in the crystallites was too small to be detected. In the expts. (covering both sulfite pulp and cotton), 0.5 g. native cellulose was treated with 50 ml NaOH of either 18 or 35% concn., and carrying about 1 mc. of Na^{24}, added as Na_2CO_3. The expts. showed that the ion exchange was complete after 3 washing periods of 10 sec. each in case of the 18% NaOH expts., and after 4 washings in case of the 35% NaOH.

5618. SCHWERTASSEK, K. **Explanation of dyeing defects in cellulose fibers by measurements of iodine sorption. II. Relation of iodine sorption and crystallinity of cellulose fibers.** *Melliand Textilber.* **31,** 764-9 (1950).—*C.A.* **45,** 5931*e*.

I_2 sorption was a measure of the colloidal surface of the fiber and therefore also of the proportion of amorphous to crystalline material but was independent of form or size of the pores. Various causes for dyeing defects and their relation to I_2 sorption were discussed.

5619. STAMM, ALFRED J. AND TARKOW, HAROLD. **Penetration of cellulose fibers.** *J. Phys. & Colloid Chem.* **54,** 745-53 (1950).—*C.A.* **44,** 9145*i*.

Fibers of pure cellulose and lignocellulosic materials such as wood can be directly penetrated only by polar liquids. These liquids, except for a small correction for adsorption compression, add their vol. to the vol. of the cell walls. Although solns. may penetrate the fibers much more slowly than the solvent in a no. of cases, they eventually swell wood more than does either component alone. This enhanced swelling can be explained on the basis of an equil. between sorption, soln. pressure, and structural resistance.

5620. SWANSTON, KATHLEEN AND PALMER, R. C. **The sorption of anionic detergents by wool.** *J. Soc. Dyers Colourists* **66,** 632-8 (1950).—*C.A.* **45,** 2217*b*.

Expts. were made on the rate of sorption of Na hexadecyl sulfate by wool at 50°C under varying conditions of salt concn. and pH. When the soln. was thoroughly stirred sorption took place rapidly at first and then more slowly. When neutral wool contg. some detergent was stirred in an alk. soln., the detergent initially in the wool came into the soln.; after about 6 min. the detergent started to go back into the wool, and continued to do so until the wool contained more than its initial amt.

5621. TROMMER, CHARLES R. **Measuring penetration and wetting.** *Am. Dyestuff Reptr.* **39**, No. 24, *Proc. Am. Assoc. Textile Chem. Colorists*, P811-12, P 830 (1950).—*C.A.* **45**, 2217*i*.
The new method involved measuring the rate of penetration of wetting agents through varying layers of fabrics without complete immersion of the samples. An elec. circuit and the subsequent lighting of an elec. light bulb marked the end point of the test by means of 2 Cu electrodes. A typical nonionic surfactant was used in the tests. An error of ± 1.5 sec. or less was considered to represent a high degree of reproducibility.

5622. VEIL, SUZANNE. **Abnormal rhythmic distribution due to chemical sorption.** *Compt. rend.* **230**, 1769-71 (1950).—*C.A.* **44**, 9775*f*.
A drop of a cupric salt soln. on gelatin impregnated with $Na_4P_2O_7$ resulted in a series of rings whose spacings decreased with increase in radius from the drop. Liesegang rings formed by the reaction of $AgNO_3$ with gelatin impregnated with dichromate showed a similar effect. Chem. sorption was postulated.

5623. WEATHERBURN, A. S.; ROSE, G. R. F., AND BAYLEY, C. H. **Sorption of soap by textile fibers.** *Can. J. Research* **28F**, 51-61 (1950).—*C.A.* **44**, 5598*c*.
Data were obtained on the sorption of Na soaps of lauric, myristic, palmitic, stearic, and oleic acids by cotton, bright and delustered viscose rayon, acetate rayon, and nylon, and wool. Sorption of fatty acid and alkali were detd. by analysis of remaining liquor after immersing a 6-g sample in 150 ml of 0.1% soap soln. for 30 min. at 70°C. Hydrolysis of the soaps played a significant part in sorption, since much sorption was of free fatty acid and of hydrolytic alkali, with a minor role played by neutral soap sorption.

5624. WILLIAMS, G. C. **Chemical composition and adsorptive properties of clear films.** *Official Digest Federation Paint & Varnish Production Clubs* No. **311**, 1020-32; *Am. Paint J.* **35**, No. 8-B (Convention Daily) 26-7, 28-9, 30 (1950).—*C.A.* **45**, 1781*g*.
The subjects discussed include: the ultimate analysis of clear films, the extn. of clear films to det. the sol. phase, and adsorptive properties of films for org. liquids.

5625. ABRAMOV, S. A. **Dyeing of caprone hosiery with direct dyes.** *Legkaya Prom.* **11**, No. 6, 26-8 (1951).—*C.A.* **46**, 741*c*.
Absorption of direct dyes followed in some respects cellulose fibers and in others animal fibers. Rate of absorption from acid solns. was close to that of cellulose fibers from neutral solns. In acid solns., absorption increased with decreasing pH.

5626. ABRIBAT, MARCEL AND POURADIER, JACQUES. **Effect of the spreading solvent on the unimolecular surface films of cellulose acetate.** *Compt. rend.* **233**, 1606-8 (1951).—*C.A.* **46**, 7402*a*.
Formation of surface films of cellulose acetate was studied in relation to the solvent used. These solns., when spread under a pressure lower than 0.1 dyne/cm produced stable surface films whose compressions and expansions were reversible, and whose characteristics varied only slightly with the compn. of the solvent.

5627. ANTZENBERGER, PAULETTE. **Study of the penetration of resins into impregnated woods by tracing the adsorption and desorption isotherms.** *Recherche aéronaut.* (Paris) No. **21**, 41-7 (1951).—*C.A.* **46**, 736*f*.
Spice-wood samples, which were either untreated, delignified, or impregnated with melamine-HCHO resin, were placed in atms. of different humidities, and the equil. moisture content of the wood was detd. Both untreated and delignified samples showed a rapid increase in water adsorption as the relative humidity was increased above about 50%, whereas the adsorption curve for the impregnated wood remained nearly linear.

5628. BAYLEY, S. T. **Dielectric properties of various solid crystalline proteins, amino acids, and peptides.** *Trans. Faraday Soc.* **47**, 509-17 (1951).—*C.A.* **45**, 9953*e*.
Insulin, chymotrypsinogen, salmine sulfate, and bovine serum albumin, the peptides glycylglycine and diglycylglycine, and the amino acids glycine and glutamic acid were studied over the range 300 to 4×10^9 cycles/sec, between −100° and 0°C. Adsorbed water increased both dielec. const. and power factor towards low (audio) frequencies, the effect being attributed chiefly to inhomogeneities and ionic conduction in the materials.

5629. BEHRANA, J. S. AND NARWANI, C. S. **Influence of chemical constitution on the adsorption of dyes by the insoluble part of heat-dehydrated gum arabic.** *J. Indian Chem. Soc.* **28**, 252-6 (1951).—*C.A.* **46**, 4799*b*.
Gum arabic heated to 165-70°C in a dry state gives the insol. metagummic acid. The H_2O-insol. acid adsorbs only basic dyes irreversibly, exchanging Ca ions for basic dye ions. Only malachite green follows Freundlich's isotherm; it is least adsorbed owing to partial dissocn. of the dye at the diln. used. Acid dyes, with the exception of Congo red in dil. soln., are not adsorbed at all. NaCl prevents the adsorption of basic dyes owing to preferential adsorption of Na^+ to the cations of the dye.

5630. BHATNAGAR, M. S. AND NIGAM, P. C. **Organic adsorbents from Indian tannins. II. Adsorption of acids, bases, and salts.** *J. Applied Chem.* **1**, 520-2 (1951).—*C.A.* **46**, 2874*a*.
Adsorption of katha and cutch for benzoic, phthalic, formic, acetic, propionic, oxalic, malonic, and succinic acids decreased with mol. wt. This reversal of Traube's rule was attributed to

orientation of mols. at the resin-water interface according to the theory of Langmuir and Harkins. The order of adsorption of Ba, Si, and Ca and the effect of substituted OH groups was explained by the polar concept.

5631. Christensen, G. N. **Diffusion in wood. II. Temperature coefficient of diffusion through wood.** *Australian J. Applied Sci.* **2**, 430-9 (1951).—*C.A.* 46, 5245*a*.

The diffusion rate depended on the cross-sectional area and the av. path length of the capillary through the lamina. The diffusion paths in both transverse directions were composed of capillary elements of similar diam.

5632. Christensen, G. N. **Diffusion in wood. III. Ion selection and its effect on the diffusion of electrolytes.** *Australian J. Applied Sci.* **2**, 440-53 (1951).—*C.A.* 46, 5245*c*.

The wood functioned as a negatively charged semipermeable selective medium in its behavior towards diffusing electrolytes and this behavior varied with the type of wood and the direction of the diffusion relative to the grain. The membrane potentials for KCl and K_2SO_4 on tangential samples were calcd.

5633. Cutler, Melvin and Kimball, George E. **Effect of adsorption on measurements of viscosities of very dilute polymer solutions.** *J. Polymer Sci.* **7**, 445-7 (1951).—*C.A.* 46, 808*g*.

The systems used were: polyvinyl alc. in water, polyethylene oxide in water, polystyrene in C_6H_6, polyvinyl acetate in C_6H_6, and polyacrylic acid solns. of various degrees of neutralization in water, in the presence of NaCl in various concns. A plot of the reduced viscosity against concn. showed a definite decrease at very low concns. At these very low concns., a straight line obeying the equation $\eta_{sp} = A(c - b)$ was obtained. The shift from the ideal straight line through the origin suggested the hypothesis that some of the polymer had been adsorbed on the viscometer.

5634. Davankov, A. B.; Perepelkin, V. P., and Sokolova, E. A. **Coloring polymerized resins in the finely dispersed state and the selective adsorption of dyes by synthetic resins.** *Zhur. Priklad. Khim.* **24**, 95-101 (1951).—*C.A.* 46, 8891*g*.

Polymers were made by emulsion polymerization of methyl methacrylate or styrene or copolymerization of methyl methacrylate and vinyl acetate, with $(NH_4)_2S_2O_8$ as a catalyst. The polymers were colored in the form of aq. dispersions by addn. of basic dyes (crystal violet, fuchsin, or methylene blue) to the dispersions. The coloring process might result from chem. interaction between the basic dye and the acidic polymer.

5635. Elöd, E. and Fröhlich, H. G. **The absorption of strong and weak acids by casein and zein fibers.** *Melliand Textilber.* **32**, 40-3 (1951).—*C.A.* 45, 8251*h*.

Acetylated and CH_2C-treated casein and zein fibers were treated with HCl, $ClCH_2COOH$, HCOOH, and AcOH of various concns. The water absorption rose only slightly with increased acidity for all fibers tested. The amt. of bound HCl acidity increased with falling pH values; the increase was largest at pH under 1, and always larger for casein than for zein.

5636. Finn, S. R. and Lewis, G. J. **The diffusion of water through an enamel based on a phenol-formaldehyde resin.** *J. Oil & Colour Chemists' Assocn.* **34**, 266-78 (1951).—*C.A.* 46, 7785*b*.

A technique has been developed in which the passage of H_2C through a "test tube" of enamel was estd. by periodic weighing. The passage of H_2O through the film was relatively rapid, but not sufficient to account for the blistering of the enamels on metal when immersed in boiling H_2O.

5637. Finn, S. R. and Lewis, G. J. **The absorption of water by enamels based on a phenol-formaldehyde resin.** *J. Oil and Colour Chemists' Assocn.* **34**, 279-94 (1951).—*C.A.* 46, 7785*c*.

These PhOH-HCHO resin enamels were capable of absorbing appreciable amts. of H_2O, as were the clear, unpigmented films of the resin. The H_2O absorption was rapid at first, became slower, and finally reached a constant value. The amt. absorbed was directly proportional to the thickness of the film.

5638. Hudson, R. F. and Schmeidler, G. A. **Kinetics of anion exchange on wool fibers.** *J. Phys. & Colloid Chem.* **55**, 1120-30 (1951).—*C.A.* 46, 11692*i*.

The kinetics of exchange of the bisulfite ion by a series of anions were followed and activation energies detd. Calcd. diffusion coeffs. decreased and activation energies increased in the order NO_3^-, Cl^-, SO_4^{--}, $C_6H_5SO_3^-$, $H_2PO_4^-$, which thus represented the ease of diffusion of these ions into the fiber. The rate of desorption of bisulfite ion from fibers in alk. soln. was much greater than that at neutrality, at pH 7.4 $D_f = 0.77$ sq. cm./sec. and at pH 13 $D_f = 3.24$ sq. cm./sec. both at 18°C.

5639. Landsberg, Rolf. **Potentials associated with the formation of precipitation membranes.** *Z. physik. Chem.* **197**, 256-64 (1951).—*C.A.* 46, 7850*g*.

The difference in potential of 2 Ag-AgCl electrodes connected by salt bridges with solns. of $K_4Fe(CN)_6$ and $CuSO_4$ or $Cu(NO_3)_2$ was followed as these solns. diffused into each other in a gelatin block. The membrane was assumed to be permeable to K^+ alone. Impermeability of the membrane to Cl^- and SO_4^{--} was confirmed by chem. tests and by the fact that the max. potential was independent of whether $CuSO_4$ or $Cu(NO_3)_2$ was used.

5640. Mann, H. B. and Richardson, R. W. **The absorption of a direct cotton dye anion associated with various cations.** *J. Soc. Dyers Colourists* **67**, 148 (1951).—*C.A.* 45, 5411*b*.

Expts. were made in which the pure acid dye was neutralized with a series of org. and inorg. bases to give the corresponding dye salts. The equil. dye absorption for purified Sky Blue FF anion assocd. with different cations in the presence of the corresponding chloride at pH 7 ± 0.5 indicated a definite variation in equil. absorption for the various cations.

5641. McGrew, F. C. and Sharkey, W. H. **Sorption of acid dyes by nylon under nonequivalent conditions.** *Textile Research J.* 21, 875-9 (1951). *C.A.* 46, 1767*i*.

Nylon filament yarn colored with acid dyes frequently shows unevenness in appearance. In others, changes in the no. of amine end-groups in the polymer cause the effect. Unevenness can be minimized, and with some colors eliminated, by dyeing in a bath so dil. in dye as to appear colorless to the eye, equalization of acid dyes can be obtained by using conditions unfavorable for attainment of equil.

5642. Neuman, W. F.; Mulryan, B. J.; Boyd, E. S., and DiStefano V. **The surface chemistry of bone. III. The role of phosphatase. IV. Further data on recrystallization. V. The ion-binding properties of cartilage.** *J. Biol. Chem.* 193, 227-35; 237-41; 243-51 (1951).—*C.A.* 46, 2159*i*.

α-Glycerophosphate was strongly adsorbed by bone ash. The presence of the adsorbed ester inhibited the accretion of addnl. mineral. A study of the interaction between powd. bone and radiophosphate buffer showed that the slow incorporation of labeled phosphate by the bone mineral required the presence of an aq. phase. This slow reaction was primarily the result of a recrystn. process rather than a simple diffusion of the phosphate through the crystal lattice. Phosphate was taken up from soln. only by cartilage contg. appreciable amts. of Ca.

5643. Nishida, Kenzo. **Donnan membrane equilibrium and direct dyeing of Cellophane. I. II.** *J. Soc. Textile Cellulose Ind.* (Japan) 7, 539-41; 541-4 (1951).—*C.A.* 46, 6389*c*.

The amts. of Diamine Blue 3B absorbed by Cellophane from a bath at 90°C contg. 0.5 of the dye and 1-35 g/liter NaCl agreed with the values derived from Donnan equil., provided that the H_2O, which adsorbed on Cellophane and served as the solvent, was assumed to be 22/100 g (of Cellophane), the amt. actually adsorbed on Neale's cotton. With Diamine Blue 2B, the actual amt. of H_2O adsorbed on Cellophane, i.e. 93/100 g, used.

5644. Olofsson, Bertil. **Combination of wool with acids in presence of salts.** *J. Soc. Dyers Colourists* 67, 57-66 (1951).—*C.A.* 45, 4049*a*.

Titrations of wool with HCl in the presence of NaCl, Na_2SO_4, KCl, K_2SO_4, and $BaCl_2$, and with H_2SO_4 in the presence of NaCl and Na_2SO_4 were made. The absorption of H, chloride, and sulfate ions were detd. Chloride and sulfate ions did not seem to be dispersed at random in the fiber phase but are somewhat localized at positive sites. The chloride ions had a greater affinity for the wool fiber than the sulfate ions.

5645. Salvinien, Jean. **Two new methods for the measurement of diffusion coefficients in gels.** *J. chim. phys.* 48, 465-70 (1951).—*C.A.* 46, 4326*i*.

Two exptl. methods were described to detn. cylindrical diffusion through a gel. Both were performed by first placing a drop of a soln. of the salt being investigated on the surface of a thin film of a gel such as gelatin. By one method, after a given diffusion time the gel film was immersed in a soln. of a material capable of forming a ppt. with the diffusing salt. From the dimensions of the resulting spot and the concn. of salt at the boundary, which could be detd. from the optical d. of the spot, the coeff. of diffusion could be calcd. The other method depended on the presence of a pptg. agent in the gel so that the advancing boundary was visible continuously.

5646. Salvinien, J.; Marignan, R., and Cordier, S. **Absolute measurement of diffusion coefficients in gels by means of radioactive indicators.** *J. chim. phys.* 48, 471-3 (1951).—*C.A.* 46, 4327*d*.

The gel was cast in a plastic tube that could be sliced into thin sections with the gel. The soln. of electrolyte contg. radioactive tracer was placed on the gel in the tube and held at const. temp. with agitation for several days. The soln. was then withdrawn, and the gel cylinder (and the plastic mold) was cut into thin equal slices, each a known distance from the gel-soln. interface. Each slice was separately dissolved in water and the radioactivity of an aliquot detd.

5647. Schmid, Gerhard. **Electrochemistry of fine-pore capillary systems. II. Electroösmosis.** *Z. Elektrochem.* 55, 229-37 (1951). *C.A.* 46, 797*i*.

The derivations of equations for electroösmosis in fine-pore capillary systems were given. The equation applied when the elec. double layer had a thickness comparable with the pore radius. Points of deviation which were explained included a decrease in electroösmotic permeability with decreasing pore radius, the constancy of the ratio of osmotic permeability to water permeability, the independence of electroösmotic pressure from the pore radius, and the decrease of electroösmotic efficiency of current with increasing c.d. Theory was compared with expt. for the elec. cond. of collodion membranes of graduated porosity in dil. KCl solns. The cond. of soln. in the pores with respect to that of soln. external to the pores increased very sharply with decreasing KCl concn. At a given KCl concn. the cond. of the pore liquid was greater for membranes treated with NaOH than for untreated membranes.

5648. Schmid, Gerhard and Schwarz, Hans. **Electrochemistry of fine-pore capillary systems. IV. Dialysis potentials.** *Z. Elektrochem.* 55, 684-9 (1951).—*C.A.* 46, 10972*g*.

An app. is described in which are measured the dialysis potentials of a series of colloidal membranes in dil. KCl solns. of varying concns. Values for the dialysis potential can be calcd. from cond. data, but are always about 3 mv. higher than the measured values.

5649. Schwertassek, K. **Iodine sorption of viscose fibers and the viscose process. III. The relation of iodine sorption and the degree of crystallization of cellulose fibers.** *Melliand Textilber.* 32, 460-5 (1951).—*C.A.* 45, 10579*d*.

I_2 sorption was related indirectly to the degree of crystallinity. A relation was found between the degree of crystallinity and degree of polymerization (D.P.). Lower D.P. gave higher I_2 sorption.

5650. Sollner, K. and Gregor, H. P. **The electrochemistry of permselective membranes. III. The electrical resistance of permselective collodion membranes in solutions of various electrolytes.** *J. Colloid Sci.* 6, 557-70 (1951).

The measurement of the electrical resistance of collodion permselective membranes in solns. of KCl, K_2SO_4, LiCl, $MgCl_2$, and HCl was described. Three types of permselective membranes were used. Equil. was attained more rapidly with membranes of higher porosity. Marked increases in resistance were found for divalent cations.

5651. Tachibana, Taro; Fukuda, Kiyoshige, and Hamaguchi, Kozo. **Adsorption of proteins from aqueous solution on films of stearate and lipides.** *Bull. Chem. Soc. Japan* 24, 155-6 (1951) (in English).—*C.A.* 46, 8930*a*.

Adsorption of egg albumin on Ba stearate film (rendered hydrophilic by Th nitrate treatment) was complete in 5 min. at a max. thickness of 50 A. and was irreversible. The adsorbed layer of protein was decreased in thickness by immersion in 8 molal urea soln. Serum albumin was adsorbed on a hydrophilic surface only, whereas serum globulin was equally adsorbed from saline soln. on both hydrophilic and hydrophobic surfaces.

5652. Tanaka, Ryukichi and Shinohara, Teruo. **Dyeing of cellulose acetate. IV. Dyeing with indigo.** *J. Soc. Textile Cellulose Ind.* (Japan) 7, 510-12 (1951).—*C.A.* 46, 6389*b*.

In the dye-bath of indigo, into which AcOH was added in increasing amts. while raising the temp., cellulose acetate fibers were dyed darker than viscose fibers at 50°C when 50% or more of the total NaOH in the bath was neutralized by the AcOH.

5653. Tattersfield, C. P. **Dyeing of blends containing regenerated protein fibers.** *Brit. Rayon & Silk J.* 28, No. 330, 64-5; No. 331, 53-4 (1951).—*C.A.* 46, 2806*h*.

Traces of formalin in the fibers will alter the shades produced from Xylene 2R, Yellow 2G, Kiton Fast Red G, and Solvay Blue PFN. All premetallized azo dyes (Neolan) are readily taken up by regenerated protein fibers. There is greater exhaustion than with wool.

5654. Wall, W. T. and Drenan, J. W. **Gelation of polyacrylic acid by bivalent cations.** *J. Polymer Sci.* 7, 83-8 (1951).—*C.A.* 45, 7850*i*.

Polyacrylic acid (av. mol. wt. 205,000) was treated with alk. earth hydroxides to bring about gelation. The gel point was recognized by a sharp increase in turbidity resulting from the pptn. of clusters in which some polyelectrolyte ions were linked by 2 or more of the bivalent cations. It required approx. half as many equivs. of $Ba(OH)_2$ as $Sr(OH)_2$ to cause gelation. $Ca(OH)_2$ was less effective on an equiv. basis.

5655. Yamamoto, Daijiro and Iwaki, Ryojiro. **Relations between dye phosphors and hydrogen bonds of rigid media or surface of adsorbents.** *J. Chem. Phys.* 19, 662 (1951).—*C.A.* 45, 7882*e*.

The dye trypaflavin phosphoresced well when adsorbed on high-mol. substances such as various celluloses, starch, dextrin, agar-agar, and various solid proteins. Nitrocelluloses were not phosphorescent adsorbents.

5656. Bartell, F. E. and Ray, B. Roger. **Wetting characteristics of cellulose derivatives. I. contact angles formed by water and by organic liquids.** *J. Am. Chem. Soc.* 74, 778-83 (1952).—*C.A.* 46, 5834*f*.

The advancing and receding contact angles of H_2O were detd. by the verticalrod, tilting plate, or controlled-drop-vol. methods in expts. at 25°C on cellulose derivs. Fibers, rods, foils, films, and coatings of the derivs. were used. A regular and systematic increase in the hydrophobic nature of the fatty acid esters was found to occur with increase in length of the hydrocarbon chain. Qualitatively, the increase in hydrophobicity with substituent groups was in the order: hydroxyl, formyl, acetyl, H phthalate, ethoxy, nitro, propionyl, and benzoyl.

5657. Beamesderfer, J. W.; Thode, E. F.; Chase, A. J., and Hubbard, R. L., Jr. **Dye adsorption on wood pulp. I. Adsorption of direct dye on unbeaten sulfite pulp.** *Tappi* 35, 374-9 (1952).—*C.A.* 47, 313*f*.

The adsorption of Benzo Fast Scarlet 4BSA on unbeaten, bleached sulfite wood pulp was studied. Langmuir-type isotherms were obtained when the specific adsorption in mg dye/g dry pulp was plotted against final dye concn. in g/liter. Parameters were obtained for time of adsorption and for KCl concn. in the dye bath. When the dye was adsorbed on carbon black of a known surface area, the area covered by a dye mol. was calcd. to be 149 A^2. This agreed quite well with an area of 141 A^2. calcd. from the structural formula.

5658. Bhat, G. N. and Rao, M. R. A. **Chrome-mordanting of wool.** *J. Sci. Ind. Research* (India) 11B, No. 2, 67-75 (1952).—*C.A.* 46, 9313*b*.

The chrome-mordanting of wool with dichromate is discussed as regards the effects of wool quality, methods of scouring, temp., wetting agents, wool porosity, and the type of acids used, their adsorption by the wool, and their effect on the dichromate adsorption. Anionic and cationic wetting agents added to the mordanting bath of previously scoured and rinsed wool adversely affect the dichromate ion adsorption.

5659. Blaker, R. H. and Laucius, J. F. **The copper method for dyeing Orlon acrylic fiber.** *Am. Dyestuff Reptr.* 41, *Proc. Am. Assoc. Textile Chem. Colorists* P39-43 (1952).—*C.A.* 46, 4800*c*.

The mechanism of the dyeing involves the formation of a cuprous salt of an acid or direct dye contg. at least one, but not over one sulfonic acid or carboxyl group in the mol. Cuprous ion is first adsorbed by the Orlon acrylic fiber, forming coordinate bonds with selected nitrile groups, after which the formation of a salt between the dye anion and the weakly bound cuprous ion takes place.

5660. BRYANT, F. **Chromatographic studies of the silk fiber. I. The amino acid composition of two sericin fractions. II. Fractionation of a fibroin hydrolyzate.** *Textile Research J.* **22**, 523-5; 525-8 (1952).—*C.A.* **46**, 9313*g*.

Sericin isolated from raw silk was readily separable into H_2O-sol. and H_2O-insol. fractions. These were qualitatively analyzed from amino content by paper chromatography. An acid hydrolyzate of silk fibroin was adsorbed on a column of a cation-exchange resin.

5661. CATES, D. M.; CAMPBELL, K. S., AND RUTHERFORD, HENRY A. **Relation between certain defects in dyed fabrics and mechanical damage in wet processing.** *Textile Research J.* **22**, 623-30 (1952).—*C.A.* **47**, 321*f*.

The mech. damage by abrasion on the surface of cotton, viscose, Fortisan, and acetate fibers results in an increase in the initial rate of dyeing at the damaged area. An abraded area appears darker than the undamaged background up to the point where the amt of dye actually adsorbed is approx. the same in both areas.

5662. CHÊNE, M. AND MANTELET, P. **Capillary properties of pulps and papers.** *Ann. inst. polytech., Grenoble* **1952**, 55-66.—*C.A.* **46**, 9305*g*.

Five sulfite pulps, relatively high in α-cellulose (91.5-95.0), were examd. Detns. were made on the time in sec. required for a 10-cm capillary rise of H_2O on the pulp strip; the time required for a 3-cm rise of 18% NaOH; "swelling" noted in *N* NaOH after 1200 sec.; the specific surface (cm^2/g); the sp. vol. (cc./g); and the av. fiber length.

5663. DICKINSON, HAROLD O. **Adsorption of carbocyanines by gelatin.** *Colloque sensibilité phot., Paris, 1951, Science et inds. phot.* **23A**, 103-10 (1952).—*C.A.* **47**, 4773*e*.

Study of the absorption spectra of a series of carbocyanines of similar structures, dissolved in dil. solns. of gelatin, indicated that the mode and degree of adsorption of dye by gelatin depended on at least 3 factors: dye structure, concn. of gelatin, and pH. Some simple carbocyanines derived from benzothiazole did not appear to to be adsorbed in the aggregate state.

5664. DRIJVERS, L. **Dyeing of textile fibers at high temperatures: above 100°C.** *Teintex* **17**, 294, 297, 299-300, 303, 305, 307, 309, 311, 313 (1952).—*C.A.* **46**, 7333*d*.

Three years of experience with high-temp. dyeing of cellulosics, wool, nylon, Orlon, and mixed fibers indicated satisfactory results.

5665. FLETT, LAWRENCE H.; HOYT, L. F., AND WALTER, J. **Quantitative data on the adsorption of a detergent by cotton sheeting under textile processing conditions.** *Am. Dyestuff Reptr.* **41**, *Proc. Am. Assoc. Textile Chem. Colorists* P139-43 (1952).—*C.A.* **46**, 5324*i*.

Minute quantities of anionic detergents that were adsorbed from soln. could be detd. by improved analytical procedures. Adsorption increased rapidly with the increasing concns. up to 0.2% of the pure org. basis. Salt-free types of detergents showed much less adsorption at equal concns. of pure org. sulfonate; the Na_2SO_4 used as a builder increased adsorption and effectiveness. In general, synthetic detergents behaved like fugitive dyes in regard to adsorption, time, temp., and washing properties.

5666. FRISHMAN, D. AND HARRIS, M. **Stripping dyes from wool.** *Dyer* **108**, 465-7 (1952).—*C.A.* **47**, 871*b*.

The mech. properties of wool fibers were harmed by the process of dye-stripping, but the harm was minimized if the stripping was carried out in the presence of a cross-linking agent. Stripping was particularly difficult in the case of wool dyed with chrome dyes.

5667. FUJITA, HIROSHI. **A numerical solution of the differential equation for adsorption-controlled diffusion in a solid. Correction to "A numerical solution of the differential equation for adsorption-controlled diffusion in a solid."** *Textile Research J.* **22**, 281-6; 556 (1952).—*C.A.* **46**, 4877*g*; 9372*g*.

An attempt was made to evaluate a numerical soln. of a set of equations, the math. difficulties of which have not been resolved either analytically or numerically.

5668. FUJITA, HIROSHI AND KISHIMOTO, AKIRA. **Diffusion with adsorption to apply to the dyeing theory of fibers.** *J. Soc. Textile Cellulose Ind.* (Japan) **8**, 244-9 (1952) (English summary).—*C.A.* **46**, 9311*h*.

The relation between the concn. of a dye in a bath and the amt. adsorbed by a fiber (considered as a porous solid cylinder) dipped in the bath while the dye diffused into the swollen fiber was theoretically expressed. From the soln. the effect of adsorption on the general sorption-time curve was numerically discussed.

5669. GAMBLE, EDWARD H. **The continuous dyeing of new synthetic fibers.** *Am. Dyestuff Rptr.* **41**, *Proc. Am. Assoc. Textile Chem. Colorists* P223-41 (1952).—*C.A.* **46**, 7333*f*.

Practical continuous processes were being developed for the dyeing of Dacron, Dynel, Orlon, and Acrilan synthetic fibers. The development of a method for the continuous application of cuprous ions to acrylic fibers was described and it was found that the treated fibers could be dyed by batch-dyeing processes with leuco esters as well as with acid dyes. A surface-stripping treatment served both to det. the extent of dye penetration and to produce dyeings of vat dyes free from crocking.

5670. GUASTALLÁ, LINA. **Adsorption of myristic and palmitic acids on paraffin.** *Compt. rend.* **234**, 2051-3 (1952).—*C.A.* **46**, 9931*g*.

When palmitic acid was adsorbed on solid paraffin from the surface of a 0.01 *N* HCl soln., a change in state occurred. This was not found for myristic acid. Comparison of the superficial area of the paraffin with the concn. of the fatty acid taken up in passing through the film gave an indication of change of state upon adsorption.

5671. GUASTALLÁ, LINA P. **Extension of the Traube-Duclaux law: the adsorption of saturated fatty acids on paraffin.** *Compt. rend.* **235**, 941-3 (1952).—*C.A.* **47**, 4165*g*.

The coeff. of the Traube-Duclaux rule, which is practically equal to 3 for the adsorption of fatty acids on the free surface of their aq. solns., becomes 3.85 for the adsorption of these materials on the surface of solid paraffin.

5672. GUTHRIE, JOHN D. **Attachment of dyes to cotton by ether linkage.** *Am. Dyestuff Reptr.* **41,** *Proc. Am. Assoc. Textile Chem. Colorists* P13-14 (1952).—*C.A.* **46,** 5319*f*.

Cotton could be colored by attaching certain azo dyes to the cellulose by ether linkage in a single operation, the dye itself acting as the etherifying agent. Ether linkage of these dyes to cellulose when applied by curing with strong NaOH was demonstrated by decolorizing the fabrics with $Na_2S_2O_3.2H_2O$, diazotizing the decolorized fabrics with HNO_2, and coupling with a phenolic substance either to restore the original color or to impart a different color.

5673. GUTHRIE, JOHN D. **Ion-exchange cottons.** *Ind. Eng. Chem.* **44,** 2187-9 (1952).—*C.A.* **46,** 11693*g*.

The exchange capacities of 9 ion-exchange cottons were detd. by using NaCl and found to be below the capacities of com. granular resins. An aminized-iminized cotton was prepd. by treating aminized cotton with ethyleneimine vapor.

5674. HARRISON, W. **The combination of wool with acids.** *J. Soc. Dyers Colourists* **68,** 176-8 (1952).—*C.A.* **46,** 8379*d*.

Exptl. evidence shows that the laws of mass action are applicable to the adsorption of acids by wool, once the conditions have been exactly defined. Calcns. from given formulas were made for different pH values for HCl with and without the addn. of KCl, and the results plotted.

5675. HEARLE, J. W. S. **Peirce's two-phase theory of absorption of water by cellulose.** *J. Textile Inst.* **43,** T354 (1952).—*C.A.* **46,** 8460*a*.

The theory is modified to take account of the division of cellulose into cryst. and amorphous regions, which allows it to be applied to cellulosic materials of β values other than 3.

5676. HINOWARA, TADAO. **Rate of sorption of sodium hydroxide on a heterogeneous solid in a solution.** *Kagaku* (Science) **22,** 38-9 (1952).—*C.A.* **46,** 2372*i*.

Rate dx/dt of sorption of NaOH by powd. wood was measured in solns. 0.05 N at 100°C and 0.1 N at 20°, 35°, 50°, and 100°C. The equation $dx/dt = K(a-x)x^n$, where a = the final amt. sorbed and n = a const., was applied to obtain the rate const. $K = 0.031$ and $n = 1$ at 0.1 N and 35°C.

5677. HIRSCH, P. **Behavior of membranes between electrolyte solutions. II. Membrane potentials at oxidized Cellophane.** *Rec. trav. chim.* **71,** 354-60 (1952) (in English).—*C.A.* **46,** 5940*b*.

Oxidation of Cellophane membranes by Br_2 in NaOH soln. increases Δ at all pH values (2.5 to 10.0); this indicates that more —COOH groups are formed by oxidation. The quantity Δ is the membrane potential minus the liquid junction potential between 2 solns. of the same electrolyte (NaCl or KCl), both adjusted to the same pH and measured between the same two concns. c_1 and c_2.

5678. HIYAMA, HACHIRO; IKEGAMI, HISASHI, AND MANABE, OSAMU. **Sulfur dyes. XXX. Sodium sulfide needed in dyeing.** *Sci. Ind.* **27,** 6-7 (1952).—*C.A.* **47,** 4612*d*.

In exptl. dyeing of fibers with Immedial Indone R ($C_{26}H_{16}O_4N_4S_5.H_2O$) the amt. of Na_2S needed was 21.7 for completely reducing the dye to its leuco base, 10 for replenishing the loss of Na_2S in the bath by oxidation by O_2 in air, and 41.7% (of the dye) for the adsorption of dye on the fibers (here Na_2S could be largely replaced by NaOH or Na_2CO_3 provided the pH was kept at 10.6).

5679. INABA, AYAKO. **Wettability of solid surfaces. V. The effect of metallic cations on wettability of stearic acid.** *Bull. Chem. Soc. Japan* **25,** 174-9 (1952) (in English).—*C.A.* **47,** 6736*d*.

The wettability of stearic acid surfaces prepd. by coating a glass rod in molten stearic acid and solidifying in air was detd. Na, K, and Rb had no effect on the wettability as a function of pH, although an increase in the salt concn. lowered the pH at which the wettability increased. Al, Th, Fe(III), Cr(III), Co, Cu, Zn, Cd, Mn, and Ag showed enhanced wettability in a pH region characteristic for each salt. Ba, Sr, Ca, Li, and possibly Hg(II), Ni, and Pb reduced wettability in the pH region above 10.

5680. JACKSON, J. H. E. AND TURNER, H. A. **The desorption of a direct cotton dye from cellulosic fibers.** *J. Soc. Dyers Colourists* **68,** 345-52 (1952).—*C.A.* **46,** 11689*h*.

A study is reported of the desorption of purified Chlorazol Sky Blue FF from dyed bleached cotton and from dyed viscose rayon into water and into NaCl solns. With cotton a dyeing hysteresis is found. Unexpected features of the desorption into very dil. solns. of NaCl are explained by assuming the presence of a small proportion of basic groups in the cotton.

5681. JENSEN, JENS. **The importance of the oil content of wool for dyeing.** *Tids. Textiltek.* **10,** 1-4 (1952).—*C.A.* **46,** 7333*a*.

The influence of the oil content of a wool on the dyeability of the latter was detd. The exptl. data of the oil content and absorbed dye showed that the presence of elain impaired the dyeing process less than anticipated and that the impairing was more perceptible with strong colorations than with weak.

5682. JOHNSON, P. **Properties of lyophilic colloids.** *Chemistry & Industry* **1952,** 206-10.—*C.A.* **46,** 5401*c*.

Lyophilic colloids, contrasted with lyophobic colloids, were quite insensitive to electrolyte concn. and showed spontaneous dispersion on addn. of much dispersion medium. Colloidal electrolytes when dissolved in water evolved heat. at first by interaction of the polar groups with water, and at higher concns. by aggregation to reduce the hydrocarbon-water interfacial energy. Water added to an aq. cellulose soln. entered the amorphous portion producing only limited swelling.

For sol. and corpuscular proteins and polypeptide chain was folded regularly on itself and stabilized by electrostatic and nonpolar linkages.

5683. Jones, W. Mervyn. **Mobility in a sorbed layer. II. Surface flow through pores of molecular dimensions.** *Trans. Faraday Soc.* 48, 562-7 (1952).—*C.A.* 46, 10776*e*.

Flow may be wholly surface flow when the ratio of the perimeter of the pores to the cross-sectional area of the pores is large (as for long thin slits) and the resistance of surface flow is, as a result, very much less than the resistance to vapor flow. It appears that, if it be possible for surface diffusion alone to contribute to the the flow of gases and vapors through certain membranes, many of the co-ordinates governing such flow would be similar to those governing flow by vacancy diffusion and flow by place exchange.

5684. Juda, W.; Rosenberg, N. W.; Marinsky, J. A., and Kasper, A. A. **Electrochemical properties of ion-exchange resins. I. Donnan equilibria, membrane potentials, and conductivities.** *J. Am. Chem. Soc.* 74, 3736-8 (1952).—*C.A.* 46, 10777*f*.

Systems involving the Na salts of 2 chemically different cross-linked polyphenol-sulfonic acids, Permionic CR-41 and CR-51, in equil. with NaCl solns. were used for transport, conductance, and Donnan studies. The data were consistent with the assumption that the Na salt of the Cr-51 material was strongly ionized, whereas the Cr-41 material might be partially assocd. into ion pairs.

5685. Kamrisch, B. **Dyeing the modern synthetic fibers.** *Dyer* 108, 709-13 (1952).—*C.A.* 47, 1395*d*.

Existing dyes, especially acetate and wool dyes, are suitable for dyeing the newer fibers, provided modified techniques are used. Ardil and Vicara require wool dyes. Dynel has much lower shrinkage at 90-100°C than do the related Fibravyl and Thermovyl fibers and can therefore be dyed with acetate dyes at the boil.

5686. Katsurai, Tominosuke. **Behavior of particles of capillary-active substances in the phase microscope.** *Kolloid-Z.* 128, 32 (1952).—*C.A.* 47, 22*i*.

If a speck of surface-active substance, such as camphor, were brought together with a drop of water in the field of the phase microscope, a rotation of the particle was observed.

5687. Kleinert, Theodor. **Bound calcium in rayon pulps and its behavior in the viscose process. II. Effect on viscose filtration.** *Textile-Rundschau* 7, 98-102 (1952).—*C.A.* 46, 9302*e*.

In the tech. filtration of viscose, the removal of the Ca from the filter cloths by acid treatment is not sufficient to permit reuse of the cloths. It is also necessary to remove the hemi-cellulose colloid formed from the Ca salts of the hemicellulose carboxylic acids.

5688. Kohlitz, Werner. **The determination of gel particles in colloid solutions, particularly viscose.** *Rayon, Zellwolle u. Chemiefasern* 30, 343-6 (1952).—*C.A.* 46, 8935*d*.

When viscose soln. was allowed to flow through a 1-mm glass capillary into streaming water, the gels became visible and could be readily counted. This test was improved by utilizing a glass ring nozzle with 0.7-mm slits. For TiO_2-filled viscose, a ring nozzle of V2A with 0.3 mm slit width gave greater accuracy.

5689. Kopaczewski, Wladislas. **Passage of hydrosols across lipide layers and the nature of the support.** *Compt. rend.* 235, 102-4 (1952).—*C.A.* 46, 10784*e*.

The passage of aq. solns. through a lipide barrier was studied for supports of different chem. natures: cellulose, wool, silk, raw silk, and cellulose impregnated with dild. horse serum. The supports were washed with alkyl arylsulfonate, rinsed in distd. H_2O, air-dried, and their ends were immersed in colored hydrosols which were either electroneg., electropos., or neutral, and in distd. H_2O. The height the color moved up the supports was measured. The penetration of colored hydrosols varied with the nature of the support and the chem. and phys. characteristics of the liquids.

5690. Kruger, Joan; Donovan, R., and Larose, P. **Sorption of Orange II by wool.** *Can. J. Technol.* 30, 215-21 (1952).—*C.A.* 47, 4614*a*.

The sorption of Orange II on wool at 100°C was detd. in the presence of AcOH and H_3PO_4 and compared with previous data with H_2SO_4 and HCl. The sorption of the dye was affected not only by pH, but also by the type of acid used and the absorption of acid by wool. The competition between the sorption of the anion and the dye depended on the concn. of the acid and its affinity for the wool. The type of the sorption isotherm was the same for all acids.

5691. Landsberg, Rolf. **Potentials in the formation of precipitated membranes. II.** *Z. physik. Chem.* 199, 280-2 (1952).—*C.A.* 46, 8936*b*.

In the formation of Cu ferrocyanide ppts. in gelatin a max. p.d. was reached with $Cu(NO_3)_2$ or $CuSO_4$. With $CuCl_2$, however, a smaller p.d. was obtained, a longer time was needed, and the zone of pptn. was more diffuse. A p.d. was observed when a plug of gelatin contg. $CuSO_4$ was dipped into a $K_4Fe(CN)_6$ soln.

5692. Laxer, G. and Whewell, C. S. **The measurement of damage produced by treatment of wool with solutions of hydrogen peroxide.** *J. Soc. Dyers Colourists* 68, 256-7 (1952).—*C.A.* 46, 8379*f*.

The percentage reduction in work to stretch the fibers 30% (% R.W.) was considered an estimate of damage. In a study, calibrated fibers of various diams. were immersed in H_2O_2 solns. maintained at const. temp. for various lengths of time. The % R.W. was very dependent upon the fiber diams., coarse fibers being less easily attacked than finer ones.

5693. Malm, C. J.; Barkey, K. T.; May, D. C., and Lefferts, E. B. **Treatment of cellulose prior to acetylation.** *Ind. Eng. Chem.* 44, 2904-9 (1952).—*C.A.* 47, 2977*e*.

High reactivity of cellulose toward acetylation was obtained when there was rapid and uniform sorption of H_2SO_4 catalyst. The amt. of sorbed H_2SO_4 was not as important as the uniformity of its distribution in the cellulose. The principal function of the catalyst treatment was the reduction of the cellulose chain length prior to acetylation.

5694. MARTIN, G. R. **Note on use of volatile filter beds.** *Chemistry & Industry* **1952**, 131.—*C.A.* 46, 5894*g*.

A suspension of finely divided naphthalene crystals, was poured into a straight-sided microfunnel fitted with a glass nail, and the excess liquid removed by suction to give a filter bed of 3-mm thickness which could be volatilized after use. The bed retentivity was 99.99% when 20 mg of I^- was converted to AgI and filtered.

5695. MEADER, ARTHUR L. JR. AND FRIES, BERNARD A. **Adsorption in the detergent process.** *Ind. Eng. Chem.* 44, 1636-48 (1952).—*C.A.* 46, 10647*c*.

The radio-active-tracer method measured directly the rate and extent of adsorption and desorption on cotton and woolen cloth of Na alkyl benzene sulfonate (A) labeled with S^{35} and Na palmitate labeled with C^{14} in the carboxyl group. Adsorption curves were plotted up to 0.01 *M* in distd. water and synthetic hard water (300 p.p.m.) at 21°, 45°, 60°, and 75°C for many of the possible combinations. Successive addn. of Na_2SO_4 progressively raised the level of the whole adsorption curve. The adsorption of miscelles was postulated and appeared consistent with the data.

5696. MONGARD, J. L. AND WASSERMANN, ALBERT. **Adsorption of electrolyte by alginate gels without and with cation exchange.** *J. Chem. Soc.* **1952**, 492-7.—*C.A.* 46, 4319*b*.

Gels of fully swollen fibrous alginates (polymeric D-mannuronic acid derivs.) undergo cation exchange with many typical ionic reagents. Alginates also are shown to adsorb significant amts. of these reagents in a manner not assocd. with cation exchange.

5697. MONGAR, J. L. AND WASSERMANN, A. **Influence of ion exchange on optical properties, shape, and elasticity of fully-swollen alginate fibers.** *J. Chem. Soc.* **1952**, 500-10.—*C.A.* 46, 4319*a*.

Fully-swollen, stretched, and optically anisotropic Ca alginate fibers undergo cation-exchange reactions with an increase of vol. and transparency of the gel, loss of birefringence, axial contraction, and increase of elasticity.

5698. MOULD, D. L. AND SYNGE, R. L. M. **Electrokinetic ultrafiltration analysis of polysaccharides. A new approach to the chromatography of large molecules.** *Analyst* 77, 964-70 (1952).—*C.A.* 47, 1546*a*.

Much of the difficulty in the chromatographic sepn. of members of a polymeric series was caused by the inability of the larger mols. to enter the porous materials by chromatography. Electrokinetic ultrafiltration was recommended to overcome this difficulty. A preliminary account was given to expts. with collodion membranes.

5699. MÜLLER, LUDWIG W. **Dyeing Perlon and nylon, alone and in mixtures with other fibers; various important characteristics of polyamide fibers.** *SVF Fachorgan Textilveredlung* 7, 20-5, 65-70, 108-12 (1952).—*C.A.* 47, 322*e*.

Dyeing methods and the suitable com. dyes for polyamide fibers were reviewed.

5700. MURAMATSU, MITSUO AND SASAKI, TSUNETAKA. **The nature of built-up films. I. Adsorption of ions on built-up films of stearic acid.** *Bull. Chem. Soc. Japan* 25, 21-5 (1952) (in English).—*C.A.* 47, 2013*g*.

The adsorption of metallic ions on built-up films of stearic acid monolayers was studied. Films were prepd. by (1) transference from H_2O and (2) conversions from Ba stearate multilayers by HCl. Various metallic ions produced a max. apparent thickness at a characteristic pH. Similar max. were obtained at a pH characteristic for each element. Cu and Hg showed small max. at pH 6.3 and 9, resp.

5701. NAGAMATSU, MASATOSHI AND SEIYAMA, TETSURO. **Electrochemical studies on ion exchangers. III. Ion-exchange reaction between solid alginic acid and neutral salt solution.** *J. Electrochem. Soc. Japan* **20**, 170-2 (1952).—*C.A.* 47, 423*e*.

The exchange reaction of solid alginic acid reached equil. only after 2 hrs. The ion-exchange power of the --COOH group was smaller than that of the --SO_3H group in a cation-exchange resin. Solid alginic acid satisfied an exptl. linear relationship between log K_a and the exchange percentage.

5702. NEALE, S. M. AND STANDING, P. T. **The measurement of Donnan potentials with cellulose and aqueous solutions.** *Proc. Roy. Soc.* (London) **A213**, 530-45 (1952).—*C.A.* 46,10786*c*.

Exptl. results show that the membrane can be regarded as an aq. region of uniform potential that depends on a Donnan distribution of the mobile ions. The degree of dissocn. of the nondiffusible ionogenic groups depends on the concn. of neutral electrolyte soln. in contact with the membrane. The dissocn. const. in the carboxylic acid groups in cellophane is derived.

5703. NISHIDA, KENZO. **Direct dyeing of cellulose. I. Construction of a photoelectric color meter and direct dyeing.** *J. Soc. Textile Cellulose Ind.* (Japan) **8**, 347-50 (1952) (English summary).—*C.A.* 46, 9851*c*.

With a photoelec. colorimeter specially constructed with a gas-filled Se cell the absorption isotherms of 0.01-0.05 g/liter Diamine Blue 2B by Cellophane and oxycellulose were detd. With NaCl added up to 5 g/liter as mordant the curves were typically parabolic or hyperbolic, but became S-shaped with higher NaCl concns.

5704. NISHIDA, KENZO. **Direct dyeing of cellulose. II. Dyeing properties of Aizen Direct Blue BBH, Diamine Blue 3B, and Nippon Sky Blue.** *J. Soc. Textile Cellulose Ind.* (Japan) **8**, 463-6 (1952) (English summary).—*C.A.* 47, 321*h*.

Finished cotton was dyed progressively better as detd. with a photoelec. colorimeter in the absorbed dye extd. with 25% pyridine, with Aizen Direct Blue BBH, Diamine Blue 3B, and Nippon Sky

Blue (Na salts of H acid coupled into disazo dyes with dianiline, ditoluidine, and dianisidine, resp.) in order in a bath at 90°C contg. 0.05-0.1 × 10^{-3} dye and 0.5-4.5 mole NaCl/kg H_2O.

5705. Nishida, Kenzo. **Effects of metallic salts in dyeing silk. I. Absorption affected in direct dyeing.** *J. Soc. Textile Cellulose Ind.* (Japan) **8**, 404-6 (1952) (English summary).—*C.A.* 47, 321*i*.

Silk cloth absorbed more Nippon Fast Yellow 3C, Nippon Brilliant Rose BD, and Nippon Violet LN when higher concns. of $FeCl_3$ or $CuSO_4$ were added (up to 20 × 10^{-4} mole/liter) to the scouring and H_2O bath.

5706. Pearl, Wesley L. **The sorption and rate of sorption of the amylose fraction of starch by papermaking fibers.** *Tappi* **35**, 41-8 (1952).—*C.A.* 46, 6830*c*.

The sorption of the amylose fraction of starch on cotton linters and wood pulp was shown to be irreversible, the rate depending upon the concn. of the soln. Sorption capacities as high as 34 g amylose/100 g pulp were noted. High pH (10.4) decreased the amt. of amylose sorbed; increased severity of beating increased the sorption.

5707. Rånby, Bengt G. **Physicochemical investigations on bacterial cellulose.** *Arkiv. Kemi* **4**, 249-55 (1952) (in English).—*C.A.* 46,8365*c*.

Electron micrographs of a sample of bacterial cellulose from *Acetobacter xylinum* showed a string diam. of 100 A. rather than 250 A. Analysis of the phase transition of cellulose I to II (mercerization by NaOH) with x-ray diffraction and water sorption had shown that bacterial cellulose had transition properties very similar to those of cotton cellulose but different from those of animal cellulose.

5708. Rastogi, M. C. **Liesegang-ring formation of the sparingly soluble salts of rarer elements in agar-agar and starch gel.** *J. Indian Chem. Soc.* **29**, 206-8 (1952).—*C.A.* 47, 25*g*.

Liesegang rings of various rarer elements (Zr, Ce, Be, U, tungstates, vanadates, etc.) were obtained in agar and starch media. Rings of some salts (i.e. Th phosphate, sulfate, and peroxide; $Zr(OH)_4$, $CaWO_4$) were not obtained at the concns. used. Rings were well defined and sepd. by clear spaces (type I), or else consisted of alternate colored bands in the otherwise continuous deposit (type II).

5709. Rigamonti, Rolando and Riccio, Virginio. **Property of ion exchange of the cellulose esters of dicarboxylic acid.** *Ann. chim.* (Rome) **42**, 580-5 (1952).—*C.A.* 47, 3080*i*.

The cellulose esters of phthalic, maleic, succinic, and adipic acids have good ion-exchange power. That of the succinate is exceptionally high when it is prepd. by boiling the cellulose impregnated with fused succinic anhydride.

5710. Ripley-Duggan, B. A. **Adsorption by wood from aqueous solutions. I. Adsorption of barium chloride, sodium chloride, and water.** *New Zealand J. Sci. Technol.* **34B**, 1-12 (1952).—*C.A.* 47, 3080*g*.

H_2O is rapidly adsorbed and equil. attained in a few min. at 15° and 25°C. Solutes were adsorbed more slowly, equil. being reached in a few hrs. The adsorption of Ba^{++} was a linear function of Ba^{++} concn. NaCl showed an apparent neg. adsorption (H_2O was adsorbed relatively more easily than is NaCl).

5711. Roy, Alexander P. **New developments in the dyeing of synthetic fibers.** *Am. Dyestuff Reptr.* **41**, *Proc. Am. Assoc. Textile Chem. Colorists* P35-8 (1952).—*C.A.* 46, 4799*d*.

The new synthetic fibers, superior to the natural fibers in many properties, are at the present time special-purpose, rather than general-purpose fibers. Improvements in the processing, dyeing, and finishing of synthetic fibers are discussed and illustrative formulas are given.

5712. Saroff, H. A. and Dillard, G. H. L. **A continuous-membrane diffusion column.** *Arch Biochem. Biophys.* **37**, 340-52 (1952).—*C.A.* 47, 356*f*.

The column allows the suspension of large areas of Cellophane in a zig-zag fashion so that thin films of solns. flow continuously on both sides of the membrane. Data are presented on the dialyzing efficiency of the app. and on the concn. contours of solns. processed. Thickness of the solns., mixing, and time of travel on the column give conditions such that the diffusion coeffs. of the solutes rather than pore size of the Cellophane can be made the controlling factor in the operation of the app.

5713. Schmid, Gerhard. **Electrochemistry of fine-pore capillary systems. VI. Convection conductivity (theoretical consideration).** *Z. Electrochem.* 56, 181-93 (1952).—*C.A.* 47, 981*i*.

The term surface cond. introduced by Smoluchowski for that part of the total cond. due to convection currents in the Helmholtz double layer is replaced by the term convection cond. Convection currents and convection cond. may occur, although a Helmholtz double layer can no longer be assumed because the pores are too narrow. The correct formulas which include the effect of convection cond. for the previously idealized fine-pore system are derived. The convection cond. can be regarded as the cond. contribution of the fixed ions in the pores. Because ion-exchange resins have high fixed-ion concns. in their pores, convection cond. can no longer be neglected, especially for resins which have high water permeability.

5714. Schöberl, A. **Green hairs, and the problem of metal deposits in wool.** *Melliand Textilber.* 33, 4-14 (1952).—*C.A.* 46, 5323*a*.

Metal deposits can be formed in wool by heating 1 g wool in 125 cc. H_2O at 90°C for several days in the presence of 1-7 g Hg, Pb, Cd, Zn, Fe, W, or Cu in the metallic form. Flocks of colored wool are obtained contg. 1-12% metal and having a pH in the range 5-8. Cu is taken up in the greatest amts. It forms brown deposits having the Cu_2S pattern. Cu-treated wool on storage, especially in light, turns green owing to oxidation of Cu_2S to form cupric compds. This is a lab. method for forming "green hairs" that correspond exactly to those that have been found to occur naturally on humans under special circumstances (e.g., Cu miners).

5715. SCHULMAN, FRED AND ZISMAN, W. A. **Surface chemical properties of solids coated with a monolayer of perfluorodecanoic acid.** *J. Chem. Soc.* 74, 2123-4 (1952).—*C.A.* 47, 6726*a*.

Compds. such as perfluorodecanoic acid are examples of a new class of surface-active compds. with CF_3 groups and 1 or more adsorbable polar groups at opposite portions of the mol. These possess both highly hydrophobic and organophobic properties, and when close packing of CF_3 groups can occur, they will have even more unusual resistance to chem. attack by bulk liquids.

5716. STANDING, H. A. **Equilibrium adsorption of direct dyes by cellulose materials.** *Chemistry & Industry* **1952**, 527-30.—*C.A.* **46**, 8857*i*.

A review of the effect of temp., dye and salt concn., and dyebath pH on the equil. adsorption of a dye by cellulose, and theories of direct dyeing since 1935.

5717. STORY, L. F. **Use of copper sulfate in dipping sheep and its effect on the subsequent processing of the wool.** *New Zealand J. Sci. Technol.* **34A**, 287-93 (1952).—*C.A.* 47, 5687*b*.

Since many chrome dyes are affected by Cu, small quantities of Cu retained on sheep wool as a result of treatment of the sheep with $CuSO_4$ can lead to faulty dyeing. General discoloration can occur because of the formation of CuS. Also, Cu has a marked catalytic effect on peroxide bleaching. Ethylene-diaminetetraacetic acid can remove 0.005% of evenly distributed Cu from wool but is less effective against a local high concn.

5718. SWILLENS, P. **The influence of temperature on dyeing and the use of dyeing temperatures exceeding 100°C.** *Rayonne et fibres synthet.* **8**, No. 4, 43-9 (1952).—*C.A.* 46, 6838*i*.

The advantageous effect of high temps. in dyeing is considered in the light of the damage done to some dyes by the reducing action of viscose in alk. solns. and of the unevenness produced by increased dye uptake.

5719. TANAKA, RYUKICHI; SEKO, KAZUMITSU, AND MURAYAMA, TETSURO. **Dyeing of cellulose acetate fibers. V. Dyeing with indigo. VI. Dyeing with indigo (dispersion).** *J. Soc. Textile Cellulose Ind.* (Japan) 8, 124-6 (1952) (English summary).—*C.A.* 46, 8858*g*.

Cellulose acetate fibers left in an indigo bath at 30°C at 0.5-32 hrs., unlike viscose rayon being dyed max. in 30 min., were dyed more deeply with longer times by progressive dissoln. of indigo in the fibers. The dispersion of indigo in 0.2 g/150 cc. soln. by adding AcOH in varying amts., as estd. from its diffusion through 5% gelatin gel, was less with more AcOH added, the indigo forming larger particles.

5720. TANAKA, RYUKICHI AND MURAYAMA, TETSURO. **Dyeing of cellulose acetate fibers. VII. Dyeing with indigo (mechanism).** *J. Soc. Textile Cellulose Ind.* 8, 194-6 (1952).—*C.A.* 46, 8858*i*.

The indigo soln. neutralized with AcOH was shaken with AcOEt at room temp. (11°-14°C) for 10-160 min. The amt. of indigo dissolved in AcOEt increased linearly with the amt. of AcOH added, and the soly. line became more horizontal with longer shaking. Since the expt. simulated the dyeing of cellulose acetate fibers with indigo, the affinity of indigo to the acetate fibers could be explained by the solid-soln. theory.

5721. THODE, E. F.; BEAMESDERFER, J. W., AND CHASE, A. J. **Dye adsorption on wood pulp. II. Relation of dye adsorption to physical properties of beater sulfite pulp.** *Tappi* 35, 379-84 (1952).—*C.A.* 47, 313*h*.

Specific dye adsorption on beaten sulfite wood pulp was detd. The specific dye adsorption for beaten sulfite pulp varied from 0.15 to 0.5 mg. dye/g. dry pulp. This value correlated well with surface areas obtained by silvering and permeability techniques, and gave straight lines, on a semilogarithmic scale, with strength values on handsheets from the pulp.

5722. TURNBULL, S. G., JR. **The dyeing of nylon, Orlon acrylic fiber, and Dacron polyester fiber.** *Am. Dyestuff Reptr.* **41**, *Proc. Am. Assoc. Textile Chem. Colorists* P75-8, P82 (1952).—*C.A.* 46, 4799*i*.

Nylon is characterized as the most dyeable of the 3 fibers; it can be effectively dyed with acetate, acid, chrome, basic, naphthol, and Capracyl dyes.

5723. VUCCINO, S. **The preparation and investigation of some thin films of high polymers used in nuclear physics.** *J. phys. radium* **13**, 543-9 (1952).—*C.A.* 47, 5717*c*.

Thin films to be used as supports for radioactive sources or as counter windows were prepd. from polyvinyl chloride, formvar, and polystyrene. Some films had a thickness of only 1 γ/cm^2. The films could be removed from the H_2O surface by adding EtOH to lower surface tension and lifting the film on a brass ring. The films were more difficult to remove from glass.

5724. WALL, FREDERICK T. AND SWOBODA, THOMAS J. **Electrolytic interaction of nylon with aqueous solutions of sodium hydroxide.** *J. Phys. Chem.* 56, 50-6 (1952).—*C.A.* 46, 7847*g*.

The theory for the interaction of charge-bearing fibers with acids and bases was generalized to cover the 6 possibilities of titration with either acid or base of nylon with $A > B$, $A = B$, $A < B$ (A = total CO_2H groups; B = total NH_2 groups). Good agreement was observed between theory and expt., and the results were used to calc. equil. consts. for ion-absorption and neutralization processes.

5725. WEATHERBURN, A. S. AND BAYLEY, C. H. **The sorption of synthetic surface-active compounds by textile fibers.** *Textile Research J.* 22, 797-804 (1952).—*C.A.* 47, 1396*i*.

Sorption decreases in the order cationic compds., anionic compds., nonionic compds. The addn. of Na_2SO_4 increases the sorption of Na alkyl sulfates. The sorption of nonionic di-Bu cresol-ethylene compds. decreases slightly with increasing length of the polyethylene oxide chain over the range studied.

5726. Weber, Rudolf. **Chemical identification of wool damage.** *SVF Fachorgan Textilveredl.* 7, 15-20, 55-9 (1952).—*C.A.* 46, 5323*d*.

Damaged wool will absorb more Cu from an ammoniated Cu_2SO_4 soln. than undamaged wool. Two g wool are digested with 100 cc. of a $[Cu(NH_3)_4]SO_4$ soln. contg. 76.5 mg Cu for 15 min. at room temp. Then the wool is removed and the residual Cu is titrated with $Na_2S_2O_3$ in a H_2SO_4-KI soln. The wool sample will show a green color after Cl or oxidation damage, gray after alk., and violet after acid damage.

5727. Bernanose, André; Comte, Marcel, and Vouaux, Paul. **A new method of emission of light by certain organic compounds.** *J. chim. phys.* 50, 64-8 (1953).—*C.A.* 47, 6258*e*.

The dyes Gonacrine and Acridine Brilliant Orange E when adsorbed upon a sheet of Cellophane and the sheet placed in a sufficiently strong alternating elec. field gave rise to rather strong light emission.

5728. Bugher, John C. **Characteristics of collodion membranes for ultrafiltration.** *J. Gen. Physiol.* 36, 431-48 (1953).—*C.A.* 47, 3047*d*.

An app. was described for securing collodion membranes of different porosity. The pore diam. was regulated by varying the amt. of PrOH soln.

5729. Deile, O.; Krämer, H. and Klaus, W. **The adsorptive retention of methylcellulose on polystyrene from the index of refraction of polystyrene sols with added methylcellulose.** *Kolloid-Z.* 130, 105-10 (1953).—*C.A.* 47, 6221*i*.

The flocculation of polystyrene sols by medium-viscosity methylcellulose was at a max. when the concn. ratio was 20:1. This was detd. by measuring n and considering a min. value of n to be indicative of max. flocculation. The adsorption of methylcellulose was believed to result from the formation of counter-ions between the sulfonate ions peptizing the Styofon and the pos.-charged O atoms of methylcellulose.

5730. Goto, Rempei; Sugano, Takeo, and Hayama, Naomi. **Protective power of surfactants for dyes.** *Bull. Inst. Chem. Research, Kyoto Univ.* 31, 133-4 (1953).—*C.A.* 47, 6663*b*.

The rubine nos. of various surfactants were examd. Nonionic and catonic surfactants showed remarkable protective power for Congo Rubine, an anionic dye, while anionic surfactants did not, and cationics induced distinct coagulation of the dye without change of color; the ppt. of the dye by KCl accompanied a distinct color change.

5731. Larose, P. **The sorption of hydrogen chloride by wool.** *Textile Research J.* 23, 91-8 (1953).—*C.A.* 47, 3571*a*.

The sorption of acids by wool from aq. solns. is generally regarded as a back-titration of the free —COOH groups present in the protein. Expts. described form part of an attempt to learn more of the interaction between wool and acids. The large amt. of HCl sorbed under certain conditions indicates that the peptide bond must be responsible for a large part of the gas sorbed.

5732. Laxer, G. and Whewell, C. S. **Adsorption of metal ions by naturally pigmented keratin fibers.** *J. Soc. Dyers Colourists* 69, 83-4 (1953).—*C.A.* 47, 5122*b*.

The amts. of Fe and Cu adsorbed by pigmented keratin fibers are much greater than those taken up by the white keratin fibers. There is an approx. linear relation between the degree of coloration of the fiber and the amt. of metal adsorbed.

5733. Rae, John. **Absorption of dyes by gels.** *Pharm. J.* 170, 30 (1953).—*C.A.* 47, 4165*h*.

Gels consisting of gelatin, agar agar, pectin, isinglass, in H_2O, and polyvinyl alc. in a buffer soln. were prepd., and the penetration of the dye was measured 24 hrs. after it was poured on the solidified gel. The dyes used were acriflavine, Congo red, Mercurochrome, Bordeaux B, trypan blue, tartrazine, and methylene blue.

5734. Ray, B. Roger and Bartell, F. E. **Hysteresis of contact angle of water on paraffin. Effect of surface roughness and of purity of paraffin.** *J. Colloid Sci.* 8, 214-23 (1953).—*C.A.* 47, 6219*c*.

The contact angle of H_2O on very thin films of purified paraffin formed on smooth glass surfaces by vacuum sublimation was 112°C, without significant hysteresis between advancing and receding angles. Hysteresis effects in the range of 5°-35°C were observed for rougher or thicker films.

5735. Smith, Denton L. and Schoonover, I. C. **Direct-filling resins: dimensional changes resulting from polymerization shrinkage and water sorption.** *J. Am. Dental Assoc.* 46, 540-4 (1953).—*C.A.* 47, 6693*e*.

Direct-filling resins shrink approx. 6-8% in vol. during polymerization; this shrinkage occurs in local areas rather than uniformly in all directions. In the absence of strain, these resins expand equally in all directions as the result of water sorption, approx. 1-1.5% by vol.

5736. Wall, Frederick T. and Saxton, Patricia M. **Electrolytic interaction of nylon with sodium hydroxide solutions at different temperatures.** *J. Phys. Chem.* 57, 370-5 (1953).—*C.A.* 47, 6146*f*.

Polyhexamethyleneadipamide (nylon 66) was studied. The adsorption of NaOH by nylon fibers was studied at 25°, 36.4°, and 49.7°C. Equil. consts. were detd. for the adsorption, which occurred in 2 stages. Equations were developed to relate the heat of adsorption with the change in OH^- concn. necessary to keep const. the amt. of adsorbed base at different temps.

Chapter III. THERMAL EFFECTS IN ADSORPTION PROCESSES

III-1. Heats of Adsorption

5737. Calvet, Édouard. **Thermal effects produced during adsorption of acetone by nitrocelluloses.** *Ann faculté sci. Marseille* **15**, 13-26 (1941).—*C.A.* **40**, 6964^3.

App. for detg. the heat of adsorption of acetone by nitrocellulose, and for measuring the total heat of soln. of nitroramie in acetone, resp. was described. Results of 15 expts. using 1 g of nitroramie contg. 14.0% N, and 23 expts. using 1 g of nitroramie with 11.47% N, were given.

5738. Calvet, Édouard. **Gelatinization of nitrocellulose. Heat of adsorption of acetone by fibers and films of nitrocellulose.** *Compt. rend.* **214**, 716-18 (1942).—*C.A.* **38**, 3888^4.

Tests with nitrocellulose films of 14% and 11.5% N gave results similar to those previously obtained with nitrated ramie fibers. Curves showed a max. evolution of heat with adsorption of 6 mols. of acetone per C_6; 24,700 cal/g for 11.5% N and 18,600 cal/g for 14% N. Beyond this concn. the curves dropped sharply for fibers of both degrees of nitration.

5739. Fricke, R. **Active substances. LVIII. Calculation of surface energy of nonpolar solids from the heat of sublimation.** *Z. physik. Chem.* **B52**, 284-94 (1942).—*C.A.* **37**, 5308^8.

The temp. dependence of the total and free surface energy of metal surfaces were calcd. for the range in which the Dulong-Petit law was valid. Both the total energy and the entropy were const. The free energy decreased linearly with increasing temp.

5740. Fricke, R. and Pfau, H. H. **Active substances. IV. Physical inhomogeneity of active solids.** *Kolloid-Z.* **100**, 153-8 (1942).—*C.A.* **38**, 1678^7.

Prepns. of active ZnO and Fe_2O_3 were caused to undergo a partial reaction (ZnO with aq. KOH, Fe_2O_3 with aq. HF, and with H_2O to give FeOOH), during which the most active portions would be expected to react preferentially. Detns. of the heat of soln. of the specimens before and after reaction showed the activity of the original specimen to be greater than that of the residue in each case.

5741. Gregg, S. John. **Heat of adsorption of ethylchloride and of sulfur dioxide on sugar charcoal.** *J. Chem. Soc.* **1943**, 351-5.—*C.A.* **37**, 6536^2.

The heats of differential adsorption on charcoal were measured in an ice calorimeter for very low pressures up to 1 atm. for SO_2, and up to satd. vapor for EtCl. From these measurements adsorption isotherms were detd. A sharp fall from 11,500 cals per mol. to 6000 cals per mol. was found for EtCl for pressures less than one quarter of the satn. pressure. This was attributed to the formation of films more than 1 mol. thick above that point.

5742. Harkins, W. D. and Jura, Geo. **The extension of the attractive energy of a solid into an adjacent liquid or film and the decrease of energy with distance.** *J. Chem. Phys.* **11**, 560-1 (1943).—*C.A.* **38**, 904^8.

The energy of adsorption or desorption of water on TiO_2 at 25°C decreased nearly exponentially from 6550 cal per mole for the 1st layer to 30 cal per mole for the 6th and successive layers. Deviations from the exponential suggest an orientation effect in some layers. N_2 at -195.8°C and H_2O at 25°C on various nonporous solids gave films 7-10 monolayers thick before satn. was attained.

5743. Haul, R. **Energy and state of order of atoms in the surface of liquids and solids.** *Z. physik. Chem.* **B53**, 331-61 (1943).—*C.A.* **38**, 1408^2.

With He, Ne, A, Hg, Na, Pb, Ag, Au as examples of simple liquids, conclusions were drawn regarding the arrangement of atoms at the surface. From crystallographic considerations, the total surface energy was obtained from the internal heat of sublimation and this was done for various temps. and crystal surfaces. A method was given for estg. the temp. coeff. of the free surface energy for solids. The surface entropy so obtained made it possible to get the free surface energy from the total surface energy.

5744. Jura, George and Harkins, W. D. **Relationship between the energy of adsorption of a vapor on a solid and of immersion of the solid in a liquid.** *J. Chem. Phys.* **11**, 561-2 (1943).—*C.A.* **38**, 904^9.

The equation, developed for calculating the heat of adsorption, was valid for either nonporous or porous solids at all relative pressures. When a solid was removed from the liquid into the vapor of the liquid, the correct film thickness was detd. by the equil. pressure.

5745. Lauer, K.; Doderlein, R.; Jackel, C., and Wilde, O. **Cellulose fibers. I. The system fiber-water.** *J. makro-mol. Chem.* **1**, 76-96 (1943).—*C.A.* **38**, 1354^8.

The heat of adsorption was detd. for a no. of pulps (including spruce, pine, cereal straws and other plants), viscose rayon and staple fibers from various woods, straws, etc. and ramie, cotton and filter paper. Cotton and filter paper, including certain pulps, gave an av. value of 1.69 (± 5%) kcal/mole $C_6H_{10}O_5$, wood pulps gave a value of 2.11 (± 10%) and rayon and staple fibers gave 3.41 (± 8%). The heat of adsorption ("heat of solvation") for regenerated cellulose was twice that of native cellulose. Calcd. for 1 mole of H_2O, the heat of adsorption was 3.40 kg-cal for both types of fibers. The heat of adsorption of mercerized cellulose increased with the time of mercerization with 20% NaOH at 20°C (the degree of polymerization was practically unchanged).

5746. Sakai, Wataru; Kurimura, Rokuro, and Okuno, Toshiro. **Catalytic powers of manganese oxides IV-V. V. Heat of adsorption and adsorption velocity of oxygen by manganese oxides.** *J. Soc. Chem. Ind. Japan* 46, 1011-18 (1943).—*C.A.* 43, 1624*b*.

The differential heat of adsorption q at the adsorption quantity a was calcd. by integrating $(d \log p/dT)_a = 2/RT^2$, between p_1 and p_2, the equil. pressures, at T_1 and T_2, resp. Adsorption of O_2 by Mn oxides was endothermic. Some samples of Mn oxides showed a secondary slower adsorption above 50°C. The velocity of this secondary adsorption was measured at 50°C by keeping the vol. of the adsorption chamber const. and recording the change in p with time. The secondary adsorption was due to the diffusion of gaseous atoms into the adsorbent.

5747. Wilhelm, R. H.; Johnson, W. C., and Acton, F. S. **Conduction, convection and heat release in catalytic converters.** *Ind. Eng. Chem.* 35, 562-75 (1943).—*C.A.* 37, 4614².

The rate of heat generation in cylindrical and slab-shaped catalyst beds and the rate of heat removal by conduction through the catalyst and gas in a direction perpendicular to the gas stream were studied. Point temps. in any catalyst cross section, the integral mean temp. of the section, and the rate of heat transfer through the periphery of the bed were related to the diam. or thickness of bed, outer bed temp., gas temp., catalyst activity, temp. coeff. of heat generation, thermal cond. of catalyst, and convection coeff.

5748. Beggerow, Gertrud and Harteck, P. **The relation between strength of adsorption and heat of adsorption for hydrocarbons.** *Z. physik. Chem.* 193, 265-73 (1944).—*C.A.* 41, 1524*e*.

The heats of adsorption on silica gel (75 g) were detd. (kcal/mole): pentane (5g) 8.8; hexane (5 g) 10.8; heptane (5 g) 11.9; octane (5 g) 14.2; 2,2,4-trimethylpentane (5 g) 12.3; benzene (5 g) 13.0; toluene (5 g) 14.4; o-xylene (5 g) 16.6; p-xylene (5 g) 16.6; cyclohexane (5 g) 10.2; methyl alc. (5 g) 15.2; ethyl alc. (5 g) 17.3; propyl alc. (5 g) 19.0_5; water (1 g) 15.5; acetone (5 g) 17.5; ether (5 g) 17.2; chlorobenzene (5 g) 17.0_5; CCl_4 (5 g) 10.8; ether (1.25, 250, 3.75, 5.00, 6.25, 7.50 g, resp.) 19.9, 18.4_5, 17.6_1, 17.2, 16.4_1, 15.5_5; benzene (1.25, 2.50, 5.00, 7.50 g, resp.) 15.3_9, 14.9_8, 13.0, 11.7_7. The heats of adsorption on different samples of silica gel and on active charcoal were the same within limits, other things being equal.

5749. Lobrowsky, A. **Heat of adsorption on ferric hydroxide sol coagulated by heating.** *Kolloid-Z.* 106, 46-50 (1944).—*C.A.* 38, 3529⁴.

A $Fe(OH)_3$ sol was coagulated by heating, and the heat of adsorption of $K_2C_2O_4$ on the resulting gel was detd. The heat of adsorption on the gel obtained by heating was greater than the heat of coagulation of the original sol. The heat of adsorption was increased by partial coagulation.

5750. Jura, George and Harkins, W. D. **Surfaces of solids. XI. Determination of the decrease (π) of free surface energy of a solid by an adsorbed film.** *J. Am. Chem. Soc.* 66, 1356-62 (1944).—*C.A.* 38, 5125⁵.

The film pressure, π, was given by the equation $\pi = \gamma S - \gamma S_f = \gamma o - \gamma$ in which γS was the free surface energy of the clean surface of a solid, and S_f was the same quantity when the surface was covered by a film. In order to obtain π or the free surface energy (γS) of the surface of a solid caused by the presence of a film adsorbed from a vapor, it was necessary to obtain exptl. data that gave the pressure of the vapor and the amt. of vapor adsorbed when the temp. was const. A method was described to detn. the pressure to 0.002 mm with a Hg manometer. Data were given for the lowering of the free surface energy of TiO_2 (anatase) by N_2 at -195.6°C, water at 25.0°C, n-heptane at 25.0°C and n-butane at 0.0°C as a function of the relative pressure of the adsorbed vapors. The spreading coeff., free energy of emersion, and work of adhesion of N_2, H_2O, n-butane and n-heptane on TiO_2 (anatase) were detd.

5751. Wicke, E. **Adsorption calorimeter for catalytic surfaces.** *Z. physik. Chem.* 193, 417-28 (1944).—*C.A.* 41, 5346*g*.

An adiabatic calorimeter was described which could be used between -80 and 150°C. The catalyst was activated at 300°C in the calorimeter itself. Heats of adsorption were obtained for iso-PrOH, water, propane, and propylene on bauxite.

5752. Kiselev, A. V. **The work and heat of adsorption.** *Acta Physicochim. U.R.S.S.* 20, 947-68 (1945).—*C.A.* 40, 3677⁶.

New expressions were obtained for the integral and differential values of the work and heat of adsorption of gases, vapors, pure liquids, and solns. Formulas were derived for the work and heat of adsorption, either involving or free from the values of surface tension, which were applicable to liquid and solid interfaces. The work (and heat) of adsorption from soln. was equal to the sum of the work (heat) of wetting of adsorbent by pure solvent, the work (heat) of adsorption from soln. of the solute and displacement of the solvent by the latter, and the work (heat) of the diln. of the soln. The differential heats of adsorption of pure substances could be expressed in terms of the isosteric or isopycnic and isothermal coeffs. of surface activity.

5753. Kiselev, A. V.; Dreving, V. P., and Runov, A. D. **The sorption and the heats of sorption of vapors and the structure of activated charcoals.** *Doklady Akad. Nauk S.S.S.R.* 46, 310-13 (1945); *Compt. rend. acad. sci. U.R.S.S.* 46, 283-6 (1945) (in English).—*C.A.* 39, 5151³.

The heat evolved by sorption of MeOH vapor on various samples of charcoal was studied. Three distinct regions of sorption were observed: (1) a region of high heats, about 18,000-20,000 cal/mole and, for some specimens, even up to 25,000-30,000; (2) a region of nearly const. heat evolution, about 14,000-12,000 cal/mole; and (3) a region where the heat declined rapidly to the value for normal condensation. The vol. of the micropores of the charcoals was estd. by measuring the vol. of MeOH vapor condensed under the influence of the adsorption field before capillary condensation began. The 2nd region of heat evolution was responsible for most of the heat of wetting.

5754. Roginskiĭ, S. Z. and Todes, O. **Statistical theory of the adsorption of gas mixtures. II.** *Acta Physicochim. U.R.S.S.* **20**, 695-712 (1945).—*C.A.* **40**, 6931^4.

The adsorption isotherms of the individual components of a binary mixt. and of the mixt. as a whole were derived by the method of the detg. band in cases where the heats of adsorption vary in opposite sense and when they are unrelated. In all cases explicit expressions were obtained for the adsorption isotherm of mixts. in terms of the adsorption isotherm of the pure components, and the laws and conditions governing mutual displacement of the components were established.

5755. Gregg, S. J. **An electrical sorption balance and calorimeter.** *J. Chem. Soc.* **1946**, 563-7.—*C.A.* **40**, 6302^4.

With a suitable sample container which was provided with a thermocouple, the sorption balance could be used to det. the differential heat of adsorption simultaneously with adsorption measurements. Residual pressure in excess of 1 mm Hg was required. A procedure for calibrating the calorimeter and calcg. the differential heat was described in detail. The performance was tested by detg. adsorption of water vapor on alumina.

5756. Miller, A. R. **The variation of the dipole moment of adsorbed particles with the fraction of the surface covered.** *Proc. Cambridge Phil. Soc.* **42**, 292-303 (1946).—*C.A.* **41**, 1511*c*.

The variation of the heat of adsorption of NH_3 on a nonconducting surface was detd. The contributions to the heat of adsorption due to the van der Waals and to the electrostatic forces were of the same order of magnitude and of opposite signs. The mutual depolarizing action of the mols. reduced the magnitude of the total variation in the heat of adsorption by a considerable amt. The heat curve, which was calcd. from the equations given by the statistical analysis, was compared with that obtained upon the assumption that the particles formed a random distribution over the surface. The effect of the clustering of the adsorbed particles on the surface on the variation of the heat of adsorption was detd.

5757. Sato, Kazuo. **Differential heat of sorption of vapor on active charcoal. II. Result of measurement.** *Rev. Phys. Chem. Japan, Shinkichi Horiba Commem. Vol.* **1946**, 1-5.—*C.A.* **44**, 4323*a*.

The heat of sorption of EtOH and benzene was measured at 25°C on Norit and on H_3PO_4- and Na_2SO_4- activated charcoal. When the charcoal was freshly outgassed, the sorption-desorption processes were irreproducible but became reproducible after several repetitions. In the reproducible isotherm, near satn., hysteresis loops were observed for both adsorption equil. and the differential heats of sorption-desorption. On bare charcoal, the differential heat of adsorption was 20 kcal/mole. A pore radius of about 20 A. was calcd. for the 3 charcoals investigated.

5758. Tamaru, Setsuro and Sato, Kazuo. **Differential heat of sorption of vapor active charcoal. I. Apparatus and method of measurement.** *Rev. Phys. Chem. Japan, Shinkichi Horiba Commem. Vol.* **1946**, 1-5.—*C.A.* **44**, 4322*h*.

An adiabatic room-temp. calorimeter was described for measuring differential heats of adsorption or desorption. The calorimeter had an oil-filled inner box of Ag contg. a quartz bulb filled with the sorbent, a large outer box filled with water surrounded by an air chamber that was automatically kept at the same temp. as the water box. By means of stirrers and heaters the temp. difference between the inner and the outer box was kept at or below 0.0027°C; this permitted measuring of the temp. of the inner box with an error below 0.001°C.

5759. Ward, A. F. H. and Tordai, L. **Standard entropy of adsorption.** *Nature* **158**, 416 (1946).—*C.A.* **41**, 1524*d*.

Equations were derived for the standard entropy of adsorption ΔS°. Values of ΔG° in kcal/mole, ΔS° in cal/degree mole, and ΔH° in kcal-mole were calcd.: EtCOOH, -1.63, -14.4, -5.9; PrCOOH, -2.45, -6.2, -4.3; BuCOOH, -3.18, +1.1, -1.8; AmCOOH, -3.72, +6.6, -1.7; $C_6H_{14}COOH$, -4.52, +7.2, -2.4.

5760. Beebe, R. A.; Biscoe, J.; Smith, W. R., and Wendell, C. B. **Heats of adsorption on carbon black. I.** *J. Am. Chem. Soc.* **69**, 95-101 (1947).—*C.A.* **41**, 1922*h*.

The differential heats of adsorption of N_2 and O_2 on carbon blacks, Spheron Grade 6 (MPC), Spheron Grade 6 "devol.", Graphon, Sterling-S (SRF), and Sterling-L (HMF) at -195°C were detd. The results were roughly consistent with the predictions of the B. E. T. theory in that the differential heats of adsorption of the monolayers were greatly in excess of the heats of vaporization, but rapidly approached the heat of vaporization in the second and successive layers. Partial "graphitization" greatly reduced the activity of the more active sites on the surface.

5761. Beebe, R. A.; Polley, M. H.; Wendell, C. B., and Smith, W. R. **Heats of adsorption on carbon black. II.** *J. Am. Chem. Soc.* **69**, 2294-9 (1947).—*C.A.* **42**, 1113*a*.

The differential heats of adsorption of *n*-butane, 1-butene, *cis*-2-butene, *trans*-2-butene, *n*-pentane, 1-pentene, 2-pentene, trimethylethylene, and butadiene were detd. on one or more of the following carbon blacks: Spheron Grade 6 (MPC), Sterling-S (SRF), Sterling-L (HMF), Spheron Grade 6 heated to 927°C, and Spheron Grade 6 heated to 2800-3300°C (called Graphon). The adsorption of both satd. and unsatd. hydrocarbons was essentially of the van der Waals type. There was no marked difference in the differential heats of adsorption for the satd. and corresponding unsatd. adsorbates.

5762. MILLER, A. R. **The heat of adsorption of diatomic molecules.** *Proc. Cambridge Phil. Soc.* **43**, 232-9 (1947).—*C.A.* **41**, 4701*c*.

The heat of adsorption of particles that occupy 2 adjacent sites on a surface was investigated statistically. A sigmoid-shaped curve was obtained for the heat of adsorption of a mobile film (expressed as a function of the fraction of the surface covered); an approx. linear curve was obtained for an immobile film. Reasonably good agreement with the equation for an immobile film was obtained with the exptl. values of the heat of adsorption of H_2 on a W surface.

5763. PERREU, JEAN. **Measurement of the heat of adsorption of gas and vapor by activated carbon.** *Compt. rend.* **224**, 1157-8 (1947).—*C.A.* **41**, 4701*b*.

An app. was described utilizing the Bunsen ice calorimeter in which the adsorption isotherm, and the integral and differential heats of adsorption could be obtained in the immediate neighborhood of 0°C. The abs. calorimetric error was less than 0.03 cal/g.

5764. PRETTRE, MARCEL AND GOEPFERT, OLIVIER. **Influence of temperature on adsorption by a heterogeneous surface.** *Compt. rend.* **225**, 737-8 (1947).—*C.A.* **42**, 1783*f*.

Three different adsorbing regions were assumed to be present in a Ni-kieselguhr catalyst and assigned values for the heat of adsorption of H_2. By using the previously assumed Langmuir consts. for each region at 438°K, the corresponding values at 456°K were calcd. by the van't Hoff isochore.

5765. SCHRENK, W. G.; ANDREWS, A. C., AND KING, H. H. **Calorimetric measurements of heats of hydration of starches.** *Ind. Eng. Chem.* **39**, 113-16 (1947).—*C.A.* **41**, 1922*g*.

The heat of hydration of several varieties of starch was found to range from 23.0 to 29.8 cal/g. Defatted starch released its heat at a slower rate than untreated starch, but the hydration energy per g. was the same.

5766. WARD, T. **Heat of adsorption of gases on manganous chromic oxide at room temperature.** *J. Chem. Soc.* **1947**, 1244-6.—*C.A.* **42**, 1113*d*.

Measurements were made of the heats of adsorption of CO, CO_2 and O_2 on the fully oxidized, reduced, and partially reduced surfaces of manganous chromic oxide. The reactions were carried out in a calorimeter at reduced pres. For most of the work the oxide was reduced with CO at 400°C. CO was irreversibly adsorbed, giving CO_2 on rise of temp. The partly reduced surface gave lower values for the heat of adsorption than either the fully oxidized or fully reduced surface.

5767. BASFORD, PAUL R.; JURA, GEORGE, AND HARKINS, WILLIAM D. **Surfaces of solids. XVIII. The heats of emersion and desorption of water from graphite at 25°C.** *J. Am. Chem. Soc.* **70**, 1444-50 (1948).—*C.A.* **42**, 5302*i*.

The heat of emersion from water of a graphite of specific area = 4.22 m^2g^{-1} and of ash content less than 0.004% (presumably free from any O-complex) was detd. as a function of the quantity of water adsorbed on the surface. For clean graphite the heat was 167 ergs cm^{-2}, decreasing to -132 ergs cm^{-2} when 1.80×10^{14} mols. of water were adsorbed per cm^2. From 2.47×10^{14} to 12.60×10^{14} mols. per cm^2 the heat of emersion increased from -32 to 49 ergs cm^{-2}. From 13.59 to 29.63×10^{14} mols. adsorbed per cm^2, the value, within a large exptl. error, was const. at -84 ergs cm^{-2}. Two finite discontinuities coincided with two discontinuities in the deriv. of the vol. with respect to the presence of the isotherm. The area of the graphite was 4.4 ± 0.6 m^2g^{-1}. The film of water on graphite attained a min. thickness of 10 A. at a relative pres. very close to satn. The extrapolation of the isotherm to unit relative pres. indicated a min. thickness of 16 A. The integral and differential heats of adsorption of water on graphite were detd. from the heats of emersion.

5768. JOYNER, L. G. AND EMMETT, P. H. **Differential heats of adsorption of nitrogen on carbon black.** *J. Am. Chem. Soc.* **70**, 2353-9 (1948).—*C.A.* **42**, 8574*e*.

Adsorption isotherms for N_2 on a sample of Grade 6 carbon black and on a sample of Graphon were detd. at -205°, -195°, and -183°C; the adsorption data were used to calc. isosterically the heat of adsorption of N_2 on the two carbon blacks. The heats were in excellent agreement with calorimetric values. ΔF and ΔS values for the process liquid N_2 going to adsorbed N_2 were calcd. as a function of the fraction of the surface covered.

5769. JOYNER, L. G. AND EMMETT, P. H. **Differential heats of adsorption and desorption of nitrogen on porous glass.** *J. Am. Chem. Soc.* **70**, 2359-61 (1948).—*C.A.* **42**, 8574*g*.

Adsorption and desorption isotherm for N_2 were measured on a sample of porous glass at -204.8° and -194.6°C. The differential heat of desorption from these data was shown to exceed the differential heat of adsorption over the hysteresis region by about 250 cals/mole.

5770. PERREU, JEAN. **The heats of adsorption of hydrogen and oxygen on active carbon.** *Compt. rend.* **226**, 907-8 (1948).—*C.A.* **42**, 4441*i*.

The heats of adsorption were measured at 0°C over a period of 30-80 min. on coconut charcoal. The integral heat of adsorption (Q_c) of H_2 decreased from 1630 to 1290 cal/mole when the adsorbed gas increased from 2.4×10^{-5} to 14.45×10^{-5} moles. The differential heat of adsorption (Q_c) decreased from 1650 to 700 cal/mole. Q_c for O_2 decreased from 78,870 to 12,530 cal/mole as the amt. of gas adsorbed increased from 0.71×10^{-5} to 43.40×10^{-5} moles.

5771. PERREU, JEAN. **Heats of adsorption of nitrogen by activated charcoal.** *Compt. rend.* **226**, 492-3 (1948).—*C.A.* **42**, 5752*d*.

The differential and integral heats of adsorption at 0°C for N_2 on activated coconut charcoal were detd. Two to 5 g of charcoal were used in measuring the integral heats of adsorption and 15 to 20 g in measuring the differential heats. The integral heats for concns. (C) > 5×10^{-5} mols./g may be expressed by the empirical formula: $Q_c = 4660 \times c^{1.001}$.

5772. Perreu, J. **Heats of adsorption of sulfur dioxide and carbon dioxide on active charcoal.** *Compt. rend.* 226, 2138-40 (1948).—*C.A.* 45, 6036*i*.

The heats of adsorption of SO_2 and CO_2 on activated coconut charcoal were detd. at 0°C. The integral heat Q_c was given by the empirical relation $Q_c = 2460c^{0.8}$ for concn. $c(2\text{-}6) \times 10^{-4}$, whence the differential heat $q_c = dQ_c/dc$ was given by $1968c^{-0.2}$. At very low c, q_c was about 11 kcal per mol. for SO_2 and about 7 kcal per mol. for CO_2.

5773. Pierce, Conway and Smith, R. Nelson. **Heats of adsorption. I.** *J. Phys. & Colloid Chem.* 52, 1111-15 (1948).—*C.A.* 43, 1638*h*.

Adsorption isotherms for EtCl were measured on graphite at -78°C and 0°C and used to calc. the isosteric heats by the Clausius-Clapeyron equation. The calcd. heat of adsorption exceeded the heat of liquefaction by about 25, 5, 2, and 1% at 1, 2, 4, and 10 statistical layers, resp.

5774. Pierce, Conway and Smith, R. Nelson. **Heats of adsorption. II.** *J. Phys. & Colloid Chem.* 52, 1115-28 (1948).—*C.A.* 43, 1638*h*.

Exptl. adsorption isotherms were measured for H_2O, NH_3 and EtCl on a sample of graphite, the B. E. T. surface area of which was 4 m^2/g. A four-const. isotherm equation was proposed and shown to be applicable to isotherms recently reported, over a relative pressure range extending from 0.05 or lower to about 0.9, $V = [ax/(1+bx)] + [\alpha x/(1-\beta x)]$, V was the vol. of gas adsorbed, x was the relative pressure and a, b, α and β, were consts. The calcd. net heat of adsorption for all layers beyond the first was found for NH_3 and EtCl on graphite and for butane on glass spheres to be given by the equation $E - E_L = K(1 - x)$.

5775. Wicke, E. **Hydrogen-exchange catalysis by oxygenic contact.** *Z. Elektrochem.* 52, 86-96 (1948).—*C.A.* 43, 6497*f*.

The heats of adsorption from -80° to 150°C of iso-PrOH, H_2O, C_3H_6, and C_3H_8 were detd. on Fe-contg. bauxite. Several adsorption isotherms for C_3H_6 and C_3H_8 were measd. These indicated that 3 types of adsorption took place for iso-PrOH and H_2O: (a) limited adsorption on 25% of the total surface with heat of adsorption of approx. 30 cal/mol.; (b) unlimited adsorption decreasing linearly with increasing surface d.; (c) multilayer adsorption.

5776. Zettlemoyer, Albert C. and Walker, Wm. C. **Active magnesia. IV. Application of dual-surface theory.** *J. Phys. & Colloid Chem.* 52, 58-64 (1948).—*C.A.* 42, 2488*i*.

The observed adsorption isotherm for N_2 at -195°C on active magnesia 2642 was best explained by assuming that 75% of the surface had a high heat of adsorption (C = 130) and 25% had a low heat of adsorption (C = 1.35).

5777. Garner, W. E.; Gray, T. J., and Stone, F.S. **The oxidation of copper and the reactions of hydrogen and carbon monoxide with copper oxide.** *Proc. Roy. Soc.* (London) **A197**, 294-314 (1949).—*C.A.* 44, 2355*h*.

The heats of adsorption of CO and O_2, the heat liberated during the catalytic reaction of CO and O_2 on a Cu_2O film formed on metallic Cu, the kinetics of the reactions, the elec. cond. of thin films of oxides during the reduction with H_2, the process of embrittlement whereby the surface was activated, and the effect of the adsorption of gases on the concn. of the Cu_2O-CuO surface were all studied. O_2 enhanced the cond., and CO and H_2 depressed it. O_2 was reversibly chemisorbed on a Cu_2O-CuO surface in a form that was specially active chemically. In this state it would combine with CO to give CO_2 at room temp. This mobile form of O was assocd. with a conductance electron, and its adsorption increased the cond. of the oxide film. At 200°C the rate of evapn. of chemisorbed-O was appreciable, but it did not appear to be entirely removed from the active areas even in a high vacuum.

5778. Guthrie, J. C. **Integral and differential heats of sorption of water by cellulose.** *J. Textile Inst.* 40, T489-504 (1949).—*C.A.* 43, 9433*i*.

The integral and differential heats of sorption of most cellulosic fibers were reported. The differential heat at zero-moisture regain was approx. equal for all such fibers, the av. value being 297 cal/g of H_2O absorbed. When the integral heat was plotted against the moisture regain on reduced coordinates, the values all fell near a single curve.

5779. Gyani, B. P. **Isosteric heats of adsorption. I. Alcohols on silica gel.** *J. Indian Chem. Soc.* 26, 345-52 (1949).—*C.A.* 44, 3344*i*.

A tensimeter was described for measuring the heats of adsorption of MeOH, EtOH, PrOH, sec-PrOH, and BuOH at different fixed concns. The heat of adsorption at comparable concns. increased as the mol. wt increased; for one substance there was a tendency for the heat of adsorption to decrease and the adsorption increased. The results were roughly the same as those calcd. by other investigators on the same vapors on charcoal by calorimetric methods.

5780. Houwink, R. **Interaction between polymers and fillers.** *J. Polymer Sci.* 4, 763-5 (1949).—*C.A.* 44, 4277*c*.

Since the initial heat of adsorption between carbon black and C_4 hydrocarbons was of the order of magnitude of 15 kcal/mole and decreased sharply until about 40% of a monolayer was formed, this indicated that 40% of the carbon black surface was covered with sites of high adsorptive capacity. Between 40 and 100% of monolayer formation, the surface was uniform with regard to adsorptive capacity; at the monolayer the values again decreased and approached the heat of liquefaction, *EL*, of the adsorbate. The heat of adsorption per CH_2 group to the carbon black was about 4 kcal/mole. Parts of these sites were of a relatively high energy content (15 kcal) leading to strong bonds.

5781. Kiselev, A. V.; Kiselev, V. F.; Mikos, N. N.; Muttik, G. G.; Runov, A. D., and Shcherbakova, K. D. **Adiabatic calorimeter with**

contant heat exchange for measuring the heats of adsorption of gases and liquids. *Zhur. Fiz. Khim.* **23**, 577-94, (1949).—*C.A.* **43**, 6871*d*.

A calorimeter was surrounded by a bath, whose temp. was kept lower than that of the calorimeter so as to remove the heat evolved by the stirrer and the elec. resistance thermometer. It could measure the heat of adsorption of gases to 0.00005-0.0002 cal, and the heat of wetting to 0.0005-0.002 cal per g adsorbent.

5782. PERREU, JEAN. **Heats of adsorption of gases and liquids by activated charcoal.** *Bull. soc. chim. France* **1949**, 919-23.—*C.A.* **44**, 3781*g*.

Integral and differential heats of adsorption were reported for NO. The adsorption of NO and H_2S was in part chem. in nature.

5783. PERREU, JEAN. **Measurement of the heat of adsorption of gases and vapors on active carbon.** *Bull. soc. chim. France* **1949**, 43-9.—*C.A.* **43**, 6903*g*.

The heats of adsorption of N_2, H_2, O_2, SO_2, and CO_2 were detd. on activated coconut charcoal by means of a Bunsen calorimeter. Results within 1% were attained with all gases except H_2. The integral heat of adsorption increased with the final concn. and the differential heat of adsorption varied inversely with the final concn. In the case of O_2, where adsorption was accompanied by chem. reaction, the variation of thermal effects was large and very rapid at low concn.

5784. PERREU, JEAN. **Heats of adsorption of acetylene and hydrogen sulfide on active carbon.** *Compt. rend.* **228**, 1427-9 (1949).—*C.A.* **43**, 7317*c*.

Values for concns. of 0.93 to 17.31 and 0.86 to 13.93×10^{-4} mol./g, resp., were tabulated. Acetylene was not polymerized at 0°C on active charcoal.

5785. PERREU, JEAN. **The heats of adsorption of ammonia gas and of ethylene gas on active charcoal.** *Compt. rend.* **228**, 833-4 (1949).—*C.A.* **43**, 4939*d*.

The differential heat of adsorption (q_c) of NH_3 on coconut charcoal at 0°C increased from 6830 cal/mole at 14×10^{-4} mole/g to a limiting value of 14,600 cal/mole at zero concn. For C_2H_4 the variation was from 6750 cal/mole at 6×10^{-4} mole/g to a limiting value of 11,800. For both gases the function $(q_c) = f(c)$ was similar to that reported for other gases except O_2.

5786. PERREU, JEAN. **The heat of adsorption of nitric oxide on active carbon.** *Compt. rend.* **229**, 590-2 (1949).—*C.A.* **44**, 1320*c*.

The integral heats of adsorption were detd. over a range of concns. and the differential heats calcd. The integral heats increased with concn. and the differential heats decreased. The ratio, q_c/L, in which q_c was the differential heat in a dil. medium and L the mol. heat of condensation, was 4.34. It was greater than for C_2H_4, H_2S, and NH_3, and varied inversely with the b. p. of the gas.

5787. RUNOV, A. D.; KISELEV, A. V.; KISELEV, V. F., AND ALEKSEEV, S. N. **Heat of adsorption from solutions at different temperatures.** *Zhur. Fiz. Khim.* **23**, 1005-17 (1949).—*C.A.* **44**, 922*i*.

The heat Q, of wetting fruit-stone charcoal by PrOH-H_2O mixts. was detd. in a calorimeter immersed in a thermostat or in a calorimeter having const. heat exchange. Q was identical at 25° and 50°C; it was 10 for H_2O, and 16, 22, 29, and 30 when the concn. c of PrOH was 1, 4, 8, and 12.4 mol./liter, resp. The apparent adsorption x of PrOH by charcoal had a max. near $c = 2$.

5788. SCHÄFER, KLAUS. **Problems concerning thermal conductivity in gases at low pressures and the transfer of energy on solid surfaces.** *Fortschr. chem. Forsch.* **1**, 61-118 (1949).—*C.A.* **44**, 8184*d*.

In gaseous adsorption on solid surfaces, quant. measurement of the transfer of energy could be made by means of a thermal accommodation coeff. The exptl. app. was designed so that this and the sp. heat of the gas could be simultaneously measd. either at low or high pres. Recent values were given for monatomic gases (He, Ne, A on W and He, A, Hg, Kr, and Xe on Pt), for diatomic gases (H_2, para-H_2, CO, O_2, N_2, and air on Pt, H_2 on W, and H_2 and air on glass), and for polyatomic gases, i. e. CS_2 and COS on Pt.

5789. SMITH, WALTER R. AND BEEBE, RALPH A. **Heats of adsorption and relative adsorbability of some gaseous hydrocarbons. Silica gel and carbon black adsorbents.** *Ind. Eng. Chem.* **41**, 1431-5 (1949).—*C.A.* **43**, 8254*h*.

The heats of adsorption of propene, 1-butene, and butane on silica gel at 0°C were detd. calorimetrically. Butane and propene had essentially the same differential heats of adsorption, but that of 1-butene was approx. 3 kcal per mole higher for the monolayer. The heats of adsorption of 1-butene and butane were essentially the same on carbon black. Butane and 1-butene could be sepd. by selective adsorption of the 1-butene on silica gel.

5790. TROESCH, ANDRE. **Kinetic laws of adsorption of methane by Fischer catalysts containing nickel.** *Compt. rend.* **228**, 1126-8 (1949).—*C.A.* **43**, 6064*b*.

Published results were analyzed kinetically and the heat of adsorption of CH_4 on a Fischer Ni catalyst approximated 17 kcal/mol.

5791. ARIFOV, U. AND LOVTSOV, V. M. **Oscillographic determination of the heats of adsorption of ions and atoms of alkali metals with the aid of functional sweep.** *Doklady Akad. Nauk S.S.S.R.* **75**, 365-6 (1950).—*C.A.* **45**, 3703*b*.

The const. a in the formula for the ionic current intensity I from an incandescent metal, $I = I_0 e^{-at}$ (where $a = Ae^{-\lambda_0/kT} + Be^{-\lambda_+/kT}$ = sum of the probabilities of evapn. of atoms and ions per sec., and λ_0 and λ_+ = heats of evapn. of atoms and ions, resp.) was detd. Measurements on K on incandescent W gave $\lambda_+ = 2.41$ e.v., The magnitude τ was the "life-time" of the adsorbed atoms, i.e. the time necessary for the ionic current I to fall to $1/e$ times I_0. For K on W, τ increased from 5.2×10^{-4} to 4.1×10^{-3} sec. with the temp. varying from 1250 to 1150°K.

5792. BASTICK, JACK. **The heats of adsorption of ammonia, arsine, and phosphine on activated carbon.** *Compt. rend.* 230, 1163-5 (1950).—*C.A.* 44, 7137*c*.

The heats of adsorption of NH_3, AsH_3, and PH_3 on a coconut charcoal were measd. in a Bunsen glass calorimeter with 2%. The adsorption at 0°C and 600 mm equil. pres. was 240 cc./g for NH_3, 132 cc./g for PH_3 and 165 cc./g for AsH_3. The differential heat of adsorption at 0°C for NH_3 (concns. greater than 6×10^{-4} mol./g) $= 1900c^{-0.216}$ for a degassing temp. of 550°C, $1344c^{-0.279}$ for a degassing temp. of 800°C and $1387c^{-0.279}$ for a degassing temp. of 1000°C; for PH_3 (concns. greater than 3×10^{-4}) $= 2446c^{-0.171}$ for a degassing temp. of 800°C; for AsH_3 (concns. greater than 2.5×10^{-4}) $= 3057c^{-0.153}$ for a degassing temp. of 800°C, where $c =$ concn. The true heat of adsorption was pos. for all 3 gases. The strong chemisorption of AsH_3 on charcoal was shown by the fact that its initial differential heat of adsorption was of the same order of magnitude as its heat of decompn.

5793. BEEBE, R. A.; KINGTON, G. L.; POLLEY, M. H., AND SMITH, W. R. **Heats of adsorption and molecular configuration. The pentanes on carbon black.** *J. Am. Chem. Soc.* 72, 40-2 (1950).—*C.A.* 44, 4747*i*.

The isotherms and calorimetric heats of adsorption were detd. at 0°C for n-C_4H_{10}, n-C_5H_{12}, neopentane, and cyclopentane on a sample of carbon black that had been extensively used for previous adsorption studies. At 0.05 coverage of the surface, the contribution per CH_2 group of the normal hydrocarbons was approx. 3 kcal per mole. In neopentane and cyclopentane, the contribution per CH_2 or CH_3 group was less than the 3 kcal encountered with normal hydrocarbons.

5794. BEECK, O.; COLE, W. A., AND WHEELER, A. **Determination of heats of adsorption using metal films.** *Discussions Faraday Soc.* **1950**, No. 8, 314-21.—*C.A.* 45, 9990*h*.

A calorimeter was described for heats of adsorption of H_2 as a function of fraction of surface covered for Ni and Fe films at room and liquid-air temps. A criterion for mobility of adsorbed layers was presented.

5795. EVERETT, DOUGLAS H. **Thermodynamics of adsorption. I. General considerations.** *Trans. Faraday Soc.* 46, 453-9 (1950).—*C.A.* 44, 9768*b*.

Four heats of adsorption were defined that were equally fundamental. That which involved principally a consideration of the decrease of potential energy of mols. on adsorption was a more useful quantity to study both experimentally and theoretically.

5796. GYANI, B. P. **Adsorption of organic bases on silica gel, and heats of adsorption. II.** *J. Chem. Soc.* **1950**, 1521-4.—*C.A.* 45, 416*h*.

The adsorptions of diethylamine, triethylamine, pyridine, α-picoline, and piperidine on silica gel were measured at 35°C. The simplest isotherm, type I, was given by diethylamine; piperidine and α-picoline isotherms were sigmoid, type IV. The isosteric heats of adsorption were obtained by a tensimetric method. The av. heats for pyridine, α-picoline, and diethylamine was practically equal to $-Q$ values from 11,270 to 12,010 cals/mole.

5797. HANSEN, ROBERT S. **Calculation of heats of adsorption from adsorption isosteres.** *J. Phys. & Colloid Chem.* 54, 411-15 (1950).—C.*A.* 44, 4768*c*.

A thermodynamic derivation of the Clapeyron equation as applied to the calcn. of heats of adsorption from adsorption isosteres led to the conclusion that the deriv. should be evaluated at a const. no. of adsorbed mols per unit surface area of the solid.

5798. HARTECK, PAUL AND MELKONIAN, G. A. **The tunnel effect in ad- and desorption of the hydrogen isotope.** *Naturwissenschaften* 37, 450 (1950).—*C.A.* 45, 4994*i*.

The heat of adsorption of heavy H_2 was only about 3% more at 80°K than that of light H_2; however, the detg. factor in the desorption was the diffusion of the gas mols. to the surface, not the evapn. For this diffusion the probability was $f \exp[-a(2mV)^{½}/h]$ as compared with the classical $f \exp(-Q/RT)$. In the former, m, the mass, entered as well as V, the height of the potential wall, not the temp., hence light H_2 would reach the surface faster and would evap. faster. In the present case the tunnel effect predominated over the Boltzmann factor. In one set of expts. with 37.8 cc. of a H_2-D_2 mixt. on 1 g of gel, final pres. 0.2 mm, 51% of D_2 was adsorbed, 0.7% desorbed, sepn. factor about 140.

5799. KEMBALL, CHARLES AND SCHREINER, G. D. L. **The determination of heats of adsorption by the Brunauer-Emmett-Teller single isotherm method.** *J. Am. Chem. Soc.* 72, 5605-7 (1950).—*C.A.* 45, 9992*i*.

The B. E. T. equation for the "phys." adsorption of gases on solid surfaces contained a const. c that included the term (a_1b_2/a_2b_1). By introducing the entropy of adsorption (a_1b_2/a_2b_1) was unity only when the differential entropy of adsorption to a standard state on the surface defined by $s_0 = s_1$ (the bare fraction of the surface being equal to the fraction covered by one layer of mols.) was equal to the entropy of liquefaction of the adsorbate. The value of (a_1b_2/a_2b_1) may range at least from 10^{-5} to 10, and the single-isotherm method of detg. heats of adsorption could be used only if the entropy of adsorption was known.

5800. KINGTON, G. L.; BEEBE, R. A.; POLLEY, M. H., AND SMITH, W. R. **The entropy of adsorbed molecules.** *J. Am. Chem. Soc.* 72, 1775-81 (1950).—*C.A.* 44, 6228*c*.

The differential heats of adsorption of N_2 and O_2 on TiO_2 were detd. calorimetrically at 78.5°K. The TiO_2 used in both cases was a sample of anatase with a B.E.T. surface of 13.9 m² per g. The magnitude of the heat in both cases indicated that the adsorption was van der Waals in nature. The initial increments of N_2 showed a heat of adsorption approx. 1 kcal per mole higher than the initial O_2 values. The partial molal entropy of the adsorbed gas was detd. from exptl. data for both N_2 and O_2 adsorbed on carbon black and TiO_2 (anatase) at 78.5°K.

5801. Laporte, Francois. **Experimental and theoretical study of the immersion of a powdery solid in a pure liquid. Construction of a microcalorimeter.** *Ann. phys.* (12) 5, 5-79 (1950).—*C.A.* 44, 7642*i*.

A microcalorimeter, kept at equil. with a stable thermal environment (cellar), was used. Measurements were made on graphite, ZnO, glass, reagent-grade TiO_2, and anatase TiO_2 immersed in distd. H_2O. The effect of degassing the specimens, as well as of the surface area of the anatase TiO_2, was also studied. Enthalpies of immersion were as follows (in joules/g): graphite 0.206, ZnO 0.462, reagent TiO_2 0.185, anatase TiO_2 0.51, glass 0.25.

5802. Mastrangelo, S. V. R. **The lambda-temperature in multimolecular helium films.** *J. Chem. Phys.* 18, 896-7 (1950).—*C.A.* 44, 7108*f*.

The 1st layer of adsorbed He was immobile and behaved like a solid under high pressure. The λ-point for 5-6 layers was 1.85°K and moved to higher temps. as the no. of layers increased. A λ-point of 1.85°K corresponded to a pressure of approx. 25 atm. The absence of a λ-point for a layer 3-4 mols. thick indicated that such a layer was "solid".

5803. Miyazaki, Shozo. **Catalytic decomposition of ammonia gas. VIII. Decomposition on molybdenum.** *J. Chem. Soc. Japan, Pure Chem. Sect.*, 71, 483-5 (1950).—*C.A.* 45, 6473*b*.

The thermal decompn. of NH_3 gas in the presence of Mo was observed in the pressure range of 3-15 mm Hg at 700-760°C. The relations between the observed reaction rates and the gas pressures were represented by the theoretical equation. The activation energy and heat of adsorption of NH_3 gas on Mo were calcd. to be 45.7 kcal $mol.^{-1}$ and 22.8 kcal $mol.^{-1}$, resp.

5804. Morrison, J. A. and Los, J. M. **The measurement of the thermal properties of gases and vapors adsorbed on solid surfaces.** *Discussions Faraday Soc.* **1950**, No. 8, 321-6.—*C.A.* 45, 9990*i*.

A low-temp. adiabatic calorimeter was described suitable for precision measurements of the heat capacity and the heat of adsorption of gases and vapors on solid surfaces.

5805. Perreu, Jean. **Heats of adsorption of nitrous oxide on active charcoal.** *Compt. rend.* 230, 642-4 (1950).—*C.A.* 44, 4768*e*.

The integral heats of adsorption of N_2O were measured at 0°C in a Bunsen ice calorimeter on active coconut charcoal. Results were expressed by $Q_c = 3046c^{0.871}$. Calcd. differential heats q_c varied from 10,700 to 6500 cal. from which the true heats of adsorption $\lambda = q_c - L$ can be calcd., where L, the heat of condensation, equals 1760 cal. At the same pressure, N_2O was adsorbed less than C_2H_2 and H_2S but more so than other gases studied.

5806. Pierce, Conway and Smith, R. Nelson. **Heats of adsorption. III. Methanol on carbon.** *J. Phys. & Colloid Chem.* 54, 354-64 (1950).—*C.A.* 44, 4768*d*.

Isosteric heats of adsorption for CH_3OH on graphite were computed from exptl. isotherms at 0° and 28.9°C. Values for these heats of adsorption exceeded the heat of liquefaction by about 3 kcal. when only 5% of a monolayer was formed, 0.6 kcal. for 0.5 to 1 layer, and 0.2 kcal. for 1.6 to 4 layers. Values for the heat of adsorption were discussed critically for systems yielding type III adsorption isotherms.

5807. Pierce, Conway and Smith, R. Nelson. **Heats of adsorption. IV. Entropy changes in adsorption.** *J. Phys. & Colloid Chem.* 54, 795-803 (1950).—*C.A.* 44, 9767*h*.

From isotherms (from 78°and 0°C) the differential entropy and heats of adsorption of EtCl by Carbolac I were calcd. From isotherms at 0° and 28.6°C similar calcns. were made for water vapor on Graphon. The differential entropy change for the transfer of a mole of adsorbate from the liquid to the adsorbed state was neg. for the EtCl adsorption and pos. for the water adsorption over most of the measured relative pressure range.

5808. Schaeffer, W. D.; Polley, M. H., and Smith, W. R. **Nature of carbon black surfaces as revealed by adsorption studies.** *J. Phys. & Colloid Chem.* 54, 227-39 (1950).—*C.A.* 44, 6700*c*.

Surface areas were evaluated from low-temp. N_2 adsorption isotherms, by assuming 16.2 $A.^2$ as the cross-sectional area of N_2. The interaction between fully reinforcing black, Spheron 6, and decane and dihydromyrcene at 100°C were given. Only the external surface, which was measured by the microscope technique, was active in adsorption of rubber. The initial heat of adsorption of dihydromyrcene was about 20 kcal $mole^{-1}$ higher than that of the satd. hydrocarbons.

5809. Schellinger, A. Kenneth. **Calorimetric method for the determination of the surface energy of a brittle crystalline solid.** *Science* 111, 693-4 (1950).—*C.A.* 44, 9239*g*.

The calorimeter consisted of a brass chamber (3 in. in diam.) suspended inside a stainless steel water jacket. A Beckmann thermometer was inserted into the bath. The brass chamber was filled with 200 g of cryst. solid and 3 kg chilled steel shot. Revolution of the whole assembly caused tumbling of the charge mass and comminution of the brittle solid. The entire assembly was placed inside a wooden box the air temp. of which was kept at 20.5°C ± 0.1°C. When quartz was added, the energy output was 10-20% lower than energy input. This remained on the solid as surface energy.

5810. Tompkins, F. C. **Adsorption isotherms for nonuniform surfaces.** *Trans. Faraday Soc.* 46, 580-6 (1950).—*C.A.* 45, 18*d*.

With certain restrictions regarding the magnitude of certain entropy changes, 4 well-known isotherms were deduced from variation of heat of adsorption with coverage. If the variation of net heat of adsorption with coverage was known either from theoretical calcns. or exptly. from calorimetric measurements, the isotherm could be reasonably well characterized. If the concept of nonuniformity of surfaces was accepted, interpretation of transformations of state on adsorbed films on solids must be reconsidered.

5811. Treffner, W. **Calorimetry of activated magnesia from natural magnesite.** *Radex-Rundschau* **1950**, 125-31.—*C.A.* 44, 7698*b*.

The heat of hydration of activated MgO was studied by thermochem. measurements in a recording adiabatic calorimeter. This special calorimeter permitted the use of samples up to 180 g and temp. changes up to 55°C. Hydration took place in four distinct steps: (1) a very rapid reaction in the first 10-20 min.; (2) a reduced rate going to a min., the length of this period being detd. by the activity of the sample; (3) a gradual acceleration of the reaction to a max. before 2/3 of the reaction time was elapsed; (4) a rate finally decreasing to zero.

5812. Aston, J. G.; Szasz, G. J, and Kington, G.L. **The zero-point entropy of nitrogen adsorbed on titanium dioxide.** *J. Am. Chem. Soc.* 73, 1937-8 (1951).—*C.A.* 45, 7424*e*.

The heat capacities of approx. a half layer of N_2 on TiO_2 were measured from 19 to 88°K. These data along with the heat capacity of a full layer and the data for differential heat of adsorption were used to obtain information on the difference in zero-point entropy between a full layer and 0.6 of a layer. The result was compared with the zero-point entropy required by a distribution of mols. on sites.

5813. Avgul, N. N. Mikos; Dzhigit, O. M.; Isirikyan, A. A.; Kiselev, A. V., and Scherbakova, K. D. **Variation of the heat of adsorption of methyl alcohol vapor on quartz and silica gel with the surface coverage.** *Doklady Akad. Nauk S.S.S.R.* 77, 625-8 (1951).—*C.A.* 45, 6037*a*.

Differential heats of adsorption Q_a were detd. in a calorimeter with const. heat exchange, as a function of the amt. adsorbed a(micromole/g), on ground quartz, a uniformly coarse-pore silica gel "K", and a uniformly fine-pore silical gel "A". The plots of Q_a as a function of a had the same appearance for the 3 samples, with Q_a first falling with increasing a, then leveling off, but the 3 plots did not coincide. If, however, Q_a was plotted as a function of a/s (micromole/m^2), where s = sp. surface area (known from previous detns.), all 3 samples fell on the same curve.

5814. Babbitt, J. D. **The diffusion of adsorbed gases through solids.** *Can. J. Phys.* 29, 437-46 (1951).—*C.A.* 46, 8930*f*.

The equations for the diffusion of an adsorbed gas through a solid were developed on the assumption that the resistive force was directly proportional to the no. of mols. adsorbed. A better assumption was that the resistive force per mol. was inversely proportional to the no. of mols. adsorbed. Heats of adsorption decreased as the amt. of adsorbed gas increased.

5815. Boer, J. H. de. **Adsorption and molecular bonding in catalysis.** *Chem. Weekblad* 47, 416-27 (1951).—*C.A.* 46, 1339*d*.

Measured heats of adsorption of N_2 and H_2 on an Fe catalyst indicated that in the NH_3 synthesis the surface was 99.99996% covered with N_2. Aside from the possible reaction of H_2 from the gas phase, 3 alternative explanations were advanced to account for the occurrence of the reaction in spite of the apparent lack of room for H_2 on the surface: (1) adsorption of N_2 and H_2 on different crystallographic sites; (2) soln. of H_2 in the metal; and (3) a decrease in the heats of adsorption with increasing coverage of the surface in such a way as to bring the values for N_2 and H_2 closer together.

5816. Calvet, Édouard. **Thermokinetics of adsorption.** *J. chim. phys.* 48, 579-81 (1951).—*C.A.* 46, 4317*b*.

If a liquid and a solid were placed in a microcalorimeter cell, the total heat effect gave directly the heat of adsorption or absorption. With both insol. substances (TiO_2 or Al_2O_3 in H_2O) and sol. substances (urea in H_2O), there was a discontinuity at the point where a monolayer had been completed, detns. of surface area of insol. solids by this method gave results within 5% of those obtained by other methods. Urea adsorbed 10% H_2O without forming a liquid phase. The heat produced in the urea-H_2O system was independent of the amt. already adsorbed, until soln. began, when it dropped. In the nitrocellulose-acetone system, there was a plateau and then a slow decrease, without discontinuity.

5817. Dobay, Donald G.; Fu, Ying, and Bartell, F. E. **Energetics of the adsorption of aliphatic amines by silica gel.** *J. Am. Chem. Soc.* 73, 308-14 (1951).—*C.A.* 45, 4523*b*.

Isosteric heats of adsorption of Et_2NH, $BuNH_2$, and Bu_2NH by silica gel were detd. by means of adsorption isotherms obtained at 25° and 40°C. The change in the heat content $\overline{\Delta H}$, the free energy $\overline{\Delta F}$ and the entropy $\overline{\Delta S}$ per mole of adsorbate were detd. The isosteric heats and $-\overline{\Delta S}$ obtained for the initial stages of adsorption were so high as to indicate that adsorption in this range was not strictly phys. From energy and entropy considerations it appeared that at high relative pressures (i.e., over the range represented by the hysteresis portions of the isotherms) condensation of vapor occurred within the capillaries.

5818. Dresel, E. M. and Pritchard, E. **Differential heats of adsorption of ethylenediamine on coal.** *Research* (London) 4, 578-9 (1951).—*C.A.* 46, 4194*i*.

The net differential heats at 2% adsorption were 16 kcal/mole for ethylenediamine and 6 kcal/mole for MeOH and their ratio was very nearly equal to the ratio of the respective total heats of wetting. The differential heats of adsorption from the vapor phase were calcd. to be 27 kcal/mole and 15 kcal/mole, resp. The considerable difference between these 2 figures was discussed.

5819. Dryden, I. G. C. **Differential heats of adsorption of ethylenediamine on coal.** *Research* (London) 4, 579 (1951).—*C.A.* 46, 4195*a*.

The difference between the heats of adsorption of ethylenediamine and MeOH on coal was a result of chem. interaction in 1 case and phys. interaction in the other.

5820. Hüttig, G. F.; Kahler, F., and Meyenburg, G. **Kinetics of aging of active magnesium oxide.** *Kolloid-Z*, **124**, 160-3 (1951).—*C.A.* 46, 5942*b*.

Active MgO was produced by heating $MgCO_3$ at low temp.; aging was effected by heating the MgO at high const. temp. The measure of the aging was a decrease of energy, detd. by reaction of the aged MgO with 11% HCl soln. in an alc. expansion calorimeter. Up to 480 °C there was no appreciable change in aging; between 480 and 600 °C only the surface was involved; at 650°C a uniform aging of the crystal lattice occurred which decreased exponentially.

5821. Kington, G. L. and Aston, J. G. **The heat of adsorption of nitrogen on titanium dioxide (rutile) at 77.3°K.** *J. Am. Chem. Soc.* **73**, 1929-34 (1951).—*C.A.* 45, 7423*i*.

The relation between the adiabatic differential heat of adsorption and the heat of compression was deduced, and the isothermal and adiabatic heats of compression were related. The relation between the calorimetric heat and isosteric heat was obtained. It was independent of any assumption of a 2-dimensional surface pressure. Data for differential heat of adsorption for the system N_2 on TiO_2 (rutile) at 77.32°K were obtained in a precision adiabatic calorimeter. Heat data were obtained for the same system by the Clausius-Clapeyron relation.

5822. Morrison, J. A.; Los, J. M., and Drain, L.E. **Heat capacity, integral heat of adsorption, and entropy of argon adsorbed on titanium dioxide.** *Trans. Faraday Soc.* 46, 1023-30 (1951).—*C.A.* 47, 2896*f*.

Direct measurements of the heat capacity of A adsorbed at 3 low concns. on TiO_2 (rutile) were made between 14° and 105°K. Argon was admitted to the calorimeter in increments (50 to 200 ml at S. T. P.) to give a temp. rise of 0.5° to 2°. At higher temps. (up to 130°K) the heat capacity of the adsorbed A was detd. from the temp. coeff. of the integral heat of adsorption. Between 14° and 25°K the heat capacity appeared to be that of a 3-dimensional oscillator. At the higher temps. the heat capacity rose to values much larger than could be accounted for on the basis of any simple model of the adsorbed phase.

5823. Polley, M. H.; Schaeffer, W. D., and Smith, W. R. **Heats of adsorption on carbon black. III.** *J. Am. Chem. Soc.* 73, 2161-5 (1951).—*C.A.* 45, 6918*h*.

The heats of adsorption of n-$C_{10}H_{22}$ and dihydromyrcene were measured at 100 °C on a series of furnace and channel carbon blacks. The adsorption appeared to be phys. in nature, and initial values between 2 and 3 kcal per CH_2 group in the adsorbate were obtained for the heat of adsorption. Dihydromyrcene appeared to undergo some degree of reaction with the chemisorbed O-complex present on the surface of channel blacks.

5824. Ashpole, D. K. **Correlation between Young's modulus and differential heat of sorption at zero regain for cellulosic fibers.** *Nature* **169**, 37-8 (1952).—*C.A.* 46, 5313*h*.

A statistical analysis of the heat of wetting and moisture regain data showed that the small differences in the regain among different cellulosic fibers were significant. For viscose and cuprammonium rayons, cellulose acetate, cotton, mercerized cotton, and flax, a good correlation (0.928 correlation coeff.) was noted between the regain and the initial Young's modulus of the fiber (g/denier). The high value of regain was associated with the high modulus with high H bonding energy in the amorphous zone.

5825. Bastick, Jack. **The heat of adsorption of ammonia, phosphine, and arsine on silica gel.** *Compt. rend.* **234**, 1279-81 (1952).—*C.A.* 46, 6921*b*.

The heat of adsorption was measured in an ice calorimeter as a function of the amt. of gas adsorbed and the temp. of degassing used originally on the silica gel. The AsH_3 and PH_3 were apparently physically adsorbed, the heat of adsorption falling steadily with an increase in the amt. of adsorption. In contrast to these two gases, NH_3 gave indications of being chemically adsorbed on the gel that had been degassed at 200 °C. Until the NH_3 equiv. to about one third of a monolayer was added, the differential heat of adsorption remained approx. const. at 13 to 15 kcal/mol.; it then dropped steadily toward the heat of liquefaction.

5826. Boer, J. H. de and Steenis, J. van. **The behavior of hydrogen atoms on surfaces. II. The heat of adsorption of hydrogen atoms on glass and the desorption curve.** *Proc. Koninkl. Ned. Akad. Wetenschap.* **55B**, 578-86 (1952).—*C.A.* 47, 5759*h*.

The heat of adsorption of H atoms on glass and the energy of activation was estd. from a desorption curve at room temp. and application of abs. rate theory.

5827. Boer, J. H. de and Steenis, J. van. **The behavior of hydrogen atoms on surfaces. III. A semiquantitative treatment of the phenomena on glass and on inorganic salt surfaces.** *Proc. Koninkl. Ned. Akad. Wetenschap.* **55B**, 587-95 (1952).—*C.A.* 47, 5759*h*.

A heat of adsorption of 47.5 kcal/mol. was given for H atoms on lead glass. A value of about 60 kcal/mol. was estd. for the heat of adsorption on CaF_2.

5828. Cabrera, N. **The structure of surfaces and their adsorption, considered as a coöperative problem.** *Z. Elektrochem.* 56, 294-6 (1952) (in French) (English summary).—*C.A.* 46, 8461*e*.

"Surface melting" occurred in crystals in contact with their vapor just below the m.p., but this temp. T_c was considerably lower for a crystal immersed in a liquid or covered with an adsorbed layer. At T_c there should be a min. in heat of adsorption, and a marked change in surface tension.

5829. HÜTTIG, G. F. AND THEIMER, O. **Gas adsorption and surface structure.** *Z. Elektrochem.* 56, 490-6 (1952).—*C.A.* 47, 378*a*.

Heat of adsorption, forms of adsorption isotherm, relation of adsorption isotherm to temp., and desorption rates for the following substances were reviewed: H_2, NH_3, CO_2, N_2, and CH_4 and C_2H_6 on wood charcoal; C_2H_5Cl; N_2 on KCl; and CO on glass.

5830. KISELEV, V. F. AND KRASIL'NIKOV, K. G. **Investigation of the adsorption and of heats of adsorption of phenol from its aqueous solutions on nonporous carbon black.** *Doklady Akad. Nauk S.S.S.R.* 86, 111-13 (1952).—*C.A.* 47, 1459*c*.

Spheron Grade 6 lampblack was heated 7 hrs. at 900°C under 0.1-0.2 mm Hg. Adsorption of PhOH from its aq. soln. and heats of adsorption (in an isothermal calorimeter) were measured up to satn. The adsorption and the heat-of-adsorption isotherms had the same S-shape. In the low-concn. range, where the adsorption curve was made up of distinct steps, the heat of adsorption curve had a series of deep minima, the positions of which corresponded to those of the steps.

5831. MOONEY, R. W.; KEENAN, A. G., AND WOOD, L.A. **Adsorption of water vapor by montmorillonite. I. Heat of desorption and application of B.E.T. theory.** *J. Am. Chem. Soc.* 74, 1367-71 (1952).—*C.A.* 46, 6459*i*.

Repeated adsorption-desorption measurements of H_2O on montmorillonite showed that the desorption isotherm was reproducible whereas the adsorption isotherm depended on the initial H_2O content. Heats of desorption were calcd. from the Clausius-Clapeyron equation and give evidence of discrete layer formation.

5832. QUARTERMAN, L. AND PRIMAK, W. **The heat of reaction of graphite and potassium.** *J. Am. Chem. Soc.* 74, 806-9 (1952).—*C.A.* 46, 5419*g*.

The heat of reaction of graphite with an excess of K was redetd. calorimetrically. Detns. at several temps. in the range 66-95°C gave a mean value of 81 ± 2 cal/g of high-d. Acheson graphite. Heats of reaction of K with pitch-bonded natural graphite, pitch-bonded lampblack, pitch-bonded petroleum coke, and natural Ceylon graphite were detd. also. All of the results were in the range 72-90 cal/g.

5833. ANTROPOFF, A. V. AND LIETZ, G. **Investigations of the adsorption of gases from very small to high pressures. V. The heat of adsorption of argon on activated charcoal.** *Kolloid-Z.* 133, 76-9 (1953).—*C.A.* 48, 5595*a*.

Adsorption of A was detd. at 0°C on a Bayer charcoal (AKTII), the rise of temp. being measured with a Pt resistance thermometer in 2 types of vessels. Mean, integral, and differential heats of adsorption were calcd. for pressures from 8 to 604 mm. Mean and differential heats fell rapidly as pressure increased, reaching an approx. const. value of 1500 cal at 220 mm.

5834. BEEBE, R. A.; MILLARD, B., AND CYNARSKI, J. **Heats of adsorption of nitrogen and argon on porous and nonporous carbon adsorbents at -195°C.** *J. Am. Chem. Soc.* 75, 839-45 (1953).—*C.A.* 47, 6241*f*.

Heats of adsorption were detd. by means of an isothermal calorimeter for N_2 and A on Spheron and Graphon, on 2 samples of Saran charcoal, and on carbon wear dust prepd. by Savage. Anomalies both in the isotherm and the heat-coverage curve were found for the system A-Graphon. The magnitude of the heats obtained with the porous Saran charcoal was related to pore diams. The carbon wear dust presented a less homogeneous surface than expected.

5835. CALVET, ÉDOUARD. **Adaptation of a microcalorimeter of four elements to the thermogravimetry of adsorption.** *Compt. rend.* 236, 486-8 (1953).—*C.A.* 47, 5178*d*.

A microcalorimeter having 4 thermally sensitive elements was described. Each contained a liquid-containing silver cell isolated thermally from the thermostatted 100 kg copper block in which they were mounted. The exptl. zero was stable to 0.00001°C for periods of several days when the app. was operated in a const.-temp., const.-humidity room controlled to 1/20°C. A liquid-vapor heat exchanger was made of thin silver foil, formed in the shape of a star around a thin glass tube having an inside diam. of 5 mm. The lower end of this glass tube was approx. 5 mm above the sealed base of the surrounding star-shaped foil cylinder. This exchanger was submerged in the liquid in the measuring cell to within 5 mm of the top of the foil. When the liquid was vaporized, the vapor was forced from top to bottom through the space between the inner surface of the silver foil and the glass tube. The vapor passed from the cell through the glass tube which was secured to the neck of the cell by a stopper.

5836. CALVET, ÉDOUARD. **Thermogravimetry of adsorption by the exclusive use of a microcalorimeter with four elements.** *Compt. rend.* 236, 377-9 (1953).—*C.A.* 47, 4723*c*.

The microcalorimeter consisted of 2 identical systems, each consisted of 2 cells, which were connected with thermoelements. A liquid was distd. from one cell (of each system) onto an adsorbent in the other one. The special circuit contg. the 4 thermoelements allowed continuous measurement of the following quantities: (1) dq/dt, the rate of change in the heat of the calorimeter due to the slow adsorption of the vaporizing liquid. (2) dp/dt, the change of the weight p of the liquid due to its vaporization. The combination of both curves gave the differential heat of adsorption dq/dp as a function of p. Changes in heat of the order of 1/1000 cal/hr could be registered.

5837. PIERCE, CONWAY AND SMITH, R. NELSON. **Heats of adsorption. V. Adsorption on a homogeneous surface.** *J. Am. Chem. Soc.* 75, 846-8 (1953).—*C.A.* 47, 7287*e*.

The adsorption isotherm of EtCl on a sample of new Graphon was concave with respect to the pressure axis up to 0.001 relative pressure and 3% of a monolayer, convex between 3% and 100% of a monolayer, concave between 1 and 1.3 monolayers, and convex at still higher coverage. The results were interpreted as indicating strong lateral interaction with the max. in the heat of adsorption vs. coverage curve at approx. a monolayer.

III-2. Heats of Wetting–Specific Heat–Wetting Phenomena

5838. ANDRIANOV, P. I. **Sorption potential and hydrophile property of soils.** *Colloid J.* (U.S.S.R.) **6**, 695-700 (1940).—*C.A.* **35**, 7613^5.

The sorption potential and vapor pres. characterized the hydrophile property of soils just as well as the ratio of heat of wetting with water to that of wetting with C_6H_6(the Rebinder method). The amts. of particles with diam. less than 0.001 mm, detd. by mechanical analysis, might not have characterized the sorption properties of soil, especially in the case of soil of the region of permanent cold.

5839. ANDRIANOV, P. I. **New methods for designating the moisture content and hydrophilic properties of soils.** *Pedology* (U.S.S.R.) **1941**, No. 1, 40-9; **Chem. Zentr. 1941, I**, 3430.—*C.A.* **38**, 2150^9.

The moisture content of soils, up to the field capacity, could be calcd. from the heat of wetting or the hygroscopic moisture. The method for characterizing the soil-moisture status by means of pF values was discussed.

5840. BOYD, GEORGE E. AND HARKINS, W. D. **The energy of immersion of crystalline powders in water and organic liquids. I.** *J. Am. Chem. Soc.* **64**, 1190-4(1942).—*C.A.* **36**, 4002^8.

Data were given for the heat of immersion (h_i) of TiO_2, ZrO_2, SiO_2, SnO_2, ZnS, $BaSO_4$, $ZrSiO_4$ and graphite in one or several of the following liquids at 25°C: water, EtOH, BuOH, ethyl acetate, butyric acid, nitrobenzene, CCl_4, C_6H_6 and isooctane. The heats of immersion varied from 0.3 to 1.8 cal/g in water with smaller values for org. liquids. The ratio $h_i/(h_i)_{H_2O}$ depended almost wholly upon the nature of the liquid for which h_i was detd., and not upon the solid immersed, provided polar liquids only were investigated. For TiO_2 (anatase) the values of the ratio were: water, 1.00; butyric acid, 0.77; ethyl acetate, 0.69; BuOH, 0.67; nitrobenzene, 0.55; CCl_4, 0.46; benzene, 0.28; isooctane, 0.20. The ratios were almost the same for other O-contg. solids.

5841. GUNDERMANN, J. **Effect of very fine grinding on the heat of solution or heat of wetting of sugar and cellulose.** *Kolloid-Z.* **99**, 142-7 (1942).—*C.A.* **37**, 4297^1.

The structure of the crystal lattice of sucrose was destroyed to a great degree by intensive grinding. This was made evident by the pos. values obtained for the heat of soln. The heat of soln. could serve as a criterion for the efficiency of the mill used for fine grinding. The destruction of the lattice structure of finely ground cellulose could be detected from changes in the heat of wetting. Similar detns. were made also with finely ground coke.

5842. KIMURA, OSAMU. **A method for measuring the surface energy of solids.** *Bull. Chem. Soc., Japan* **17**, 61-3 (1942).—*C.A.* **41**, 4348*b*.

A float pycnometer method was used to measure the surface energy of solids. The surface energy of $CaSO_4.2H_2O$ was found to be 3.9 × 10^2 dynes/cm.

5843. MULLER, P. B. **The calorimetric standardization of the activity of adsorbents for chromatographic analysis with specific consideration of alumina.** *Helv. Chim. Acta* **26**, 1945-65 (1943) (in German).—*C.A.* **39**, 10^9.

The activity of an adsorbent was detd. by measuring the heat effect produced when 50 g of the absorbent and 65 ml of the solvent were mixed in a specially designed calorimeter. Four Al_2O_3 prepns. were used. Solvents used were petr. ether (b. 90-110°C) unpurified and purified in several ways, mixts. of the several grades of petr. ether with ethyl ether, ethanol, chloroform and hexane. Various combinations of the oxides with the solvents were measured. The correlation of the heat effect and the activity of the oxides was good.

5844. CANNON, C. G.; GRIFFITH, M., AND HIRST, W. **The carbonization of coals.** *Proc. Conf. Ultra-fine Structure of Coals and Cokes, Brit. Coal Utilisation Research Assoc.* **1944**, 131-46.—*C.A.* **39**, 1274^2.

Heats of wetting by MeOH of carbonized residues from coals of different ranks were detd. as a function of the max. carbonizing temp., carbonization being in N_2. In general, coals of low coking rank showed highest heats of wetting and this was also true of the coked residues. There usually were 2 maxima in heat of wetting vs. carbonization temp. curves, one in the range 300° to 500°C and the other 500° to 700°C. Heat of wetting over the lower ranges was suppressed by carbonization in a closed bomb.

5845. EICHBORN, JOHANN-LUDWIG v. **Mutual adhesion of substances not miscible spatially. I. Problems of the contact angle theory, especially of liquids on solid surfaces.** *Kolloid-Z.* **107**, 107-28(1944).—*C.A.* **39**, **11**^{5}.

A theoretical discussion was presented. An appendix was included dealing with the distinctions and ambiguities in phys.-chem. terms, such as "tension," "stress" or "strain."

5846. GRIFFITH, M. AND HIRST, W. **The heat of wetting of coals in organix liquids.** *Proc. Conf. Ultra-fine Structure of Coals and Cokes, Brit. Coal Utilisation Research Assoc.* **1944**, 80-94.—*C.A.* **39**, 1267^5.

Measurements in an ice calorimeter (min. rate of liberation of heat of 1 cal/hr) showed that MeOH liberated 94% of the heat of wetting within 10 min. and 99% within 25 min. Optimum conditions for the coal sample were: through 72 B.S.S. mesh, dried for 1/2 hr at 105°C in air, and final evacuation at 10^{-5} mm Hg. Heat of wetting due to ash constituents under 5% and up to 4% water in MeOH was negligible. Heat of wetting values of the coals by MeOH, expressed as cal/g of dry, ash-free coal, showed a decrease with increasing volatile from 6 to 20%. Between 20 and 30% volatile the heat of wetting is a min. Beyond 30% volatile the heat of wetting shows a marked and abrupt spread covering 3-24 cal/g.

5847. Deryagin, B. **Thickness of the liquid film adhering to the walls of a vessel after emptying.** *Acta Physicochim. U.R.S.S.* 20, 349-52 (1945).—*C.A.* 40, 774^4.

For the case of the thick liquid films adhering to a vessel being emptied (or to a plate being drawn from the liquid), the thickness of the liquid layer was independent of surface tension. The av. film thickness $\bar{h} = 2h_o/3$ and $h_o = (nU/pg \sin \alpha)^{1/2}$, where n was the viscosity and p the d. of the liquid, g was the gravitational const., h_o was the film thickness just above the "water-line," which made an angle α with the wall and receded with velocity U parallel to the wall.

5848. Deryagin, B. and Titievskaya, A. **Experimental determination of the thickness of the liquid layer left on a solid wall behind the receding meniscus.** *Doklady Akad. Nauk S.S.S.R.* 50, 307-10 (1945).—*C.A.* 43, 2059*b*.

Exptl. tests were made with 11 various oils and solns. of rosin in oil of different n. The thickness of the residual layer of liquors was detd. by weighing a glass cylinder of 3.5 cm diam., wall thickness 0.15 cm immersed in the liquid and either raised vertically at the rate U or kept stationary, with the surrounding liquid being siphoned off at that rate. The "end effect" i.e. the effect of the liquid adhering to the bottom end of the cylinder, was eliminated.

5849. Dimo, V. N. **Heat of wetting of soils, minerals, and rocks in relation to their surface properties.** *Pedology* (U.S.S.R.) 1946, 301-8.—*C.A.* 41, 825_g.

The heat of wetting was accompanied by adsorption and hydration; max. hygroscopicity was assocd. with adsorption, hydration, and capillary condensation. Since the latter was conditioned by the size of the ultrapores, a value for ultraporosity could be obtained from the ratio of heat of wetting to max. hygroscopicity. There seemed to be no proportional relation or constancy of the values of max. hygroscopicity, heat of wetting, and specific surface.

5850. Herbst, Heinrich H. **Heat of wetting of metal surfaces by oils.** *Petroleum Refiner* 25, No. 3, 133-7 (1946).

The quantity adsorbed on a smooth metallic bearing was not related to the quantity adsorbed by the powder (of the same metal) in the same ratio as bearing surface area to powder surface area. Capillary structure and "ultraporosity" exerted considerable influence on these phenomena. For instance, various adsorbates of variable large molecular sizes would tend to give different surface area relationships with one and the same powder. The heat-of-wetting of metals by oils must be carried out directly on the smooth metal or bearing-metal itself. An apparatus was described.

5851. Onusaǐtis, V.A. and Yur'evskaya, N.P. **Investigation of the process of coke structure formation. II. Electrical conductivity, heat of wetting, and sorption properties of cokes.** *Bull. acad. sci. U.R.S.S., Classe sci. tech.* **1946**, 1635-47(in Russian).—*C.A.* 41, 3278*f*.

Heats of wetting Q with MeOH were detd. calorimetrically on 2 granularly different grades of coke (0.104-0.208 and 0.043-0.061 mm grain size) for 600 and 850°C cokes. Irrespective of coal sort and grain size, higher coking temp. always resulted in lower Q. Distinctly different Q values were found with cokes made from 3 portions of a given coal sorted out by petrographic types, glossy, half-glossy, and half-dull. Sorption expts. were made at 20°C on powd. cokes evacuated at 400°C for 6-8 hrs. Water vapor was adsorbed at all pressures up to that of satd. vapor with the exception of 1200°C glossy-coal coke where no sorption occurred at any pressure; sorption of C_6H_6 was very slight and ended at 4-5 mm. Max. sorption values for the coarse-grain total-coal cokes, 800, 1000, 1200°C, were H_2O 41.5, 13.1, 3.84 mg/g; C_6H_6 9.0, 6.6, 2.07 mg/g; for glossy-coal coke, H_2O 26.5, 6.2, 0; C_6H_6 2.48, 7.28, 2.65; half-glossy, H_2O 41.5, 22.1, 6.9; C_6H_6 4.55, 10.3, 4.4 mg/g.

5852. Skuratov, S. M. and Shkitov, M. S. **Specific heat of water bound by high polymeric substances.** *Compt. rend. acad. sci. U. R. S. S.* **53**, 627-9 (1946) (in English).—*C. A.* 41, 2633*b*.

The calorimeter consisted of a thin-walled cylindrical Ag ampoule fitting tightly in a Ag container. A bifilar coil of manganin wire served as heater. The sp. heat of gelatin, H_2O content ranging from 16.7 to 0.46%, gave a value coinciding within 1% with that computed from addn. equations. The sp. heat of both types of starches also yielded very close values, deviating but slightly from the computed ones. The departure from the straight line somewhat increased with the H_2O content.

5853. Baticle, Robert L. **The rate of wetting of a pulverulent solid by a liquid.** *Compt. rend.* 224, 339-40 (1947).—*C. A.* 41, 3677*i*.

The wetting of a pulverulent solid by a liquid was usually characterized by the two static quantities adhesive tension and heat of wetting. A dynamic quantity, the rate of wetting, had also been used. For a given liquid-solid couple, the movement of liquid in a compressed powder was given by the equation: $t = Kl^2$, where K was a const. depending on the packing of the powder, and l the depth of bed of the solid. The rate of wetting of powders was detd. experimentally in an app. consisting of a brass cylinder for holding the compressed powder fitted with a vertical glass tube for observing the fall of the liquid level with time. For TiO_2 powder, the curve was rigorously parabolic for a no. of the usual liquids.

5854. Dumanskiĭ, A. V.; Mezhennyĭ, Ya. F., and Nekryach, E. F. **Lyophilism of disperse systems. I. Heat of wetting.** *Kolloid, Zhur.* 9, 355-66 (1947).—*C.A.* 43, 6042_c.

Heats of wetting Q with H_2O were detd. calorimetrically for potato starch of different moisture contents m. At 20°C, $m = 0.00$, 0.55, 5.12, 10.26, 16.02, 18.58, 22.02, 28.24, $Q = 28.06$ cal/g sample (28.06 cal/g dry starch), 26.24 (26.38), 16.29 (17.16), 10.36 (11.42), 4.21 (5.01), 2.10 (2.58), 1.09 (1.395), 0.48 (0.67). Log Q was very nearly a linear function of m; its extrapolation gave $Q = 0$ at $m = 25.7\%$. The surface area was $S_0' = 0.7 \times 10^{-7}$ cm^2/cc. For powdered gelatin, at 20°C, $m = 0.00$, 4.73, 9.47, 15.40, 26.16, $Q = 32.50$, 23.58.

15.45, 8.26, 1.13 cal/g dry gelatin, and for powd. agar, $m = 0.00$, 7.56, 10.48, 14.73, 20.92, 29.18, $Q = 44.85$, 28.10, 22.45, 11.25, 6.99, 3.24 cal/g dry agar; the linearity between log Q and m held in both cases.

5855. HORMATS, SAUL; ZEFFERT, B. M., AND DOLIAN, F. E. **Heat of wetting of charcoal and its retentivity for ethyl chloride.** *J. Colloid Sci.* **2,** 307-14 (1947).—*C. A.* **41,** 6454*c*.

Retentivity was defined as the wt of adsorbed gas or vapor per unit vol. of adsorbent in equil. in air with a concn. of the gas or vapor just below that of physiological significance. There was a ten-fold variation in the retentivity of com. activated charcoals for EtCl. Changing the size and shape of the charcoal container, the vol. of charcoal, or the flow rate of desorbing air within practical limits did not affect retentivity. There was no correlation between the heats of wetting of a charcoal in C_6H_6 and its retentivity for EtCl. This was thought due to (1) small heat effect and (2) small extent of surface concerned with retentivity as compared to total surface contributing to heat of wetting by the benzene.

5856. HUTCHINSON, E. **III. Heats of wetting and adsorption on ionic crystals.** *Trans. Faraday Soc.* **43,** 443-7 (1947).—*C. A.* **42,** 1477*i*.

The heats of wetting and adsorption on NaF of a no. of liquids were measured. The response to small temp. changes was less than one sec. The heats of wetting on NaF per g powder (cal) and per g-mol. of liquid (kcal.) were, resp: CCl_4, 0.96, 24.7; chlorobenzene, 0.48, 12.3; petr. ether, 0.31, 8.1; benzene, 0.54, 14.0; octyl alc., 0.42, 10.0; nitrobenzene 0.84, 21.7; amyl acetate, 0.92, 23.7; acetone, 0.33, 8.6; acetophenone, 0.33, 8.6; benzaldehyde, 0.64, 16.6; oleic acid, 0.92, 23.3; caprylic acid, 0.94, 24.3. These heats were greater for highly polar than for nonpolar liquids.

5857. IL'IN, B.V. **The van der Waals forces at the edges of crystals. The work of the electrostatic forces in the wetting of the alkaline earth sulfates.** *Doklady Akad. Nauk S.S.S.R.* **56,** 269-71(1947).—*C.A.* **44.** 8191*h*.

When crystals of $CaSO_4$, $SrSO_4$, and $BaSO_4$ were wet with water, EtOH, or other alcs., van der Waals forces developed between the mols. of the liquid and those of the solid material. These consisted of adsorptive forces of 3 components: electrostatic, dispersive, and repulsive forces. The dispersive component amounted to only 1-2% of the experimentally obtained energy of adsorption. Neglecting this component, the electrostatic work of wetting was calcd. for the above salts and compared with the experimentally detd. heat of wetting. The agreement was only in order of magnitude.

5858. KING, G. **The effect of strongly hydrogen-bonding agents on some polar polymers.** *J. Colloid Sci.* **2,** 551-62 (1947).—*C.A.* **42,** 2826*h*.

The dielec. const., relative rigidity, swelling, heat of wetting, and sorption were detd. for the systems: nylon-H_2O vapor, keratin-H_2O vapor, nylon-HCOOH vapor, and keratin-HCOOH vapor. The effect of temp. over the range 20-140°C on the relative rigidity of nylon and of sorbed H_2O on the relative rigidity of silk were also detd. Both H_2O and HCOOH decrease the dielec. const. of the polymers over and above their effect as absorbates. Calcns. were made to det. the approx. no. of mols. of bound H_2O and low energy sites per unit wt. of keratin, nylon, and silk.

5859. PESEZ, MAURICE AND BERRET, RENÉ. **Method of measuring the heat of wetting of decolorizing carbons.** *Chimie & industrie* **58,** 28-30 (1947).—*C.A.* **42,** 425*c*.

The adsorbing power of carbons was proportional to the heat of wetting in benzene. The construction and operation were described of a special calorimeter, in which the heat of wetting was compared with the amt. of heat given off by an elec. resistance through which passed a known current.

5860. ADAM, N. K. **Principles of penetration of liquids into solids.** *Discussions Faraday Soc.* **1948,** No. 3, 5-11.—*C.A.* **43,** 1239*f*.

The min. contact angle obtainable was zero, not uncommon for "receding" angles; the max. possible advancing angle on a "smooth" surface, important for waterproofing problems, was probably between 110° and 120°. For rough surfaces, apparent contact angles as high as 160° were found. The water-repellence of duck feathers was due to well-designed structure and not to any water-repellent wax. Simple geometrical considerations showed that the penetration pressure may become neg. in the presence of constritions in a pore. An attempt was made to confirm this experimentally in a tube with zigzag walls.

5861. CASSIE, A.B.D. **Contact angles.** *Discussions Faraday Soc.* **1948** No. 3, 11-16.—*C.A.* **43,** 1239*d*.

The difficulty of reproducing a "smooth" surface doubtless is the cause for so many published values of contact angles. Despite this, the abs. values of these angles give a useful relation between measurable roughness and angle and this treatment may be extended to hetergeneous surfaces. Advancing contact angles only appear to give agreement between theory and expt. and probably no phenomenon in textiles that involves receding contact angles has been explained satisfactorily. The multimol. sorption theory indicates that the advancing angle will be unique whereas the receding one will generally be less than the advancing angle and need not have a unique value.

5862. DRESEL, EVA H.; GRIFFITH, M., AND HIRST, W. **The free and total energies of interaction of coals with methyl alcohol.** *Trans. Faraday Soc.* 44, 992-1001 (1948).—*C.A.* 43, 8835*i*.

The heat of wetting (ΔH_L) of coal by MeOH was detd. from adsorption measurements. The isotherms were measd. by a volumetric method on 3 kinds of coal. Hysteresis was observed, and only the desorption isotherm was suitable for the detn. of the free-energy lowering (ΔG_T) for the adsorption of MeOH vapor at two different pressures. In detg. the temp. coeff. of ΔG_T it was necessary to make measurements at the higher temp. first. There was no evidence from these results that heat was liberated slowly in the calorimetric measurements. The differential heats of adsorption were also calcd. Even after subtracting the latent heat of condensation of MeOH, all of the differential heats were considerably greater than zero. The behaviors of the 3 kinds of coal were interpreted in terms of a model of coal structure.

5863. Dumanskiĭ, A. V.; Mezhenniĭ, Ya. P., and Nekryach, E. F. **The lyophilism of disperse systems. II. Heat of wetting of starch, gelatin, agar, and silica with water and alcohol.** *Kolloid. Zhur.* **10**, 103-11 (1948).—*C.A.* 7781*f*.

Q of sol. starch in H_2O and in EtOH was 24.5 and 1.3 cal/g and of silica gel 22.7 and 25.2 cal/g. Agar and gelatin gave $Q = 0.62$ and 0.08 in EtOH. Potato starch had 1.68 in EtOH and 27.5 in *M* aq. sucrose soln. The percentage *A* of H_2O that lowered *Q* to zero was calcd. to be 37 and 30% for starch and silica gel, resp. The ratio of *Q* for dry powder to *A* was almost const. (0.67-0.81); this showed that the heat of adsorption of 1 g of water was const. (approx. 75 cal). Increases of the concn. of sucrose on mixing its solns. with starch yielded for "bound" H_2O 31-34%, in agreement with the *A* calcd. from *Q*. The real heat of wetting was greater than *Q*, because *Q* included the neg. heat of swelling and soln.

5864. Gapon, E. N. **Work of wetting and heat of wetting of soils.** *Kolloid Zhur.* **10**, 259-64 (1948).—*C.A.* 43, 7619*e*.

The thermodynamic relations between the differential heat Q_d, integral heat Q_i, differential work A_d and integral work A_i of wetting were derived. For soils, A_i decreased in the series Mg> Ca> H> Na. Q_d was always greater than A_d, but the difference was small at low humidities.

5865. Gapon, E. N. and Zuev, L. A. **Heat of wetting of soils.** *Kolloid. Zhur.* **10**, 83-93 (1948).—*C.A.* 43, 7619*c*.

Chernozem, the satn. capacity of which was 31 milliequiv./100 g, was transformed into the Mg, Ca, Na and H forms. These were dried at 107°C in a high vacuum, and 20-g samples were immersed in 500 g H_2O either dry or after having adsorbed *s* g H_2O per 100 g soil. The heat of wetting *q* of dry samples in cal (±0.05) per g soil was 5.71, 5.48, 4.42, and 5.22 for the above forms, resp., at 15°C. Between about $s = 0.2$ and 3, *q* decreased linearly when *s* increased. The series Mg > Ca > H > Na agreed with that valid for adsorption of H_2O at low vapor pressures.

5866. Gregg, S.J. **Hysteresis of the contact angle.** *J. Chem. Phys.* **16**, 549-50 (1948).—*C.A.* **42**, 5302*b*.

The angle of contact θ of a liquid against a solid was profoundly affected by the presence of an adsorbed film on the unimmersed portion of the solid. In the "adsorption increasing" run of a vapor-adsorption expt. there was an advancing contact angle θ_a; in the "adsorption decreasing" run there was a receding contact angle θ_r. Adsorption hysteresis was aggravated in some cases by air—an impurity almost inevitably present during measurements of the contact angle. Phase transformations were frequent causes of adsorption hysteresis. Perhaps adsorption hysteresis, and therefore, hysteresis of the contact angle might in principle be eliminated by allowing sufficient time to elapse before measuring θ; under conditions attainable in practice, there would be a residue of cases in which hysteresis of the contact angle would persist despite the most careful precautions.

5867. Guastalla, Lina P. and Guastalla Jean. **Direct measure of adhesive tension. Modes of wetting.** *Mém. services chim. état* (Paris) 34, 373-9(1948).—*C.A.* 44, 5679*b*.

Adhesive tension was measured directly by a sensitive torsion balance and a galvanometer. The exptl. results were shown graphically as the force per unit length of perimeter as a function of depth of the sheet in the liquid. There was a hysteresis on introducing and withdrawing the sheet. Paraffin and a pure water gave a mean value of -27 dynes/cm, mica and pure water about +55 dynes/cm. A monolayer of oleic acid on the paraffin resulted in a mean value of +12 dynes/cm. Results were also given for some vegetable waxes.

5868. Inaba, Ayako. **Wettability of solid surface. I. Wettability of paraffin surface.** *Mem. Faculty Sci. Kyūsyū Univ.*, Ser. C., Chem. **1**, 1-17 (1948).—*C.A.* 46, 2374*f*.

The advancing contact angle of water on crude paraffin (117°) was almost equal to that of purified paraffin (116°), whereas the receding contact angle of the former (103°) was smaller than that of the latter (108°). The wettability of crude paraffin increased with time of contact with water, reaching after 10 hrs const. values of 93° for the advancing angle and 75° for the receding angle. Purified paraffin showed only a slight increase in wettability after several hrs contact with water.

5869. Plaksin, I. N. and Bessonov, S. V. **Change of the wettability of metals and sulfides under the action of gases.** *Doklady Akad. Nauk S.S.S.R.* 61, 865-8 (1948).—*C.A.* 43, 2485*h*.

Contact angles θ between the solid surface and a drop of H_2O were measured as a function of time in O_2, N_2, and CO_2. Only O_2 proved to have an effect in the direction of increased hydrophobization of the surface. Thus, under O_2, for Au, θ increased from 61 to 78° in 60 min., for Ag from 52 to 68° in 30 min., remaining practically const. after about 60 min. For pyrite and sphalerite, θ passed through a max. (after about 50 and 34 min., resp.), then decreased and, eventually, fell below the initial value.

5870. Rees, W. Howard. **Heat of absorption of water by cellulose.** *J. Textile Inst.* **39**, T 351-67 (1948).—*C.A.* 43, 1180*h*.

Heat-of-wetting measurements were made on various cottons by the method of mixts. with 2 cylindrical Dewar flasks of internal diam. 2.5 in. and 540 cc. capacity. Distd. H_2O (200 cc.) was placed in each flask so that, before the container was lifted, the specimen was completely below H_2O level but isolated from it. Heats of absorption were derived from exptl. data of heats of wetting and also from moisture-absorption data, and the value for cellulose at zero-moisture regain was found to be 283 cal/g of liquid H_2O (15.6 kcal per mole H_2O vapor).

5871. Wahba, Maurice. **Moisture relationships of cellulose. I. The heat of wetting in water and in certain organic liquids.** *J. Phys. & Colloid Chem.* 52, 1197-1208 (1948).—*C.A.* 43, 1638*f*.

The heats of wetting of dried, outgassed samples of raw cotton, medicated cotton, standard cellulose, and viscose in water were measured calorimetrically and found to be 12.3, 10.0, 10.7, and 20.3 cal per g, resp. Similarly, heats of wetting in MeOH, acetone, and benzene were 13.5, 2.6, and 1.3 for viscose, and 7.6, 1.5, and 0.8 for cellulose. The heats of wetting of cellulose in the different liquids changed in the same order as the adsorption values from the vapors of the liquid.

5872. Weil, Louis. **Calorimeter for measuring heats of wetting.** *Compt. rend.* 226, 2130-2 (1948).—*C.A.* 46, 2351*b*.

A Dewar vessel, suitably enclosed, was used as an adiabatic calorimeter for measuring the heat of wetting of bentonite by benzene.

5873. Andrianov, P. I. **Heat capacity of bound water.** *Doklady Akad. Nauk S.S.S.R.* 66, 219-22 (1949).—*C.A.* 43, 6069*e*.

By calorimetric measurements, the sp heats of starch with 22.98 and 10.84% moisture were found to be 0.402 ± 0.006 and 0.322 ± 0.003 cal/g, resp.; hence the sp heat of the hydrophylically bound H_2O is 0.91 ± 0.03 and 0.76 ± 0.03 cal/g, resp., i.e. considerably lower than the sp heat of free H_2O, and decreasing with the relative H_2O content of the starch.

5874. Aron, Ya. B. and Frenkel, Ya. I. **Behavior of liquid drops (and bubbles) on the surface of a solid. II. Experimental verification of the formulas for the critical sliding angle and the minimum mass of the drops (bubbles).** *Zhur. Eksptl. Teoret. Fiz.* 19, 807-13(1949).—*C.A.* 46, 10780*c*.

The formula for the limiting slope α at which a drop or a bubble began to roll down an inclined plane solid surface, $\sin\alpha = 2r\Delta\sigma/mg$ (where $2r$ = diam. of the wetting area, $\Delta\sigma$ = adhesion energy, m = mass of the bubble) was verified for drops of H_2O on paraffin and muscovite and of Hg on sphalerite, talc., calcite, and glass. The min. mass m_m at which the drop would roll down at all was $m_m = 2r\Delta\sigma/g$. Drops of H_2O of m up to 0.0350 g. did not roll down on paraffin at any inclination, which was somewhat below $m_m = 0.0400$ g. The exptl. m, below which the drops did not roll, was slightly less than $2r\Delta\sigma/g$, and only in the case of Hg on glass was it exactly equal to $m_m = 0.0081$ g.

5875. Bernard, René, and Hirtz, Jean. **Effect of adsorbed films on the energy of solid-liquid adhesion. Influence of thin adsorbed layers on the energy of adhesion of liquids to solids.** *Compt. rend.* 228, 1859-61 (1949); *J. chim. phys.* 47, 95-8 (1950).—*C.A.* 43, 8234*e*.

The contact angles of small drops of tritolyl phosphate were measd. on calcite, Cu and quartz surfaces, and found to drop steadily. Equil. was reached at 25°C only after 3 weeks. The progressive increase in adsorption energy was due to replacement of a film of water, initially present, by tritolyl phosphate.

5876. Bond, R. L. and Maggs, F. A. P. **A new basis for measurement of specific surface of carbonaceous powders.** *Fuel* 28, No. 8, 169-71 (1949).—*C.A.* 43, 7207*i*.

A rapid and accurate, though comparative, assessment of specific surface was provided by the heat-of-wetting measurement. Abs. values were obtained only if the heat liberation on wetting unit area was known. It was approx. 400 ergs/cm^2 for several types of carbonaceous surface.

5877. Dresel, Eva M. and Griffith, Margery. **The significance of the heats of wetting of coal powders ground to various degrees of fineness.** *Fuel* 28, 193-9 (1949).—*C.A.* 44, 6099*f*.

The effects of fine grinding on coal powders were detd. by combining heat of wetting measurements with vapor adsorption detns. Drastic grinding in a ball mill considerably increased the sorptive power of coals, and the effect was ascribed to the production of fresh internal as well as external surface. There was a limit to the increase in total surface which might have been effected by fine grinding. The heat of wetting by MeOH detd. on 240 B. S. S. coal was a more characteristic property than the value obtained on 72 B. S. S. powders.

5878. Dumanskii, A. V. **Heats of wetting and swelling.** *Doklady Akad. Nauk. S.S.S.R.* 64, 537-40 (1949).—*C.A.* 43, 4553*d*.

The heat of wetting, Q, by H_2O was detd. as the sum of the heats of dissocn. of $(H_2O)_n$ mols. into H_2O, of the reverse assocn., of sorption of H_2O and of the loss, q, of kinetic energy of the H_2O mols. undergoing sorption; since the sum of the 1st 3 terms = 0, $Q = q$. If the kinetic energy of a H_2O mol. = 5/2 kT, $Q = q = 10 \times 10^{-14}$ erg, in very good agreement with that calcd. from the heat of wetting of dry starch (1512 cal/mole H_2O adsorbed). The heat of wetting could not have been due to H-bonding which would have required about 5000 cal/mole. Similar considerations for the swelling process involved dissocn. of $(H_2O)_n$, decompn. of micelles into macromols. and decompn. of the latter, sorption of H_2O mols., and the corresponding reverse assocns.

5879. Enright, D. P.; Sonders, L. R., and Weyl, W. A. **Surface polarization and wettability of inorganic substances by water.** *J. Applied Phys.* 20, 1011-12 (1949).—*C.A.* 44, 409*f*.

The incomplete wettability of sol. inorg. substances by water was the result of weak forces emanating from the strongly polarized surface ions; in contact with water, the liquid had a contrapolarized effect.

5880. Inaba, Ayako. **Wettability of solid surfaces. III. Relation between aggregative states in phase diagrams and wettability for palmitic acid-paraffin systems.** *Mem. Faculty Sci., Kyūsyū Univ.* 1, 63-7 (1949).—*C.A.*46, 3842*i*.

The wetting by water of solid surfaces of mixts. composed of palmitic acid and paraffin increased with time of contact. The rate of increase of wetting depended on the proportion of the 2 components, and it changed in a complex manner with the concn. of palmitic acid. Correlations were drawn between the rate of increase of wetting with time and the phase diagram.

5881. MAFFEI, FRANCISCO J. AND HOFFMAN, FRIDA A.M. **Heat of hydration of national cements.** *Anais assoc. quim. Brasil* **8**, 178-87 (1949).—*C.A.* 44, 6095*f*.

Seven com. samples of Brazilian cements were examd. according to the A.S.T.M. method. The averages of 2 detns. expressed in cal/g referred to calcined material ranged for the heat of soln. from 570 to 634, after 3 days 535-581, 7 days 520-581, 7 days 520-562, 28 days 501-530, and for the heat of hydration after 3 days from 33 to 84, 7 days 31-85, 28 days 68-104.

5882. MAJUMDAR, K. K. **Contact angle of natural graphite** *J. Sci. Ind. Research* (India) **8B**, No. 12, 232-4 (1949).—*C.A.* 44, 5765*d*.

The water-air-solid contact angle of graphite was measured by the spheroidal segment method. The shape of small bubbles of air held against the solid under water was observed. The formula $\tan[(180-\theta)/2] = 2h/b$, was used where θ = contact angle, h = height of bubble, and b = base of bubble. Values found ranged from 17° 49′ to 25° 28′, increasing reqularly with decrease in ash content (range of ash content 3.6 to 0.87% by wt).

5883. PERREU, JEAN. **The heats of adsorption of methyl oxide and the heats of wetting of different liquids on activated charcoal.** *Compt. rend.* **229**, 195-7 (1949).—*C.A.* 43, 8835*e*.

The integral and differential heats of adsorption of $(CH_3)_2O$ on activated charcoal were given as a function of concn. of $(CH_3)_2O$ in the gas phase. The resulting curves resembled those for other gases except O_2 and were most similar to those for NH_3. The heats of wetting of activated charcoal at 15-16°C were given for H_2O, $n\text{-}C_7H_{16}$, CCl_4, C_6H_6, $C_6H_5CH_3$, $o\text{-}C_6H_4\text{-}(CH_3)_2$, $C_6H_5NH_2$, MeOH, EtOH, PrOH, BuOH, AmOH, glycol, glycerol, cyclohexanol, HCOOH, AcOH, AcOEt, and AcOAm. The values ranged from 25 to 34 cals with the exception of H_2O, glycerol, and cylohexanol, which had lower values.

5884. ZOCHER, H. AND GOLDSTEIN, D. **The wetting of vanadium pentoxide tactosol.** *Anais Assoc. quim. Brasil* **8**, 20-4(1949).—*C.A.* 45, 22*c*.

The prepn. and sepn. by gravity of V_2O_5 sol into a dil. optically isotropic fraction and a denser anisotropic fraction contg. oriented particles was described. The latter or "tactosol" phase showed irregular orientation on glass slides and very little if any on mica. Air bubbles orient the particles parallel to the interface, and metal fragments conc. the particles.

5885. ARON, YA. B. AND FRENKEL, YA. I. **Limitations of the validity of Neumann's rule for contact wetting angles.** *Zhur. Eksptl. Teoret. Fiz.* **20**, 453—7(1950).—*C.A.* 45, 8849*d*.

Exptl. measurements on H_2O on mica, H_2O on calcite, and Hg on glass showed a dependence of θ on the inclination α of the solid surface. With increasing α, at const. wt m of the liquid drop, θ increased at the top and decreased at the bottom of the drop, and the divergence increases with α. Even on a horizontal surface ($\alpha = 0°$), θ increased with m (for Hg on mica).

5886. BIDLOT, R. AND LEDENT, P. **Study of the wetting of coal dusts by aqueous solutions of wetting agents.** *Ann. mines* **139**, No. 4, 29-32 (1950).—*C.A.* 44, 10296*f*.

The time required to wet coal dust contg. 25% volatile matter was detd. for 0.02 to 2.0% aq. solns of the 5 com. wetting agents. The curve of surface tension vs. concn. of the addnl. agent was found to be similar to those previously detd. Lowering of the surface tension to approx. 35 dynes/cm appeared to be a necessary condition for complete wetting of the particles. A wetting speed of 12 mg/sec or greater was attained at 0.2% for one agent, at 0.5% for one, and at 2.0% for 3, while 2 agents showed speeds of only 3.0 and 3.5 mg/sec at 2.0%.

5887. DUMANSKIĬ, A. V. **Heats of wetting and hydrophily of disperse systems.** *Kolloid. Zhur.* **12**, 319-25 (1950).—*C.A.* 45, 927*e*.

The amt. A of "bound" H_2O could be calcd. from the heat of wetting (Q), from n, cryoscopy, dielec. const., and by freezing out; e.g., for H_2O "bound" by starch these methods gave $A = 0.31\text{-}0.36$ g/g. The ratio Q/A was independent of sorbent, being 73-80 cal/g for agar, starch, silica gel, clay, kaolin, Na stearate, and the insol. fraction of gelatin. The area of sorbent covered by 1 g of "bound" H_2O was $Q/116A$ cm^2 if Q was measured in ergs; 116 ergs was the total surface energy of 1 cm^2 H_2O.

5888. DUMANSKIĬ, A. V. AND OVCHARENKO, F. D. **Heats of wetting of Glukhovets kaolin and Chasov-Yar clay.** *Kolloid. Zhur.* **12**, 331-7 (1950).—*C.A.* 45, 1315*c*.

Kaolin and clay, when raw, had lower heats of wetting (Q) than when satd. with K^+. For K-kaolin and K-clay after drying at 110°C, Q was 1 and 6 cal, resp. If the thickness of the adsorbed H_2O layer was 3.5 A., the amt. (A) of H_2O "bound" by K-kaolin and K-clay was 1.3% and 7.8%, resp. From the neg. adsorption of sugar, A was 2 and 7%, resp. The specific surface of K-kaolin and K-clay, calcd. from Q, was 35 and 210 mm^2.

5889. HASEDA, TAIICHIRÔ; ÔTSUBO, AKIO, AND KANDA, EIZÔ. **Specific heat of amorphous state.** *Science Repts. Research Insts. Tôhoku Univ.* **Ser. A, 2**, 16-21(1950).—*C.A.* 45, 10029*d*.

A general model for supercooled liquids was proposed which involved the "ideal supercooled liquid," crystal nuclei, microcrystallites, and crystals. Inhomogeneities which appeared in the supercooled liquid were attributed to these nuclei and microcrystallites. In the amorphous state it was assumed that heat energy was absorbed in two ways, one by the kinetic portion and the other by the configurational portion. The former absorbed heat energy instantaneously, while the latter absorbed through a mol. relaxing process.

5890. HOWARD, FRANK L. AND CULBERTSON, J. L. **Some heats of wetting of unit surfaces.** *J. Am. Chem. Soc.* **72**, 1185-7(1950).—*C.A.* 44, 5202*e*.

Heats of wetting at 25°C were measured for the systems involving H_2O, CCl_4, or heptane as the wetting liquid and sphalerite, galena, fluorite, or quartz as the wetted solid, also for the systems sylvite-CCl_4 and sylvite-heptane. These heats of wetting were reduced to a unit-surface basis by means of the B.E.T. surface areas of the solid. The relative and abs. magnitudes of these heats of wetting showed evidence of chem. reaction rather than mere dipole interaction at some wetted surfaces.

5891. Il'in, B. V.; Kiselev, A. V.; Kiselev, V. F.; Likhacheva, O. A., and Shcherbakova, K. D. **Absolute heats of wetting of barium sulfate by water and by alcohols.** *Doklady Akad. Nauk. S. S. S. R.* **75**, 827-30 (1950).—*C.A.* **45**, 3232*i*.

Calorimetric detns. were made on 2 samples of $BaSO_4$, one of surface area 7 m^2/g, the other 9.7 m^2/g, outgassed at 400 and 300°C, resp. The exptl. values, at 20°C, were, on the smaller surface, H_2O 0.75 ± 0.02, MeOH 0.58_6 ± 0.005, BuOH 0.56 ± 0.03 cal/g; on the larger surface, H_2O 1.07 ± 0.03, MeOH 0.81_5 ± 0.005, EtOH 0.80 ± 0.01, PrOH 0.08 ± 0.01, BuOH 0.79 ± 0.02, $C_6H_{13}OH$ (at 50°C) 0.81_5 ± 0.01, $C_8H_{17}OH$ (at 50°C) 0.79 ± 0.01. The values for all the alcs. were practically identical. The data recalcd. for equal surface area were H_2O 455, alcs. 335-350 $ergs/cm^2$.

5892. Miller, John G.; Heinemann, Heinz, and McCarter, W.S.W. **Heat of wetting of activated bauxite and Attapulgus clay.** *Ind. Eng. Chem.* **42**, 151-3(1950).—*C.A.* **44**, 2821*d*.

The heats of wetting were detd. of bauxite and fuller's earth (Attapulgus clay) by water, motor gasoline, benzene, and alc. The natural clay was dried raw, dried below 450°F, at 450°C, 550°C, and 900°C, and extruded clay at 450° and 900°C. Arkansas bauxite was dried at 700° and 1200°C; South American bauxite was dried raw, at 700° and 1200°C. The sp heats of wetting of Arkansas bauxite, Attapulgus clay, charcoal, and silica gel were detd. with methyl, ethyl, Pr, Bu, isobutyl, and tert-Bu alcs. Data were also obtained for bauxite and clay with acetone, propinaldehyde, propionic acid, EtOAc, bromobenzene, aniline, $PhNO_2$, benezene, furan, cumene, butane, C_8 gasoline fraction, pyridine, thiophene, and Bu mercaptan. Change of activation of the clay had a marked effect on the surface area.

5893. Moser, Frank. **Approximating the attractive forces of adhesion for glass and other surfaces.** *ASTM Bull.* No. **169**, 62-6(1950).—*C.A.* **45**, 419*g*.

Contact-angle measurements were used to predict polarity and adhesion. Compatibility between an adhesive and a surface was assumed if approx. the same angles were obtained for the adhesive-coated surface as for a clean surface. Compatibility and subsequent adhesion of materials could be obtained by using a heterogeneous adhesive contg. both polar and nonpolar functional groups which were compatible with the dissimilar materials.

5894. Neudert, W. **A spreading test for drops for characterizing wetting.** *Kolloid-Z.* **118**, 113-14(1950).—*C.A.* **45**, 1406*a*.

Since wetting angles were greatly affected by uncontrollable factors, the calcn. of spreading potentials from such angles and surface tension was not reliable. However, wettability could be characterized by the consts. *A*, *B*, *C* in the equation $R = Av^B — Cv$, where *R* was the measured radius of drops of known vol., *v*, on a solid surface.

5895. Quarterman, Lloyd A. and Primak, Wm. L. **The capillary rise, contact angle, and surface tension of potassium.** *J. Am. Chem. Soc.* **72**, 3035-7(1950).—*C.A.* **44**, 8720*f*.

A sample of pure K was prepd. and distd. into a Pyrex glass surface-tension app. that was baked out in high vacuum and K vapor. The K wetted the glass with a small contact angle and exhibited a capillary rise that would have required a surface tension of 86 dynes/cm if the contact angle were 0°. On standing the glass surface altered, causing the contact angle to increase. Contact angles were measured by two methods.

5896. Schwarz, F. **The heat of wetting of clays and fuller's earths.** *Sprechsaal* **82**, 24-5 (1950).—*C.A.* **44**, 9650*g*.

The heats of wetting of 5 different clays, fuller's earths, and kaolins, dried at temps. between room temp. and 530°C, were detd. Large differences were found between kaolins and fuller's earths and also between lightly and strongly heated materials. Loss and pickup of H_2O when heated to several temps. between 110° and 950° C were given.

5897. Tachikawa, Shoichiro and Hosho, Hideo. **The wettability of coal.** *J. Fuel Soc. Japan* **29**, 2-7(1950).—*C.A.* **46**, 3236*e*.

In order to clarify the wettability of various coals (38 samples) and cokes (5 samples), two series of expts. for calcg. the work of wetting with H_2O and C_6H_6 were carried out. The wettability increased with the ash content and brown coals or anthracites were more wettable than bituminous coals which gave indefinite values. The calorimeter method was used to det. the relationship between the heat of wetting and the time of drying as well as the ash content of coal and coke. The heat of wetting was proportional to some powers of drying time.

5898. Wahba, Maurice. **Moisture relations of cellulose to heats of wetting of partially saturated viscose rayon and standard cellulose in water.** *J. Phys. & Colloid Chem.* **54**, 1148-60 (1950).—*C.A.* **45**, 3591*c*.

The heats of wetting of partially satd. samples of standard cellulose and viscose rayon (regenerated cellulose) were detd. in water in the absence of air at 30°C. Adsorption isotherms at 30°C with H_2O vapor were also measured on these 2 adsorbents. The ratio of the values for adsorption, heats of wetting, and heats of adsorption for the 2 cellulose samples were not const. when compared at const. relative humidities. The differential entropy for the transformation of the liquid into the adsorbed phase was neg. throughout the entire range of relative pressures used in the adsorption measurements.

5899. Wahba, Maurice and Nashed, Shawky. **Change with temperature of the heat of wetting of dry cellulose in water, and its bearing on the specific heat of the adsorbed water and of the swollen cellulose.** *Nature* **166**, 998(1950).—*C.A.* **45**, 5401*e*.

The exptl. results showed a linear decrease in the heat of wetting of dry cellulose between 0 and

40°C equal to about 0.042 cal/degree/g cellulose. The heat of wetting represented the decrease in the heat content of the system ($-\Delta H$), and the change of this with temp. represented the difference between the heat capacity of the system before and after wetting ($d(\Delta H)/dT = \Delta C_p$). The heat capacity of the system was thus shown to be increased by wetting.

5900. Wolf, F. and Sauerwald, F. **Surface-tension measurements. VI. Experiments utilizing the bubble-pressure method in the case of poor-wetting.** *Kolloid-Z.* **118**, 1-10(1950).—*C.A.* **45**, 409*h*.

Even with capillaries that were not well wet with a liquid, correct surface-tension values were obtained by the max.-bubble-pressure method if allowance was made for the effective diam. of the orifice from which the bubble parted. Observations were made with water in paraffin-, ceresin-, and silicone-coated capillaries (the silicone being dichlorodimethyl-silane) and with silicone oil in an ice capillary for poor wetting combinations. Combinations with good wetting were CH_3OH, $CHBr_3$, $C_2H_2Br_4$, $BaHgI_4$ soln., and Tl formate-malonate soln. in glass and silicone-coated glass capillaries.

5901. Benedicks, Carl. **The relation of the surface tension of a liquid to the wetting effect.** *Compt. rend.* **232**, 2435-7(1951).—*C.A.* **45**, 8849*b*.

The wetting effect was an alternation of the resistance of a solid to rupture when a liquid wets it; the effect was neg. (decreased resistance) for most liquids but pos. for some. Solids studied included hardened steel, plate glass, marble, and sugar; liquids included hydrocarbons, Et_2O, glycerol, glycol, EtOH, CCl_4, H_2O, and aq. NaOH. The neg. wetting effect on a given solid was a linear function of the surface tension of normal liquids.

5902. Berkowitz, N. and Schein, H.G. **Heats of wetting and the spontaneous ignition of coal.** *Fuel* **30**, 94-6(1951).—*C.A.* **45**, 4426*c*.

Some coals (especially certain lignites) had heats of wetting sufficient to raise the temp. of coal up to a max. of 36°C after thorough wetting of previously dry coal; this greatly increased the rate of oxidation of the coal and sometimes caused a rise to dangerous temps., even though the S content of the coal was low. Ignition may occur even in medium and small piles if they were first partially dried by exposure to dry weather and subsequently rapidly wetted. Fires have occurred when dry coal was dumped on water-logged ground, or on relatively wet coal.

5903. Chatterji, A.C. and Srivastava, R. D. **Heat of wetting of animal charcoal by different solvents.** *J. Indian Chem. Soc.* **28**, 547-50(1951).—*C.A.* **46**, 5398*g*.

The heats of wetting were detd. of MeOH, EtOH, PrOH, BuOH, acetone, AcOH, C_6H_6, $C_6H_5CH_3$, C_6H_6Cl, C_6H_{14}, $CHCl_3$, and CCl_4, of 1-5% solns. of $C_{10}H_8$, and adsorption of C_6H_5COOH, *o*-nitrobenzoic acid, phthalic acid, $C_{10}H_8$, and acenaphthene from 0.2 *M* solns. on animal charcoal, —60 mesh, free of Cl and PO_4. The adsorption of acids decreased as the heat of wetting by the solvent increased. The adsorption of $C_{10}H_8$ and acenaphthene was proportional to the heat of wetting.

5904. Dumanskiĭ, A. V. and Nekryach, E. F. **Heats of wetting and the hydrophily of flour.** *Kolloid. Zhur.* **13**, 20-6(1951).—*C.A.* **45**, 3702*i*.

Flour was kept over *x*% H_2SO_4 until equil.; then the water content *y* of the flour was 28-33%, 12-14%, 11-13%, and 4.6-5.0% at $x = 5$, 20, 60, and 90%. The differences between *y* of wheat flour (3 sorts), rye (2 sorts), barley, and oat flour were insignificant. The heat of wetting decreased when *y* increased; it was 22-28, 7.5-9.9, 4.9-5.2, and 0.4-0.7 cal/g at $y = 0$, 10, 14, and 30%.

5905. Gruntfest, I. J. **The mechanism of the wetting of textiles.** *Textile Research J.* **21**, 861-6 (1951).—*C.A.* **46**, 1771^f.

The wetting process applied to textiles could be resolved into two independent elements, often competitive with one another. One, the escape of occluded gases, was essentially mech., and the other rate of advance of the liquid phase into the mass to be wet was a physicochem. problem. The rates of surface-tension lowering appeared to correlate well with wetting-agent performance.

5906. Leadbeater, C. J. **The surface energies of metals and alloys.** *Selected Govt. Research Repts.* (London) (Powder Metallurgy) **9**, 1-21 (1951).—*C.A.* **46**, 7838*d*.

Five different methods of detg. surface energy were used. The max.-bubble-pressure method appeared to be the most reliable, but no purpose was served in making too fine a comparison between this and other methods, since differences up to 10% for Sb was found in the results of 3 investigators who used the bubble method. A table was given of the surface energies of Bi, Zn, Cd, Sb, Sn, Pb, Cu, Ag, Au, Hg, and Al. The problem of the theoretical derivation of surface energies was considered on the basis of the binding energy and electronic theory of metals.

5907. Morrison, J. A. and Drain, L. E. **Heat capacity of multimolecular layers of adsorbed argon.** *J. Chem. Phys.* **19**, 1063(1951).—*C.A.* **46**, 1839*d*.

Heat-capacity detns. of A adsorbed on TiO_2 were extended to the multimol. region in which the properties of the adsorbate approached those of the bulk substance. The heat capacity was a continuous function of the temp. with a max. a little below the normal m.p. The max. was at a lower temp. and was less pronounced, the smaller was the amt. of substance adsorbed. The maxima indicated rearrangement in the adsorbed film equiv. to fusion in the bulk substance. The onset of bulk properties accured at concns. between 1.6 and 2.9 V_m ($V_m = 755$ cc. at standard conditions). The partial molar heat capacities of adsorbed A were also evaluated for various concns.

5908. Plaksin, I. N. and Vladimirov, S. I. **Change in the wetting of platinum under the influence of various gases.** *Doklady Akad. Nauk. S.S.S.R.* **78**, 933-6(1951).—*C.A.* **47**, 23*d*.

The measurement of the contact angle at the tri-phase boundary in the system water-air-metal was used. Interaction of the gas with the Pt surface was continued for a period of 3 hrs; the contact angle was measured every 15 min. In the case of the action of O_2 a considerable increase of the hydrophobicity was noted. Nitrogen, A, and CO_2 gave identical curves of wettability. The activity of O_2 dissolved in water was also tested. The aq. medium contg. dissolved O_2 had a greater effect on the Pt surface than did gaseous O_2. The effect of H_2 on Pt surfaces was tested and found negligible.

5909. ROBERT, LOUIS. **Relation between the heat of wetting and the adsorability of liquid organic compounds on solid surfaces.** *Compt. rend.* **233**, 1103-4(1951).—*C.A.* **46**, 3366*f*.

A series of 15 org. compds. arranged in order of increasing heats of wetting on silica gel or Al_2O_3 gel was the same as that of degree of adsorbability. The heats were detd. by heating the powd. solid *in vacuo* at 110°C for 1 hr, sealing it in a glass ampule, breaking the ampule in the liquid, and measuring the temp. rise. For C_6H_6 and hexane, the heats of wetting were of the same order of magniture on silica or Al_2O_3 gel, but for EtOH the value was 2½ times that on Al_2O_3 and for H_2O 3 times.

5910. SCHEIN, H. G. **The spontaneous heating of coals.** *Brennstoff-Chem.* **32**, 298-301(1951).—*C.A.* **46**, 706*a*.

The initial heating of coal was due to the heat of wetting with water, rather than to the adsorption of O_2. Data were presented for the heat of wetting at 25°C and 40°C of a variety of coals. However, heating due to the initial heat of wetting may raise the temp. sufficiently so that the rate of oxidation of the coal was very greatly increased, so that further heating occurred, leading to ignition of the coal.

5911. SCHULTZE, K. **Hysteresis of contact lines and angles.** *Kolloid-Z.* **122**, 43-50(1951).—*C.A.* 45, 8322*d*.

The advantages of the B-no. method over that of contact angles in the choice of drop size for the detn. of contact angles were pointed out. The angle for a supposedly nonwetting system, paraffin, was only about 108°C. The B-no. method on the other hand gave a whole scale of degrees of wetting, approaching tne limit. Since the B-nos. indicated that paraffins were slightly wetted by H_2O, treatment was caused by a roughening of the surface and a consequently increased no. of accessible sensitive regions. This was demonstrated also for glass.

5912. SCHULTZE, K. **Wettability and methods for its measurement.** *Kolloid-Z.* **121**, 57-65 (1951).—*C.A.* **45**, 6897*e*.

All methods were based on the gradual transfer of a drop of water, the size of which was reproducible, to the surface to be measured. The no. of contacts required was a measure of the wettability of the surface and was designated as the B no. The wt of the water transferred at each contact was another measure of the wettability. A third measure of wettability was the force, expressed in mg, required to lift the Pt ring from the surface. Differences of paraffin surfaces treated in various ways were given.

5913. TAKAGI, SHUNSUKE. **Thermodynamics of liquids in small drops and in a meniscus. Heats of wetting and dilution.** *Rept. Inst. Sci. Technol., Univ. Tokyo* **5**, 245-52(1951).—*C.A.* **46**, 5920*c*.

Thermodynamic properties of liquids in small drops were computed by considering the surface area as one of the independent variables. The heat of vaporization from the meniscus in a capillary was also derived as a function of the capillary. The Clausius-Clapeyron formula was extended to the case where surface energy had to be taken into consideration. Heats of wetting and diln. were $-RT \log (p_0/p)$, where p_0 was the vapor pressure of pure water at temp. T, and p that of the sample to be considered.

5914. AZAROV, K. P. **Wetting of solids by silicate melts.** *Doklady Akad. Nauk. S.S.S.R.* **82**, 79-82 (1952).—*C.A.* **47**, 4169*c*.

Cylindrical shapes pressed from a powd. glass with and without various admixts., were heated to 950°C on different solid supports in a furnace, cooled rapidly, and outer angle of wetting projected magnified on a screen. Wetting of CaO, Al_2O_3, TiO_2, and quartz by the glass melt, without admixts., improved with an increase in the electronegativity of the cations of the solid. Wetting of acid solids (SiO_2, TiO_2, Fe_2O_3, Cr_2O_3) by the glass melt contg. oxides or carbonates of the metals of groups I and II were much better than wetting of basic solids (CaO and Al_2O_3). In general, as the acidity of the solid increased, wetting improved; as basicity increased, wetting decreased. With an increase in ion radius and a decrease in electronegativity of cations of group I, wetting of acid solids decreased and that of basic solids improved; for cations of group II the results were the reverse.

5915. BERKOWITZ, N. AND SCHEIN, H. G. **Inner surface of coal.** *Fuel* **31**, 130-2 (1952).—*C.A.* **46**, 1733*e*.

It was not valid to compare adsorption expts. on coal at 25°C with those made at—190°C as there was reason to think that at the latter temp. the pore surface would be much less accessible. While the high values of the heat of wetting derived from MeOH adsorption isotherms were almost certainly affected by swelling of the coal, the internal evidence of the data suggested that the available surface was not very much smaller.

5916. BERKOWITZ, N. AND SCHEIN, H. G. **Some aspects of the ultrafine structure of lignites.** *Fuel* **31**, 19-32 (1952).—*C.A.* **46**, 1734*i*.

Heat of wetting measurements with a series of Southern Hemisphere lignites, not previously systematically investigated, indicated that lignites might possess surface areas ranging up to about 380 m^2 per g (dry, ash-free). The individual measurements of the heat of wetting were in excellent agreement with results obtained from concurrent adsorption studies. Swelling of the coal substance in MeOH during adsorption or in the course of a heat of wetting detn. was not regarded as invalidating this conclusion.

5917. Good, Robert J. **A thermodynamic derivation of Wenzel's modification of Young's equation for contact angles; together with a theory of hysteresis.** *J. Am. Chem. Soc.* **74**, 5041-2 (1952).—*C.A.* **47**, 1460*g*.

A theory was presented for the hysteresis of contact angles. The driving force toward the attainment of an equil. contact angle was equal to the surface tension of the liquid times the deviation of the cosine of the contact angle from its equil. value. It was shown that this may be equated to the "contortional energy" F_c that the drop must have in order for its edge to surmount a ridge.

5918. Il'in, B. V. and Kiselev, V. F. **Absolute heats of wetting of strontium, lead, and barium sulfates, with water and with alcohols.** *Doklady Akad. Nauk S.S.S.R.* **82**, 85-7 (1952).—*C.A.* **46**, 4901*e*.

The heats of wetting Q were detd. by calorimetry on $SrSO_4$ and $PbSO_4$ preliminarily heated to a temp. low enough (200°C) to guarantee against sintering. B.E.T. surface areas were: $SrSO_4$ 4.5, $PbSO_4$ 2.3 m²/g, comparing with 5.3 and 2.4 by electron-microscope photography. The mean values of Q, with H_2O, MeOH, and $C_8H_{17}OH$, were, for $SrSO_4$, 0.34 ±0.01, 0.22 ± 0.005, and 0.23 ± 0.02, and for $PbSO_4$, 0.28 ± 0.01, 0.17 ± 0.01, and 0.17 ±0.02 cal/g. The abs. values of Q, per unit surface area, were for $SrSO_4$, 315, 200, and 215, and for $PbSO_4$, 490, 320, and 310 ergs/cm².

5919. Jura, Geo. and Hill, Terrell L. **Thermodynamic functions of adsorbed molecules from heats of immersion.** *J. Am. Chem. Soc.* **74**, 1598 (1952).—*C.A.* **47**, 5241*e*.

5920. Kiselev, A. V.; Krasil'nikov, K. G.; Pokrovskiĭ, N. L.; Avgul, N. N. Mikos; Dzhigit, O. M., and Shcherbakova, K. D. **Variation of the heat of wetting of silica gel by water with surface coverage.** *Zhur. Fiz. Khim.* **26**, 986-97 (1952).—*C.A.* **47**, 5786*d*.

The heat of adsorption of water on a silica gel with homogeneous pore-size distribution (40 A.), a surface area of 420 m²/g, and pore vol. equal to 0.90 ml/g, prepd. by hydrolysis of $SiCl_4$, was measured calorimetrically. An adsorption isotherm at 25°C was also taken. The differential heat curve dropped steeply at first from an initial value of about 15 kcal/mole, then more slowly and linearly until capillary condensation set in, at which stage the curve sloped down still more slowly. The abs. heat of wetting is 215 ergs/cm².

5921. Landt, E. and Gettmann, H. **Heat of wetting as characteristic value of powders.** *Naturwissenschaften* **39**, 279-80 (1952).—*C.A.* **47**, 6241*d*.

The heat of wetting of a pulverized material was detd. first with the material *in vacuo* before it was brought into contact with the completely wetting fluid, then with the material in equil. with increasing vapor pressure p of the fluid prior to contact with liquid phase. Thus, an isotherm of B, heat of wetting, vs. p was obtained. Exptl. values for the system of active charcoal and C_6H_6 were given.

5922. Mongar, J. L. and Wassermann, A. **Heat effects accompanying the absorption of simple electrolytes by fully-swollen alginate and cellulose gels.** *J. Chem. Soc.* **1952**, 510-13.—*C.A.* **46**, 4349*g*.

A *microcalorimeter* was described that enabled a detn. of small heat effects accompanying the reaction of fully-swollen gels with solns. of electrolytes. The heats of swelling of gels in H_2O and in $CaCl_2$ and NaCl solns. were detd. For $CaCl_2$, the heat of swelling was neg.; for NaCl it was pos.

5923. Neudert, W. **Mechanics of deformation at interfaces (spreading experiments).** *Kolloid-Z.* **126**, 104-8 (1952).—*C.A.* **46**, 9934*c*.

Data were given for the drop radius r of liquids on polished glass (in one case on a liquid) surface *vs.* the wt of the drop g. A parameter K was detd. which was a direct measure of the wetting power of the liquid. The equation was $r = R(1 - e^{-g/\Gamma}) - Kg$ in which K, R, and Γ were consts. for a given combination of spreading liquid and supporting surface. With increasing concn. of a wetting agent (BHF VII) on a glass plate K varied thus: 5.6 at 0.0%; 7.1 at 0.1%; 19.9 at 1.0%; and 15.9 at 10.0%.

5924. Neudert, Walter; Röpke, H., and Reitstötter, J. **Effect of surface properties of solid materials on the formation of the angle at the solid/liquid boundary (wetting number and working number).** *Kolloid-Z.* **125**, 35-40 (1952).—*C.A.* **47**, 5762*h*.

Angles of wetting (θ) were detd. with a microscope for drops of triolein and sesame oil on unworked and polished glass; stainless steel in unfinished, heat-treated, and polished states; Cu; and Ag-coated Cu. The observed angles increased with time, 15 min. being usually sufficient for reaching a steady state, and varied with the roughness of the surfaces. The concept of wetting no. (Z) was introduced; $Z = 1000(1 - \cos\theta)$, varying from 0 for complete wetting to 2000 for complete nonwetting ($\cos\theta = -1$).

5925. Puri, Balwant Rai; Lakhanpal, M. L., and Varma, Balvir. **Adsorption of vapors by charcoal.** *J. Indian Chem. Soc.* **29**, 841-5 (1952).—*C.A.* **47**, 7285*d*.

The adsorptions and relative wetting powers of H_2O, MeOH, EtOH, acetone, and C_6H_6 vapors on 5 types of charcoal were detd. at 20°C. The approx. equal vols. adsorbed at different relative vapor pressures, which correspond to the same capillary size, support the capillary condensation hypothesis. Minor variations in the vols. adsorbed are attributed to differences in the relative wetting powers of the compds.

5926. Röpke, H.; Neudert, Walter, and Reitstötter, J. **Effect of surface treatment of solids on the solid-liquid contact angle.** *Z. Elektrochem.* **56**, 639-43 (1952).—*C.A.* **47**, 3653*c*.

The contact angles of triolein and sesame oil on glass, stainless steel, and Cu were measured by means of a microscope for different conditions of surface prepn. (etched, polished, fired, etc.).

Differences were observed that suggest the definition of empirical indexes characterizing the spreading tendency of a liquid on a solid and also the degree of surface roughness. The latter improved wetting.

5927. STOWE, VERNON M. **Activated alumina. Heat of wetting by water. Heat of wetting by hydrocarbons.** *J. Phys. Chem.* 56, 484-6; 487-9 (1952).—*C.A.* 46, 7866*c*.

The heat of wetting on adsorption of a monolayer of H_2O on com. activated Al_2O_3 was measd. by a differential method. The value was in the range 150-190 cal/g H_2O and did not vary greatly with different grades of Al_2O_3. Measurements were extended to wetting by n-C_7H_{16}, Me_3CCHMe_2, toluene, and methylcyclohexane. The heat evolution was least for the paraffins and greatest for the naphthalene. Activated Al_2O_3 showed preferential adsorption for H_2O but no preferential adsorption for any specific type of hydrocarbon.

5928. WOLLENBERG, H. G. **The heats of wetting of hide substance between 0° and 60°C.** *J. Soc. Leather Trades' Chemists* 36, 172-81 (1952).—*C.A.* 47, 1416*i*.

Heats of wetting were detd. calorimetrically for limed, isoelectric, degreased collagen; green, and salted green, degreased pelts in the normal and shrunken states; and powd. gelatin at 0°, 20°, 40°, and 60°C. The results varied from 49 cal per g at 0° to 16.5 cal per g at 60°C for normal pelt, and from 38 cal per g at 0° to 16 cal per g at 60°C for shrunken pelt. The lower values for shrunken pelt resulted from the folding of polypeptide chains upon themselves during the shrinking process, causing a reduction in active sorption sites.

5929. YAGISHITA, HIDEHARU. **Coking IV. Structural analysis of coal by heat of wetting.** *Misc. Repts. Research Inst. Nat. Resources No.* 27, 69-79 (1952).—*C.A.* 47, 2960*a*.

Heats of wetting were more varied and lower in coals of low coalification, such as lignite, than in high coking coals with more regular structure; exceptionally high and varied in anthracite. Coal seemed to be carbonized as follows: at 400°C the mols. developed into cryst. macromols. in the amorphous region by accelerated micro-Brownian movement, which slide against one another in unit segments, as the coal melted. Low polymers then began to decomp., decreasing the cryst. region which increased about 600°C with the aromatic condensation.

5930. BANERJI, B. K. **The theory of contact angles.** *Mining Mag.* 88, 23-5 (1953).—*C.A.* 47, 3652*i*.

The total energy of the system was attributed mainly to the mutual van der Waals forces of attraction of the normal hydrocarbon chains and the fact that more dipoles were enabled to come in direct contact with the solid surface; any forces of repulsion present were considered negligible. After a collector was adsorbed, the polar parts did not contribute much to the intermol. forces, and the van der Waals forces between the hydrocarbon chains increased with chain length. From $(1+\cos\theta)/(1-\cos\theta)=C/f$ (where C was a const., f was the attractive force, and θ was the angle at a point of triple contact measured through the liquid phase between the solid surface and the tangent to the air-liquid interface) f was calcd. for each hydrocarbon chain of the satd. homologous series, by the successive addns. of 0.1159 C for each CH_2 group, and from these values the corresponding contact angles were calcd. There was very close agreement in a no. of cases with exptl. values.

5931. CALVET, ÉDOUARD; BOIVINET, PIERRE; NOËL, MICHELINE; THIBON, HONORÉ; MAILLARD, ALBERT, AND TERTIAN, ROBERT. **Alumina gels.** *Bull. soc. chim. France* 1953, 99-108.—*C.A.* 47, 3655*h*.

Gels prepd. at pH less than 6 were amorphous. At pH 9 the gels were α-boehmite. The amts. of SO_4^{--}, Cl^-, and NO_3^- adsorbed by the gel when the corresponding acids were added to Na aluminate were detd. In microcalorimetric measurements, it was found that the temp. at which the gel was dried, the adsorbed anion content, and the degree of crystallinity affected the heat of wetting of the gel in 4 N NaOH. The temp. effect was attributed to the irreversible dehydration of the gel, and confirmed by infrared-spectrum studies of three amorphous gels dried at 50°C. Only OH^- was detected in these gels, H_2O being absent.

5932. DENNIS, KENT S.; PACE, E. L., AND BAUGHMAN, CHARLES S. **Heat capacities of multimolecular layers of methane adsorbed on rutile.** *J. Am. Chem. Soc.* 75, 3269-70 (1953).—*C.A.* 48, 423*d*.

The multilayer heat capacities were investigated of CH_4 adsorbed on rutile in 1.0 to 5.8 monolayers over a temp. range of 72-116°K; 0.03106 mole constituted a monolayer. Above 1 monolayer, the adsorbed gas exhibited bulk properties. The max. in the curves of heat capacity vs. abs. temp. were interpreted as indicating a rearrangement in the adsorbed film which correspond to melting in the bulk phase. For A, bulk properties began between 1.6 and 2.9 monolayers; for CH_4 they began between about 3 and 4 monolayers.

5933. FOWKES, FREDERICK M. **Role of surface-active agents in wetting.** *J. Phys. Chem.* 57, 98-103 (1953).—*C.A.* 47, 4691*e*.

The relation between sinking time and wetting agent depended on the extent of adsorption during penetration. For strongly adsorbed substances such as Triton X-100 and Nonic 218, the rate of wetting was affected by the extent of diffusion of agent from the bulk soln. to the surface. Sinking times were related to surface tension by log $t_s=A+B\gamma$ (where t_s was the sinking time and γ was the surface tension which was concn. dependent and was related to the contact angle). Wetting properties could be correlated with the mol. structure of the wetting agent by a knowledge of the crit. concn. needed for micelle formation.

Chapter IV. THEORIES OF ADSORPTION

The literature on this phase of the subject has been grouped into four sections: chemisorption from the gaseous phase, physical adsorption of gases, capillary condensation of gases and other empirical theories, and adsorption from solutions. The first two sections are the primary categories of adsorption processes and these contain much of the basic work which has been published. About 60 percent of the literature for 1943–53 in Chapter IV is in these two sections.

The names of many scientists, who have been active in the field of adsorption phenomena, are associated with isotherm equations. Among these are the relationships of Gibbs, Langmuir, Freundlich, Polanyi, Brunauer, Emmett, Teller, Harkins, Jura, and Halsey. With the exception of the Gibbs equation, the development of these expressions have involved special models of adsorption which have been very useful in guiding new researches. It was not practical, however, to arrange the investigations according to these names. The Subject Index can be used to locate a number of papers specifically concerned with these isotherm equations.

One of the important developments in the physical adsorption of gases during the last decade had been the evaluation of surface area. The success has been due largely to the development of the Brunauer, Emmett and Teller[4] theory of multimolecular adsorption and to the constructive critical work which followed. The isotherm equations developed from this model are usually valid for surface coverages in the neighborhood of about a monolayer. They are not valid, in general, for coverages corresponding to equilibra at lower or at higher pressures. Nevertheless, the surface area determined from a selected part of the isotherm has been so helpful that it warrants the use of the familiar abbreviation B. E. T. area.

The present day requisites of a theory of adsorption are far more exacting than formerly. It was once sufficient to develop merely an algebraic equation relating the extent of adsorption to some parameter such as pressure, temperature, or volume. In present day investigations it is necessary, in addition, to calculate the heat, entropy, and free-energy quantities and, furthermore, to relate these to the fundamental constants associated with intermolecular forces.

The literature on chemisorption is extensive, varied, and puzzling. Dealing with primary valence forces as it does, it may be expected that the phenomena would have all the complications of chemical reactions. In addition, there are complications in that the behavior of the surface is influenced strongly by sample preparation, the presence of large steric factors, and a critical dependence on diffusion processes.

Theories of adsorption from solutions have generally evolved from an empirical point of view. The solid itself has usually been considered to be the adsorbent, but it is more realistic to associate the adsorption with the interface between solid and solution rather than with just one of the components of the system. Although no simple relationship can be expected between adsorbability and the chemical and physical properties of molecules, it appears possible to design the experimental procedures so as to expedite the test of various concepts and theories. In this connection Tiselius and his coworkers have been able to introduce arrangements for chromatographic analysis which have greatly aided theoretical interpretations.

The fundamental theory of ion exchange in the batch test has not progressed very far. Several investigators have pointed out that the exchange resin phase is essentially a concentrated electrolyte solution. The laws governing the distribution of ions between the solution and the ion exchanger cannot, therefore, be expected to develop further than has the general theory of concentrated electrolytic solutions. In the column technique of ion exchange definite progress has been made. The general behavior of an ion-exchange packing is similar to a chromatographic column, and theory has been developed of value to the interpretation of break-through curves, elution curves, and exchange-capacity determinations. It is a fact, however, that the empirical applications are far in front of theoretical interpretations.

---

[4] J. Am. Chem. Soc. 60, 309–19 (1938).

IV-1. Chemisorption From the Gaseous Phase

5934. Calvet, Édouard and Izac, Henri. **Calorimetric study of the adsorption of acetone by the nitrocelluloses.** *Compt. rend. trav. faculté sci. Marseille* **1**, 4-6 (1941).

The nitrocellulose contained 14% N. The heat liberated was proportional to the wt of acetone adsorbed and was 3900 g cal per mole of acetone. The thermal effect was the same for the first adsorbed layers which satd. the exterior of the cotton as for the last which penetrated into the structure.

5935. Goldfeld, Yu. M. and Kobozev, N. I. **Experimental study of the role of the action of forces in the adsorption process. I. Adsorption equilibrium.** *J. Phys. Chem.* (U.S.S.R.) **15**, 257-74 (1941).—*C.A.* **38**, 4481⁶.

Adsorption isotherms were detd. for CO, H_2, C_2H_4 and C_3H_6 on Cu, and NH_3 on Fe. With increased satn. of the surface a systematic departure from the Langmuir equation appeared. The adsorption of CO on Cu was affected by poisoning with CN. The deviations in question were strengthened by the poisoning. Recrystn. of the Cu effected a marked decrease in adsorptive capacity, but led to no greater deviations from the Langmuir isotherm and likewise had little effect on the adsorption coeff. The observed behavior was discussed on the assumption of intermol. repulsive forces. In the region of small surface concns. the energy of the adsorptive binding was a linear function of conc.

5936. Roginskiĭ, S. Z. **Theory of preparation of catalysts. The role of the free energy of the processes of preparation.** *J. Phys. Chem.* (U.S.S.R.) **15**, 708-30 (1941).—*C.A.* **37**, 821⁴.

The active "points" were considered as points of "supersatn." with respect to free energy. Four types of such "points" were considered: a definitely distinct phase, local or general structural variations of a given phase, anomalous chem. compn. of a phase and, finally, the degree of dispersion of a phase. The free energy of such active centers and of the formation of such centers was discussed essentially according to Gibbs' technique.

5937. Taradoire, F. **The role of moisture in the reaction of solid substances.** *Chimie & industrie* **45**, 334-7 (1941).—*C.A.* **38**, 6168⁸.

Sorbed H_2O created a surface film which adhered to other matter in contact and caused double decompn. Presence of H_2O vapor and stirring may lead to many solid reactions even at room temp. Corrosion, or the formation of unstable or dangerous products, often resulted.

5938. Antropoff, A. v. **The adsorption of gases at pressures varying from very low up to very high values. I. Mathematical analysis of the equations for ideal absolute and differential adsorption.** *Kolloid-Z.* **98**, 249-57 (1942).—*C.A.* **37**, 4949⁸.

A distinction was made between abs. and differential adsorption. The first referred to the total mass of gas adsorbed in a space with dimensions detd. by the range of operative mol. forces. The second one referred to the excess over the amt. normally present in this vol.

5939. Frank-Kamenetskiĭ, D. A. **Activation in heterogeneous reactions.** *Depovidi Akad. Nauk U.R.S.R., Physico-Chem. and Math. Sci. Sect.* **1942**, No. 1-2, 55-9 (in Russian, 59, in English, 60).—*C.A.* **38**, 677².

If the reaction started at the moment when the gas mols. hit the solid surface, the activation took place in the gas phase. The energy of activation did not depend in this case on the specific properties of the surface, or on its energy and kinetic characteristics. On the other hand, if adsorbed mols. participated in the reaction the activation took place on the surface. In this case the surface energy may participate in the activation even though the mechanism was not clear, and the kinetics of the reaction depended on the nonuniformity of the surface. The theories and discussion presented were illustrated with the reaction of CO_2 with carbon.

5940. Hashiguchi, Ryukichi. **Relation between activation energy of recrystallization and that of self-diffusion in a metal.** *Proc. Phys. Math. Soc. Japan* **24**, 270 (1942).—*C.A.* **41**, 6099*f*.

Activation energy of recrystn. of pure Cu was plotted against the degree of cold-working, the former being calcd. from the data of Karnop and Sachs. The activation energy of recrystn. tends to that of self-diffusion at the zero of cold-working degree.

5941. Havinga, E. **Chemical reactions in unimolecular films.** *Chem. Weekblad* **39**, 266-71 (1942).—*C.A.* **37**, 4950⁸.

A survey of methods of investigation and of results.

5942. Kantarovich, B. V. **Heterogeneous process in a burning layer of carbon particles.** *J. Tech. Phys.* (U.S.S.R.) **12**, 640-6 (1942).—*C.A.* **37**, 4225⁸.

The curves for the distribution of oxygen in a burning layer of carbon particles for different periods were constructed math.

5943. Karve, D. D. **Reaction velocity in heterogeneous liquid-liquid systems.** *J. Univ. Bombay* **10**, Pt. 5, 159-66 (1942).—*C.A.* **37**, 562⁹.

Neither the chemical nor the diffusion process was the sole determining factor of the velocity of heterogeneous reactions.

5944. Miller, A. R. **The number of configurations of a coöperative assembly.** *Proc. Cambridge Phil. Soc.* **38**, 109-24 (1942); 42, 303-10 (1946).—*C.A.* **36**, 1827²; **41**, 1521*e*.

Formulas were derived for the no. of configurations of particles on a two-dimensional and three-dimensional lattice when each particle (a) occupied two closest neighboring sites and (b) consisted of 3 groups that occupied 3 sites on the lattice in such a way that adjacent groups in the mol. occupied closest neighboring sites on the lattice. Bethe's method was used to det. the equil. conditions of the corresponding order-disorder problem and the no. of configurations detd. from these equil. conditions. The no. of configurations of mixts. of dimer and single mols., of trimer and single mols., and of trimer and dimer mols. was examd. by using the Bethe technique when there might be some vacant sites.

5945. DAMKÖHLER, GERHARD AND EDSE, RUDOLF. **State of motion of adsorbed molecules when the Langmuir isotherm is valid.** *Z. physik. Chem.* **B53**, 117-23 (1943).—*C.A.* **37**, 6186[4].

As the adsorption force increased, the value of b_0 in the Langmuir adsorption isotherm decreased. The value of 10^{-7} for b_0 found with CO in the catalytic oxidation of CO on CuO by Schwab and Drikos indicated a high mobility in the adsorbed phase with 2 to 3 translational degrees of freedom and practically free rotation.

5946. WAGNER, CARL. **The interaction of streaming diffusion and chemical reaction on heterogeneous catalysts.** *Z. physik. Chem.* **193**, 1-15, (1943).—*C.A.* **39**, 2689[1].

The concn. distribution of reactants within a catalyst grain was calcd. in a stationary state and for the exchange in a given synthesis which was a special case.

5947. GUGGENHEIM, E. A. **Number of configurations of molecules occupying several sites.** *Nature* **153**, 406-7 (1944).—*C.A.* **38**, 5701[6].

A general formula was given for the no. of configurations of mols. in which the no. of pairs of sites occupied was specified. The formula given could be used to drive the thermodynamic properties of mixts. with non-zero energies of mixing, whereas the previous formula given could be used only with zero energies of mixing.

5948. LANDAU, L. **Theory of slow combustion.** *J. Exptl. Theoret. Phys.* (U.S.S.R.) 14, 240-5; *Acta Physicochim. U.R.S.S.* **19**, 77-85 (1944).—*C.A.* **39**, 2023[2].

5949. TRAVERS, A. **"Physical" adsorption and "chemical" adsorption.** *Chimie & industrie* **52**, 35-43 (1944).—*C.A.* **40**, 2371[5].

Phys. adsorption brought into action orienting forces due to permanent or induced dipoles. Chem. adsorption corresponded to binding forces of the covalence type, and consequently involved much greater energies. The 2 types of adsorption could be superposed; or phys. adsorption could be followed by adsorption or soln. in the mass of adsorbent and/or by capillary condensation.

5950. FRENKEL, YA. I. **Surface motion of particles in crystals and natural roughness of crystalline faces.** *J. Phys.* (U.S.S.R.) **9**, 392-8 (1945).—*C.A.* **40**, 3321[5].

Vicinal faces, with a slightly higher value of surface tension, must arise as a result of thermal fluctuations. These vicinal faces could be treated as terraces formed on the main faces, which thus acquired a natural roughness increasing with temp. The boundaries of such terraces were not fixed. Variations in shape and size of a crystal proceeded by transition of atoms from the surface of a terrace through the one-dimensional edge phase into the 2-dimensional adsorbed-gas phase, and vice versa. The "active" points in heterogeneous catalysis were identified with the terrace edges.

5951. GUGGENHEIM, E. A. **The number of arrangements on a lattice of molecules each occupying several sites.** *Trans. Faraday Soc.* **41**, 107-15 (1945).—*C.A.* **39**, 3715[3].

The statistical treatment by Chang of mols. each occupying 2 sites (dimers) in a lattice and that by Miller for mols. each occupying 3 sites (trimers) was simplified and extended to a mixt. of dimers and trimers and to rigid straight-chain mols. each occupying four sites (tetramers). The simplification in procedure was restricted to assemblies with zero energy of interaction between the mols.

5952. GYANI, B. P. **Distribution law, adsorption, and chemical reaction.** *J. Phys. Chem.* **49**, 442-53 (1945).—*C.A.* **40**, 2371[3].

Adsorption was examd. on the assumption that not only the planar surface of the adsorbent was important in the process, but the entire bulk of the solid and patches, active lines, and points on the surface came into operation, either individually or in superposition with one another. A simple interpretation of the classical adsorption equation was indicated on this basis and a few applications of the hypothesis to some general facts of adsorption, chem. reaction and surface catalysis were discussed.

5953. ROGINSKIĬ, S. Z. **Statistical theory of adsorption rates.** *Acta Physicochim. U.R.S.S.* **20**, 227-46 (1945).—*C.A.* **40**,11[8].

In adsorption processes requiring the overcoming of activation barriers, the laws of kinetics were affected by the inhomogeneity of the surface. The time t was substituted for the pressure p, and distribution functions of activation energies were calcd. from exptl. equations. When there was no relation between energy of activation E and heat of adsorption Q at.const. p, the kinetics followed a unimol. law and redistribution on the surface did not occur. When E and Q varied in the same sense there was redistribution of adsorbed mols. to areas with max. Q and the process had const. velocity.

5954. ROGINSKIĬ, S. Z. **Statistical theory of velocities of activated adsorption on nonuniform surfaces.** *Bull. acad. sci. U.R. S.S., Classe sci. chim.* **1945**, No. 1, 14-28 (in English 28-9).—*C.A.* **39**, 5150[3].

Three main types of kinetics of adsorption on nonuniform surfaces were discussed on the bias of the theory of activation barriers in adsorption processes. If the heat of activation was independent of the heat of adsorption, the process was of the first or second order with a const. activation energy. When activation energy dropped with an increase of adsorption heat, which was the case in an adsorption without redistribution of mols. on the surface through diffusion, the kinetics were represented by the Freundlich formula.

5955. TODES, O. M. **The dynamics of the sorption of mixtures.** *Acta Physicochim.* (U.R.S.S.) **20**, 859-86 (1945).—*C.A.* **40**, 3663[3].

The concns. for low velocities of the air current carrying the sorbate gases through the solid sorbent were detd. from static adsorption isotherms of the mixt. The sorbent was traversed by a series of successive sorption waves of the individual components, each of which entailed the partial desorption of the remaining components. The velocities of the individual waves formed a series whose terms were inversely proportional to the relative sorptivity of the respective components. For adsorption of Langmuir type and concns. not closely approaching satn., the first wave was followed by a second and accompanied by partial desorption of the first component. Addn. of a second substance to the sorbate, which caused its partial desorption from the surface of the sorbent, accelerated propagation of the principal component, regardless of which component was adsorbed better, and hence propagated with a correspondingly smaller velocity.

5956. TREJO, ALFONSO. **The modern theory of catalysis. Catalysis by activated adsorption.** *Quimica* (Mex.) 3, 65-8 (1945).—*C.A.* 39, 3997².

5957. BALANDIN, A. A. **Theory of catalyst selection.** *J. Gen. Chem.* (U.S.S.R.) 16, 793-804 (1946).—*C.A.* 41, 1920*b*.

On the basis of the multiplet theory, there must exist an energy correspondence, analogous to structural correspondence, between the catalyst and the reacting mol. The catalytic activity was max. when the adsorption potential of the catalyst was approx. equal to 0.5 the sum of energies of the reactants.

5958. BRADBURN, MARY. **Graphite crystals and crystallites. I. Binding energies in small crystal layers.** *Proc. Roy. Soc. Edinburgh* 62A, 336-49 (1946-48).—*C.A.* 43, 2484*b*.

The resonance energy, bond, order, and bond length were calcd. in a series of graphitic layers of varying size. The C—C bond lengths appeared to vary little in size with increasing no. of C atoms, in agreement with expt. However, variations in resonance energy were significant, and indicated clearly that resonance, by itself favored an approx. square, rather than oblong, shape; but in the case of such layers in equil. in the presence of H_2, the most stable layer contg. a given no. of C atoms was of the long, thin polyphenyl type.

5959. KLOTZ, IRVING M. **The adsorption wave.** *Chem. Rev.* 39, 241-68 (1946).—*C.A.* 41, 234*e*.

The adsorption wave was studied in connection with the nature of the steps involved in the removal of a toxic gas from air by a granular adsorbent. Where the rate-controlling process was a single one of these steps, it was possible to develop a complete analytical expression for the adsorption wave. Where 2 steps contributed to the rate of removal, a complete theory was still lacking, but it was possible to develop criteria for the evaluation of the relative importances of diffusion in air and reactions in the granule in the removal process.

5960. MORRISON, J. L. **The interpretation of pressure dependence of accommodation coefficients.** *J. Chem. Phys.* 14, 466 (1946).—*C.A.* 40, 5316².

Amdur interpreted the pressure dependence of the accommodation coeffs. of several gases on Pt as a simple Langmuir adsorption of the same gas as the one for which the coeff. was measured. This interpretation was found correct for H_2, D_2, N_2, CO, and O_2: impurities in He, Ne, A, Kr, and Xe invalidated this interpretation for these gases.

5961. VERWEY, E. J. W. AND ASSCHER, J. E. **Lattice structure of the free surface of the alkali halide crystals.** *Rec. trav. chim.* 65, 521-8 (1946) (in English).—*C.A.* 41, 1522*e*.

Calcns. of lattice deformation at the free surface of the cube face of alkali halide crystals were made on the basis of Born's lattice theory. The difference in displacement of the pos. and neg. ions in the nonsym. surface field was considered. With neg. ions pointing away from the crystal, and pos. ions in the surface layer being shifted toward the crystal, a lattice distortion resulted, leading to an ionic double layer of appreciable strength. Dipole moments were calcd. for surface ions of alk. halides.

5962. VIALLARD, RODOLPHE. **The evolution of heterogeneous solid-gas systems.** *Compt. rend.* 222, 1233-5 (1946).—*C.A.* 40, 6327⁹.

Solid-gas reactions of the type $A + B \rightarrow C$, in which A and C were solids and B was a gas, followed either of two courses. In one, the speed of the reaction was greater than the rate of diffusion of gas, and in the other the converse was true. There was a third type of reaction, for example, the reaction of H_2 with Gd, which followed an S-shaped curve. A mechanism for this reaction was proposed, in which the mols. first penetrated the metal; later mols. penetrated the expanded reaction product, in which they sep. into atoms, which penetrated farther and reacted.

5963. BREGER, A. KH. AND ZHUKHOVITSKIĬ, A. A. **A possible mechanism of interaction between adsorbed atoms.** *J. Phys. Chem.* (U.S.S.R.) 21, 423-30 (1947) (in Russian).—*C.A.* 41, 6791*e*.

An adsorbed atom repeled another adsorbed atom because of the same forces that caused the orienting effect of one substituent in the C_6H_6 ring on the following substituents. These forces could be calcd. semiquantitatively (a) by treating the electrons in the adsorbent as a Sommerfeld electron gas or (b) according to the theory of Hückel assuming that the electron of the adsorbent atom at which adsorption took place was excluded from the resonance.

5964. CREMER, E. **The meaning of the exponent in the Freundlich adsorption equation.** *Monatsh.* 77, 126-33 (1947).—*C.A.* 42, 5297*i*.

By assuming a heterogeneous surface on which the activities of the adsorption centers followed an exponential distribution law, it was shown that the equation $a = kC^n$ representing the variation of adsorption, *a*, with concn. of adsorbate, *C*, could be derived from a Langmuir equation. A plot of log *n* against *T* for a no. of gas-solid systems passed through the origin. The slope of this plot times the crit. temp. of the adsorbate was a const. for the adsorption of A, Kr, Xe, and C_2H_2 on activated carbon. The proportionality const. in the Freundlich adsorption equation was shown to be equal to KV^n, where *K* for the above adsorbates was approx. 10^4 for all temps. studied and *V* was the molal liquid vol. of the adsorbate.

5965. FORESTIER, HUBERT AND HAASSER, CHARLES. **Effect of physical state on the rate of reaction between metal oxides in the presence of water vapor.** *Compt. rend.* 225, 240-1 (1947).—*C.A.* **44**, 3774*d*.

The effect of H_2O on reactions between solids was greater for those solids having greater affinity for H_2O, either by adsorption or by hydrate formation.

5966. KEIER, N. P. AND ROGINSKIĬ, S. Z. **Statistics of the surface of activated charcoal deduced from the kinetics of activated adsorption** *Acta Physicochim. U.R.S.S.* 22, 61-80 (1947) (in English).—*C.A.* **41**, 7199*e*.

The behavior of active charcoals in the activated adsorption of different gases agreed with the conception that the surface of the adsorbent was inhomogenous with respect to the activation energy. Langmuir's redistribution scheme seemed to be invalid in all cases. The expts. were performed with: activated birchwood charcoal, activated sugar charcoal, anthracite recuperation charcoal, charcoal + K_2SO_3, charcoal + KNO_3; charcoal + K_2SO_4, charcoal + Cu acetate, charcoal + Pt, + O_2, + H_2, and + CO.

5967. TAYLOR, HUGH S. AND LIANG, SHOU-CHU. **The heterogeneity of catalyst surfaces for chemisorption. I. Zinc oxide.** *J. Am. Chem. Soc.* 69, 1306-12 (1947).—*C.A.* **41**, 5772*d*.

A new technique for detg. adsorption isobars of H_2 by ZnO between 77-600 °K showed desórption of chemisorbed H_2 on raising the temp. through certain temp. ranges, followed by readsorption at still higher temp. The data indicated a marked heterogeneity of the ZnO surface for the adsorption of H_2.

5968. TAYLOR, HUGH S. AND LIANG, SHOU-CHU. **The heterogeneity of catalyst surfaces. II. Zinc oxide-chromic oxide, manganous oxide-chromic oxide, chromic oxide gel.** *J. Am. Chem. Soc.* 69, 2989-91 (1947).—*C.A.* **42**, 1793*b*.

These substances revealed heterogeneity of surface. $MnO-Cr_2O_3$ catalysts did not show desorption-readsorption phenomena on raising the temp. The isobar on decreasing temp. was consequently horizontal over a considerable temp. range. The surface, nevertheless, exhibited a partial heterogeneity.

5969. VOL'KENSHTEĬN, F. F. **Interaction of adsorbed molecules and the theory of adsorption on inhomogeneous surfaces.** *J. Phys. Chem.* (U.S.S.R.) 21, 163-78 (1947).—*C.A.* **41**, 6105*d*.

If the adsorbent surface was plane and uniform, the adsorption layer unimol., and the deviations from Langmuir's elementary theory were due to interaction of adsorbed mols. only, then the laws of this interaction could be derived from the empirical adsorption isotherm. Freundlich's isotherm was obtained when the adsorbed mols. repelled one another with a force that was a linear function of the log of their mutual distance. There existed a definite correlation between the laws of mol. interaction and the distribution of inhomogeneities. This correlation was calcd. for several instances.

5970. VOL'KENSHTEĬN, F. F. **The electron levels of atoms adsorbed on a crystal surface. I.** *J. Phys. Chem.* (U.S.S.R.) 21, 1317-34 (1947) (in Russian).—*C.A.* **42**, 5340*i*.

The adsorbed atom and the lattic of the adsorbent were treated as one quantum-mech. system. The electron levels and the corresponding wave functions of this system were calcd. The difference between "phys." and "chem." adsorption were formulated mathematically.

5971. WELLER, SOL. **Chemisorption of gases.** *J. Chem. Phys.* 15, 336 (1947).—*C.A.* **41**, 4991*h*.

The appropriateness of including the amt. of chemisorbed gas (for which the heat of adsorption was comparable with the heats of chem. reactions) in applying the B.E.T. theory to an adsorption isotherm was discussed. When both phys. adsorption and chemisorption occurred, the total adsorption was correct, whether or not the chemisorption was reversible.

5972. BALANDIN, A. A. **Thermodynamic properties of adsorption complexes in heterogeneous catalysis.** *Doklady Akad. Nauk S.S.S.R.* 63, 33-6 (1948).—*C.A.* **43**, 1634*i*.

The abs. and the relative adsorption coeffs., a_r and z_r of a substance *r* (z_r relative to substance *I*), had the meanings, resp., of an adsorption equil. const. for *r* and of a displacement const. of *r* by *I* from the adsorbed layer: $a_r = [A_rS]/[S]\,[A_r]$ and $z_r = [A_IS]\,[A_r]/[A_rS]\,[A_I]$, where *S*, A_IS, and A_rS represented, resp., the surface concns. of unoccupied active centers and of adsorption complexes of *S* with *I* or *r*. This permitted formulation of the standard thermodynamic functions $\Delta F°$, $\Delta H°$, $\Delta S°$ for adsorption of *r* and displacement of *r* by *I*, by the known expressions in terms of a_r and z_r. Examples were given for dehydrogenation of cyclohexanes by Pd, Pt and Ni, dehydrogenation of alcs. on Cu at 240-275 °C, and dehydrogenation of butylene to butadiene on Cr_2O_3 at 560 °C.

5973. BONHOEFFER, K. F. **Periodic chemical reactions. I.** *Z. Elektrochem.* 52, 24-9 (1948).—*C.A.* **43**, 7791*i*.

The form which the functions $dx/dt = f\,(x,\ y)$ and $dy/dt = \phi\,(x,\ y)$ must have to give periodic changes in *x* and *y* were investigated. An autocatalytic process greatly facilitated periodicity. An important requirement was that the concn. of the initial reactants be nearly const. during a series of periods. This was automatically true at a phase boundary where *x* and *y* represented amts. of 2 surface films. This and other requirements were so exacting that periods were never observed in homogeneous systems.

5974. Booth, F. **Theory of surface diffusion reactions.** *Trans. Faraday Soc.* 44, 796-801 (1948).—*C.A.* 43, 3694*d*.

An exact solution was derived for the rate of the reaction between a solid and a gas or liquid, in which the reaction proceeded by the diffusion of the reactants through a layer of the product formed on the surface of the solid. The rate of growth of the product was inversely proportional to its thickness as in simple diffusion theory, but the const. of proportionality depended on the d. of the reactants in the product and the d. of the product.

5975. Eley, D. C. **Absolute rate of conversion of parahydrogen by metallic catalysts.** *Trans. Faraday Soc.* 44, 216-26 (1948).—*C.A.* 43, 26*g*.

The general concept as an interaction between a van der Waals layer and a chemisorbed layer seemed satisfactory, The "temp.-independent" factor was calcd. for the exchange of atoms between H_2 in a dil. van der Waals layer and a H atom in an adjacent position in the underlying stable chemisorbed layer on the metal. The results so obtained agreed within a factor of about 3 with data for the catalysts W, Ni, Pt, and Pd. The coulombic potential of the pos. cores might have a general effect in lowering energy barriers.

5976. Komarewsky, V. I. and Coley, J. R. **Vanadium oxides, hydrogenation catalysts. II.** *J. Am. Chem. Soc.* 70, 4163-4 (1948).—*C.A.* 43, 2853*c*.

The formation of the V-olefin complex in the chemisorption of olefins on V_2O_5 may be effected with very little distortion of the valence angle. The reaction temp. at which V_2O_5 gave max. activity as a hydrogenation catalyst corresponded closely with the reduction temp. of V_2O_5 to V_2O_3.

5977. Kunze, F. **The relation of the activation heat and the reaction constant for heterogeneous reactions.** *Monatsh.* 79, 267-71 (1948).—*C.A.* 43, 2850*i*.

The current theories were extended in scope.

5978. Levin, V. I. **Analysis of processes on nonhomogeneous surfaces.** *Doklady Akad. Nauk S.S.S.R.* 59, 269-72 (1948).—*C.A.* 43, 3264*a*.

The distribution function ρ of activation energies E in activated adsorption was calcd. from the known kinetic function $\psi(t)$ of the change of the free fraction of the surface with time t. A general solution was given in the form of a series $\rho(x) = \sum_{1}^{\infty} a_m (-1)^m \gamma^{(m)} (x - \ln k_0)$, where $x = E/RT$, $\gamma(y) = \psi(e^y)$, $y = \ln t$, $k_0 =$ rate const. of the adsorption $k_0 = k_0 p^{a}$, where k_0' was pressure independent. Instead of ψ, one could use the amt. q of adsorbed substance, $q = S(1-\psi)/s_0$, where $S =$ surface area, $s_0 =$ area per adsorbed mol.

5979. Miller, A. R. **Monolayers adsorbed on metal surfaces.** *J. Chem. Phys.* 16, 841-2 (1948).—*C.A.* 43, 3263*g*.

Halsey and Taylor concluded from a study of Frankenburg's data for the adsorption of H_2 on powd. W that a theory of interactions on a surface in which all the sites involved the same energy of adsorption could not account for these exptl. results. This conclusion was not well founded.

5980. Sips, Robert. **Structure of a catalyst surface.** *J. Chem. Phys.* 16, 490-5 (1948).—*C.A.* 42, 4824*h*.

The distribution of the adsorption energies of the sites of a catalyst surface was calcd. when the adsorption isotherms were known, if the adsorption was localized and there were no interactions. This method was applied to Freundlich isotherm and also to a new theoretical isotherm that reduced to the Freundlich type for small pressures but showed satn. for large pressures. This isotherm corresponded to a distribution function that differed very little from a Gaussian one.

5981. Todes, O. M. and Bondareva, A. K. **Theory of adsorption equilibria on non-homogeneous surfaces.** *Zhur. Priklad. Khim.* (J. Applied Chem.) 21, 693-707 (1948).—*C.A.* 44, 402*d*.

Integral equations were established for the distribution function $n(b)$, where $n =$ relative fraction of portions of the surface with values of the sorption coeff. h between 0 and b, the latter defined by the application of Langmuir's equation to a single portion of the surface, considered homogeneous. $\Phi_b(p) = (p + b)$, where $p =$ partial pressure of the adsorbable substance, and $b = b_{oe}^{-Q/RT}$, with $Q =$ heat of adsorption on the given portion. An expression was then obtained for the total surface coverage as a function of p. Solution of these integral equations might be sought by choosing an empirical function $\psi(b)$ which agreed best with exptl. pairs of values Φ, p, equating $\psi(p) \approx \Phi(p)$, and then finding the exact solution analytically. Very complete exptl. data, extending up to surface coverages close to unity, permitted the use of developments by Laguerre and Hermite polynomials.

5982. Vol'kenshtein, F. F. **Electron theory of promoting and poisoning ionic catalysts.** *J. Phys. Chem.* (U.S.S.R.) 22, 311-30 (1948).—*C.A.* 42, 6628*e*.

The dissocn. of the adsorbed mols. A_2 and B_2 was an essential stage in the heterogeneous reaction $A_2 + B_2 = 2AB$ on the surface of an ionic crystal. This surface was treated as a semiconductor in which the adsorbed mols. were admixts. The dissocn. was a result of interaction between the mols. and the electrons and holes of the crystal lattice. The rate of chem. reaction depended on the numbers of the electrons and the holes, and these numbers depended on the surface concn. of the promoters of poisons present. Hence small amts. of a foreign substance often increased, and larger amts. reduced, the catalytic activity.

5983. Bosworth, R. C. L. **The mechanisms of diffusional processes.** *Roy. Australian Chem. Inst. J. & Proc.* 16, 460-82 (1949).—*C.A.* 44, 10383*i*.

Chem. diffusion might occur by moving molecules, by molar aggregates (eddies or hydrodynamic streams), or sometimes by ions or atoms. Mol. diffusion might be "ordinary" in which the carrier moved continuously (gases and liquids), or "activated" in which it remained at equil. pts. for definite periods of time between successive "jumps" (solid surfaces). When the apparent diffusion coeff. exceeded the product of the carrier velocity and the mean free path, as in electrolytic conduction in aq. solns., "shortcut" diffusion was said to occur. The migration of mols. on solid surfaces, which was important in solid-fluid systems as in adsorption and catalysis, was a case of activated diffusion.

5984. CASSEL, HANS M. **Condensation coefficient and adsorption.** *J. Chem. Phys.* 17, 1000-1 (1949).—*C.A.* 44, 2323*g*.

The condensation coeff. α, the ratio of the observed rate of evapn. to the computed excess of mols. striking the surface of the condensed phase, was calcd. by use of the Langmuir adsorption isotherm. $\alpha = A/(1/\tau + A + \beta bp)(1 + \tau\beta bp_o)$, where τ was the av. period of time that mols. remained on the surface, b was $(2\pi mkT)^{1/2}$, p was the vapor pressure, and β and A were consts.

5985. CREMER, E. **The absolute calculation of the velocity of heterogeneous reactions.** *Z. Elektrochem.* 53, 269-74 (1949).—*C.A.* 44, 2344*g*.

The kinetics of a variety of heterogeneous reactions were discussed in terms of the relation $\log A = (q/a) + \text{const.}$, where A and q were quantities in the Arrhenius equation, $k = A \exp. (-q/RT)$. The reactions included the decompn. of EtOH, PrOH, and BuOH on group III and rare earth oxides; C_2H_5Cl on $BaCl_2$; N_2O on CuO; and the formation of vinyl chloride on $HgCl_2$ and Hg_2Cl_2. The implications of the relation between $\log A$ and q were discussed in terms of the assumption of a Boltzmann distribution of "active centers" and the assumption that the rate-detg. step was the leakage of electrons through a potential barrier.

5986. GLAUBERMAN, A. E. **Theory of the surface energy of heteropolar crystals.** *Zhur. Fiz. Khim.* 23, 124-30 (1949).—*C.A.* 43, 5653*b*.

The lattice energy of an ionic crystal of the NaCl type was calcd. The distance d between 2 nearest ionic planes was 0.8% less at the surface than that far from the surface.

5987. GYANI, B. P. **Distribution law, adsorption, and chemical reaction. II.** *J. Phys. & Colloid Chem.* 53, 1091-1101 (1949).—*C.A.* 44, 3766*h*.

The adsorption of dissolved substances and vapors on liquid surfaces was examd. Systems were chosen so as to have ideally homogeneous adsorbing surfaces, thus removing some disturbing factors that might otherwise interfere with a rigorous test. The translatory motion of the adsorbed mols. could be confined rigidly to a plane. In some other cases the motion became gradually restricted to one dimension as the crowding on the surface increased. Assocn. among some adsorbed mols. was indicated in the adsorption of some polar mols. on Hg.

5988. HALSEY, G. D. JR. **Catalysis on nonuniform surfaces.** *J. Chem. Phys.* 17, 758-61 (1949).—*C.A.* 44, 1313*i*.

With NH_3 decompn. as an example, the kinetics of a heterogeneous reaction were discussed. On a continuously nonuniform surface, no single reaction step was the limiting one; on the optimum sites 2 reaction steps were equally slow. The expression for over-all velocity was developed, and solved exactly for the case of an exponential distribution of activation energies. If the distribution was broad, its exact shape was unimportant, but that a factor r, connected with the amt. of adsorption energy available for catalytic work, was important. Because the position of the optimum depended on pressure, it could not be assumed that the surface was "effectively uniform."

5989. HEDVALL, J. ARVID. **The development and application of the reaction theory of the solid state.** *Z. anorg. Chem.* 258, 180-7 (1949).—*C.A.* 44, 25*i*.

The important developments in the present state of knowledge of reactions in the solid state were discussed.

5990. HUANG, K. AND WYLLIE, G. **The surface free energy of certain metals.** *Proc. Phys. Soc.* (London) 62A, 180-91 (1949).—*C.A.* 44, 894*h*.

The valence electrons were treated according to a simple Sommerfeld model, and the pos. charge of the ions was distributed uniformly through the metal. The surface energy and the strength of the double layer were calcd. The surface double layers for the metals considered lie in the range 0.1-0.5 e.v. The contribution to the surface energy from the electrostatic energy in the double layer was very small. Calcns. were reported for Cu, Ag, Au, Li, Na, K, Rb, and Cs.

5991. LAIDLER, KEITH J. **The kinetic laws of adsorption in the particular case of surface penetration.** *Bull. soc. chim. France* 1949, D171-6.—*C.A.* 43, 6489*a*.

The sorption of a gas by a solid, in the case of surface penetration, was controlled by 2 processes, either of which may be the rate-controlling step. At sufficiently low pressures the rate of sorption was controlled by activated adsorption, but at higher pressures the rate was controlled by diffusion. If the rate of sorption was directly proportional to the gas pressure, the mols. adsorbed were not dissocd. in the solid. When the rate varied with the sq. root of the pressure, it was certain that atoms or radicals were diffusing. The theory was applied to the sorption by org. polymers and by metals and to the sorption of H_2 and O_2.

5992. LEVIN, V. I. AND ROGINSKIĬ, S. Z. **Kinetics of contact reactions. I. Processes on homogeneous surfaces.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* 1949, 134-43.—*C.A.* 44, 2352*i*.

Provided each adsorbed particle occupied one active center only, γ (unoccupied fraction of the surface) $= [1 + \Sigma c_j/b_j]^{-1}$, where the reciprocal adsorption coeff. $b = b_o e^{-Q/RT}$, with $Q =$ heat of adsorption of the jth substance. If the adsorption was not in equil. with the space phase, in particular in the case of slow desorption of the certain substances, γ was a function of the ratio of the rate of formation and of desorption. If the desorption of the products could be disregarded, and other substances were not adsorbed, and the concns. of the initial reactants were const., $-d\gamma/dt = mf(c)e^{-E/RT}\gamma s$, where $f(c) = k_o \Pi c_i^{\nu}$.

5993. MARBOE, EVELYN C. AND WEYL, W. A. **A method for studying the forces between metals and ionic substances.** *J. Applied Phys.* 20, 124 (1949).—*C.A.* 43, 2485*f*.

When changing from atomic to cryst. aggregate, adsorbed Au went through a highly colored red or purple stage. The rate at which this surface diffusion occurred was a measure of the forces acting between Au and a carrier surface. The substance to be examd. was treated with a dil. soln. of $AuCl_3$ in water (4×10^{-3} g/ml). The gold ions were adsorbed at the surface, and by heating in H_2 at 150°C for a few min. water and HCl were removed and Au atoms were formed. Upon heating for about an hr at 200° to 800°C, the faint pink color deepened, changed to purple, and gradually faded as the crystals become larger.

5994. MAXTED, E. B. **The nature of chemisorptive bonds. I. Some observed regularities.** *J. Chem. Soc. 1949,* 1987-91.—*C.A.* 44, 3777*h*.

Catalytic activity seemed to be detd. by the structure of the *d*-band of the metal; the disappearance of catalytic properties with disappearing fractional electron deficiencies in this band suggested that these deficiencies played a crit. part in hydrogenation catalysis and adsorption. The poisoning process might consist of, or include, the elimination of the *d*-band deficiency. Three types of strongly-held adsorbates were discussed as to toxicity: (a) nonmetals of groups Vb and BIb: S, P, or N compds.; (b) metallic ions; (c) compds. with unsatd. bonds. Participation of the metal in a resonance system of the bond multiplicity (CO, C_2H_4) appeared more likely than formation of some type of covalent bond.

5995. MOLIFRE, K.; RATHJE, W., AND STRANSKI, I. N. **Surface structures of ionic crystals.** *Discussions Faraday Soc.* **1949**, No. 5, 21-32.—*C.A.* 44, 2320*g*.

Calcns. were made to det. the effect on surface structures of the ionic polarizability in the case of the NaCl-type lattice. No tendency towards tangential contraction existed in the case of low polarizability in the surface. Only a decrease in the distance between the two uppermost lattice faces was to be expected. With more highly polarizable ions, tangentially deformed surface structures were favored from the standpoint of energy.

5996. STARODUBTSEV, S. V. **Investigation of adsorption phenomena by the method of modulated molecular beams.** *Zhur. Eksptl. Teoret. Fiz.* **19**, 215-24 (1949).—*C.A.* 44, 6699*b*.

An at. or mol. beam produced by evapn. and collimated through slits was aimed at an incandescent filament, and was interrupted periodically by a mech. device, producing a periodically modulated beam. Modulation of the beam gave rise to a modulation of the current due to ionization of the particles adsorbed on the filaments. Exptl. detns. were made with beams of K and of Na on a W filament.

5997. VAN DER MERWE, J. H. AND FRANK, F. C. **Misfitting monolayers.** *Proc. Phys. Soc.* (London) **62A**, 315-16 (1949).—*C.A.* 44, 399*b*.

Surface dislocations due to at. misfits in monolayer were treated as analogous to crystal dislocations. Up to a crit. amt. of natural misfit, the state with no dislocation (a monolayer fitting the substrate) was the one of lowest energy. The theory was applied to the mechanism of oriented overgrowth.

5998. VOL'KENSHTEIN, F. F. **Characteristics of adsorption due to "thermal disorder" on crystal surfaces.** *Zhur. Fiz. Khim.* **23**, 917-30 (1949).—*C.A.* **44**, 18*c*.

If gas mols. were adsorbed by identical spots of lattice defects on the surface and these defects were in equil. with other defects that had no adsorbent capacity, then adsorption that inactivated the spots shifted the equil. so that addnl. active spots formed from the inactive defects. If active spots were one of two dissocn. products of inactive spots, the adsorption isotherm would be $N = kp^{0.5}$, $N =$ adsorbed amt., $p =$ gas pressure. If formation of active from inactive defects was assocd. with energy changes, the exptl. heat of adsorption changed with N although the net heat of adsorption (of a mol. by an active spot) was independent of N. Temp. increase might augment the no. of active spots and thus simulate "activated adsorption".

5999. WERT, CHARLES A. AND ZENER, C. **Interstitial atomic diffusion coefficients.** *Phys. Rev.* **76**, 1169-75 (1949).—*C.A.* 44, 14*i*.

When cognizance was taken of an addnl. strain in the lattice surrounding a solute atom as it passed over a potential-energy divide, and of the increase in entropy assocd. with an increase in lattice strain energy, it was possible to est. a "theoretical" range within which these entropy factors should lie. All past observations, except for C and N in α-Fe, were consistent with this theoretical range. The assocd. entropy factors were consistent with the theoretical range.

6000. ZIMMERMAN, JUNE F. **Diffusion and activation control in heterogeneous reactions.** *J. Phys. & Colloid Chem.* **53**, 562-9 (1949).—*C.A.* 44, 2833*h*.

The characteristics of reaction-and diffusion-controlled heterogeneous reactions were reviewed. Criteria for the recognition of a heterogeneous reaction under joint activation and diffusion control were set up. A general equation was introduced to show the variation in observed velocity of activation.

6001. BABBITT, J. D. **Differential equations of diffusion.** *Can. J. Research* **28A**, 449-74 (1950).—*C.A.* 44, 10384*b*.

The pressure rather than the concn. was the quantity to be used in the differential equations for diffusion. The relation between p and c was generally not linear when the diffusion was through solids. Starting from fundamentals the equations for the interdiffusion of two gases, for the diffusion of vapors, and for the diffusion of gases and vapors through solids were derived.

6002. COULSON, C. A. AND BALDOCK, G. R. **Conditions for the existence of surface states.** *Discussions Faraday Soc.* **1950**, No. 8, 27-33.—*C.A.* 45, 9985*e*.

The mol. modification of Bloch wave functions were used to study the existence or nonexistence of surface states on the boundary of a univalent metal for simple cubic models in 1, 2, and 3 dimensions. Surface states may be induced by the perturbation caused by the approach of a polar, or ionic group. These states were more easily produced close together than separately. In certain noncubic systems, e.g. graphite, surface states existed even without any necessary changes in their Coulombic terms or resonance integrals on the boundary.

6003. Dowden, D. A. **Heterogeneous catalysis, I. Theoretical basis.** *J. Chem. Soc.* **1950**, 242-65.—*C.A.* **44**, 7634*h*.

The rate of reaction was controlled by the formation of a chemisorbed complex which may be bound to the solid surface by ionic or covalent bonds. If the rate was limited by the formation of a pos. ion at a metal surface, the process was most favored and fastest when both the ionization potential of the metal atom and the metal work function were large, and when the gradient of electron-level d. with electron energy at the Fermi surface was large and pos. Formation of neg. ions was optimum with small metal ionization potentials and work functions but with an electron-level d. gradient that was large and neg.

6004. Eley, D. D. **A calculation of heats of chemisorption.** *Discussions Faraday Soc.* **1950**, No. 8, 34-8.—*C.A.* **45**, 9985*f*.

Heats calcd. by Pauling's equation for covalent bonds were in good agreement with expt. for H_2 on W, Cu, and Ni. For O_2 on W the calcns. indicated that the film was not at. For C_2H_4 on Ni the values were for associative chemisorption.

6005. Eucken, A. **The existence of active centers in chemical adsorption and contact catalysis.** *Discussions Faraday Soc.* **1950**, No. 8, 128-34.—*C.A.* **45**, 9987*a*.

The supposed effect of active defects in a catalytic surface was rejected in favor of the theory that the essential factor was the active intermediate states of the adsorbed reactant.

6006. Eyring, Henry; Colburn, Charles B., and Zwolinski, Bruno J. **The activated complex in chemisorption and catalysis.** *Discussions Faraday Soc.* **1950**, No. 8, 39-46.—*C.A.* **45**, 9985*g*.

A general treatment of chemisorption and catalysis was given in terms of the activated complex theory of chem. kinetics. The mechanism proposed for hydrogenation of C_2H_4 was that both C_2H_4 and H_2 were adsorbed on the surface, but C_2H_4, being much more tightly held, tended to displace H_2. The activated complex was an ethane just desorbed from its two positions on the surface.

6007. Hill, Terrell L. **Generalizations of the quasichemical equilibrium approximation in statistical mechanics.** *J. Chem. Phys.* **18**, 988-9 (1950).—*C.A.* **44**, 7627*i*.

The work of Li on a generalization (from pairs of sites to larger groups of sites) of the quasichem. approximation was developed for adsorption.

6008. Huang, K. and Wyllie, G. **Theories of adsorption and properties of surface layers. Behavior of a molecule near a metal surface.** *Discussions Faraday Soc.* **1950**, No. 8, 18-27.—*C.A.* **45**, 9985*c*.

The energy changes assocd. with electron transfer to or from a mol. at distances from the metal surface may be such that the quantum-mech. tunnel effect could be neglected. The distribution of charge on a large adsorbed mol. was found by a self-consistent treatment of the image field. A representation of electronic conditions at the catalytic metal surface was proposed as giving a reasonable phys. approximation to the real situation.

6009. Kington, G. L. and Morrison, J. A. **Comment on "Thermodynamic properties of the surface of magnesium oxide."** *J. Chem. Phys.* **18**, 759 (1950).—*C.A.* **44**, 6714*i*.

6010. Laidler, Keith J. **The activated complex in heterogeneous catalysis.** *Discussions Faraday Soc.* **1950**, No. 8, 47-54.—*C.A.* **45**, 9985*h*.

General rate expressions were developed for reaction between two mols., of which *A* was more strongly adsorbed. assuming alternative mechanisms of interaction: (1) adsorbed *A* and adsorbed *B*, (2) adsorbed *A* and gaseous *B*, (3) adsorbed *B* and gaseous *A*. The rate expressions for these mechanisms were compared to the reaction between C_2H_4 and H_2. The low-frequency factor ($\sim 10^{-6}$) was due to the loss of translational and rotational freedom in forming the activated complex.

6011. Levin, V. I. and Roginskiĭ, S. Z. **Kinetics of contact reactions. II. Processes on heterogeneous surfaces.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* **1950**, 137-51.—*C.A.* **44**, 9783*f*.

Only the concept of the heterogeneity of the surface in adsorption and heterogeneous catalysis was capable of accounting for a variety of phenomena, particularly at very low coverages where interaction between adsorbed mols. could be invoked. A surface may be homogeneous either with respect to the heats of adsorption Q, or the activation energies E; Q and E could vary symbatically or antibatically, or could stand in no functional relation to each other.

6012. Maxted, E. B.; Moon, K. L., and Overgage, E. **The relationship between sensitivity to poisoning and catalytic surface.** *Discussions Faraday Soc.* **8**, 135-40 (1950).

The expected inverse variation of sensitivity to catalyst poisoning with the surface area of a catalyst was confirmed experimentally for Pt hydrogenation catalysts poisoned with MeS, a relationship of the type: $\alpha_1 s_1 = \alpha_2 s_2$, in which α was a measure of the sensitivity and s of the surface area, being obtained. This relationship apparently held even when the variation in the area of a constant weight of Pt was induced by sintering. A characteristic value for the product αs has been obtained which should make possible the calculation of the surface area of Pt catalysts in general.

6013. Mills, G. A. and Hindin, S. G. **Chemical characterization of catalysts. II. Oxygen exchange between water and cracking catalysts.** *J. Am. Chem. Soc.* **72**, 5549-54 (1950).—*C.A.* **45**, 5394*g*.

O^{18} was used for measuring the rate by which this compd. exchanged O with solid oxides such as silica gel, active silica-alumina cracking catalyst, kaolin, bentonite, and acid-activated bentonite, and acid-activated bentonite, at temps. of 100°C, and in a few cases, at 565°C. After the exchange period, the amt. of O^{18} in the water was detd. by permitting O exchange between water and CO_2, and measuring in the mass spectrometer the ratio O^{18}/O^{16} in the CO_2. These solids having high specific surfaces exchanged rapidly 10 to 25% of all their oxide oxygens, followed by a slow further exchange that led, at 105°C, to exchange of an addnl. 10 to 60% of the oxide oxygens over a period of one month.

6014. MIYAZAKI, SHOZO. **The catalytic decomposition of ammonia. V. The equation of reaction rates.** *J. Chem. Soc. Japan, Pure Chem. Sect.* **71**, 335-8 (1950).—*C.A.* **45**, 5011*e*.

A theoretical equation on the reaction rate was derived by statistical mechanics. The structure of the adsorbed or activated NH_3 gas mol. was discussed by comparing theoretical and empirical equations.

6015. MOORE, A. J. W. **The structure of a metal surface.** *Trans. Australian Inst. Metals* **3**, 37-49 (1950); *Australaisian Engr.* Oct. 7, **1950**, 65-8.—*C.A.* **46**, 8447*c*.

Real surfaces showed large irregularities in contour, relatively thick flims of foreign atoms and considerable deformation at or near the surface. The techniques for the measurement of these surface features and the types of results obtained for them were described.

6016. SCHWAB, GEORGE-MARIA. **Alloy catalysts in dehydrogenation.** *Discussions Faraday Soc.* **8**, 166-71 (1950).

In homogeneous Hume-Rothery alloys the activation energy of HCOOH dehydrogenation increased in proportion to the square of the increase of the electron concentration caused by the multivalent solute metal. The catalytic activation consisted in an entrance of substrate electrons into empty levels of the first Brillouin zone of the metal. It was suggested that in alloys containing polar or covalent bonds the conductivity electron concentration was lowered. Catalytic experience confirmed this view.

6017. SIPS, ROBERT. **The structure of a catalyst surface. II.** *J. Chem. Phys.* **18**, 1024-6 (1950).—*C.A.* **45**, 426*e*.

A revised theory, assuming localized adsorption without interaction, led to only a limited no. of math. forms for the adsorption isotherm. The simplest of these isotherms was a generalization of the Freundlich and Langmuir isotherm.

6018. TAYLOR, HUGH S. **Effect of the heterogeneity of catalysts on chemisorption and chemical kinetics.** *J. Chim. phys.* **47**, 1225 (1950).—*C.A.* **44**, 7132*g*.

In expts. on the exchange between CH_4 and CD_4 it was shown that fragments CH_3, CH_2, CH, C, CD, CD_2, and CD_3, existed on the surface of the Ni catalyst. Furthermore, the ratio of the concn. of the radicals CD, CD_2, and CD_3 to the concn. of C atoms increased as the catalyst temp. was increased from 100° to 225°C. The exchange of N_2^{28} and N_2^{30} to form N_2^{29} occurred rapidly at the temp. of NH_3 synthesis over Fe and Re if the metals were produced by passing pure dry H_2 through the bed of metallic oxide for a sufficient time to effect substantially complete reduction. However, surfaces of these metals, incapable of causing the reaction of N_2^{28} and N_2^{30} because of incomplete reduction, still cause exchange between H_2 and D_2, H_2O and D_2O, and NH_3 and ND_3.

6019. BONCH-BRUEVICH, V. L. **Electronic levels of atoms adsorbed on a crystal surface. II.** *Zhur. Fiz. Khim.* **25**, 1033-42 (1951).—*C.A.* **46**, 2862*h*.

The adsorption of an electropos. atom A on the face of a crystal M^+R^- (body-centered rhombic of parameters a and b) contg. only M^+ ions, was treated as a one-electron problem. Interaction between adsorbed atoms was neglected; they were assumed to form a regular arrangement on the surface, such that between two adsorbed atoms there are N-1 surface ions. Adsorption was possible by reason of the formation of two localized surface levels detaching themselves from the conduction band.

6020. BRUIJN, D. DE. **Heterogeneous catalysis, surface structure, and kinetics.** *Chem. Weekblad* **47**, 436-43 (1951).—*C.A.* **46**, 2383*g*.

Periodic and random discontinuities in crystal lattices were discussed with reference to adsorption and catalysis.

6021. COOK, MELVIN A.; PACK, DOUGLAS H., AND OBLAD, ALEX G. **Structural model of low-pressure "physical" adsorption.** *J. Chem. Phys.* **19**, 367-76 (1951).—*C.A.* **45**, 8846*c*.

A new type of adsorption potential was proposed assocd. with surface strain induced in the elimination of unbonded electron orbitals (1st-order strain), and strain due to surface (chem.) heterogeneities, or surface impurities (2nd-order strain). These surface strains were assumed to give rise to a semi-chem. adsorbate-adsorbent bonds in the 1st layer of multimol. films. Termed "structural adsorption" it was considered largely responsible, along with ordinary van der Waal's potentials, for the low-pressure region of the type II isotherm. The theory was applied in the calcn. of the adsorption isotherms for N_2, O_2, and mixts. of N_2 and O_2 on anatase.

6022. DANCKWERTS, P. V. **Absorption by simultaneous diffusion and chemical reaction into particles of various shapes and into falling drops.** *Trans. Faraday Soc.* **47**, 1014-23 (1951).—*C.A.* 2874*b*.

A substance diffused into an absorbent in which it was destroyed by a 1st-order process. Expressions for the transient concn.-distribution and rate of absorption could be obtained by transformation of expressions for diffusion without reaction. The method was applied to the sphere, parallelopiped, cylinder and semi-infinite absorbent, and also to a liquid drop moving through another liquid. Steady-state solns. were also discussed. The expressions might prove useful in connection with unsteady state diffusion into porous adsorbents and catalysts, liquid drops in two-phase reaction systems, or living cells, including the microörganism.

6023. GINSTILING, A. M. **Physical characteristics of fine-grained crystalline materials and reactions of their mixtures.** *Zhur. Priklad. Khim.* **24**, 567-75 (1951).—*C.A.* **46**, 7841*h*.

The av. distance between the surfaces of neighboring particles of real fine-grained materials is 10^5-10^7 times that of the radius of action of at. and other forces that bind the elements of the cryst. lattice. The speed of mass transfer by "jumping over" of elements of the lattice of one reagent into the lattice of another reagent (without the formation and participation of gaseous and liquid substances) was extremely limited by the insignificant surface contact.

6024. HALSEY, G. D. JR. **The rate of adsorption on a nonuniform surface.** *J. Phys. & Colloid Chem.* **55**, 21-6 (1951).—*C.A.* **45**, 3220*g*.

The activation energy for the adsorption process was assumed proportional to the zero-point energy between the gas and the solid. An expression was derived for the rate of adsorption of a gas on a nonuniform surface. It was in qual. agreement with the observations of Taylor and Liang for the adsorption of H_2on ZnO.

6025. LEVICH, V. G. AND MEĬMAN, N. N. **Theory of slow heterogeneous reactions in a moving liquid.** *Doklady Akad. Nauk S.S.S.R.* **79**, 97-100 (1951).—*C.A.* **46**, 4892*h*.

The differential equation of collective diffusion was solved under the general boundary condition $D(\partial c/\partial n)=\beta c$; further conditions were, $c=c_0$ at $y\rightarrow\infty$, and $c=c_0$ at $x=0$, $y\neq 0$. Near the edge of the x, y plane, the flow was detd. solely by the rate of the chem. reaction; farther from the edge, the rate of transfer of the substance played an increasingly prominent role. At variance with Nernst's elementary theory of the diffusion layer, the effective thickness of the boundary diffusion layer varied following different laws in different portions of the x, y plane.

6026. MACDONALD, J. Y. **Formation and growth of nuclei in the decomposition of solids.** *Trans. Faraday Soc.* 47, 860-3 (1951).—*C.A.* 46, 2371*i*.

Possible mechanisms were examd. in the light of the lattice energies of reactant and product. It was difficult to see how a reversible decompn., such as the dehydration of a hydrate, could occur in the interior of a perfect crystal. The role of surface migration in the decompn. of solid substances was discussed.

6027. MACGILLAVRY, D. **A comparative study of unpolarizable and polarizable metal-solution systems.** *J. Chem. Phys.* 19, 1499-1504 (1951).—*C.A.* 46, 5939*i*.

The properties of the metal-sol. potentials of Ni in Ni-free hydroxide and phosphate solns. were compared with the properties of unpolarizable electrodes and with the properties of polarizable metal-soln. systems. Chemisorption in the inner Helmholtz layer was discussed in connection with "reversibility" and polarizability of the system.

6028. OTOZAI, KIYOTERU. **Activation energy. I. A new empirical rule for the calculation of activation energy.** *Sci. Papers Osaka Univ.* No. 20, 8 pp. (1951).—*C.A.* 46, 3814*b*.

The bond distance in an activated complex was assumed equal to the bond distance corresponding to the inflection point on the potential-energy curve of a pair of atoms. Among all the possible structures that could be constructed by the use of the fixed values of the activated internuclear distances of the bonds to be broken as well as formed, that structure in which the sum of the energies of the activated bonds became a min. represented the structure of the activated complex and this min. sum of the energies of the activated bonds gave the activation energy of the reaction, when it proceeded in the exothermic direction. The activation energy for the dissocd. adsorption of H_2 on the surface of charcoal was calcd. as a function of the distance between two C atoms.

6029. PRIGOGINE, I. **The activated complex. The equilibrium hypothesis in chemical kinetics.** *J. Phys. & Colloid Chem.* **55**, 765-72, discussion 772-4 (1951).—*C.A.* **46**, 25*e*.

The effect of the chem. reaction on the equil. distribution of a constituent taking part in the reaction proceeded mainly from 2 functions: 1st, particles with higher kinetic energy had an increased probability of inelastic collision, and therefore the chem. reaction must decrease the no. of fast mols. and, 2nd, the various species of particles formed by the chem. reaction had, in the moment of their creation, mean energies that generally differed from the mean thermal energy. This excess energy must be redistributed among all the mols. present and finally to the walls.

6030. TOMITA, AKIRA. **Zinc catalysts for methanol synthesis. V. Action of the water molecule on the zinc oxide catalyst in the catalytic decomposition of methanol.** *J. Chem. Soc. Japan, Ind. Chem. Sect.* **54**, 368-70 (1951).—*C.A.* **47**, 5045*b*.

The promoter action of the hydrated water mol. combined with ZnO was discussed thermodynamically.

6031. BALDOCK, G. R. **Electronic bound states at the surface of a metal.** *Proc. Cambridge Phil. Soc.* **48**, Pt. 3, 457-69 (1952).—*C.A.* **46**, 9926*d*.

Modifications were required to produce bound states assocd. with all of the atoms in the surface and bound states assocd. with particular small groups of atoms, since most of the simple crystal structures did not exhibit surface states without modifications being applied. No surface states were assocd. with the following crystal surfaces if interactions between all nearest neighbors were neglected: (1) the (100), (110), and (111) faces of the simple cubic lattice; (2) the (110) face of the body-centered cubic lattice (with next nearest neighbors included); (3) the (100) and (111) faces of the face-centered cubic lattice; (4) the (100) face of the body-centered cubic lattice (including next-nearest-neighbor interaction); (5) the (110) face of the face-centered cubic lattice; and (6) the (0001) and (2110) faces of the hexagonal close-packed lattice. Surface states existed solely by virtue of the lattice geometry in the graphite and diamond lattices.

6032. BLACKMAN, M. **Oriented crystalline overgrowth.** *Proc. Phys. Soc.* (London) **65A**, 1040-3 (1952).—*C.A.* 47, 3073*g*.

The oriented overgrowth of very thin deposits of alkali halides evapd. onto cleavage surfaces was reviewed. The theoretical implications of some of these results were considered. The discussion applied mainly to monolayers on mica.

6033. BOUDART, M. **Electronic chemical potential in chemisorption and catalysis.** *J. Am. Chem. Soc.* 74, 1531-5 (1952).—*C.A.* 46, 6475*f*.

The electronic chem. potential of a semiconductor changed with temp. and impurity concn. This variation was essential to the properties of semiconducting surfaces in adsorption and catalysis. A qaul. discussion of induced heterogeneity and of its consequences was given on the basis of a simple model of a catalyst surface. Active centers were still essential but their localized description became superfluous.

6034. BOUDART, M. **Heterogeneity of metal surfaces.** *J. Am. Chem. Soc.* 74, 3556-61 (1952).—*C.A.* 46, 10780*h*.

An atom was chemisorbed on a clean and bare metal surface by means of a no. of covalent-resonating (metallic) bonds. If a fraction θ of this ideal surface was covered with adatoms, a double layer was set up which changed the work function of the adsorbent by an amt. $\Delta\phi$ and the adsorption heat by an amt. Δq. If the adatoms did not interact, $\Delta\phi$ and Δq varied linearly with θ. Moreover, $\Delta q = (n/2)\Delta\phi$, where n was the no. of valence electrons of the adatom taking part in the bonding. This effect was termed "induction." It provided a quant. explanation of the fall in adsorption heat with coverage in all cases where pertinent data were available.

6035. DOWDEN, D. A. **Catalytic activity of nickel.** *Ind. Eng. Chem.* 44, 977-85 (1952).—*C.A.* 46, 9960*c*.

Chemisorption of substances by metals depended upon the "residual valencies" of the giant-mol. crystallites. Vacant *d* orbitals appeared necessary for rapid, general chemisorption and, therefore, also for catalytic activity of certain types. The binding potential of the valencies varied inversely as the Fermi energy of the metal electrons and inversely as the ionization potential of the relevant substrate valence electron. These concepts were used in a rationalization of the properties (sp area and sp activity) of Ni and its alloys as catalysts in industry and research.

6036. HAUFFE, K. AND ENGELL, H. J. **The mechanism of chemical sorption from the standpoint of the disorder theory.** *Z. Elektrochem.* 56, 366-73 (1952).—*C.A.* 47, 1457*b*.

By the sorption of O_2 at surfaces of semiconductors, barrier layers were formed, either of high resistance for *n*-type (ZnO) or of low resistance for *p*-type semiconductors (NiO, Cu_2O). The formation mechanism of the barrier layer and its dependence on O_2 pressure, as well of this layer as of a polycryst. *n*-seimconductor with comparable values of bulk and barrier cond., were calcd. and compared with measurements of the mixed systems (ZnO with 2 mol. % Ga_2O_3 or 0.5 mol. % Cr_2O_3) with variable donor concn. between 665 and 800°C.

6037. JURY, STANLEY H. AND LICHT, WM. JR. **Drying of gases. Adsorption wave in desiccant beds.** *Chem. Eng. Progress* 48, 102-9 (1952).—*C.A.* 46, 2854*i*.

The transient conditions which prevailed during adsorption in a desiccant bed gave rise to an "adsorption wave" (concn. gradient in the fluid stream) which originated at the entrance and gradually moved toward the opposite end of the bed. Solutions for certain cases showed how, by utilizing a dimensionless form, all cases cited could be reduced to a single generalized theory. The paper also presented results of an investigation of the kinetic mechanism of the reaction between humid air and the granular desiccant, anhyd. $CaCl_2$. The exptly. detd. adsorption waves were presented for various sets of operating conditions as controlled by the variables: gas velocity, granule size, and length of bed.

6038. ROBERTS, L. E. J. AND ANDERSON, J. S. **Fundamental processes in heterogeneous reactions.** *Revs. Pure & Applied Chem.* (Australia) 2, 1-22 (1952).—*C.A.* 46, 8478*h*.

The fundamentals of solid-phase reactions, chiefly gas-solid reactions and particularly chemisorption, in terms of the modern theory of solids, were critically reviewed.

6039. SCHWAB, GEORGE-MARIA. **Lattice defects in surfaces.** *Z. Elektrochem.* 56, 297-302 (1952).—*C.A.*46, 8447*f*.

The lattice defects, responsible for elec. conduction in semiconductors, phosphorescence, etc., formed the "active points" of a solid catalyst surface. The surface energies corresponding to defects caused by an interstitial cation adjacent to a vacant cation site in a NaCl-type lattice were calcd. for different crystal faces and edges. The same calcn. was made on the defect caused by the replacement of a univalent by a bivalent cation, adjacent to a vacant cation site, and on that caused by the replacement of a bivalent by a trivalent cation, adjacent to a point where the bivalent cation had been replaced by a univalent one.

6040. TAYLOR, H. AUSTIN AND THON, NATHANIEL. **Kinetics of chemisorption.** *J. Am. Chem. Soc.* 74, 4169-73 (1952).—*C.A.* 47, 21*i*.

The equation $dq/dt = ae^{-\alpha q}$, where q was the fraction of gas chemisorbed at time t, and a and α were consts. was shown to be applicable to a large body of data on rate of chemisorption. An extended range of the whole course of the adsorption or reaction was covered; most often it failed toward the reaction end only. Initially the prime function of the gas was the production of sites that decayed at a bimol. rate over the course of the slow adsorption. The rate of slow chemisorption was governed solely by the availability of sites. Parallels to the proposed schemes were found in kinetics of luminescence and photocond. of solids.

6041. TURNBULL, DAVID. **Theory of catalysis of nucleation by surface patches.** *J. Chem.Phys.* 20, 1327 (1952).—*C.A.* 46, 10819*d*.

To account for the effect of surface films on the solidification of supercooled Sn droplets, Kimball proposed that each drop contained m units or patches equally effective in catalyzing crystal nucleation. To account for the temp. dependence of m and for the order-unity value commonly found for m, it was now suggested that (1) the radius R of a patch was of the order of the crit. radius r^* for the growth of a nucleus into the supercooled liquid, and (2) there existed a statistical distribution of patch sizes described by $n_A = f(R)$, where n_A was the no. of patches per unit area with radius equal to or greater than R.

6042. UHLIG, HERBERT H. **Metal surface phenomena.** *Offic. Dig. Federation Paint & Varnish Production Clubs* No. **333**, 650-70 (1952).—*C.A.* **47**, 3774*f*.

Unsatisfied valence forces at the surface of a metal led to a state of tension of the surface atoms and compression of metal underneath. These forces also account for adsorbed films of substances bonded to the metal surface in varying degrees. Films with low energies of bonding were so-called physically adsorbed, and with high energies of bonding were said to be chemisorbed.

6043. DIENES, G. J. **Entropies of activation in metallic diffusion.** *Phys. Rev.* **89**, 185-8 (1953).—*C.A.* **47**, 4679*h*.

The various contributions to the entropy of activation for metallic diffusion were examd. theoretically. In particular, the entropy contribution arising from the altered vibrational frequencies around the saddle point was estd. Neg. overall entropies of activation were theoretically permissible and were likely to arise when the over-all activation energy was small.

IV-2. Physical Adsorption of Gases

6044. EVERSOLE, W. G. AND LAHR, PAUL H. **Evidence for a rigid multilayer at a solid-liquid interface.** *J. Chem. Phys.* **9**, 530-4 (1941).—*C.A.* **35**, 6172^4.

Assuming an immobile hydrous multilayer at a wall of fixed potential, equations were derived relating zeta potentials, concentrations of univalent salt solution, wall potential, and thickness of the immobile layer. Values of 8A to 63A were obtained for the thickness of the immobile layer. The values of wall potential and film thickness were considered sufficiently consistent for each set of data to justify the original assumption.

6045. KRAMERS, H. A. AND WANNIER, G. H. **Statistics of the two-dimensional ferromagnet. Part I.** *Phys. Rev.* **60**, 252-62 (1941).

In an effort to make statistical methods available for the treatment of cooperational phenomena, the Ising model of ferromagnetism was treated by rigorous Boltzmann statistics. A method was developed which yielded the partition function as the largest eigenvalue of some finite matrix, as long as the manifold was only one dimensionally infinite.

6046. KRAMERS, H. A. AND WANNIER, G. H. **Statistics of the two-dimensional ferromagnet. Part II.** *Phys. Rev.* **60**, 263-76 (1941).

The sp heat of the two-dimensional Ising model at the Curie point was investigated. The sp heat was infinite at the Curie point. A new closed form approximation of the partition function λ was developed by using the matrix method in its variational form.

6047. ZHUKHOVITSKIĬ, A.; ZABEZHINSKIĬ, YA. L., AND VENICHKINA, A. **Rate of molecular sorption on active charcoal.** *J. Phys. Chem.* (U.S.S.R.) **15**, 174-83 (1941).—*C.A.* **37**, 5298^8.

Theoretical considerations based on the analogy between diffusion and heat transfer and exptl. data (higher rate of adsorption of Et_2O dild. with H_2 than when dild. with air) showed that external diffusion to charcoal grains was more important than the internal diffusion within particle voids.

6048. ANTROPOFF, A. v. **The adsorption of gases at pressures varying from very low up to very high values. I. Mathematical analysis of the equations for ideal absolute and differential adsorption.** *Kolloid-Z.* **98**, 249-57 (1942).—*C.A.* **37**, 4949^8.

A distinction was made between abs. and differential adsorption. The first referred to the total mass of gas adsorbed in a space with dimensions detd. by the range of operative mol. forces. The second one referred to the excess over the amt. normally present in this vol.

6049. ANTROPOFF, A. v. **The adsorption of gases from the smallest to the highest pressures. II. Derivation and physical discussion of the equations of ideal adsorption.** *Kolloid-Z.* **99**, 35-52 (1942)—*C.A.* **37**, 3989^6.

Differential adsorbed gas was characterized by increasing to a max. and then dropping to zero with increase of pressure. It was the quantity usually measured by direct adsorption methods. Abs. adsorbed gas was the total quantity of gas found in the "adsorption space" in which condensation occurred. Equations of the Langmuir type for the abs. adsorption in terms of d. or pressure were derived.

6050. DAMKÖHLER, G. **Laminar boundary layers in the transfer of matter between smooth plates and [a fluid] streaming parallel to them.** *Z. Elektrochem.* **48**, 178-81 (1942).—*C.A.* **37**, 3991^3.

In the transfer of matter from plate to fluid the thickness of the boundary layer depended on both the rate of flow and the length of the plate measured along the direction of flow, whereas in transfer from fluid to plate it was independent of both factors. A practical corollary was that the rate of adsorption of a gas by a granular adsorbent could not, although the rate of desorption could, be increased by increasing the rate of flow and by decreasing the grain size of the adsorbent.

6051. GREGG, S. J. **Resemblance between surface films on solids and on water.** *J. Chem. Soc.* **1942**, 696-708.—*C.A.* **37**, 1912^1.

The quantities *FA* and *FS* (*F*, surface pressure of the adsorbed film, *A*, area occupied per adsorbed mol., *S*, specific surface of the adsorbent, i.e., its adsorbing area per g), could be calcd.

for the adsorbed film of a gas on a solid from the adsorption isotherm by integration of the Gibbs adosprion equation. The gaseous, expanded liquid, condensed liquid, and the intermediate state between expanded and condensed liquid had their analog in gas-solid adsorption. From the linear range of the above plots both the adsorbing area S and the monolayer capacity of the adsorbent (the no. of mols. per g taken up in a completed monolayer) could be found. Sometimes layers more than one mol. thick were formed.

6052. Rowley, H. H. and Innes, W. B. **Relationships between the spreading pressure, adsorption, and wetting.** *J. Phys. Chem.* **46**, 694-705 (1942).—*C.A.* **37**, 1072^9.

The total spreading pressure for an adsorbed phase on a solid surface was subdivided into that due to the first layer and that due to succeeding layers. The contact angle of a liquid on a solid was detd. by the work of wetting of the adsorbed layer rather than of the solid itself. Similarly, the interfacial contact angle of 2 immiscible liquids with a solid was detd. in most cases by the work of wetting a single adsorbed phase rather than the solid itself. The development was applied to porous solids. Data for the spreading pressure of numerous organic vapors on charcoal were given.

6053. Boyd, G. E. **Some aspects of the properties of solid surfaces.** *Pub. Am. Assoc. Advancement Sci.* No. **21**, 128-40 (1943).—*C.A.* **38**, 3888^1.

The free surface energy of solids could be detd. from theoretical considerations or by detg. the heat of soln. of extremely fine and very coarse cryst. powders. Changes in total surface energy of solids on immersion in liquids could be detd. calorimetrically. Values for the change in free surface energy of solids on exposure to vapors or liquids were obtained by the combination of adsorption data with the Gibbs adsorption theorem.

6054. Dunken, H. **Orientation of molecules by electrostatic forces at interfaces and in supermolecules.** *Z. physik. Chem.* **193**, 40-54 (1943).—*C.A.* **39**, 5151^7.

The same theoretical considerations could be used to treat the combination of dipoles and mols. of higher symmetry to form supermols. and their adsorption on metallic surfaces. The conditions for parallel and antiparallel orientations as well as for normal and tangential adsorption were derived.

6055. Jura, Geo. and Harkins, Wm. D. **A new adsorption isotherm which was valid over a very wide range of pressure.** *J. Chem. Phys.* **11**, 430-1 (1943).—*C.A.* **37**, 6518^5.

Condensed monolayers on water exhibited the linear pres.-area relation $\pi = b - a\sigma$ (π = pres.; σ = area). This equation was valid for condensed films on solids: the linear relation persisted up to higher pressures where the film was several mols. thick. For convenient exptl. use, the equation became $\log (p/p_0) = B - A/v^2$ (p = pres.; v = vol.). This equation gave better agreement with expt., especially at pressures above 200 mm Hg, than did the B. E. T. isotherm.

6056. Kao, S. K. and Chang, T. S. **Arrangement of double molecules on a lattice.** *Trans. Faraday Soc.* **39**, 288-94 (1943).—*C.A.* **38**, 1158^8.

The method consisted of a study of the adsorption of double mols. upon a solid surface and a calcn. of the equil. conditions by a method due to Bethe and Peierls. The no. of ways of arranging 1/2 Nθ double mols. on a lattice of N points, valid for all values of θ, were calcd. The agreement obtained was satisfactory.

6057. Löwry, H. **Solidified water films.** *Phil. Mag.* **34**, 67-70 (1943).—*C.A.* **37**, 3988^3.

A simple method, based on a knowledge of electrodynamic vol., was given for detg. the mean d., the vol., and the thickness of solidified water films.

6058. Cassel, Hans M. **Condensation and supersaturation of adsorbed phases.** *J. Chem. Phys.* **12**, 115-16 (1944).—*C.A.* **38**, 1932^2.

Extensions of the simple Langmuir mechanism to the treatment of multilayers in the adsorption of vapors could not account for the final liquefaction of the adsorbate. This was due to the disregard of lateral cohesion in the design of the film model.

6059. Cassel, Hans M. **Cluster formation and phase transition in the adsorbed state.** *J. Phys. Chem.* **48**, 195-202 (1944).—*C.A.* **38**, 5125^3.

Equations derived for the treatment of multilayer adsorption was incompatible with the Gibbs surface-tension equation. Cohesion forces in mono- and polylayers were discussed on the basis of polar attraction between mols. A relation between the crit. temps. of 2- and 3-dimensional condensation was derived assuming van der Waals equation of state for the monolayers and the coexisting vol. phases. Hysteresis observed in the sorption and desorption of vapors on porous and powd. solids was attributed to super-satn.

6060. Gregg, S. J. **A method for determining the internal area of coal.** *Proc. Conf. Ultra-fine Structure of Coals and Cokes, Brit. Coal Utilisation Research Assoc.* **1944**, 110-17.—*C.A.* **39**, 1277^4.

The internal area, or the monolayer capacity, of a porous solid such as coal, was detd. from FA-$F\Sigma$ graphs (F, surface pres. of adsorbed film; A, area occupied per mole of adsorbate; Σ internal area of adsorbent per g). Graphs of FA *vs.* $F\Sigma$, taken from published adsorption data, showed close resemblance to the FA-F curves for surface films of insol. substances on water ("trough films"). Branches of the curves showed changes of state: gaseous (G), expanded liquid (L_1), condensed liquid (L_2), and the intermediate state (I) between L_1 and L_2, similar to those among trough films, and a state O denoting layer thickening.

6061. Guggenheim, E. A. **Statistical thermodynamics of mixtures with zero energies of mixing.** *Proc. Roy. Soc.* (London) **A183**, 203-12 (1944).—*C.A.* **39**, 1339^1.

A general formula was obtained for the no. of distinct arrangements of a mixt. of any no. of different types of mols. each with its own geometric properties. The thermodynamic properties were deduced for such mixts. in which the energies of mixing were zero. The generalization of Raoult's law was derived by a math. technique much simpler than was used in this type of problem. The formulas were derived in an elementary way for systems with zero energy of mixing and zero vol. change of mixing.

6062. Harkins, William D. and Jura, George. **The decrease (π) of free surface energy (γ) as a basis for the development of equations for adsorption isotherms and the existence of two condensed phases in films of solids.** *J. Chem. Phys.* **12**, 112-13 (1944).—*C.A.* 38, 1932³.

Equations were developed for condensed insol. films on water which fit equally well adsorbed films on solids: $\pi = b - a\sigma$ or $\log (f/f_o) = B-(A/v^2) = B' - (A'/m^2) = \log (p/p_o)$, where π = film pressure, p = gas pressure, f = fugacity, σ = mol. area, v = vol. of material adsorbed, and m = mass of material adsorbed.

6063. Harkins, William D. and Jura, George. **Surface of solids. X. Extension of the attractive energy of a solid into an adjacent liquid or film, the decrease of energy with distance and the thickness of films.** *J. Am. Chem. Soc.* **66**, 919-27 (1944).—*C.A.* 38, 4175³.

At 25°C, the energy of vaporization of water was 10,540 cal per mole. If, however, the water was in the form of a monolayer on the otherwise clean surface of cryst. TiO_2 (as anatase), the heat of vaporization was increased by 62%. For the 2nd layer the increase was 13%, or 1380 cal per mole, for the 3rd 4%, or 450 cal per mole, and for the 4th and 5th layers 80 and 40 cal per mole, resp. The film of water adsorbed on TiO_2 (anatase) should have attained a min. thickness of 5 mol. layers before satn. of the vapor was attained. Measurement of the thickness of the film just below satn. confirmed this, since the thickness was over 15 A. (five mol. layers). The measd. thickness attained was 36 A. or 10 mol. layers for N_2 at -195.6°C. Almost all of the films adsorbed on the surfaces of nonporous solids that were investigated were highly multi-mol. at vapor pressures very slightly below satn. Capillary condensation played no significant role in the sorption with a cryst. powder.

6064. Jaffé, George. **The equation of state of monolayers.** *Phys. Rev.* **66**, 131-8 (1944).—*C.A.* **39**, 236².

The equation of state of monolayers was worked out from exactly the same point of view as the statistical theory of liquids. The formulas obtained should be applicable as well to gaseous films as to condensed films, though not to the domain of transition between the 2, since a change in the potential must be supposed to occur in the transition. The resulting formulas were compared with 2 groups of observations of gaseous films.

6065. Jura, George and Harkins, William D. **Existence of expanded and intermediate phases in films on solids.** *J. Chem. Phys.* **12**, 114 (1944).—*C.A.* 38, 1932⁶.

Equations developed for insol. monolayers on water in the liquid expanded and intermediate phases were valid for certain films adsorbed on solids.

6066. Livingston, H. K. **Contact angles and adsorption on solid surfaces.** *J. Phys. Chem.* 48, 120-4 (1944).—*C.A.* 38, 3529³.

Available adsorption and contact-angle data for 2-component solid-liquid-vapor systems indicated that in most cases the thermodynamic contact angle (θ) was zero and the fraction of the solid surface covered with adsorbed mols. from the vapor (σ) was unity.

6067. Livingston, H. K. **The relationship between the Brunauer-Emmett-Teller adsorption isotherm and the new isotherm of Jura and Harkins.** *J. Chem. Phys.* 12, 466 (1944).—*C.A.* 39, 660³.

The observed correlation between the Jura-Harkins and the B. E. T. isotherms were in agreement with the results obtained from a math. treatment of the 2 isotherms.

6068. Onsager, Lars. **Crystal statistics. I. A two-dimensional model with an order-disorder transition.** *Phys. Rev.* 65, 117-49 (1944).—*C.A.* 38, 1930².

6069. Roginskiĭ, S. Z. **Method of deriving statistical relations in the field of surface phenomena and its applications to adsorption problems.** *Compt. rend. acad. sci. U.R.S.S.* 45, 61-4 (1944).—*C.A.* 40, 4931⁸.

The forms of the functions $\theta(Q)$ and $p(Q)$ were considered, where θ was the fraction of surface covered for surface patches on which the heat adsorption = Q. The distribution function for such patches was $p(Q) = dn/dQ$. Relations deduced permitted the approx. calcn. of the distribution function from the adsorption isotherm or vice versa.

6070. Roginskiĭ, S. Z. **Statistical theory of adsorption isobars and isosteres for nonuniform surfaces and a graphical method of finding the distribution from the isotherms and isobars.** *Compt. rend. acad. sci. U.R.S.S.* 45, 194-6 (1944).—*C.A.* 40, 4931⁹.

Equations previously developed were modified so that they could be utilized directly in the analysis of exptl. data.

6071. Stranski, I. N. **Adsorption on solid bodies.** *Z. anorg. Chem.* **252**, 241-8 (1944).—*C.A.* 40, 4274⁷.

The step-like form of adsorption isotherms of solid bodies was traced to the formation of condensed solid films. The decrease of the satg. value of the adsorbate with increasing temp. was due to the existence of such films.

6072. Wang, J. S. and Mei, Jenn-Yueh. **The application of Kirkwood's theory of order-disorder transformation to adsorption.** *Chinese J. Phys.* 5, No. 1, 64-88 (1944) (in English).—*C.A.* 40, 2710⁶.

The penomenon of superlattice formation on an adsorbed layer was treated theoretically by applying both Kirkwood's and Bethe's theories of order-disorder transformation. The adsorbed layer was regarded as a 2-dimensional lattice in which each site was capable of accommodating only one adsorbed atom. The lattice was divided into a-sites and β-sites, and the numbers of the 2 classes were assumed to be equal. For this type of superlattice it was shown that when the interaction energy between the adsorbed atoms in pos. and the temp. was below a certain crit. temp., the slope of adsorption isothermals and heat of adsorption had a discontinuity at a certain transition θ, where θ was the fraction of the surface covered by adsorbed atoms.

6073. CASSIE, A. B. D. **Multimolecular adsorption.** *Trans. Faraday Soc.* **41**, 450-8 (1945).—*C.A.* **40**, 786[3].

Statistical formulas for multi-mol. adsorption of a single species were derived based on the assumption that if A mols. of pure liquid were adsorbed by unit mass of solid, X were adsorbed at low-energy sites, and $(A - X)$ were adsorbed at sites identical with those available to the mols. in the pure liquid. Interchange between the two forms gave a free energy of mixing, and the distribution between the two forms was detd. by the condition that the total free energy of the phase should be a min. Each contribution to the total free energy was calcd. When applied to localized sites, an equation is derived identical with that of B. E. T. When applied to a mobile monolayer, the latter must be gaseous to give an adsorption isotherm or to give surface adsorption that varied with the concn. of the solute in the soln.

6074. FOSTER, A. GRAHAM. **The sorption of condensable vapors by porous solids. III. Multimolecular adsorption.** *J. Chem. Soc.* **1945**, 769-73.—*C.A.* **40**, 1375[5].

A simplified derivation of the general equations of the B. E. T. theory was followed by a discussion of the application of this theory to several abnormal types of isotherms.

6075. FOSTER, A. GRAHAM. **The sorption of condensable vapors by porous solids. IV. Linear isothermals and the Langmuir equation.** *J. Chem. Soc.* **1945**, 773-6.—*C.A.* **40**, 1375[5].

The theory of multimol. adsorption was applied to linear isothermals such as have been reported for MeOH, PrOH, iso-PrOH, and BuOH on certain silica gels. By making due allowance for multilayer adsorption, the first layer adsorption was accurately fitted by the Langmuir equation. The satn. values for unimol. adsorption calcd. from the corrected data at lower relative pressures agreed with those derived by the "point A" method of Emmett and Brunauer from the data at higher relative pressures.

6076. INNES, W. B. AND ROWLEY, H. H. **Equilibria of two-dimensional systems. II.** *J. Phys. Chem.* **49**, 411-17 (1945).—*C.A.* **40**, 2371[9].

Several thermodynamic relations involving equilibria between a three-dimensional gas or vapor phase and a two-dimensional insol. surface phase for a two-component system were derived. One of these relations made possible the evaluation of spreading pressures from two-component adsorption data. Equilibria between a three-dimensional liquid and vapor phase and a surface phase for a two-component system were also treated and several relations derived; one of these related the selective adsorption to the change of spreading pressure with chem. potential.

6077. MCMILLAN, W. G. JR. AND MAYER, JOSEPH E. **The statistical thermodynamics of multicomponent systems.** *J. Chem. Phys.* **13**, 276-305 (1945).—*C.A.* **39**, 3999[6].

Distribution functions for multicomponent systems were defined as proportional to the probability that n mols. in an infinite isothermal system of fugacity set z would occupy the configurational coödinates symbolized by $\{n\}$. All thermodynamic functions could be obtained as certain sums of integrals of these distribution functions. The general equations were applied to the imperfect multicomponent gas, to isotopic gas mixts., and to condensed systems with the variables converted to the usual activities and activity coeffs.

6078. MOKRUSHIN, S. G. **Application of the Maxwell-Boltzmann distribution law to colloid chemistry.** *J. Gen. Chem.* (U.S.S.R.) **15**, 259-68 (1945 (English summary).—*C.A.* **40**, 3324[3].

The Maxwell-Boltzmann equation can be used for the deduction of the basic equations of colloid chemistry, i.e., Gibbs' adsorption equation, Langmuir and Freundlich adsorption equations, Kelvin's vapor-pressure expression, Traube rule, etc.

6079. PICKETT, GERALD. **Modification of the Brunauer-Emmett-Teller theory of multimolecular adsorption.** *J. Am. Chem. Soc.* **67**, 1958-62 (1945).—*C.A.* **40**, 1374[9].

All the simplifying assumptions made in the B. E. T. development except one were accepted. The B. E. T. theory was modified to take into account a decrease in probability of escape of mols. in the nth layer as more of the surface was covered with n layers. The equation was tested with data on the adsorption of N_2 on Fe-Al_2O_3 catalyst. It was assumed that the no. of layers on a part of the surface was limited to n and that more than n layers could be accommodated on the rest of the surface, the fraction of the surface accommodating a given no. of layers being related to the no. exponentially. This equation was tested with hydrated cement paste with good results.

6080. ROGINSKIĬ, S. Z. **A general analysis of processes on inhomogeneous surfaces and its application to the theory of adsorption. I. The adsorption equilibrium.** *J. Phys. Chem.* (U.S.S.R.) **19**, 185-200 (1945).—*C.A.* **39**, 5141[9].

The theory was based on Langmuir's equation for adsorption on inhomogeneous surfaces, i.e., it assumed the adsorption layer to be unimol. and the interaction between the adsorbed mol. to be negligible. It allowed a calcn. of the inhomogeneity from the exptl. isotherms and isobars.

6081. ROGINSKIĬ, S. Z. AND TODES, O. **Statistical theory of the adsorption of gas mixtures. I.** *Acta Physicochim.* U.R.S.S. **20**, 307-26 (1945).—*C.A.* **40**, 785[8].

The statistical theory of the adsorption of gases on complex inhomogeneous surfaces was extended to gas mixts. Probable relations between the heats of adsorption of different gases on the same areas of a complex surface were discussed for the cases when the adsorption forces were of different nature. The heats of adsorption may vary in like or in contrary sense or be unrelated. The conditions and relations governing the mutual displacement of the gases were established for the cases of heats of adsorption varying in the same sense.

6082. Ying, C. F. **Approximate partition function in the statistical theory of adsorption.** *Chinese J. Phys.* **6**, 1-16 (1945).—*C.A.* **40**, 5975^6.
The configurational partition function of the adsorbed layer was modified in two wyas: (1) by correcting the configuration energy expression and (2) by modifying the formulas of equil. distribution. It was evaluated by both methods and the adsorption isotherm, and the heat of adsorption computed for the case of a quadratic lattice with a dipole moment. Values for the last two quantities were also given when a uniform continuous distribution of the distant adsorbed particles was assumed.

6083. Anderson, Robert B. **Modifications of the Brunauer, Emmett, and Teller equation.** *J. Am. Chem. Soc.* **68**, 686-91 (1946).—*C.A.* **40**, 3322^5.
The B. E. T. equation could be fitted to the isotherms to relative pressures greater than 0.7 by multiplying the relative pres. by a const. that was less than one. This const. was interpreted to mean that the heat of adsorption in the second to ninth layers was less than the heat of liquefaction. An equation of a similar type for adsorption isotherms on porous solids and a new type of equation for adsorption limited to n layers were derived. The equation reduced to the Langmuir equation when $n = 1$ and to the simple B. E. T. equation when $n = \infty$. When the relative pres. equaled 1, V was equal to nV_m. The n-equation of B. E. T. reduced to $V_{mc}/(c + 1)$ for the case when $n = 1$ and $x = 1$, whereas the proposed equation reduced to V_m under these conditions.

6084. Bangham, D. H. **The recognition of phase transitions in adsorbed films on solids.** *J. Chem. Phys.* **14**, 352 (1946).—*C.A.* **40**, 4274^9.
From dimensional changes accompanying adsorption, films adsorbed on charcoal blocks were mobile and obeyed equations of state similar to those of films at liquid/gas interfaces. Phase transitions occurred and metastable films frequently were observed. A two-dimensional condensed phase did not necessarily confer complete wettability nor render capillary condensation in cavities inevitable.

6085. Bangham, D. H. **Aggregational states in adsorbed films on incompletely wettable solid surfaces.** *J. Chem. Phys.* **14**, 352-3 (1946).—*C.A.* **40**, 4275^4.
Substances completely wettable by water were those on which the pattern of adsorbed water mols. resembled that of the mols. of ordinary water or could fade imperceptibly into it. Incompletely wettable surfaces were not necessarily those that did not adsorb water, but those on which the pattern was incompatible with that of ordinary water. Differences in behavior between water, C_6H_6 and CCl_4 were too slight to suggest that the more general aspects of the phenomenon depended on the H-bond structure peculiar to water.

6086. Bangham, D. H. **Saturated adsorbed films and the structure of deeply supercooled water.** *Nature* **157**, 733 (1946).—*C.A.* **40**, 5313^4.
Droplets of supercooled water flattened at -50°C and spread to a film at -70°C. In H_2O (and alcs.) the H bond was important in detg. mol. configuration, but the presence of H bonds was not essential to the formation of molecularly thick films in which the mol. pattern differs from that of the normal liquid.

6087. Defay, R. and Prigogine, I. **The extension of the formula of Gibbs to the surface tension of surfaces not in equilibrium.** *Bull. classe sci., Acad. roy. Belg.* **32**, 36-51 (1946).—*C.A.* **41**, 4351^e.
If adsorption equil. is not established, new functions, lateral chem. potential, must be added to the usual chem. potentials in the surface. These affect dynamic surface tension. A Gibbs model with a geometrical surface is discussed and is compared to a model with a finite thickness of interphase layer. For these models equations are compared for the velocity of passage of a component from a bulk phase to the surface region.

6088. Elton, G. A. H. **Note on the multilayer postulate of Eversole and Lahr.** *J. Chem. Phys.* **14**, 463 (1946).—*C.A.* **40**, 5315^7.
The data of Eversole and Lahr were not very consistent, and the validity of their assumption was questionable. Using a similar exptl. technique, values were obtained for the "rigid" layer which approached zero.

6089. Emmett, P. H. **Multilayer adsorption equations.** *J. Am. Chem. Soc.* **68**, 1784-9 (1946).—*C.A.* **40**, 6931^3.
The significance, usefulness, limitations, and relation of the Harkins and Jura method and the B. E. T. method for measuring the surface area of porous or finely divided solids were discussed.

6090. Hill, Terrell L. **Proposed modification of the Brunauer-Emmett-Teller theory of multimolecular adsorption.** *J. Am. Chem. Soc.* **68**, 535-6 (1946).—*C.A.* **40**, 2710^9.
The Pickett modification of the B. E. T. theory of multimol. adsorption applied to those cases where the max. no. of adsorbed layers was restricted. A discussion of Pickett's assumptions led to the conclusion that, although the equations may improve the agreement with exptl. data in some cases, the modification should not be considered a really fundamental improvement over the B. E. T. theory.

6091. Hill, Terrell L. **Theory of multimolecular adsorption from a mixture of gases.** *J. Chem. Phys.* **14**, 46-7 (1946).—*C.A.* **40**, 3322^9.
The B. E. T. theory of multimol. adsorption was extended to a mixt. of two gases.

6092. Hill, Terrell L. **Statistical mechanics of multimolecular adsorption. I.** *J. Chem. Phys.* **14**, 263-7 (1946).—*C.A.* **40**, 3958^8.
The B. E. T. equation, though not completely satisfactory, was apparently the correct equation for the particular model used. Real improvements

in the theory should have followed from refinements in the model rather than from modifications in the treatment. The B. E. T. model was a special case of the model suggested here, but it had the advantage of presenting no math. difficulties. Preliminary results based on improved models indicated that a somewhat refined multimol. adsorption theory was capable of predicting capillary condensation for suitable values of parameters.

6093. Hill, Terrell L. **Theory of multimolecular adsorption from a mixture of gases.** *J. Chem. Phys.* **14**, 268-75 (1946).—*C.A.* **40**, 3959^2.

By making use of the evapn-condensation properties of liquid mixts., the B. E. T. theory of multimol. adsorption was extended to a mixt. of gases. No satisfactory exptl. data were available with which to test the theory.

6094. Hill, Terrell L. **Statistical mechanics of multimolecular adsorption. II. Localized and mobile adsorption and absorption.** *J. Chem. Phys.* **14**, 441-53 (1946).—*C.A.* **40**, 5315^8.

The transition from localized to mobile adsorption (in the first adsorbed layer) took place at rather low temps. for potential barriers of around 1000 cal/mole or less, so that localized phys. adsorption should be a very rare phenomenon at the temps. usually used in adsorption expts. Since the B. E. T. (and Langmuir) isotherm actually assumed localized adsorption, a new approx. isotherm equation was derived on the basis of a mobile first layer obeying a two-dimensional van der Waals' equation. This isotherm was in semi-quant. agreement with the two-dimensional phase changes observed by Jura, et al., and by earlier workers, at very low pressures. The localized-mobile transition in the adsorption of H_2 by metals was mentioned briefly.

6095. Jura, George and Harkins, William D. **Surfaces of solids. XIV. A unitary thermodynamic theory of the adsorption of vapors on solids and of insoluble films on liquid subphases.** *J. Am. Chem. Soc.* **68**, 1941-52 (1946).—*C.A.* **41**, 1908*c*.

Empirical equations of state were derived for the phases (1) gas, (2) liquid expanded, (3) liquid intermediate, (4) liquid condensed, and (5) higher pres. condensed. These equations were valid for adsorbed films on solids. The effects of temp. were in general the same on a solid subphase as on water in the low-pres. region, but the sign of the entropy term was reversed at high pressures. The relations of the various phases on the surface of a solid were capable of statistical treatment. The general phase relations of adsorbed films on solids were essentially the same as those of monolayers of oil on water.

6096. Kiselev, A. V. **Thermodynamics of adsorption processes.** *Uspekhi Khim.* **15**, 456-84 (1946).—*C.A.* **41**, 1139*h*.

6097. Luttinger, J. M. and Tisza, L. **Theory of dipole interaction in crystals.** *Phys. Rev.* **70**, 954-64 (1946).—*C.A.* **41**, 2290*d*.

Dipole arrays may be represented as vectors in a many-dimensional vector space. An arbitrary array may be decompd. into a linear combination of basic arrays, the energies were additive and may be obtained from the characteristic values of the quadratic form. The method was demonstrated by the complete solution of the characteristic value problem of a highly symmetric class of cubic arrays. The min.-energy arrays were obtained without and with an external magnetic field for the simple cubic, body-centered cubic and face-centered cubic lattices.

6098. Powers, T. C. and Brownyard, T. L. **Studies of the physical properties of hardened portland cement paste. III. Theoretical interpretation of adsorption data.** *J. Am. Concrete Inst.* **18**, 469-504 (1946).—*C.A.* **41**, 2545*h*.

Adsorption of water and conditions of equil. were explained in terms of the B. E. T. theory and the capillary condensation theory. Adsorption characteristics were considered with reference to age and original water-cement ratio of hardened pastes and to the influence of cement compn. The sp surface of solids in hardened paste was calcd. from the adsorption characteristics, and was an index of the amt. of colloidal material present.

6099. Roginskiĭ, S. Z. and Todes, O. **Limits of the applicability of statistical methods in the analysis of adsorption phenomena.** *Acta Physicochim. U.R.S.S.* **21**, 519-38 (1946) (in English).—*C.A.* **41**, 19*g*.

The difficulties inherent in any attempt to differentiate between adsorption effects caused by interaction of adsorbed mols. and those caused by heterogeneity of the adsorbent surfaces were discussed. An adsorption expt. using isotopes was suggested as a crit. means of such differentiation.

6100. Temkin, M. and Levich, V. **Adsorption equilibrium on heterogeneous surfaces.** *J. Phys. Chem.* (U.S.S.R.) **20**, 1441-57 (1946) (in Russian).—*C.A.* **41**, 2958*h*.

By assuming that the adsorbed layer was unimol. and that no forces operated between the adsorbed mols., it was possible to calc. the relation between the value of the energy of adsorption and the area for which this value was valid, if the adsorption isotherm was given.

6101. Cassie, A. B. D. **Multimolecular adsorption. II.** *Trans. Faraday Soc.* 43, 615-20 (1947) .—*C.A.* **42**, 3639*df*.

The B. E. T. adsorption isotherm was applicable only to systems in which adsorption occurred as distinct clusters of mols. It was not applicable to multimol. adsorption as continuous layers superposed on a continuous monolayer. If mols. were adsorbed as clusters at the localized sites, distinct configurations may be counted as those that were obtained by interchanging clusters of different size. The increase in the no. of distinguishable configurations by this method of counting gave the required increase of entropy. The surface of keratin at satn. vapor pressure consisted of small clusters of water mols. spaced apart on an otherwise water-repellent surface.

6102. FRÖHLICH, H. AND SACK, R. A. **Light adsorption and selective photoeffect in adsorbed layers.** *Proc. Phys. Soc.* (London) 59, 30-3 (1947).—*C.A.* 42, 1492*a*.

The probability was calcd. for the adsorption of a light quantum by a single layer of atoms adsorbed on a nonmetallic surface. The spectral width of the emission band should increase proportionally to $\sqrt{T}$, similarly to the increase in width of the absorption band in solids. Thus, the higher the temp., the further should the photoelec. threshold be shifted towards longer wave lengths. No exptl. evidence on this point was available.

6103. GURNEY, C. **Surface tension in liquids.** *Nature* 160, 166-7 (1947).—*C.A.* 41, 6788*e*.

The tension stress in planes of surfaces was explained by a mol. interpretation of the thermodynamics of surfaces developed by Gibbs. The chem. potential, μ, of surface mols. was higher than that of interior mols. More mols. thus left the surface than entered it. A tension was then set up in the remaining surface mols. When this stress was increased to that necessary to equalize the μ of surface and interior mols., equil. was established.

6104. HILL, TERRELL L. **Statistical mechanics of multimolecular adsorption. III. Introductory treatment of horizontal interactions. Capillary condensation and hysteresis.** *J. Chem. Phys.* 15, 767-77 (1947).—*C.A.* 42, 806*h*.

Calcns. on multimol. adsorption and capillary condensation, which took into account horizontal interactions in an approx. manner, were presented. Several other topics were discussed briefly, including the quasichem. method and reversible hysteresis. Reversible hysteresis involved the use of metastable portions of the adsorption isotherm. The theory predicted, in agreement with expt., that the adsorption curve should be below the desorption curve.

6105. ITTERBEEK, A. VAN. **Adsorption of gases by solid materials.** *Symposium Grenslaagverschijnselen, Verhandel. Koninkl. Vlaam. Acad. Wetenschap., Belg.* 1947, 38-61.—*C.A.* 43, 3263*f*.

Both activated, unimol. adsorption, and van der Waals' multimol. adsorption are discussed on the basis of the Langmuir, Polanyi, and B. E. T. theories. Van der Waals' adsorption involved 2 kinds of energy, one resulting from direct interaction between surface and gas mols., and one due to forces acting between adsorbed mols. When the latter prevails, the isotherm curve has an S shape, and the adsorbed layer may tend to form a film.

6106. MAYER, JOSEPH E. **Integral equations between distribution functions of molecules.** *J. Chem. Phys.* 15, 187-201 (1947).—*C.A.* 41, 3333*b*.

Integral equations were derived that relate variations in the potentials of av. force between mols. of a system at two different ds. or activities. These permitted the calcn. of the change in thermodynamic properties, or of the change in the distribution of mols. in space, in a liquid or cryst. phase, if either the temp. was varied, or if the mutual potential between the mols. was assumed to change.

6107. MCMILLAN, W. G. **Multilayer gas adsorption on composite surfaces.** *J. Chem. Phys.* 15, 390-7 (1947).—*C.A.* 41, 4992*b*.

The B. E. T. equation for adsorption of a gas on a free plane homogeneous surface was extended to the case of a mixt. of two such surfaces, in an attempt to explain the observed deviations below one monolayer. The resulting equation may be greatly simplified for the case that the adsorption-energy parameter, c, for each component surface, was large with respect to unity, as was usually the case in low-temp. adsorptions of N_2, A, etc. This approx. form of the equation was applied to the N_2 isotherm on an inorg. salt and gave substantially better agreement with expt. than did the simple B. E. T. equation.

6108. RICE, O. K. **The behavior of pure substances near the critical point.** *J. Chem. Phys.* 15, 314-32 (1947).—*C.A.* 41, 2984*f*.

Some aspects of the surface tension of the liquid near the crit. point were considered in some detail. The highest temp. T_m at which a meniscus could exist was assumed to be the temp. at which the surface tension vanished at the same time that the condition for equil. between liquid and vapor phases was fulfilled. The pressure-vol. isotherm at T_m had a finite horizontal region, corresponding to the squeezing out of surface when the surface tension was zero. The slope of the isotherm at T_m in the vapor region outside the horizontal portion was closely related to the slope in the liquid region just to the other side of the horizontal part; these slopes approached zero as the flat part was approached. Above T_m there was still a process that may be called condensation, but no horizontal part to the isotherms.

6109. WHITE, LOCKE, JR. **A limitation of the determination of surface area by the "point B" method.** *J. Phys. & Colloid Chem.* 15, 644-7 (1947).—*C.A.* 41, 4994*d*.

The "point B" method for selecting the point on a low-temp. adsorption isotherm corresponding to a monolayer of adsorbed gas will agree with the B. E. T. method only when the const. c of the B. E. T. equation has a value somewhat larger than 9.

6110. ANDERSON, ROBERT B. AND HALL, W. KEITH. **Modification of the Brunauer, Emmett and Teller equation. II.** *J. Am. Chem. Soc.* 70, 1727-34 (1948).—*C.A.* 42, 6198*g*.

The B. E. T. equation was modified to the form $V/V_m = ckx/[(1 - jkx)[1 - (c - j)kx]]$. The factor j took into account the decrease in area of a pore with increasing adsorption and was defined as the ratio of the no. of mols. required to fill the nth layer to the no. required to fill the $(n - 1)$ layer; k equaled $e^{d/RT}$, d being the no. of cals by which the free energy of adsorption in the second and higher layers differed from the free energy of liquefaction of the adsorbate. For type IV isotherms flattening off at values of x smaller than 0.85 k was in the range 1.4 to 2.2. The relative pres. at which most of the capillaries would have been filled was approx. $1/k$. The const. j was always less than 1 for a porous solid, ranging from 0.01 to as high as 0.9 depending on the pore size of the adsorbent.

6111. BOER, J. DE. **Quantum theory of condensed permanent gases. I. The law of corresponding states.** *Physica* **14**, 139-48 (1948).—*C.A.* **42**, 6187*e*.

The equations of state of the gases H_2, D_2, and N_2 can be written in a reduced form, in which the thermodynamic quantities T, P.V. etc., are expressed in "molecular units," i.e., units obtained from the characteristic parameters of the inter-mol. field. In general, the reduced equations of state contain a parameter A*, h, and the mol. masses. This parameter is a measure of the effect of quantum mechanics.

6112. COOK, MELVIN A. **Theory of adsorption of gases on solids.** *J. Am. Chem. Soc.* **70**, 2925-30 (1948).—*C.A.* **43**, 1237*d*.

The adsorption forces were described by terms expressing (1) the interaction forces of adsorbed mols. with the adsorbent and (2) the adsorbate interaction forces, the latter being largely empirical. The derived equations agreed with sigmoid isotherms over the entire range of relative pressure x above 0.05, certain obvious modifications being required to provide agreement for $x < 0.05$. Heats of adsorption derived from the theory appeared consistent with isosteric and colorimetric heats of adsorption.

6113. CREMER, ERIKA. **Adsorption on solid surfaces.** *Osterr. Chem.-Ztg.* **49**, 1-10 (1948).—*C.A.* **44**, 9769*b*.

Langmuir's adsorption isotherm was theoretically investigated.

6114. DERYAGIN, B. V. AND KROTOVA, N. A. **Electric theory of adhesion of films to solid surfaces.** *Doklady Akad. Nauk, S.S.S.R.* **61**, 849-52 1948); *Uspekhi Fiz. Nauk* **36**, 387-406 (1948).—*C.A.* **43**, 2842*i*, 7769*e*.

A film gutta-percha was made to adhere to the lower face of a solid plate (glass, Ni, Zn, steel) which could be rotated around a horizontal axis so as to form any desired angle α with the perpendicular. Under the action of a load P suspended on the lower end of the film, detachment began to a certain angle α_0 and proceeded at a rate v (in cm/sec.) which increased with P and with α. If the work of detachment A was taken to be equal to the work of the falling load, $A = (P/b)\ (1 - \cos\ \alpha)$. Exptl. plots of A as a function of v showed an initial very rapid increase of A with v, and A of the order of magnitude of 10^5 ergs/cm². A correct theory was developed on the assumption that almost all work of detachment was spent to overcome electrostatic forces between opposite charges formed in the process of detachment.

6115. DOLE, MALCOLM. **Statistical thermodynamics of the sorption of vapors by solids.** *J. Chem. Phys.* **16**, 25-30 (1948).—*C.A.* **42**, 1476*c*.

The statistical method of treating the sorption of vapors was further generalized to include variable heats of sorption in different layers. It was shown under what conditions multilayer sorption could lead to a linear isotherm and to various modifications of the B. E. T. equation. The interaction between sorbed mols. in the same layer was also treated.

6116. FOSTER, A. GRAHAM. **Pore size and pore distribution.** *Discussions Faraday Soc.* **1948**, No. 3, 41-51.—*C.A.* **43**, 1240*c*.

The detn. of capillary radii of porous solids by application of the Kelvin equation and other adsorption methods was discussed. Condensation did not occur until after the formation of an adsorbed layer approx. 2 mols. thick. Assuming that the mol. d. $(\sigma) = 1.33 \times 10^{-8}\ (M/d)^{1/3}$ and that the Kelvin equation gave the remaining radius r, the true pore radius r_0 was given by $r_0 = r - 2\sigma$ for a given adsorbent and should have been independent of the nature of the adsorbed substance. Data of Broad and Foster plotted as r_0 vs. v curves showed virtual coincidence for EtOH, dioxane, morpholime, triethylamine, *n*-hexane, $CHCl_3$, and PhH on Fe_2O_3, but PhMe, cyclohexane, CCl_4, *n*-octane, H_2O and D_2O did not agree so well. There was no proof of the correctness of the values of r calcd. by the Kelvin equation, but only a demonstration of its apparent validity for comparative purposes.

6117. GREGG, S. J. AND MAGGS, F. A. P. **Detection of changes of state in films adsorbed at the gas-solid interface.** *Trans. Faraday Soc.* **44**, 123-36 (1948).—*C.A.* **42**, 6602*d*.

The occurrence of phase transformation in adsorbed films on solids, and the existence of phases resembling the gaseous, liquid-expanded, and liquid-condensed phases of films on water were indicated by plotting the 2-dimensional compressibility β against surface pressure. A method for the calcn. of β from the adsorption isotherm was given. Examn. of the plots of β' against log p for a no. of published isotherms showed: (a) true 1st-order transformations were rare; (b) diffuse 1st order transformations were common; (c) 3rd-order transformations were sometimes found; (d) a true or diffuse 1st order transformation between 2 phases in the monolayer (such as $L_1 \rightleftharpoons L_2$) gave rise to a max. in the curve of β' against log p, multilayer formation was exhibited as a rising branch not followed by a falling branch.

6118. HALSEY, GEO. **Physical adsorption on non-uniform surfaces.** *J. Chem. Phys.* **16**, 931-7 (1948).—*C.A.* **42**, 8573*i*.

Adsorption on a uniform surface with interaction showed that the hypotheses of the B. E. T. theory led to substantially no adsorption beyond the first layer if $E_2 = E_L$, and stepwise isotherms if $E_1 > E_2 > E_3 > \ldots > E_L$. For the monolayer adsorption of gases on Ag, Pt, and steel, the heterogeneous nature of the adsorbing surface was clearly indicated. The typical multilayer isotherm was shown to be composed of 3 regions: noncooperative adsorption on a strongly heterogeneous surface; cooperative adsorption on a still heterogeneous surface; and cooperative multilayer adsorption induced by small van der Waals perturbations some distance from the surface. The isotherm $p/p_0 = \exp. \{-a/\theta^r\}$ was derived.

6119. Hill, Terrell L. **"Derivation" of the complete van der Waals equation from statistical mechanics.** *J. Chem. Education* 25, 347-8 (1948).—*C.A.* 42, 6594*d*.

The assumptions that must be made in deriving the van der Waals equation by statistical mechanics were presented.

6120. Hill, Terrell L. **Statistical mechanics of multimolecular adsorption. IV. The statistical analog of the B. E. T. constant a_1b_2/b_1a_2. Hindered rotation of a symmetrical diatomic molecule near a surface.** *J. Chem. Phys.* 16, 181-9 (1948).—*C.A.* 42, 3236*g*.

An approx. study was made of the restricted rotation of a sym. diatomic mol. near a surface. This makes possible some calcns. concerning the B. E. T. const. $c = R \exp (\epsilon_1 - \Delta)/kT$, and especially the factor R (which is customarily set equal to unity). This factor was of the order of 5-10. A method of estg. the area occupied per mol. in a completely filled monolayer was mentioned. The temp. dependence of the quantity R was of some exptl. interest, and a brief discussion of this dependence as predicted by this approx. treatment was included.

6121. Hill, Terrell L. **Steric effects. I. Van der Waals potential energy curves.** *J. Chem. Phys.* 16, 399-404 (1948).—*C.A.* 42, 4009*c*.

Reliable van der Waals potential energy functions were available in only a limited no. of cases. An approx. semi-empirical method was presented for estg. these curves in other cases, based on an extrapolation from the nature of the curves that were known.

6122. Hüttig, G. F. **The evaluation of adsorption isotherms.** *Monatsh.* 78, 177-84 (1948).—*C.A.* 42, 7598*a*.

The isotherm equation was derived: $\theta = [K_1 p/(1 + K_1 p)][1 + (p/P)]$, where θ was the ratio between the vol. of gas adsorbed and that required to form a single layer on the adsorbent, p was the partial pressure of the adsorbate, P was the liquefaction pressure, and K_1 was the ratio between k_1, the rate of condensation per unit pressure per unit amt. of bare surface, and k_2, the rate of evapn. from a layer per unit no. of mols. in that layer. The equation was shown to apply to the adsorption of MeOH by Fe_2O_3 and to the adsorption of MeOH and EtOH by powd. quartz.

6123. Keenan, A. G. **Anderson's modifications of B. E. T. equation.** *J. Am. Chem. Soc.* 70, 3947-8 (1948).—*C.A.* 43, 4075*f*.

Published data on heats of adsorption of A and N_2 on carbon blacks actually supports Anderson's equation for the monolayer vol. An expression for the vol. adsorbed in the nth layer, when summed for n from 1 to ∞, gives an isotherm equation identical with one derived more directly by Anderson.

6124. Kemball, C.; Rideal, E. K., and Guggenheim, E. A. **Thermodynamics of monolayers.** *Trans. Faraday Soc.* 44, 948-54 (1948).—*C.A.* 43, 8795*d*.

Formulas analogous to those for adsorbed monolayers of a single species were derived for the free energy, spreading pres. (ϕ), and log $l_i p_i/kT$ (l_i was a quantity having the dimensions of length and p_i was the partial v. p. of species $i = 1$ or 2) of both mobile and localized monolayers of 2 adsorbed species. In the special case when $B_{12} = (1/2)(B_1 + B_2)$, it was shown that $l_1 p_1 \exp. (-B_1 \phi/kT) + l_2 p_2 \exp. (-B_2 \phi/kT) + l_2 p_2 \exp. (-B_2 \phi/kT) = \phi$, where the B parameters were analogous to 2nd virial coeffs. of slightly imperfect gases. For ideally dil. solns. a similar equation applied in which $l_1 p_1$ was replaced by $s_1 C_1$ (s_i was a parameter independent of the compn. of the soln.).

6125. Mennessier, André; Boucher, Raymond, and Montigny, Pierre. **Theoretical bases for the coefficient τ of the rates of adsorption.** *Compt. rend.* 226, 1090-2 (1948).—*C.A.* 42, 4817*c*.

An equation is derived on the basis of the Langmuir theory of unimol. adsorption for the rate of adsorption of a gas on a solid. The equation has the following form, $m = m_o{}^{-t/K+b}$, where m is the mass of gas adsorbed, m_o is the mass of gas required for a monolayer, t is the temp., and K and b are consts. This equation is similar to that detd. experimentally, for the rate of adsorption of dry benzene on active charcoal in times greater than 60 sec.

6126. Smith, T. D. and Bell, R. **Relation between the Brunauer-Emmett-Teller and Harkins-Jura isotherms.** *Nature* 162, 109-10 (1948).—*C.A.* 42, 8046*d*.

When the exponent n in the B. E. T. isotherm was finite and equal to or less than 5, the surface pressure calcd. from this isotherm was no longer a linear function of the surface area. Harkins-Jura isotherm would not be expected to apply. This was in accord with the observation that the Harkins-Jura isotherm did not fit adsorption data for highly porous amorphous carbon for which $n < 3$.

6127. Vinogradov, G. V. and Borodulina, L. P. **Nomograms for Langmuir's [absorption] equation.** *Zhur. Priklad. Khim.* (J. Applied Chem.) 21, 249-50 (1948).—*C.A.* 44, 402*b*.

6128. Walker, Wm. C. and Zettlemoyer, Albert C. **A dual-surface B. E. T. adsorption theory.** *J. Phys. & Colloid Chem.* 52, 47-58 (1948).—*C.A.* 42, 2488*g*.

The B. E. T. equation was extended to cases in which the surface was assumed to be composed of two parts, A and B, in relative amts. V_{mA} and V_{mB} characterized by consts. C_A and C_B. They showed that if the heat of adsorption on part A of the surface was small ($C = \sim 2$) and the heat of adsorption on part B was large ($C = \sim 100$), then a plot of $x/V(1-x)$ against x would give a curve concave to the x axis rather than a straight line.

6129. Yu, Hun-Tsen. **A statistical derivation of the Brunauer-Emmett-Teller adsorption equation.** *J. Chinese Chem. Soc.* 15, 193-9 (1948).—*C.A.* 42, 6602*c*.

Derivation directly from distribution considerations was attempted without making explicit reference to the thermodynamic relations. As in the B. E. T. model, localized sites were assumed, and interactions between mols. in the same layer, as well as transmissions of the polarizing effects from the first to higher layers, were neglected.

6130. Band, William. **Anomalous adsorption of helium at liquid-helium temperatures.** *Phys. Rev.* 76, 441-2 (1949).—*C.A.* 43, 8778*d*.

The results of Long and Meyer raised a serious question of the validity of the B. E. T. theory. The anomalously high values of the vol. of gas that would just fill the first monolayer at its satn. of d. yielded by the ordinary B. E. T. plot were real, and indicated only that the B. E. T. theory required generalization.

6131. Cook, Melvin A. and Pack, Douglas H. **Extrapolation of adsorption isotherms to high relative pressures and the determination of the surface pressure of adsorbed films on solids.** *J. Am. Chem. Soc.* 71, 791-7 (1949).—*C.A.* 43, 6033*g*.

Methods were outlined for handling the complex infinite series of the theoretical equation. The convergence and divergence properties of the equation were discussed. The Bangham equation derived from the Gibbs' adsorption equation for the surface pressure π of an adsorbed film was integrated by means of the crit. adsorption isotherm equation and found to yield values that agreed well with those obtained by graphical integration of the exptl. isotherms. The theory offered a method for evaluating the surface pressure from all types of phys. adsorption isotherms, including those exhibiting capillary condensation.

6132. Crisp, D. J. **A two-dimensional phase rule. I. Derivation of a two-dimensional phase rule for plane interfaces.** *Research* (London), *Suppl.*, *Surface Chemistry* 1949, 17-22.—*C.A.* 43, 8795*i*.

A modified general phase rule was developed employing the basic principles of Gibbs for defining phase relations. The generalized equation was considerably simplified when restricted to a single surface, contg. q surface phases. The no. of degrees of freedom, F, was $F = C - P^B - (q-1)$, where C was the no. of components, and P^B the no. of bulk phases. The simplified rule was sufficient to cover most applications.

6133. Drenan, J. W. and Hill, Terrell L. **Statistical mechanics of adsorption. VIII. The statistical analog of the B. E. T. constant a_1b_2/b_1a_2 for simulated benzene and hydrogen iodide molecules on graphite.** *J. Chem. Phys.* 17, 775-81 (1949).—*C.A.* 44, 1303*c*.

The approx. study of the restricted rotation of mols. near a surface was extended to an unsym. diat. mol., HI, and a ring mol., C_6H_6, for a graphite surface in each case. Calcns. of the factor $R[C = R$ exp. $(\epsilon_1 - \lambda)kT]$ were made for these cases. R was the same order of magnitude (2-20) as for the sym. diat. mol., λ = heat of vaporization of the liquid; $-\epsilon$ was the energy of an isolated mol. in its ground state relative to infinite sepn. from the surface as the zero of energy; k was the Boltzmann const.; and T, the abs. temp.

6134. Gorter, C. J. and Frederikse, H. P. R. **Physical adsorption.** *Physica* 15, 891-6 (1949).—*C.A.* 44, 3332*a*.

A method was developed for calcg. the entropy of the adsorbed matter from the measurements. The total entropy was max. when the first layer was approx. half occupied. The kinetic theory gave a valuable first approxn. to the distribution of adsorbed matter, but generally predicted too rapid a variation of the quantity adsorbed with the pressure. The thermodynamic treatment was independent of any model and was also valid in the case of capillary condensation.

6135. Gregg, S. J. **Phase changes in adsorbed films at the gas/solid interface.** *Research* (London), *Suppl.*, *Surface Chemistry* **1949**, 205-16.—*C.A.* 43, 8789*c*.

Film compressibilities calcd. from the adsorption isotherms permitted elucidation of the transformations between the different states in gas films adsorbed on solids. Calcd. abs. values of the compressibilities were of the same order as those established for films on water. Adsorption hysteresis appeared to arise in many, but not all, instances from a suspended phase transformation within the film.

6136. Hill, Terrell L. **Physical adsorption on nonuniform surfaces.** *J. Chem. Phys.* 17, 106 (1949).—*C.A.* 43, 2840*a*.

The B. E. T. model of adsorption, although it assigns extremely unrealistic properties to the liquid state, nevertheless leads to correct deductions.

6137. Hill, Terrell L. **Thermodynamic transition from adsorption to solution.** *J. Chem. Phys.* 17, 507 (1949).—*C.A.* 43, 7804*h*.

Thermodynamic studies indicated that the results of a previous study carried over to the more general case without formal change.

6138. Hill, Terrell L. **Statistical mechanics of adsorption. V. Thermodynamics and heat of adsorption.** *J. Chem. Phys.* 17, 520-35 (1949).—*C.A.* **43,** 8791*e*.

The thermodynamics of an adsorbate on an inert adsorbent was discussed. Particular attention was given to heats of adsorption in an attempt to clarify and extend the available methods in this field. The true equil. $\Delta H = T\Delta S$ of adsorption for adsorbate molecules was given by $(\partial \ln \rho/\partial T)\gamma = \Delta H/RT^2$, where ϕ was the two-dimensional spreading pressure.

6139. Hill, Terrell L. **Physical adsorption and the free-volume model for liquids.** *J. Chem. Phys.* 17, 590 (1949).—*C.A.* 43, 8777*g*.

The method of Lennard-Jones and Corner, in which a free-vol. model of the liquid state was used for treating surface tension, was applied to the liquid like adsorbate (of 3 or more layers) on a free adsorbent surface.

6140. Hill, Terrell L. **Extension of Fowler's treatment of surface tension to physical adsorption.** *J. Chem. Phys.* 17, 668-9 (1949).—*C.A.* 43, 8776*h*.

The free-vol. model of a liquid could be applied to a liquid-like adsorbate (three or more layers). An analogous extension of Fowler's treatment of surface tension was given.

6141. Hill, Terrell, L. **Statistical mechanics of adsorption. VI. Localized unimolecular adsorption on a heterogeneous surface.** *J. Chem. Phys.* 17, 762-71 (1949).—*C.A.* 44, 1303*a*.
The Langmuir isotherm for localized unimol. adsorption was generalized (using statistical methods) in order to discuss adsorption on a heterogeneous surface, with and without interactions between adsorbed mols. The configurational entropy, and the nature of the phase changes on a random heteregeneous surface were discussed. On this type of surface the theory predicted, at least for one special case, that condensation would occur in two steps at low enough temps.

6142. Hill, Terrell, L. **Statistical mechanics of adsorption. VII. Thermodynamic functions for the B. E. T. theory.** *J. Chem. Phys.* 17, 772-4 (1949).—*C.A.* 44, 1303*b*.
Thermodynamic functions were calcd. from the B. E. T. statistical model.

6143. Joly, M. **General theory of transformations of different orders in monolayers.** *Research* (London), *Suppl.*, *Surface Chemistry* 1949, 37-46 (in French) (English summary).—*C.A.* 43, 8796*b*.
The points of transformation were assumed to correspond to states of a stable equil. between all mols. of the films. For areas between points of transformations, the film was formed from a mixt. of mols. corresponding to the nearest equil. states. This hypothesis permitted the establishment of area-temp. diagrams representing the constitution of all possible phases of unimol. films. The transformations of different orders corresponded to a discontinuous transition from one mol. form to another, and the order of transformations depended on the miscibility or nonmiscibility of the successive mol. forms. The transition from one mol. form to another was accompanied by changes in the no. of degrees of freedom. The mols. of the film could occupy only a discrete series of areas characteristic of their degrees of freedom.

6144. Livingston, H. K. **The cross-sectional areas of molecules adsorbed on solid surfaces.** *J. Colloid Sci.* 4, 447-58 (1949).—*C.A.* 44, 19*c*.
The ratio between the cross-sectional area of adsorbed N_2 and of other adsorbed mols. was detd. from published data. The adsorbed areas were calcd. from these ratios, by taking a value of 15.4 A.^{2}/mol. for N_2 adsorbed at -196°C: H_2, 8.3, -253°C; D_2, 7.2, -253°C; CH_4, 16.0, -183°C; C_2H_2, 21.1, -78°C; C_2H_6, 32.3, 25°C; C_7H_{16}, 59.4, 24°C; NH_3, 14.6, -32°C; O_2, 14.6, -183°C; H_2O, 10.8, 25°C; PrOH, 19.8, 25°C; CO, 16.3, -183°C; CO_2, 19.5, -78°C; N_2O, 20.4, -78°C; Ne, 10.0, -253°C; CS_2, 37.9, 0°C; $CHFCl_2$, 38.2, 0°C; EtCl, 24.8, 0°C; A, 14.6, -195°C; Kr, 18.5, -195°C.

6145. Osawa, Fumio and Satô, Hisanao. **A theory of adsorption.** *Busseiron Kenkyû* (Researches on Chem. Phys.) No. 20, 94-101 (1949).—*C.A.* 47, 1457*g*.
The adsorption isotherm of gases on solid surfaces obtained in terms of cluster integrals was of the form of a B. E. T. type-II isotherm. The internal structure of adsorbate mols. was ignored in calcn. The necessary conditions for the occurrence of 1st-order phase transition in the adsorbed film were discussed in detail.

6146. Ross, Sydney and Secoy, C. H. **Physical adsorption. III. A simplified equation of state at high pressures and its application to surface films on liquids and solids.** *J. Phys. & Colloid Chem.* 53, 306-18 (1949).—*C.A.* 43, 6034*a*.
An empirical equation of state ascribed to Amagat was put into a form suitable for an integration of the Clausius equation for estg. the latent heat of 2-dimensional phase transitions. Heat values of 4.2, 3.0, and 8.0 kcals. per mole were found for phase transitions of ethyl palmitate, α-monopalmitin, and pentadecylic acid, resp., on a liquid substrate. A value of 11.46 kcals. was obtained for the phase transition of *n*-heptane on solid graphite.

6147. Ross, Sydney. **Physical adsorption. IV. A comparison of two theories of multilayer adsorption.** *J. Phys. & Colloid Chem.* 53, 383-91 (1949).—*C.A.* 43, 6034*b*.
The theory of multilayer adsorption proposed by Hüttig was applied to isotherms of C_2H_6 on NaCl at 90°K., CH_3OH and C_2H_5OH vapor on SiO_2, and TiO_2 at 298°K. The isotherms plotted according to the Hüttig equation were linear up to relative pressures of 0.6 to 0.8, whereas those plotted according to the B. E. T. equation were linear to about 0.35 relative pressure. The two equations yielded the same surface area values.

6148. Semenchenko, V. K. **Molecular theory of surface phenomena in solutions. II. Adsorption in multicomponent systems.** *Kolloid. Zhur.* 11, 109-15 (1949).—*C.A.* 43, 6884*e*.
General equations were derived.

6149. Tanaka, Tomoyasu. **Statistical theory of adsorption.** *Busseiron Kenkyû* (Researches on Chem. Phys.) No. 14, 1-17 (1949).—*C.A.* 46, 8455*h*.
The method of characteristic-value problems, such as the 2-dimensional ferromagnetic lattice, was applied to the adsorption of gas on a doughnut-shaped surface. Adsorption isotherms for low- and high-pressure regions were derived, but these 2 limiting curves did not coincide at the intermediate region.

6150. Zhukhovitskiĭ, A. A. and Rubinshtein, R. N. **Theory of multimolecular adsorption.** *Doklady Akad. Nauk S.S.S.R.* 65, 41-4 (1949).—*C.A.* 45, 6452*g*.
The theory was developed for a smooth homogeneous adsorbent with the inclusion of interaction between mols. for the case of a mixt. of substances. The partition functions of the mol. in a liquid cell and in a cell corresponding to the adsorbed phase were assumed identical and independent of the coverage. The B. E. T. equation might have been taken as zero approximation. The latter gave reasonably acceptable values of the

sp surface area at high c, but rendered incorrect isotherms at low and medium c. As an example, at $c = 2$, $p = 0.62$, $x = 1.13$, whereas by B.E.T., $x = 2.03$; at $c = 1.2$, $p = 0.9$, $x = 1.8$, whereas B.E.T. gave $x = 12$.

6151. ZHUKHOVITSKIĬ, A. A. AND RUBINSHTEIN, R. N. **Determination of the surface area of adsorbents.** *Doklady Akad. Nauk S.S.S.R.* 66, 73-5 (1949).—*C.A.* 43, 6036*c*.

If the heat of adsorption was much greater than the heat of condensation, there was a range where the adsorption a was equal to the no. of mols. in a monolayer. At the pres. p_m, the equation could be written $a/a_m = 1 - (1/\Gamma_1 p) + (\Gamma_2 p)$, with the 3 consts. a_m, Γ_1, and Γ_2. A more complete equation was $v = 1 - (1/\eta) + \alpha\eta + B\,[(-1/\eta^2) + \alpha\,^2\eta^2]$; the parameter α characterized the tendency to form a 2nd layer while the 1st layer was not yet completed. The parameter B characterized the interaction between absorbed mols. For practical detn. of a_m, the exptl. adsorption isotherm, in logarithmic coordinates, traced on transparent paper, was made to coincide with one of the family of the theoretical curves $v(\eta)$. The adsorption of H_2O vapor on CuO, $a_m = 18$ mg/g; for N_2 on a promoted Fe catalyst, the value of a_m was almost identical with the B. E. T. value.

6152. DAVIS, LANNES E. AND RIBLE, JOHN M. **Monolayers containing multivalent ions.** *J. Colloid Sci.* 5, 81-3 (1950).—*C.A.* 44, 6242*d*.

Guggenheim's statistical theory of mixed liquids was applied to 2-dimensional systems to develop analogous equations.

6153. DRENAN, JAMES W. AND HILL, TERRELL L. **The two-component van der Waals fluid.** *J. Phys. & Colloid Chem.* 54, 1132-48 (1950).—*C.A.* 45, 1830*h*.

The partition function was derived for a 2-component fluid, each component of which satisfied the statistical model leading to van der Waals' equation of state. The equation of state for the system in 3 dimensions, crit. consts. of the system and the vapor pressures of components were derived from this. Because of deficiencies in the van der Waals concept the model failed when the mol. vols. of the 2 components were very dissimilar.

6154. DUBININ, M. M. AND ZAVERINA, E. D. **Sorption and structure of active carbon. IX. Adsorption of gases by active charcoals.** *Zhur. Fiz. Khim.* 24, 1262-72 (1950).—*C.A.* 45, 5484*h*.

The equations: $a = (W_0/v) \exp\left[-BT^2(\log p/p_s)^2/\beta^2\right]$ (1) and $W = W_0 \exp(-k\epsilon^2/\beta^2)$ (2) were derived from Polanyi's theory and verified for a series of vapors adsorbed on charcoals of the 1st structural type (i.e., with relatively shallow micropores). The symbols meant: W and W_0 = adsorption space and its limiting value (cc./g); β = a scale factor (= 1 for the standard substance, benzene); B = a const. detd. by the pore-size distribution; a = the amt. absorbed (millimol./g); p/p_s = the equil. relative pres.; ϵ (cal/M) = adsorption potential; v = mol. vol. of the liquefied vapor. Adsorption of ethylene, for which $b = v_c/3 = 4.33$, was detd. at 20°C, between 1 and 400 mm on 12 charcoals of 3 origins, activated to various extents in CO_2. Benzene adsorption was also measd. at 20°C on the same samples. The agreement with the theory was good but only semiquant.

6155. EVERETT, DOUGLAS H. **Thermodynamics of adsorption. I. General considerations.** *Trans. Faraday Soc.* 46, 453-9 (1950).—*C.A.* 44, 9768*b*.

Measurement of isotherms at one temp. could never distinguish conclusively between the various possible models. Four heats of adsorption were defined from thermodynamics that were equally fundamental. That which involved principally a consideration of the decrease of potential energy of mols. on adsorption was a more useful quantity to study both experimentally and theoretically than that the interpretation of which involved, in addn., a consideration of spreading pressures.

6156. EVERETT, DOUGLAS H. **Thermodynamics of adsorption. II. Thermodynamics of monolayers on solids.** *Trans. Faraday Soc.* 46, 942-57 (1950).—*C.A.* 45, 4521*f*.

For adsorption, two possible reference systems were the ideal localized monolayer and the ideal nonlocalized monolayer. The former was more appropriate for systems at low temps., and especially where the adsorbent may be expected to possess definite active sites; whereas the latter model should be applicable to systems at high temps., especially where the surface forces were expected to exhibit no strongly localized max.

6157. EVERETT, DOUGLAS H. **Thermodynamics of adsorption. III. Analysis and discussion of experimental data.** *Trans. Faraday Soc.* 46, 957-69 (1950).—*C.A.* 45, 4521*h*.

Thermodynamics of adsorbed monolayers may be discussed very satisfactorily by employing the Langmuir adsorption model as the ideal reference system. Nonideal behavior arises from deviations of both the heat and entropy of adsorption from the ideal values. A linear relation exists between the nonideal entropy and the heat of heat adsorption which for adsorption on charcoal at 0°C is identical with that between heats and entropies of condensation of vapors to pure liquids, or into soln.

6158. FERGUSSON, R. R. AND BARRER, R. M. **Derivation and development of Hüttig's multilayer sorption isotherm.** *Trans. Faraday Soc.* 46, 400-7 (1950).—*C.A.* 44, 9768*g*.

A statistical derivation was given of a generalized sorption isotherm based on evapn.-condensation properties of a sorbed mol. Characteristic isotherm equations were obtained analogous to the various modifications of the B. E. T. isotherm. Isotherms of types I, III, and to some extent V, were obtained, but not types II and IV. A major objection to this and the B. E. T. treatment of multilayer sorption was the lack of interaction laterally with mols. in adjacent columns, although interaction with mols. in the same column was permitted.

6159. Groot, S. R. de; Hooyman, G. J., and Seldam, C. A. ten. **The Bose-Einstein condensation.** *Proc. Roy. Soc.* (London) **A203**, 266-86 (1950).—*C.A.* **45**, 4506*e*.

A variety of potential fields in which the particles of the gas move were investigated, and the no. of dimensions was not restricted to 3. A well-defined transition point appeared only for a very large (theoretically infinite) no. of particles.

6160. Halsey, G. D. Jr. **The role of heterogeneity in adsorption and catalysis.** *Discussions Faraday Soc.* **1950**, No. 8, 54-6.—*C.A.* **45**, 9986*a*.

Deviations from the Langmuir equation were explained in terms of the nonuniformity of the adsorbing surface. For phys. adsorption near the satn. pressure, interaction was important in detg. the isotherm. Refined treatment of a uniform surface did not lead to the B. E. T. equation, but led to the conclusion that heterogeneity and interaction operated simultaneously. The satisfactory B. E. T. surface-area detn. using N_2 was discussed. Because a group of sites which were overwhelmingly important catalytically may not contribute appreciably to adsorption, little direct information could be gained about catalysis from adsorption studies.

6161. Higuchi, Izumi. **Capillary condensation theory and the B. E. T. theory for multimolecular sorption.** *J. Chem. Soc. Japan, Pure Chem. Sect.*, **71**, 142-5 (1950); Chem. Researches (Japan) **9**, 85-131 (English summary, 132) (1951).—*C.A.* **45**, 4100*f*, 7406*e*.

The exptl. results on the freezing of nitrobenzene sorbed on silica gel were assembled and crit. discussions were made on the capillary condensation theory and on the B. E. T. theory. The former was found to succeed in obtaining full understanding of the phenomena, whereas the latter failed even in qual. explanation. The shape of isotherms above the relative vapor pressures P/P_0 (P = vapor pressure of capillary-condensed liquid, P_0 = ordinary vapor pressure) of 0.3 ~ 0.4 depended upon the pore-size distribution of the sorbent, regardless of adopting any theory for the formation of unimol. layer.

6162. Hill, Terrell L. **Statistical mechanics of adsorption. IX. Adsorption thermodynamics and solution thermodynamics.** *J. Chem. Phys.* **18**, 246-56 (1950).—*C.A.* **44**, 9209*g*.

It was shown that the usual soln. thermodynamics could be recast into an equiv. but alternative form that was more natural and useful in adsorption work. Relations between the two systems of thermodynamics were pointed out. The extension to the case of sorption from a mixt. of gases was included.

6163. Hill, Terrell L. **Statistical mechanics of adsorption. X. Thermodynamics of adsorption on an elastic adsorbent.** *J. Chem. Phys.* **18**, 791-6 (1950).—*C.A.* **44**, 10441*d*.

Thermodynamic equations were derived which should be useful in the analysis of exptl. data and theoretical models referring to the adsorption of a one-component gas on an elastic adsorbent. This problem was closely related to the thermodynamics of adsorption of solute from a liquid soln. onto an elastic adsorbent immersed in the soln. (e.g., a myosin thread).

6164. Hill, Terrell L. **Hüttig multilayer adsorption isotherm.** *J. Am. Chem. Soc.* 72, 5347-8 (1950).—*C.A.* **46**, 4880*d*.

The Hüttig modification of the B. E. T. equation is criticized on the following points: (1) violation of the principle of microscopic reversibility, (2) incorrect equil. condition in the Fergusson and Barrer statistical derivation of this theory. The elimination of these 2 difficulties leads uniquely to the B. E. T. equation.

6165. Hüttig, G. F. and Theimer, O. **Theory of adsorption. I. A proposal for a compromise between the adsorption isotherms of Brunauer, Emmett, and Teller, and that of Hüttig.** *Kolloid-Z.* **119**, 69-73 (1950).—*C.A.* **45**, 4994*e*.

Reference was made to the modified and expanded form of Langmuir's adsorption isotherm (Hüttig equation). A compromise equation was proposed that took into account both this Hüttig-isotherm and the B. E. T. equation. The proposed equation fitted the exptl. data better than either one of the 2 other isotherm equations.

6166. Hüttig, G. F.; Schreiner, H., and Klein, R. **Theory of adsorption. II. The phenomena of the real adsorption.** *Kolloid-Z.* **119**, 157-60 (1950).—*C.A.* **45**, 4994*f*.

Factors were enumerated that influence considerably the amts. of gas adsorbed and the shape of the isotherms: (1) presence of foreign gases at the adsorbing surfaces, depending on the previous treatment of the adsorbent, (2) changes of the adsorbing surfaces due to the adsorption and subsequent desorption of a gas, (3) changes of the affinity between adsorbent and adsorbate as a function of time, and (4) effect, on the shape of the adsorption isotherm, of the quantity of gas that was admitted as the first portion to the outgassed adsorbent.

6167. Joly, M. **General theory of the structure, transformations, and mechanical properties of monolayers.** *J. Colloid Sci.* 5, 49-70 (1950).—*C.A.* 44, 6232*b*.

Mols. in a monolayer were assumed to exist only in a finite no. of energy states corresponding to a discrete series of mol. areas, which are the areas at the points of transformation. The transformations of the different orders correspond to the discontinuous change from one mol. form to another, the order depending on the miscibility or nonmiscibility of the successive mol. forms.

6168. Miyake, Akira. **Elasticity of keratin.** *Busseiron Kenkyû* (Researches on Chem. Phys.) No. **30**, 63-76 (1950).—*C.A.* **46**, 4889*a*.

The mol. structure of the keratin mol. was assumed to be perfect α-type (bent form) with no load. Part of the α-type configuration then changed gradually to β-type (stretched form) configuration by elongation, becoming perfectly β-type with 30% elongation. The effect of water absorption, which occurred on the back-bone of the chain and affected H bonds, was taken into consideration by use of the B. E. T. theory of multilayer adsorption.

6169. Ono, Syû. **Application of Ursell and Mayer's treatment for imperfect gases to adsorption.** *J. Chem. Phys.* **18**, 397 (1950).—*C.A.* **44**, 6228*b*.

A general development of the Gibbs phase integral was presented for a system consisting of adsorbate mols. and an adsorbent. From the results the adsorption isotherm could, in principle, be calcd.

6170. Ono, Syû. **Statistical mechanics of adsorption.** *Mem. Faculty Eng. Kyushu Univ.* **12**, 9-19 (1950).—*C.A.* **44**, 8733*a*.

Adsorption of gaseous mols. on a solid surface was considered using the statistical theory of multimol. adsorption with suitable terms included for horizontal interaction between mols.

6171. Ono, Syû. **Statistical thermodynamics of multimolecular adsorption. I.** *J. Phys. Soc. Japan* 5, 232-7 (1950).—*C.A.* 45, 924*h*.

The statistical method was applied to the adsorption of gases on a solid wall. It was concluded that the adsorption was effectively unimol. except in the immediate vicinity of the condensing point. Comparison with exptl. results showed considerable discrepancy between theory and expt., especially in the high-pressure region. The discrepancy may be due to neglect of the interactions between the mols. in the 2nd layer and wall.

6172. Ono, Syû. **Statistical mechanics of adsorption. I. II. III.** *Busseiron Kenkyû* (Researches on Chem. Phys.) No. **19**, 1-8; No. **21**, 46-58 (1949); No. **23**, 10-17 (1950).—*C.A.* **46**, 10775*g*.

The statistical-mech. theory of multicomponent systems was applied to the adsorption of gases on solid surfaces. Formulations and discussions were given of the mol. distribution function in terms of cluster integrals.

6173. Ôsawa, Fumio and Satô, Hisanao. **A theory of adsorption of polar and asymmetrical molecules.** *Busseiron Kenkyû* (Researches on Chem. Phys.) No. **22**, 14-25 (1950).—*C.A.* **47**, 1457*i*.

In the case of adsorption of polar or asym. mols. on a solid, the B. E. T. type-II isotherm was obtained. The adsorbed mols. were apt to lie flat on the surface. There were 2 alternatives of the possibility that the phase transition in the adsorbed film occurred; one corresponded to the condensation of 2-dimensional gas and the other was of new type which was due to the interaction between adsorbed mols. whose orientation was fixed to some extent on the surface.

6174. Peek, H. Milton and Hill, Terrell L. **Lattice theories of the liquid state.** *J. Chem. Phys.* **18**, 1252-5 (1950).—*C.A.* **45**, 2736*a*.

The Lennard-Jones and Devonshire theory of the liquid state was modified by introduction of the quasichem. method to allow for both holes in the liquid and an expandable lattice. The essential step was to minimize the free energy with respect to a lattice-expansion parameter. On the whole, crit. consts. obtained in this way were in appreciably better agreement with expt. than those of the L.-J. and D theory. However, the equil. no. of holes turns out to be much too small.

6175. Taylor, Hugh S. **Physical adsorption in heterogeneous systems.** *J. chim. phys.* 47, 74-81 (1950).—*C.A.* 44, 6699*g*.

The concept of surface heterogeneity permitted the Freundlich equation to be derived from the Langmuir equation by assuming a distribution function for the active centers suggested by Zel'dovich. Conversely, Sips was able to deduce the distribution curve for the active centers from adsorption isotherms. Finally, Halsey's arguments were summarized to show that through coöperative adsorption 2nd and higher layers of physically adsorbed gas may be formed on an adsorbent at relative pressures given approx. by the equation $P/P_0 = e^{-\Delta E/RT}$, where ΔE was the difference between the heat of adsorption of the gas in a higher layer and the heat of liquefaction.

6176. Theimer, O. **Thermodynamic derivation and interpretation of Hüttig's adsorption isotherm in terms of a model.** *Monatsh.* **81**, 1120-8 (1950).—*C.A.* 46, 2871*e*.

Hüttig's adsorption isotherm, corresponded to a monolayer adsorption with group formation. It was shown mathematically that this adsorption isotherm corresponded to the equation of state for the adsorbed phase, $\Pi\Omega = (1 - \alpha)\, RT\ \{1 + [\beta(1 - \alpha)/2\Omega] + [\beta^2(1 - \alpha)^2/3\Omega^2] + \ldots\}$, with $(1 - \alpha) = 1 - Kp + K^2p^2 - \ldots$, where Ω was the partial molar surface, Π was the 2-dimensional pressure, p was the pressure of the gas, α was the fraction of mols. that occurred in groups, and β was approx. 4 times the surface occupied by a mole of densely packed, 2-dimensional arrangement of mols. of the adsorbed substance.

6177. Tompkins, F. C. **Physical adsorption on nonuniform surfaces.** *Trans. Faraday Soc.* **46**, 569-80 (1950).—*C.A.* 45, 18*c*.

The non-uniformity of an adsorbent surface affected the isotherm obtained in phys. adsorption, both for localized and nonlocalized monolayers. Subject to the approxn. that the internal partition function of the adsorbed mol. was independent of the adsorption potential at each site, it was shown that the log pressure vs. log amt. adsorbed was a linear plot, whether the adsorbed film was regarded as a polyphase or nonophase system.

6178. Troesch, A. **Kinetic equations for adsorption and desorption.** *J. chim. phys.* 47, 145-7 (1950).—*C.A.* 44, 8194*c*.

The adsorption of CH_4 on a Ni-Al-Mn-kieselghur catalyst obeyed a simple Langmuir rate equation in which desorption was neglected and the rate of adsorption was proportional to the fraction of the surface not covered by adsorbate. The rate of adsorption of H_2 did not follow such an equation but indicated that the surface was heterogeneous. Desorption of CH_4 from the Ni surface at 170°C and a const. pressure of 10^{-4} mm could not be measured because the evolved gas was all H_2. The rate of

H_2 desorption did not follow the simple Langmuir equation and again indicated surface heterogeneity.

6179. Wentorf, R. H., Jr.; Buehler, R. J.; Hirschfelder, J. O., and Curtiss, C. F. **Lennard-Jones and Devonshire equation of state of compressed gases and liquids.** *J. Chem. Phys.* 18, 1484-1500 (1950).—*C.A.* 45, 3272*g*.

The reduced equation of state for compressed gases and liquids A, N_2, and H_2 was computed according to the theory of Lennard-Jones and Devonshire for many temps. and ds. The corrections due to gas imperfection of internal energy, sp heat, and entropy as well as the compressibility factor (pv/RT) were expressed in terms of reduced variables. The calcns. were made by punched-card methods. The theory of Lennard-Jones and Devonshire was unsatisfactory at ds. near crit. point and lower but improved at higher ds., becoming better for normal liquids.

6180. Aigrain, Pierre; Dugas, Claude, and Germain, Jean. **Adsorption on semiconductors.** *Compt. rend.* 232, 1100-1 (1951).—*C.A.* 45, 6454*a*.

The adsorption of gases on certain semiconductors could be explained on the basis of purely electrostatic phenomena. Such adsorption was due to an ionic bond between the gas impurities in the semiconductor. Values of heats agreed within reasonable limits with exptl. data.

6181. Aston, J. G. and Mastrangelo, S. V. R. **Anomalous first layer of adsorbed helium and a modified Brunauer-Emmett-Teller theory.** *J. Chem. Phys.* 19, 1067-8 (1951).—*C.A.* 46, 2871*i*.

The 1st completed B. E. T. "monolayer" had an anomalous d.; it was composed of more than 1 layer, with thermal properties and d. of packing in layers analogous to those of the bulk solid in equil. with liquid He at the temp. of the isotherm detns. The solid layers melted when the pressure required to solidify them was larger than the effective "system pressure" (analogous to the pressure inside a small drop). There should be transitions analogous to melting on going from 2 to 4°K., at const. coverage, when the 3rd (uppermost), 2nd, and 1st (innermost) layers were melting. When the outer layer was completely liquid and the layer below started to liquefy, the completely liquid layer became the 2nd B. E. T. layer.

6182. Balázs, N. L. **The statistical theory of adsorption.** *Physica* 17, 865-75 (1951) (in English).—*C.A.* 46, 2871*g*.

By using a statistical treatment, not only were the consts. appearing in the kinetic arguments defined, but a description of the totality of the equil. properties was immediately obtained. The method was applied to unilayers that were either mobile or immobile, and to various multilayer models. The isotherms of Langmuir, of Cassie, and of B. E. T. were derived.

6183. Band, William. **Mobile multilayer adsorption of a Bose-Einstein gas: helium.** *J. Chem. Phys.* 19, 435-8 (1951).—*C.A.* 45, 9321*f*.

If the energy of adsorption was assumed to decrease with thickness according to a simple power law, the theory gave an isotherm in good agreement with observations on He adsorption at temps. above the λ-temp. of liquid He, for all gas pressures higher than 10% satn. With mixts. of He^3 and He^4 isotopes the theory predicted appreciable adsorption of He only in the first or localized monolayer; all mobile monolayers should be practically pure He^4 at all gas pressures.

6184. Barrer, R. M. **Hüttig's multilayer isotherm.** *J. Chem. Soc.* 1951, 1874-6.—*C.A.* 45, 9992*a*.

The Hüttig isotherm was thermodynamically consistent with a succession of layers in a potential field, vertical interactions between sorbate mols. in successive layers being omitted with lateral interactions allowed. The Hüttig isotherm was thus complementary to the B. E. T. isotherm where vertical interactions were introduced and lateral interactions were omitted.

6185. Barrer, R. M. and Robins, A. B. **Multilayer sorption in terms of an equation of state.** *Trans. Faraday Soc.* 47, 773-87 (1951).—*C.A.* 46, 317*h*.

Multilayer formation occurred below the crit. temp., and a boundary between a densely populated film and a dil. region may move slowly outward as p/p_0 increased. On plane surfaces allowing unrestricted sorption, N_2 gave Langmuir-like isotherms above its crit. temp. and type-II isotherms near its b.p. Water, on the other hand, in unrestricted sorption may give isotherms of types I, II, and III. Type-III isotherms arose when the van der Waals potential $2a/b$ was considerably larger than the energy of interaction $-E_1$ between monolayer mols. and the sorbent. In the spaces between parallel plates or in cylindrical capillaries open at both ends, N_2 gave type-IV isotherms and H_2O gave isotherms of type IV and V according to the relative values of $2a/b$ and $-E_1$.

6186. Benson, G. C. and Shuttleworth, R. **The surface energy of small nuclei.** *J. Chem. Phys.* 19, 130-1 (1951).—*C.A.* 45, 3677*c*.

The surface energy of a 3-dimensional crystal depended on 3 terms proportional, one each, to the area, edge length, and no. of corners. Various energy and distance relations were calcd. for an aggregate of 13 mols. arranged in cubic close-packed, hexagonal close-packed, and pentagonal forms. Even for clusters of only 13 mols. the surface energy was less than 15% below that for a plane surface.

6187. Bering, B. P. and Serpinskiĭ, V. V. **Theory of unimolecular adsorption on homogeneous surfaces.** *Doklady Akad. Nauk S.S.S.R.* 79, 273-6 (1951).—*C.A.* 46, 19*a*.

The general form of the equations for the two-dimensional pres. π as a function of the no. Γ of mols. adsorbed per unit surface area, and of the coverage θ, was known for a localized layer and for a nonlocalized layer, resp. Assuming the interaction function to be of the form $f(r)=2\mu_e{}^2/r^4$ (where r = distance between mols. in the layer, μ_e = effective dipole moment), the adsorption isotherms were found with the aid of Gibbs adsorption equation. The effective μ_e was considered temp. independent, as in fields of the order of 10^8 v./cm the Langevin function varied by no more than 2% between 200 and 300°K. With the aid of the Clausius-Clapeyron equation, the differential heat of adsorption was: $q = q_o - D\sigma^{3/2} = q_o - 6.66 \times 10^{-24}\ \mu e^2 \alpha^{3/2}/S^{3/2}$, where q_o = heat of adsorption at $\theta = 1$. Exptl. verification was found in the data on adsorption of MeOH on Hg at 25° and 50°C.

6188. CORRIN, M. L. **A comparison of the specific surface areas of solids as calculated by the Brunauer-Emmett-Teller and the Hüttig equations.** *J. Phys. & Colloid Chem.* 55, 612-13 (1951).—*C.A.* 45, 6003*g*.

From the adsorption isotherms of 4 adsorbates on 10 adsorbents the surface area was calcd. by means of the B. E. T. and Hüttig methods. The 40 isotherms yielded 39 B. E. T., and 26 Hüttig, straight-line plots. The B. E. T. results were more self-consistent for different gases on the same solid. As the sp surface area of the solid increased, the no. of isotherms yielding a Hüttig straight line increased, the Hüttig results became more self-consistent, and the agreement between B. E. T. and Hüttig areas improved.

6189. FERIDUN, H. **van der Waals absorption.** *Rev. faculté sci. univ. Istanbul* **16A**, 174-99 (1951) (in English).—*C.A.* 46, 4316*d*.

Several equations of state (van der Waals, Berthelot, Wohl, and Dieterici) were reduced to two dimensions and combined with the Gibbs equation to give adsorption equations applying to mobile gaseous or liquid adsorbed films. The equation derived from van der Waals adequately represented the adsorption of CO on charcoal and of A on charcoal. The derived equation correctly described the adsorption isotherms of Cl_2, Br_2, and I_2 on silica gel even though the 3 forms of isotherms were different.

6190. GUGGENHEIM, E. A. AND MCGLASHAN, M. L. **Interaction between next-nearest neighbors in regular mixtures.** *Trans. Faraday Soc.* 47, 929-37 (1951).—*C.A.* 46, 2869*i*.

The quasichem. treatment of regular mixts. was extended for simple cubic and body-centered cubic lattices so as to include the interaction between next-nearest neighbors in a manner analogous to that used by Hill for monolayers on a simple square lattice. The effect between next-nearest neighbors was much less important than the correction for nonrandom mixing which was itself very small, and, therefore, the effect was entirely negligible.

6191. HALSEY, G. D. JR. **A new multilayer isotherm equation with reference to surface area.** *J. Am. Chem. Soc.* 73, 2693-6 (1951).—*C.A.* 45, 8320*d*.

An isotherm equation for coöperative multilayer adsorption for gases near their b.ps. was derived from the London law for the dispersion force and assuming an exponential distribution of adsorbing centers. When conditions were such that satn. of the 1st layer was complete at a low value of the relative pressure, p/p_0, the equation yielded data that formed a good B. E. T. plot giving a satisfactory value for V_m, the vol. of gas required to form a monolayer. Under certain conditions, isotherms calcd. from the above equation gave only a pseudo-agreement with B. E. T. treatment.

6192. HILL, TERRELL L. **Liquid-vapor transition region and physical adsorption according to van der Waals' equation.** *J. Chem. Phys.* 19, 261-2 (1951).—*C.A.* 45, 3681*a*.

The statistical-mol. foundation of van der Waals' equation was applied to the liquid-vapor transition region and to phys. adsorption. Discontinuities in d. were avoided in the transition regions in both problems. The adsorption isotherm reduced to an equation found previously as a limiting approximation.

6193. HILL, TERRELL L. **Thermodynamics of adsorption.** *Trans. Faraday Soc.* 47, 376-80 (1951).—*C.A.* 45, 8846*a*.

The discussion concerned utility and completeness rather than correctness of different thermodynamic points of view in adsorption work. The B. E. T. theory was used as an illustration. For a one-component system, for purposes of interpretation, the molar integral was of more interest than the differential energy and entropy of adsorbed mols.

6194. HILL, TERRELL L.; EMMETT, P. H., AND JOYNER, L. G. **Calculation of thermodynamic functions of adsorbed molecules from adsorption-isotherm measurements: nitrogen on Graphon.** *J. Am. Chem. Soc.* 73, 5102-7 (1951).—*C.A.* 46, 1839*c*.

The distinction between differential and integral entropies was illustrated by use of the B. E. T. theory. From isotherm measurements for the system N_2 on Graphon the complete set of thermodynamic functions was calcd. The extreme sensitivity of the calcns. to inaccuracies of low-pressure measurements indicated the need for further refinements in exptl. techniques.

6195. JONES, D. C. **The B. E. T. adsorption equation.** *J. Chem. Soc.* **1951**, 126-30.—*C.A.* 45, 4994*c*.

The resemblance between Langmuir's Case VI and the B. E. T. equation for adsorption on a free surface was shown by a series of adsorption equations. The same basic equations held for Langmuir's Case IV. The B. E. T. equations represented an extension of Langmuir's theory to cover the case where adsorption might be limited by the width of the capillary spaces in the adsorbents.

6196. JONES, D. C. AND BIRKS, E. W. **The adsorption isotherm of Langmuir and of Brunauer, Emmett, and Teller for multilayers where *n* is 2.** *J. Chem. Soc.* **1951**, 1127-30.—*C.A.* 45, 7844*g*.

Realizable isotherms changed as a function of the ratio of the relative lives of adsorbed mols. in the 1st and 2d layers.

6197. JONES, D. C. **The adsorption isotherms of Langmuir and of Brunauer, Emmett, and Teller for multilayers where $n = 3$.** *J. Chem. Soc.* **1951**, 1464-7.—*C.A.* 45, 8846*b*.

Equations were derived and graphs discussed in the analysis in which the no. of multilayers was limited to 3. The isotherms changed from type I through IV and V and then to VA as the values of c changed from just greater than 2.16 to about 0.25. Three was the smallest value of n where all the known isotherm types for a limited no. of multilayers could be encountered as c varied. At values of c greater than 1000, the change of adsorption type from I to IV again occurred.

6198. KINGTON, G. L. AND ASTON, J. G. **A correlation of the thermodynamic properties of nitrogen adsorbed on titanium dioxide.** *J. Am. Chem. Soc.* 73, 1934-6 (1951).—*C.A.* 45, 7424*b*.
A comparison of published exptl. thermodynamic properties of N_2 adsorbed on TiO_2 with those calcd. from the B. E. T. theory indicated that the simplified assumptions of the theory were inadequate to predict a set of thermodynamic properties that were even qualitatively consistent.

6199. KRISHNAMURTI, K. **A new adsorption isotherm.** *Proc. Indian Acad. Sci.* 33A, 92-6 (1951).—*C.A.* 45, 7844*f*.
The equation, $n = A/(1 + ae^{-kc})$, where n was the no. of mols. adsorbed, A was the total no. of mols. originally present in the gas space or soln., c was the concn. of the unadsorbed mols., and a and k were consts., was derived for those cases of adsorption where previously adsorbed mols. facilitate the adsorption of more mols. striking the surface of the adsorbent. This equation fits adsorption data yielding S-shaped curves.

6200. LEVIN, V. I. **Multilayer adsorption on heterogeneous surfaces.** *Zhur. Fiz. Khim.* 25, 453-8 (1951).—*C.A.* 46, 2372*b*.
From the B. E. T. equation and with the formalism of adsorption theories characterizing a heterogeneous surface by means of a continuous broad distribution of adsorption heats, a generalized B. E. T. equation was derived. There were 2 limiting cases: (1) For very small relative pressures, the equation gave the known adsorption isotherms on heterogeneous surfaces; (2) for relative pressures corresponding to at least one complete layer, the equation reduced itself to the B. E. T. expression.

6201. LIANG, S. CHU. **The calculation of surface area.** *J. Phys. & Colloid Chem.* 55, 1410-12 (1951).—*C.A.* 46, 7398*f*.
Substituting the V_m from the B. E. T. equation into the Harkins and Jura equations gave log $P/P_o = B - (K/V_m)^2/\theta^2$, where $\theta = V/V_m$ and $K = V_m$. Thus, the Harkins and Jura equation reduced to a form involving the same constant for the surface-area V_m: log $p = X - V_m^2/V^2$, where X was a const. Comparison of surface areas obtained from the B. E. T. equation with those obtained from the above gave good agreement.

6202. MCMILLAN, W. G. AND TELLER, E. **The assumption of the Brunauer, Emmett, and Teller theory.** *J. Phys. & Colloid Chem.* 55, 17-21 (1951).—*C.A.* 45, 3220*f*.
An adsorption-isotherm equation valid in the region of multilayer adsorption was obtained. The effect of surface tension of the adsorbate and the effect of the extension of the adsorbent attractive forces beyond the first adsorbed layer were considered.

6203. MCMILLAN, W. G. AND TELLER, E. **The role of surface tension in multilayer gas adsorption.** *J. Chem. Phys.* 19, 25-32 (1951).—*C.A.* 45, 6454*b*.
The assumptions of the B. E. T. theory were examd. with regard to the possibility of taking account of the effect of surface tension. The surface energy of the adsorbed phase was calcd. by the use of a Fourier analysis of the surface configuration. This energy was then used in the calcn. of the corresponding factor in the partition function, leading ultimately to an isotherm equation that included the surface-tension effect. This isotherm was compared with expt. with the result that the surface-tension effect alone overcorrected the B. E. T. theory. When compared with the result of recent theoretical treatments of the extension of the attractive forces into the adsorbed phase, the authors' expression was shown to have the same dependence on layer thickness, but to be a relatively unimportant correction under usual conditions.

6204. MIYAHARA, KÔSHIRÔ AND TAKAISHI, TETSUO. **Mixed adsorption. I. The critical adsorption of a binary mixture of gases.** *Busseiron Kenkyû* (Researches on Chem. Phys.) No. 40, 70-89 (1951).—*C.A.* 46, 4881*h*.
Statistical mech. theory was developed of the mixed adsorption on a given no. of sites. The crit. adsorption which resulted in phase sepn. in the adsorbed phase, could take place even if the interaction between adsorbed mols. was repulsive. The conditions for the existence of phase sepn. were discussed in detail.

6205. ONO, SYÛ. **Statistical mechanics of adsorption from multicomponent systems.** *J. Phys. Soc. Japan* 6, 10-15 (1951)(in English).—*C.A.* 45, 5483*g*.
Math. equations were developed starting from the general development of the Gibbs phase integral.

6206. THEIMER, O. **The theory of adsorption. IV. Critical discussion of more recent adsorption theories.** *Kolloid-Z.* 121, 55-7 (1951).—*C.A.* 45, 8320*a*.
The comparative merits of the newer theories dealing with phys. adsorption of gases and vapors on solids were discussed. The isotherms were compared with exptl. isotherms measured for the adsorption of water vapor on $BaSO_4$. For this case the formulas of Halsey and Theimer yielded isotherms in close agreement with expt., whereas those of B. E. T., and Harkins-Jura deviated appreciably. The phys. meaning of the various equations was discussed.

6207. THEIMER, O. **The "maximum surface concentration x" of adsorbed molecules.** *Z. Elektrochem.* 55, 709-15 (1951).—*C.A.* 46, 4880*f*.
The Langmuir function x(= no. of adsorption sites on the surface) is replaced by x^*, the function that, in the case of an adsorption isotherm that does not follow the Langmuir, Brunauer, of Hüttig formulas, will transform the isotherm automatically into one of these forms. The new function bears the same relation of x that the

"reduced vol." v^* (where v^* = ratio of v to vol. at the crit. point) does to the observed vol. v of a nonideal gas. This concept is extended to developed formulas incorporating "reduced temps." and "reduced 2-dimensional pressures" for nonideal adsorption isotherms.

6208. TOSHIMA, SÔICHIRÔ AND TANAKA, TOMOYASU. **Multimolecular adsorption.** *Busseiron Kenkyû* (Researches on Chem. Phys.) No. 40, 90-9 (1951); No. 41, 89-95 (1951).—*C.A.* 46, 8456*a*, 1838*g*.

Multimol. adsorption on a planar trignol lattice was detd. The dependence of the isotherm on the relative magnitudes of W and H was examd., where W and H were the potentials between an adsorbed mol. in the 1st layer and the solid surface and between adsorbed mols., resp. Comparisons of the result with the B. E. T. isotherm were made. A statistical-mech. derivation was developed for the adsorption of gases between parallel walls, by counting no. of configurations directly. The equation gave type-IV and -V isotherms when $W = 10H$ and $W = 4H$, resp., where W and H were attractive energies between a gas mol. and the wall, and between gas mols., resp.

6209. TROESCH, A. **A generalization of the multimolecular adsorption equations of Brunauer, Emmett, and Teller and of Hüttig.** *J. chim. phys.* 48, 454-64 (1951).—*C.A.* 46, 4316*f*.

A generalized equation of adsorption, valid up to satn. contained 4 parameters: V_m = vol. occupied by a unimol. layer of adsorbate; α = a const. characteristic of the no. of layers adsorbed at satn.; c = a const. The ratio c/p_o was characterized by the heat of adsorption of the first layer; β = a coeff. that defined the heat of interaction between adsorbed layers. The general equation was: $V = cV_m x[1 + x(1-b)]/(1-bx)[1 + (c-b)x]$ where $b = \alpha x\beta$ and $x = p/p_o$. The constants were detd. from exptl. data for the adsorption of H_2O on $BaSO_4$ at 0° and 20°C. From β the extent of interaction between adsorbed layers was $\beta = Ae^{Q/RT}$; $Q = 3500$ cal.

6210. BAND, WM. AND EMERY, EARLE B. **Approximate adsorption isotherms for a mixture of two isotopes.** *J. Phys. Chem.* 56, 384-8 (1952).—*C.A.* 46, 8456*c*.

The B. E. T. theory of multimol. adsorption was generalized to include the case of mixts. of 2 isotopes in which one of the 2 was present in only very small concns. Appropriate data for applying the theory to the adsorption of mixts. of He^3 in He^4 did not exist. Application to data for O_2-N_2 systems showed improved agreement as compared to the original B. E. T. equation.

6211. EVERETT, D. H. AND WHITTON, W. I. **General approach to hysteresis.** *Trans. Faraday Soc.* 48, 749-57 (1952).—*C.A.* 47, 2568*b*.

Hysteresis was attributed in general to the existence in a system of a very large no. of independent domains, at least some of which could exhibit metastability. The features of this model that led to hysteresis were analyzed in terms of potential energy surfaces, and it was pointed out that similar surfaces would be observed for mol. systems if the potential energy was replaced by the chem. potential of the system. The thermodynamic implications of this model were considered briefly.

6212. EVERETT, D. H. AND YOUNG, D. M. **Thermodynamics of adsorption. IV. Onset of multilayer formation.** *Trans. Faraday Soc.* 48, 1164-70 (1952).—*C.A.* 47, 6213*i*.

The estd. ideal differential configuration entropy of the surface phase showed an initial fall with coverage following closely the general form of an ideal localized monolayer. Divergence from this curve was observed in most cases at a value of θ between 0.5 and 0.8, when the configurational entropy became larger than that for a monolayer. It was suggested that new adsorption sites on top of the first layer were becoming available.

6213. HALL, W. KEITH. **Halsey's new multilayer adsorption equation.** *J. Am. Chem. Soc.* 74, 1081 (1952).—*C.A.* 47, 4163*h*.

Two of the assumptions made by Halsey in deriving a multilayer isotherm were incompatible.

6214. HALSEY, G. D., JR. **Multilayer adsorption.** *J. Am. Chem. Soc.* 74, 1082-3 (1952).—*C.A.* 47, 4163*h*.

A math. discussion of adsorption and a reply to the criticism offered by Hall.

6215. HERZFELD, KARL F. AND REED, SIDNEY G. JR. **The concept of free surface energy of very small particles.** *Z. Elektrochem.* 56, 308-10 (1952).—*C.A.* 46, 8465*c*.

The free surface energy (the work required for the reversible sepn. of a particle) could not be thermodynamically defined for very small particles (those contg. up to 2000 or 5000 mols.), not because the geometric definition of the surface was difficult, but because the free surface energy depended on the concn. of the particles. The total surface energy was a definite quantity. Another property, the "effective free surface energy," was defined, and applied to particles of solid N_2 contg. 2 to 8 mols.

6216. HILL, TERRELL L. **Statistical thermodynamics of the transition region between two phases. I. Thermodynamics and quasithermodynamics.** *J. Phys. Chem.* 56, 526-31 (1952).—*C.A.* 46, 7859*h*.

An alternative formulation of Gibbs' surface thermodynamics and an improvement on the Tolman quasithermodynamic theory was derived for plane and spherical surfaces.

6217. HILL, TERRELL L. **Statistical thermodynamics of the transition region between two phases. II. One-component system with a plane interface.** *J. Chem. Phys.* 20, 141-4 (1952).—*C.A.* 46, 6476*g*.

An approx. statistical theory was used to investigate the nature of the d.-transition curve in passing from a one-component liquid phase to the equil. vapor phase. This d. curve was related thermodynamically to the surface tension, the surface energy, the location of the surface of tension, and the dependence of surface tension on curvature.

6218. Hüttig, G. F. and Theimer, O. **Gas adsorption at high pressures.** *Monatsh.* 83, 650-63 (1952).—*C.A.* 46, 10772*a*.

At high pressures, lateral interactions predominated; these, however, also depended on the nature of the surface. Mobile adsorption in monolayers on a continuous homogeneous surface led to condensation of the 2-dimensional gas, and therefore to stepwise adsorption isotherms. The B.E.T. theory could therefore apply only to discontinuous surfaces. In this case, most of the usual objections to the theory vanished. The B.E.T. theory was modified by assuming that the chem. potential in layers above the 1st was less than that in the liquid, or that it depended on the pressure. The modified theory was applied to discontinuous homogeneous and inhomogeneous surfaces. It was concluded that, owing to lattice defects, most actual surfaces were discontinuously inhomogeneous.

6219. Innes, W. B. **The treatment of complex adsorbates as a single phase.** *J. Colloid Sci.* 7, 447-8 (1952).—*C.A.* 46, 10775*a*.

Hill's objections to the treatment of a multilayer adsorbate as a single phase could be avoided if the adsorbate was visualized as made of negligibly small phase units (i.e., mols.) all with the same phys. properties. A reply by T. L. Hill was included.

6220. Long, Earl and Meyer, Lothar. **Some experiments on flow in the unsaturated helium II film.** *Phys. Rev.* 85, 1030-5 (1952).—*C.A.* 46, 5918*g*.

The mass flow in adsorbed layers of He was measured. Superfluidity occurred at all temps. below the λ-temp. of the bulk liquid down to 1.5 statistical layers. The bearings of these results on the thermodynamics of transition He I-He II in adsorbed layers was discussed.

6221. Meyer, Lothar and Long, Earl. **Phase transitions in adsorbed films.** *Phys. Rev.* 85, 1035-7 (1952).—*C.A.* 46, 5918*h*.

A thermodynamic treatment of transitions for the case in which a condensed phase did not exist in bulk, but as adsorbed layers, was of interest. Exptl. data have recently become available for 2 examples of such systems: the transition He I-He II (λ-transition) and the m.p. of A. The effect of surface energies on the melting process (as an example of a 1st-order transition) and the λ-transition (as an example of a 2nd-order transition) were treated thermodynamically.

6222. Sakaki, Tomohiko. **Statistical-mechanical interpretations of Harkins-Jura's theory of adsorption.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 73, 218 (1952).—*C.A.* 46, 10773*d*.

6223. Sakaki, Tomohiko. **Physical chemistry of adsorbed layers. I. Relation between isotherms and heat of adsorption. A new theory of adsorption including some important isotherms as its special cases.** *J. Chem. Soc. Japan, Pure Chem. Sect.*, 73, 680-2 (1952); 73, 217 (1952).—*C.A.* 46, 10773*c*.

The theory was based on an improved model of multimol. adsorption. The inhomogeneity of the adsorbing surface and the mutual interaction of the mols. were taken into consideration. An adsorption isotherm was obtained that contained the B. E. T. equation, and the Langmuir isotherm as a special case. The formula led also to the other isotherms such as Harkins-Jura, deBoer-Zwikker, and Freundlich's.

6224. Shimokawa, Junichi. **Interface adsorption and condensation. I. Brunauer-Emmett-Teller theory of multilayer adsorption and phase transitions in monolayers.** *Busseiron Kenkyû* (Researches on Chem. Phys.) No. 57, 101-19 (1952).—*C.A.* 47, 1457*f*.

Lattice models were not adequate for the treatment of a system under inhomogeneous field of force such as an adsorbed phase. The theory of imperfect gases of Mayer was extended to the surface phase. The B. E. T. theory of adsorption was inconsistent with the former and gave rise to a phase transition at $\theta = ½$, where θ was the fraction of the surface covered by the adsorbed matter.

6225. Theimer, O. **Multilayer adsorption isotherms.** *Trans. Faraday Soc.* 48, 326-31 (1952).—*C.A.* 46, 9930*h*.

The distribution of adsorbing centers along the surface was restricted in the B. E. T. theory to arrangements excluding 2-dimensional condensation. Under this condition the most probable surface structure allowing for the B. E. T. mechanism was a loose arrangement of centers located practically outside the range of mutual attraction. The adsorbed mols. formed clusters around these centers. The chem. potential μ_h of the mols. adsorbed in higher layers was no longer considered equal to the chem. potential μ_L of mols. in the liquid adsorbate.

6226. Wylie, R. G. **The hysteresis of adsorption on solid surfaces.** *Australian J. Sci. Research.* A5, 288-302 (1952).—*C.A.* 46, 9930*g*.

The effect of surface discontinuities on 2-*dimensional phase transitions* was examd. theoretically. Hysteresis was related semiquantitatively to nucleation, profile, and interfacial free energy of the α-phase.

6227. Bering, B. P. and Serpinskiĭ, V. V. **Adsorption of mixtures of gases. III. Possibility of a statistical treatment of the adsorption of a mixture of gases.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* 1953, 37-47.—*C.A.* 47, 5757*e*.

If the adsorption functions $a_1^0 = f_1^0 (p_1, \theta)$ and $a_2^0 = f_2^0 (\theta, p_2)$ of the pure sep. components were known, soln. of the problem of finding the functions $a_1(p_1, p_2)$ and $a_2(p_1, p_2)$ of the mixt. was possible, in principle, in any scheme which introduced no new parameters for the mixt. other than those involved in the a^0. The problem was analyzed on the basis of the Langmuir scheme, which met this requirement, with extension to surface inhomogeneity. The analysis was applied to the data on $CO-C_2H_4$ and $C_2H_4-C_3H_6$. The observed growth of the slope of the a_{12} isosteres and the decrease of a_2 with increasing θ was taken to be due to increased importance of portions with greatest ϵ_1 (i.e., greatest b_1) at lower coverages.

6228. Champion, W. M. and Halsey, G. D., Jr. **Physical adsorption on uniform surfaces.** *J. Phys. Chem.* 57, 646-8 (1953).—*C.A.* 48, 21*a*.

Stepless isotherms were calcd. for a uniform surface by use of modifications of Hill's treatment of lateral interaction. In order to secure stepless isotherms several assumptions were necessary. These assumptions were so specific and unreal that the necessity of assuming surface heterogeneity for real isotherms was thereby demonstrated.

6229. Honig, J. M. **Analysis of multilayer gas adsorption isotherms using the concept of surface heterogeneity.** *J. Phys. Chem.* 57, 349-51 (1953).—*C.A.* 47, 6213*h*.

A simple extension of the theory was presented which permitted application of the heterogeneous surface model to multilayer adsorption systems. The adsorption of N_2 on rutile at 77°K. was discussed in terms of the theory.

6230. Maslan, F. D.; Altman, M., and Aberth, E. R. **Prediction of gas-adsorbent equilibria.** *J. Phys. Chem.* 57, 106-9 (1953).

A modified Polanyi-Dubinin theory could be used to correlate the adsorption of various gases on activated carbon, silica gel and activated alumina with good accuracy both above and below the critical point. The adsorbate was considered as a highly compressed gas, and its vol. and fugacity were calcd. at the adsorption temp. The method was tested on nine systems and good checks with exptl. results were obtained. Binary gas adsorption could be predicted from single gas adsorption data when $N_{12}V_{12} = N_1V_1 + N_2V_2$. This method has been tested on the system O_2-N_2-activated carbon with success.

6231. Shimokawa, Junichi. **Interface adsorption and condensation. II. The behavior of the adsorbed layer and derivation of the Brunauer-Emmett-Teller equation.** *Busseiron Kenkyû* (Researches on Chem. Phys.) No. 58, 8-16 (1953).—*C.A.* 47, 3079*a*.

The method of cluster integrals was used for deriving the B. E. T. equation by assuming the condensation of adsorbed mols. and by replacing the cluster integrals by the partition function of condensed mols. The sp vol. of the 1st-layer mols. was equal to that of the 2nd-layer mols. after the phase transition in the adsorbed layer had occurred. This fact had been a priori used in previous theories of adsorption. The method surpassed the treatment by the lattice model in that the former dealt with the adsorbed layer as a whole.

6232. Snelgrove, J. A. and McIntosh, R. **The orientation polarization of adsorbed polar molecules.** *Can. J. Chem.* 31, 84-90 (1953).—*C.A.* 47, 5746*i*.

The orientation polarization of a polar mol. adsorbed on a solid surface was deduced for two cases leading to zero temp. coeff. of the polarization arising from oscillating dipoles and to the normal temp. coeff. for freely rotating dipoles within some given angle of permitted rotation.

IV-3. Capillary Condensation of Gases and Other Empirical Theories

6233. Deryagin, B. V. **A theory of capillary condensation in the pores of sorbents, and of other capillary phenomena, taking into account the disjoining action of multimolecular liquid films. Repulsive forces between surfaces divided by liquid films.** *Acta Physicochim. U.R.S.S.* 12, 181-200, 314-16 (1940).—*C.A.* 34, 7697^3.

Capillarly condensation, capillary rise, and the pressure on the walls in flat and cylindrical capillaries were discussed. Exptl. data for dil. electrolytes were in agreement with the above theory, but higher concns. yielded large deviations, and some nonelectrolytes also showed the effect.

6234. Guggenheim, E. A. **Thermodynamics of interfaces in systems of several components.** *Trans. Faraday Soc.* 36, 397-412 (1940).—*C.A.* 34, 3965^2.

The thermodynamic properties of a plane interface having a finite thickness were derived. The treatment was correlated with that of Gibbs. The formulas derived for plane surfaces may be applied to curved interfaces, provided that the thickness of the inhomogeneous layer was negligibly small compared with its radius of curvature, a condition usually fulfilled in practice.

6235. Held, E. F. Maximilian van der. **Diffusion phenomena in connection with the drying of materials.** *Gesundh. Ing.* 64, 211-16 (1941).—*C.A.* 38, 1159^7.

A differential equation was derived for diffusion at const. and variable temps. in a gas, and applied for the case of evapn. from a surface. For diffusion in porous materials a modified diffusion factor was assumed, derived from that for the diffusion of two gases into one another.

6236. Sprengel, Ernst. **Possibility of application of capillary condensation in adsorption refrigeration apparatus.** *Wiss. Veröffent. Siemens-Werken* 20, 135-70 (1941).—*C.A.* 37, 2226^5.

Theoretical consideration was given to the derivation of an equation for pore sizes, dependence of the pore const. on temp. and pressure, effect of mol. diam., heat of sorption, etc. Exptl. results were reported for adsorption of pure CH_2Cl_2, and tech. NH_3, SO_2, and CF_2Cl_2 on silica gel and chabazite at 25-40°C and from 0.1 to 760 mm. Capillary condensation was not significant for NH_3 and another type of binding was present. Sorption on chabazite ceased before satn. pressure was reached.

6237. Velisek, Josef. **Physical reasons for the adhering of soluble materials to capillaries and to the surface of ceramic bodies.** *Stavivo* **22,** 1-3, 17-19, 29-31, (1941).—*C.A.* 37, 2899^5.
The infiltration of water into capillaries and ceramic bodies was governed by the laws of solubility, absorption, diffusion, and osmosis. Equations were used for the osmotic pressure of solutions, absorption of gases by liquids, diffusion in liquids, the heat relationship by changes of the surface of solutions, concentration of solutions in the surface film, vapor pressure in curved surfaces of solutions, salt hydrates in aqueous solutions, dissociation of hydrated salts, and hydrated salts exposed to the atm.

6238. Yu, Hun-Tsen. **Thermodynamics of interfaces in equilibrium.** *J. Chinese Chem. Soc.* **8,** 147-51 (1941).—*C.A.* 37, 6517^4.
By treating the equil. as an equil. between 3 phases in contact the conditions for thermodynamic equil. were obtained for curved surfaces and for 2 cases involving plane surfaces: (1) a nonvolatile liquid and an insol. gas, (2) a surface of n components at a given pressure and temp.

6239. Liempt, J. A. M. van. **The drying of gases.** *Rec. trav. chim.* **61,** 341-7 (1942).—*C.A.* **38,** 2239^1.
It was assumed that a no. of canals were formed in the absorbent and the current of gas divided among them. By considering the diffusion processes which entered into the picture, the following formula was derived for the decrease in concn. of the impurity (in the special case, water vapor): $\log (c/c_0) = -2n(DL/V)^{1/2}$, in which c_0 was the initial and c the final concn., n was the no. of canals per m. diam. of absorbent material, D the diffusion coeff. of the impurity, L the thickness of the layer of absorbent and V the rate of flow.

6240. Rao, Kittur Subba. **Hysteresis in sorption. VII. Scanning of the hysteresis loop. Alumina gel-water system.** *Proc. Indian Acad. Sci.* **16A,** 298-300 (1942).—*C.A.* 37, 3316^2.
A reproducible loop was obtained after 3 sorption cycles at 30°C. The sorptive capacity of the gel at saturation pressure (32 mm) was 28.52 g of water per 100 g of activated gel. At the end of the first desorption, 2.25 g of water per 100 g was held irreversibly.

6241. Rao, Kittur Subba. **Hysteresis in sorption. VIII. Permanence and scanning of the hysteresis loop. Titania gel-carbon tetrachloride system.** *Proc. Indian Acad. Sci.* **16A,** 301-4 (1942).—*C.A.* 37, 3316^3.
The hysteresis loops for the second to twelfth sorption-desorption cycles at 30°C were found to be identical. The capacity for CCl_4 at satn. pressure (14 cm) was 27.32 g per 100 g of activated gel. The characteristics of the loop were explained by the cavity concept.

6242. Rao, Kittur Subba. **Hysteresis in sorption. IX. Effect of temperature on the hysteresis loop. Silica gel-water system.** *Proc. Indian Acad. Sci.* **16A,** 305-6 (1942).—*C.A.* 37, 3316^4.
Hysteresis loops were obtained at 30°, 35°, and 40°C in which the amount of water adsorbed was plotted against relative vapor pressure. The loops were almost identical in shape and size; this was to be expected if the adsorbent was rigid, and the total capillary volume did not change in this temperature range. The sorptive capacity of silica gel for water at 30°C, 35°, and 40°C were 27.71, 27.36, and 27.01 g of water, respectively, per 100 g of activated gel.

6243. Harvey, Edmund N. Jr. **Surface areas of porous materials calculated from capillary radii.** *J. Am. Chem. Soc.* **65,** 2343-6 (1943).—*C.A.* **38,** 905^5.
Equations were developed that permitted relatively easy calcns. of the surface areas of porous adsorbents from the high-pressure portion of adsorption isotherms. When the adsorbed layer was taken into consideration and the desorption isotherm used, pore radii usually gave surface areas in good agreement with those obtained by the "Point B" method of Emmett and Brunauer.

6244. Othmer, Donald F. and Sawyer, Frederick G. **Correlating adsorption data.** *Ind. Eng. Chem.* **35,** 1269-76 (1943).—*C.A.* **38,** 671^7.
A straight line was obtained when the logarithm of the equil. pressure at a const. concn. (g adsorbate/g adsorbent) was plotted against the vapor pressure of some substance at the same temp. The slope was equal to the ratio of the total heat required to desorb 1 mole of adsorbate at the given temp. to the molal heat of vaporization of the reference substance at the same temp. The estd. heats of adsorption checked the calorimetric data closely.

6245. Cohan, Leonard H. **Hysteresis and the capillary theory of adsorption of vapors.** *J. Am. Chem. Soc.* **66,** 98-105 (1944).—*C.A.* **38,** 1158^6.
Several predictions based on the capillary theory of adsorption and the open pore theory of hysteresis were shown to agree reasonably well with exptl. data. The capillary theory of adsorption which postulated the formation of a unimol. layer followed by capillary condensation was a fairly good first approxn. for the adsorption mechanism in the systems considered. The surface tension and molal vol. of a liquid confined in a capillary of radius only twice the diam. of the liquid mol. appeared to be about the same as for the liquid in bulk.

6246. Scholberg, Harold M. and Wetzel, W. W. **Some observations on the theory of contact angles.** *J. Chem. Phys.* **13,** 448 (1945).—*C.A.* **40,** 263^9.
An equation was developed for the contact angle of a meniscus on a plane solid surface. Agreement was found with measurements on paraffin against water.

6247. Deryagin, B. **Dependence of the contact angle on the microrelief or roughness of a wetted solid surface.** *Compt. rend. acad. sci. U.R.S.S.* **51,** 361-4 (1946).—*C.A.* **40,** 6933^2,
In any thermodynamically reversible and isothermal displacement of a wetting boundary along a solid wall, the total work A of the forces of interfacial tension equaled the product of the difference $(\sigma_1 - \sigma_2)$ by ΔS_1, the total increase in the surface area wetted by the liquid. σ_1 and σ_2 represented the work of formation of unit surface of the solid and solid-liquid interface, resp.

6248. GURNHAM, C. FRED AND MASSON, HENRY J. **Expression of liquids from fibrous materials.** *Ind. Eng. Chem.* **38**, 1309-15 (1946).—*C.A.* **41**, 1504*a*.

A general equation, applicable to all fibrous materials, was: $\log P = a + b/V$. Exptl. data were obtained that indicated that the formula gave a good correlation for various substances, under varying conditions of wetness, etc. Certain limitations as to high and low pressures were found.

6249. VERSCHAFFELT, J. E. **Adsorption.** *Symposium Grenslaagverschijnselen, Verhandel. Koninkl. Vlaam. Acad. Wetenschap.* **1946**, 12-19 (Pub. 1947).—*C.A.* **43**, 3263*d*.

From the kinetic theory of gases the quantity of gas adsorbed was correlated with the pressure. A thermodynamic correlation between adsorption and surface tension was presented.

6250. VINOGRADOV, G. V. **Nomograms for the Thomson equation.** *J. Phys. Chem.* (U.S.S.R.) **20**, 1053-64 (1946) (in Russian).—*C.A.* **41**, 2299*i*.

Nomograms were given for detg. the vapor pressures p of small droplets of H_2O, CCl_4, Et_2O, MeOH, hexane, benzene, and EtOH as a function of the drop radius r. At a given r, $\log (p/p_o) = a + bt$, p_o being the vapor pressure above a plane surface, t temp., and a and b consts. Only esters failed to follow this rule.

6251. VINOGRADOV, G. V. AND BORODULINA, L. P. **Calculations by Freundlich's equation.** *J. Applied Chem.* (U.S.S.R.) **19**, 673-7 (1946) (in Russian).—*C.A.* **41**, 4692*e*.

A nomogram was given relating the amt. of adsorbed matter Γ to its concn. c or pressure p for given values of Freundlich's coeff. β and exponent $1/n$, with Γ and β on straight lines, $1/n$ and c, p on an ellipse. A nomogram of two paralled straight lines Γ and c permitted smoothing calcns. interpolations and extrapolations, on exptl. data without the explicit values of β and $1/n$ by locating the center of gravity of points of intersection.

6252. COLIN-RUSS, A. **The theory of desorption in extraction systems of porous complexes.** *Proc. Intern. Congr. Pure and Applied Chem.* **11**, 381-9 (1947); *J. Intern. Soc. Leather Trades' Chemists* **31**, 369-78 (1947).—*C.A.* **44**, 4306*a*; **42**, 1101*h*.

6253. LYKOV, A. V. **Theory of migration of moisture in capillary-porous colloidal bodies.** *Kolloid. Zhur.* **9**, 117-24 (1947).—*C.A.* **47**, 944*f*.

Equations were derived for the isothermal movement of moisture, as liquid and as vapor, in gels (owing to osmotic forces), in porous bodies, and in gels that became porous during drying.

6254. SCHILLING, K. **A simple derivation of the Freundlich adsorption equation.** *Monatsh.* **77**, 134-6 (1947).—*C.A.* **42**, 5297*h*.

The amt., a, of C_2H_5OH adsorbed on Nd_2O_3 obeyed the equation $a = k(vc)^{T/bT'}$ where c was the concn. of the adsorbate in the gas phase, T was the temp. of the expt., b a const. equal approx. to unity, T' the max. temp. to which the oxide was heated prior to the adsorption measurements, k a const., and v a vol. term proportional to the molal liquid vol. of the adsorbate.

6255. CHUMUTOV, K. V. **Sorption phenomena in capillary systems.** *Kolloid. Zhur.* **10**, 47-56 (1948).—*C.A.* **43**, 5256*a*.

Kelvin's formula relating the vapor pressure over a curved liquid surface with its radius of curvature and surface tension was studied using a capillary system consisting of a convex glass or quartz lens pressed against a plane surface. The clearance between the 2 surfaces, at a given distance from the center, was detd. with high accuracy by measurements of the Newton interference rings. The setup was superior to methods using cylindrical capillaries. It provided a continuous series of "capillaries" of increasing radii, and thus represented a model of an actual sorbent with a continuous pore size distribution.

6256. GREGG, S. J. AND JACOBS, J. **Adsorption theory of Brunauer, Emmett, and Teller and Brunauer, Deming, Deming, and Teller.** *Trans. Faraday Soc.* **44**, 574-88 (1948).—*C.A.* **43**, 2065*h*.

The relation that the theory implied between the integration consts. of the vapor equation and the adsorption isostere, resp., was not found to hold in practice. Arguments were given against the assumption that the evapn.-condensation conditions of the adsorbed multilayer differed inappreciably from those of the bulk liquid. The adsorption isotherm could not invariably be represented by a single equation as assumed by the B. E. T.-B. D. D. T. theory; where phase changes occurred, the isotherm was split up into sep. parts, each following its own equation.

6257. HIRST, W. **The mechanical interaction between mobile insoluble adsorbed films, capillary condensed liquid, and fine-structured solids.** *Discussions Faraday Soc.* **1948**, No. 3, 22-8.—*C.A.* **43**, 1238*g*.

In adsorption without capillary condensation, 3 cases were treated: swelling by stretching the structural units in which the simple case for a cylindrically-shaped cavity was derived; the widening of crevices; rigid surfaces held together by surface forces with some elastic restraint. The treatment with capillary condensation dealt with condensation in a cylindrical cavity with thin walls of isotropic material and condensation between plane-parallel rigid surfaces held by restraints.

6258. SHULL, C. G. **The determination of pore-size distribution from gas-adsorption data.** *J. Am. Chem. Soc.* **70**, 1405-10 (1948).—*C.A.* **42**, 6602*i*.

A simplified procedure for applying the theory of capillary condensation to exptl. data on adsorption was presented for detg. the phys. structure of finely divided and porous materials. The adsorption of N_2 on two silica gels was used. Standard inverted isotherms were calcd. for Maxwellian and Gaussian distribution of pore sizes. The observed isotherm was matched with a standard inverted isotherm or resolved into two or more standard isotherms. Thereby, pore distribution and diam. were evaluated.

6259. SHUTTLEWORTH, R. AND BAILEY, G. L. J. **Spreading of a liquid over a rough solid.** *Discussions Faraday Soc.* **1948**, No. 3, 16-22.—*C.A.* **43,** 1240*a*.

Hysteresis of the contact angle arose merely because of the inevitable roughness of solid surfaces. In particular systems, adsorption contributes to hysteresis and the relative importance of the two could be decided only by expt. On solids, whose roughness was formed by isolated pits, subsidiary minimums of total surface energy existed and hysteresis of contact angle arose because the liquid came to rest at a different min. after spreading and recession.

6260. VASSILIOUS, B. AND WHITE, J. **Vapor pressure-capillarity relations in clays and their application to certain aspects of drying.** *Trans. Brit. Ceram. Soc.* 47, 351-77 (1948).—*C.A.* **43,** 2748*c*.

The movement of moisture occurring in clay columns subjected to a temp. gradient was studied. The distributions obtained were consistent with the operation of an evapn.-condensation process, resulting in the setting up of a temporary equil. distribution at any stage detd. by the vapor-pressure/moisture content/temp. relationships for the particular clay. A relationship between *r*, the effective capillary radius, and *W*, the moisture content of the clay, was derived. A reasonable estimate of the surface area of the clay could be made from this relationship.

6261. VINOGRADOV, G. V. **Recalculation of adsorption isotherms.** *Zhur. Priklad. Khim.* **21,** 101-3 (1948).—*C.A.* **44,** 9209*e*.

The equil. adsorption pressures P_1 and P_2 at the abs. temps. T_1 and T_2, and the satn. vapor pressure P_s at T_2, were related by $(\log P_2 - \log P_s)/(\log P_1 - \log P_s) = \theta = B(T_1/T_2)$, where B = affinity coeff., defined by the av. ratio of the adsorption potentials of 2 adsorbed vapors at a stated vol. of liquid condensed in the pores of 1 g of the adsorbent. The magnitude θ, and hence B, was detd. graphically from the exptl. concns. c and c_s, corresponding to the equil. pressures P and P_s. Nomograms were given for the detn. of the equil. c and of the adsorption potential.

6262. ZHDANOV, S. P. **Calculation of the structure of porous sorbents from the sorption isotherms.** *Doklady Akad. Nauk S.S.S.R.* **61,** 853-6 (1948).—*C.A.* **43,** 461*i*.

Adsorption and desorption isotherms were detd. for EtOH on two samples of specially prepd. porous glass. One contained an artificially produced secondary finer pore structure within the original pores, the other consisted of two layers of different porosities glued together. Any correctly derived distribution curve should indicate the bi-dispersity of these sorbents. Actually, only the distribution function calcd. from the desorption branch, by Thomson's equation, gave the expected two peaks.

6263. ANTONOFF, GEORGE. **Evidence of long-range force in capillary phenomena.** *Rec. trav. chim.* **68,** 1011-12 (1949).—*C.A.* **44,** 2821*g*.

Capillary rise for polar liquids was found dependent on the length of the capillary; this indicated a long-range force. This may be due to a liquid film on the wall of the capillary that could support a column of liquid. The thickness of the film may differ according to the range of the force exercised by the solid. The effective radius varied with the nature of solid and liquid, the force of attraction between the 2 being greater than between particles of the liquid itself.

6264. BIKERMAN, J. J. **Remarks on the theory of capillarity.** *J. Chem. Education* **26,** 228-9 (1949).—*C.A.* **43,** 5255*i*.

Two criticisms of the usual theory of capillarity were discussed.

6265. DUBININ, M. M.; ZAVERINA, E. D., AND TIMOFEEVA, D. P. **Sorption and structure of active carbons. VI. The structure types of active carbons.** *Zhur. Fiz. Khim.* **23,** 1129-40 (1949).—*C.A.* **44,** 1303*d*.

There were 3 main types of adsorption carbons: (1) carbons having very small pores, such as carbons in which the wt loss was less than 50%; their adsorption isotherm was $\log a = C - D(\log p_s/p)^2$; a was the amt. adsorbed, p_s the satn. vapor pressure, p vapor pressure, C and D were const., and D was proportional to $(\text{temp.})^2$; (2) carbons having no small pores, such as carbons obtained after a wt loss of more than 75% or nonporous carbons; their isotherm was $\log a = M - N \log (p_s/p)$, i.e. the Freundlich isotherm; N was proportional to temp.; (3) intermediate type in which the isotherm was the sum of the 2 preceding isotherms.

6266. GURNEY, C. **Surface forces in liquids and solids.** *Proc. Phys. Soc.* (London) **62A,** 639-48 (1949).—*C.A.* **44,** 894*e*.

The aspects treated included stresses in the uncontaminated surfaces of solids at temps. at which migration of atoms took place, uniform stresses in uncontaminated surfaces of solids at temps. at which migration of atoms did not take place, the Laplace φ force and equil. at angles of contact, and surface energy and surface tension.

6267. HELD, E. F. M. VAN DER. **Theory of evaporation during drying.** *Chem. Weekblad* **45,** 285-9 (1949).—*C.A.* **43,** 8753*b*.

The mechanism of evapn. was discussed in terms of mol. interaction, and boundary-layer concept. Effects were given of material consts., as thermal cond., heat of vaporization, grain size, capillarity, and moisture retention through adsorption or otherwise upon drying operations.

6268. KATZ, SIDNEY, M. **Permanent hysteresis in physical adsorption. A theoretical discussion.** *J. Phys. & Colloid Chem.* **53,** 1166-86 (1949).—*C.A.* **44,** 4305*f*.

Self-consistency rules were derived for the scanning behavior of adsorption and desorption curves in the hysteresis loop region for rigid nonswelling systems. Application of these rules to existing data, correcting for the possibility of exptl. error, confirmed the ink-bottle mechanism for hysteresis.

6269. LAMER, V. K. AND POUND, G. M. **Surface tension of small droplets from Volmer and Flood's nucleation data.** *J. Chem. Phys.* **17,** 1337-8 (1949).—*C.A.* 44, 4748*g*.

The crit. droplet size for a no. of vapors was computed using the ratio of the crit. supersatn. pressure to the equil. vapor pressure of the bulk phase (P/P_∞) and the value for the surface tension measured on the bulk liquid phase σ_o. Fair agreement was found between measured values of P/P_∞ and the values calcd. from σ_o, but the values of P/P_∞ detd. from σ were in definitely inferior agreement with the measured values.

6270. MIZUSHIMA, MASATAKA. **A new method of estimating the surface area of powder.** *J. Chem. Phys.* **17,** 1357 (1949).—*C.A.* 44, 4749*c*.

From a knowledge of adsorption isotherms, and the contact angle between the liquid used in measuring the adsorption isotherm and the solid on which the isotherm was measured, the surface area of a powder could be measured.

6271. PORKHAEV, A. P. **Kinetics of imbibition of liquids by single capillaries and porous materials.** *Kolloid. Zhur.* **11,** 346-53 (1949).—*C.A.* 44, 903*g*.

Equations were derived for the rate of capillary rise (dl/dt) considering the nonsteady character of the flow and the variation of the liquid mass involved during the process. If l was the length of the liquid column, dl/dt must be a linear function of $1/l$. This conclusion was confirmed by expts. on rise of castor oil (at 6-34°C), glycerol, fish-liver oil, and machine oils in glass capillaries. The effect of the hysteresis of wetting was calcd. and compared with expt.

6272. RADUSHKEVICH, L. V. **Sorption and structure of active carbons. VII. The potential theory of adsorption and the structure of active carbons.** *Zhur. Fiz. Khim.* **23,** 1410-20 (1949).—*C.A.* 44, 2819*e*.

The rule $w = w_o \exp(-k\epsilon^2)$ (w was the liquid vol. of vapor adsorbed at the adsorption potential ϵ, w_o was the max. vol. adsorbed, and k was a const.) was accounted for if $f(\epsilon) = (2k/\rho b)\epsilon^2 \exp(-k\epsilon^2)$. ϵ was proportional to the probability of the adsorption potential being between ϵ and $\epsilon + d\epsilon$, ρ was the d. of the adsorbed liquid, and $b = \epsilon v$; v was the vol. of a pore, and the mean adsorption potential ϵ in the pore was assumed to be inversely proportional to v. The vol. of micropores was not accidental but depended on the mol. structure of the adsorbent.

6273. TVERSKAYA, N. P. **Evaporation of a falling drop.** *Uchenye Zapiski, Leningrad. Gosudarst. Univ. im* A. A. *Zhdanova* No. **120,** *Ser. Fiz. Nauk* No. **7,** 241-66 (1949).—*C.A.* **46,** 7401*a*.

The change in size of drops of water or ice in streams of air flowing at various rates was measured over the temp. range from -20° to +25°C. The drop size was of the the order of 500μ, and the relative humidity of the air varied from 40 to 80%. In static air, the function $X = dD^2/dt$, where D = drop diam. and t = time, was independent of drop size at const. relative humidity and temp. The evapn. rate of supercooled water drops was almost comparable to the rate for ice drops, but the rate for the liquid was always somewhat greater, showing its max. difference at -12°C.

6274. BAXTER, S. **Wetting and contact-angle hysteresis.** *Nature* **165,** 198 (1950).—*C.A.* 44, 5182*b*.

A preliminary account was given on the study of contact angles and contact-angle hysteresis when all interfacial energies were modifed by the adsorption of a wetting agent.

6275. BRIGGS, LYMAN J. **Limiting negative pressure of water.** *J. Applied Phys.* **21,** 721-2 (1950).—*C.A.* 44, 8720*b*.

Water under examn. was held in a capillary tube open at both ends. The tube was spun about an axis normal to it at its center, until the column tore. The neg. pressure was greatest (277 bars) at about 10°C. It dropped to less than 10% of the max. between 5° and 0°C. The temp. coeff. between 25° and 50°C was about 2 bars/degree.

6276. BUFF, FRANK P. AND KIRKWOOD, JOHN G. **The surface tension of small droplets.** *J. Chem. Phys.* **18,** 991-2 (1950).—*C.A.* 44, 7620*e*.

The surface tension of a droplet was not independent of the radius. The macroscopic concepts could not be extrapolated into the realm in which nucleation occurred without a complete and elaborate analysis.

6277. CONSTABLE, F. HURN. **The Freundlich isotherm. Its deduction for adsorption from dilute solutions.** *Rev. faculte sci. univ. Istanbul* **15A,** 127-9 (1950).—*C.A.* 44, 10441*b*.

Thermodynamic consideration of the free energies involved in solute adsorption at a solid-liquid interface led to definitions of k and n, the consts. of the empirical Freundlich equation. It was shown that the Freundlich isotherm was founded on a linear variation of the free surface energy with compn. in the surface layer.

6278. HILL, TERRELL L. **Note on the physical adsorption of gases and capillaries on small particles (nucleation of condensation).** *J. Phys. & Colloid Chem.* 54, 1186-91 (1950).—*C.A.* 45, 3220*h*.

The phenomena of capillary condensation, nucleation of condensation, and adsorption on small spherical particles were treated on the basis of a simple equation in which the concn., Γ, of adsorbed mols. on a surface was related to relative pressure, x, of the adsorbate by the equation $\log x = -a/\Gamma'$.

6279. HILL, TERRELL L. **The dependence of the surface energy and surface tension of spherical drops and bubbles on radius.** *J. Am. Chem. Soc.* **72,** 3923-7 (1950).—*C.A.* **45,** 1841*b*.

The approx. model used by Fowler to investigate theoretically the surface energy and surface tension of a plane liquid surface was extended to spherical drops and bubbles, with the addnl. assumption of liquid incompressibility. It was possible to derive a simple expression for the correction (to the plane surface tension) owing to curvature, which predicted that the surface tension decreased with radius. However, the magnitude of the effect was not large in this zero-order approximation.

6280. Lafargue, Camille. **Freezing of droplets of water at -41°.** *Compt. rend.* **230**, 2022-4 (1950).—*C.A.* 44, 8722*a*.

The freezing of water droplets of 1 to 20mμ diam. at 41°C was due to the mol. structure of water and not to the intervention of strange nuclei. A nucleus isomorphous with ice could cause water to freeze spontaneously at a temp. T detd. by $(T_f - T)T_f = 2SM/rQD$, where T_f was the normal f.p. of water, Q the mol. heat of fusion, M the mol. wt, D the d. of ice, S a coeff. detd. by Volmer as 10.5 ergs/mole, and r the radius in cm of the isomorphous nucleus.

6281. Luchak, G. and Langstroth, G. O. **Applications of diffusion theory to evaporation from droplets and flat surfaces.** *Can. J. Research* **28A**, 574-9 (1950) .—*C.A.* **45**, 1831*g*.

A rigorous treatment, in which the decreasing size of the drop was taken into account, was applied to the problem of the evapn. from droplets. The results indicated that the equations obtained by the method of quasi-stationary states were good to a high degree of approximation under ordinary circumstances.

6282. Manegold, Erich and Hartel, Martin. **Capillaries, capillarity, and capillary systems. XXV. 1. Free and restricted forms of contraction in capillary contraction of lyogels and lyopastes.** *Kolloid-Z.* **116**, 66-80 (1950).—*C.A.* **44**, 7619*b*.

The contracted form of lyogels depended on the presence of skeletonized or nonskeletonized gels, preferential areas of drying detd. the resulting shape. With shrinkage occurring outwardly first from corners and edges geometrical shapes were formed, often with hollow interiors. With inward shrinkage shapes followed the original, but with a crinkled surface. Upon artificial restriction various forms resulted with tendency toward min. surfaces and min. internal tensions.

6283. Schmid, Gerhard. **The electrochemistry of fine capillary systems. I. Summary.** *Z. Elektrochem.* **54**, 424-30 (1950).—*C.A.* **45**, 5544*h*.

Capillary systems in which the pore diams. were so small (less than 0.1 μ) that the usual assumption that the thickness of the Helmholz double layer was negligible compared with the pore diam. no longer held. Expressions for electrokinetic phenomena, elec. cond., and dialysis potential were given, which have been derived consistent with the picture for such systems as homogeneous electrolytes in which the charges on the wall were treated as fixed ions.

6284. Shereshefsky, J. L. and Carter, Clarence P. **Liquid-vapor equilibrium in microscopic capillaries. I. Aqueous system.** *J. Am. Chem. Soc.* **72**, 3682-6 (1950).—*C.A.* **44**, 10416*f*.

An app. for measuring the vapor pressure of liquids in microscopic capillaries was described. The lowering of vapor pressure of H_2O in cone-shaped capillaries of 3 to 10 μ in radius was found to be from 7 to 80 times as great as the values calcd. from the Kelvin equation, $(P/P_0) = \pm 2\sigma V/RTr$. The validity of the Kelvin equation was discussed in light of available exptl. studies.

6285. Shuttleworth, R. **The surface tension of solids.** *Proc. Phys. Soc.* **63A**, 444-57 (1950).—*C.A.* 44, 7607*f*.

Thermodynamic formulas of surface physics were reviewed. The surface free energy appeared in the expression for the equil. contact angle and in the Kelvin expression for the excess vapor pressure of small drops, but the surface tension appeared in the expression for the difference in pressure between the 2 sides of a curved surface. The surface tensions of homopolar crystals were zero if it was possible to neglect the interaction between atoms that were not nearest neighbors. Surface tensions were calcd. for the (100) faces of the crystals of Ne, A, Kr, and Xe and for the (100) faces of NaF, NaCl, NaBr, NaI, KF, KCl, KBr, KI. Except for NaF the calcd. values were neg.

6286. Wilke, C. R. **Diffusional properties of multicomponent gases.** *Chem. Eng. Progress* **46**, No. 2, 95-104 (1950).—*C.A.* 44, 3757*h*.

Approx. methods for calcn. of rates of diffusion in complex mixts. for stagnant films, and also with simultaneous diffusion of all components were presented. Effects of simultaneous diffusion on mass-transfer coeffs. were discussed.

6287. Barrett, Elliott P.; Joyner, Leslie G., and Halenda, Paul P. **The determination of pore volume and area distributions in porous substances. I. Computations from nitrogen isotherms.** *J. Am. Chem. Soc.* **73**, 373-80 (1951).—*C.A.* 45, 6010*a*.

An analysis of the N_2 desorption isotherms based upon the Wheeler theory of combined phys. adsorption and capillary condensation had been developed. A method for computing the pore vol. and area distribution directly from the desorption isotherm of porous substances was presented. The method had been successfully applied to adsorbents covering a wide range of pore vol. maxima.

6288. Carman, P. C. and Raal, F. A. **Physical adsorption of gases on porous solids. I. Comparison of loose powders and porous plugs.** *Proc. Roy. Soc.* (London) **A209**, 59-69 (1951).—*C.A.* 46, 6896*g*.

Comparison was made of adsorption on a given surface both as a free surface and as the internal surface of a porous plug. Direct evidence could be provided both for capillary condensation and for blockage of capillaries with adsorbed layers in porous solids. At the low-pressure end of adsorption isotherms, plug and powder gave identical results, and until blockage or capillary condensation was manifested, the total particle surface was accessible to adsorption. The adsorption isotherms for loose powders and for plugs of various porosities showed that, although pores could be filled by n-limited multilayer formation in certain limited cases, the main method of pore-filling was by capillary condensation. Expts. were made with CF_2Cl_2 on Ag and carbon black.

6289. Carman, P. C. **Physical adsorption of gases on porous solids. II. Calculation of pore-size distributions.** *Proc. Roy. Soc.* **A209**, 69-81 (1951).—*C.A.* 46, 6896*i*.

When capillary condensation took place, it was accompanied by multilayer adsorption in empty capillaries. To apply the Kelvin equation to pore-size distributions, allowance must be made for multilayers, and a method of doing so was presented. Modification of the calcn. when capillaries fill by blockage instead of condensation was discussed. Pore-size distribution curves were derived and compared for plugs of varying porosity. Results were reported for Ag plugs and carbon black.

6290. HILL, TERRELL L. **Gibb's theory of surface tension.** *J. Chem. Phys.* **19**, 1203 (1951).—*C.A.* **46**, 1832*c*.

The objections of Guggenheim to Gibbs' discussion of curved surfaces could be removed by starting with macroscopic independent variables only, avoiding Gibbs' immediate introduction of a dividing surface. The development was carried through.

6291. HIRTZ, J. AND BERNARD, R. **Adsorbed layers on a solid in the vicinity of a drop of liquid having a low vapor pressure.** *J. chim. phys.* **48**, 52-4 (1951).—*C.A.* **45**, 6454*h*.

From the change of the contact angle between a drop and the surface below, as a function of time, it was concluded that a peripheric area was formed that was progressively satd. by the evapn. of the drop. Condensation of the vapor either from the liquid that constituted the drop or water confirmed this hypothesis.

6292. KUHRT, FRIEDRICH. **Vapor pressure of small drops.** *Naturwissenschaften* **38**, 281 (1951).—*C.A.* **46**, 2373*a*.

Instead of the Thomson-Gibbs equation, log $(P_v/P_\infty) = 2\sigma O_v/3kT_v$, where p_v is the vapor pressure of a droplet contg. v mols., R the radius, O_v the surface, and σ the surface tension, the correct equation, if the droplets are free-moving, requires an addnl. term of $-4/v$. The correction is derived statistically and contains a rotation element of $5v/2$ as well as a translation element of $3v/2$. The corrected equation leads to a modified equation for nucleus formation frequency in supersatd. vapors.

6293. POUND, G. M. AND LAMER, V. K. **Surface tension of small droplets as a function of size from critical supersaturation data.** *J. Chem. Phys.* **19**, 506-7 (1951).—*C.A.* **45**, 7408*b*.

There was a small decrease in surface tension as the droplet size was reduced.

6294. WHEELER, AHLBORN. **Reaction rates and selectivity in catalyst pores.** *Advances in Catalysis* **3**, 250-327 (1951).—*C.A.* **45**, 8337*b*.

6295. CARMAN, P. C. **Diffusion and flow of gases and vapors through micropores. IV. Flow of capillary condensate.** *Proc. Roy. Soc.* (London) **A211**, 526-35 (1952).—*C.A.* **46**, 10734*g*.

If capillary condensation occurred in a porous plug and a steady pressure difference of an adsorbed gas was maintained across the plug, capillary condensate behaved as if it were bulk liquid in viscous flow through the pore-space. The driving force producing flow was not the pressure difference of the gas, but a very much larger difference of capillary pressure resulting from this pressure difference, presumably due to action of surface tension at curved menisci in the pores. The mechanism contrasted sharply with flow in adsorbed films. Expts. were reported for Linde silica II and CF_2Cl_2 at -33.1°C.

6296. FOSTER, A. GRAHAM. **Sorption hysteresis. II. The role of the cylindrical meniscus effect.** *J. Chem. Soc.* **1952**, 1806-12.—*C.A.* **46**, 8456*e*.

The correct formulation of the equations for the cylindrical meniscus effect was discussed. The potential due to multilayer adsorption was calcd. from the B.E.T. equation and added to the potential due to the cylindrical meniscus effect in the same pore. This sum (total free-energy decrease accompanying the formation of a given adsorbed layer) passed through a min. at some state of the sorption process. Hysteresis could occur only when the Kelvin potential curve (obtained from the Kelvin equation relating the vapor pressure to the curvature of a liquid surface) intersected the total free-energy curve before the min. was reached. When the pore radius and the no. of adsorbed layers were both large, and the heat of adsorption of the 1st layer was very much greater than that in the subsequent layers, a simplified math. treatment led to the prediction that hysteresis was possible when the product $V\gamma/RT\sigma$ for the adsorbed liquid exceeded unity (where V was the molar vol., γ the surface tension, and σ the mol. diam.).

6297. HENNIKER, JOHN C. **Retardation of flow in narrow capillaries.** *J. Colloid Sci.* **7**, 443-6 (1952).—*C.A.* **46**, 10788*h*.

The flow of H_2O through a ceramic disk was greatly increased by coating the pores with oleic acid. Expts. with flow of water and paraffin oil through a Pyrex disk with and without surface-active additives ($C_{12}H_{25}OH$, $C_{12}H_{23}NH_2$, and $C_{17}H_{35}NH_2$) gave no evidence of slippage. Expts. with the flow of distd. water and 0.0001-0.01 *N* KCl solns. through a normal porcelain filter and the same filter after it had been made hydrophobic by treatment with $C_{12}H_{25}NH_2$ gave no evidence of a streaming potential large enough to affect the results. The intense elec. field in the double layer at the capillary surface may produce the apparent increase in viscosity at the surface of the untreated capillaries.

6298. HIGUCHI, IZUMI AND IWAGAMI, YOSHITOMO. **Calorimetric evidence for the capillary condensation theory.** *J. Phys. Chem.* **56**, 921-7 (1952).—*C.A.* **47**, 959*e*.

The heat capacities of C_6H_6 and CCl_4 on silica gel and of C_6H_6 on charcoal were detd. by calorimetric measurements over the temp. range -160° to 10°C. Heat capacity was measured as the increase of temp. (ΔT) over a time interval (Δt) and plotted *vs.* temp. of calorimeter. Min. in the curve indicated melting of the sorbate. These min. depended on the pore size, which was detd. by means of the Thomson isotherms at 0°C. The pores of the charcoal were too small and no evidence of melting was obtained. The radius of pores in which the max. amt. of sorbate would melt was related to the f.p. depression by the thermodynamically derived $\Delta T/T^\circ = 2\gamma M/\rho r \Delta H$, where ΔT = f.p. depression; ρ = d., γ = surface tension, M = mol. wt,

ΔH = heat of fusion, T° = m.p. of bulk liquid, r = radius of pore. The fit with the exptl. values was good.

6299. Higuchi, Izumi and Utsugi, Hiroshi. **Capillary condensation in the sorption of vapors by nonporous powders. I. II.** *J. Chem. Soc. Japan, Pure Chem. Sect.* **73**, 395-7; 397-9 (1952).—*C.A.* **47**, 4163*i*.

Theoretical. Capillary condensation could take place in the contact zones of nonporous spherical particles. Formulas for capillary condensation curves were given. The sorption equil. of C_2H_5OH by TiO_2 powder was studied.

6300. Huggill, J. A. W. **The flow of gases through capillaries.** *Proc. Roy. Soc.* (London) **A212**, 123-36 (1952).—*C.A.* **46**, 10735*c*.

The flows of H_2, He, N_2, ethylene, A, and CO_2, through capillaries were measured at room temp. in the region of transition between mol. and viscous flow for capillary walls of polymethyl methacrylate and Au. Large nos. of capillaries were used in parallel, each from 2 to 3 mm long and about 0.08 mm in diam. The differential flows of the mixts. N_2/CO_2, A/CO_2 and N_2/ethylene were detd. by measurement of the change of concn. during effusion through similar capillaries, and the discrepancies with kinetic theory were conformed. The expts. on specific flow have shown that the flow of different gases at zero pressure was not exactly proportional to $M^{-1/2}$, but that there were small but definite discrepancies depending on the gas and on the material of the capillary wall.

6301. LaMer, Victor K. and Gruen, Ruth. **Direct test of Kelvin's equation connecting vapor pressure and radius of curvature.** *Trans. Faraday Soc.* **48**, 410-15 (1952).—*C.A.* **46**, 10736*b*.

The verification was based on an extension of the growth method of measuring the radii of monodiperse aerosol droplets initially too small for accurate detn. by light-scattering methods. The range was detd. to which the Kelvin relation controlled under equil. conditions the growth of monodiperse nonvolatile aerosol droplets when exposed to the vapors of a master soln. consisting of the nonvolatile component plus an excess of a volatile miscible solvent. Excellent quant. confirmation has been obtained for the systems dioctyl phthalate + PhMe, and oleic acid + $CHCl_3$. The success of the method depended on starting with a monodiperse aerosol.

6302. Lilley, G. G. **Moisture penetration.** *Refrig. Eng.* **60**, 143-5, 196-200 (1952).—*C.A.* **46**, 4302*i*.

Based on the relation of vapor pressure, capillarity, and absorption, an equation was given for detg. the rate of moisture flow.

6303. Schultze, Karl. **The capillary paradox.** *Kolloid-Z.* **127**, 164-6 (1952).—*C.A.* **47**, 22*h*.

The capillary paradox is the fact that a liquid will rise in a capillary to the same height no matter what the dimensions of the capillary below the meniscus. This is explained on the basis of the angle between the tangent to the outer curve of the meniscus and the horizontal at the base of the meniscus.

6304. Yates, D. J. C. **Proposed equations of state for the expansion of rigid porous solids on the adsorption of gases and vapors.** *Proc. Phys. Soc.* (London) **65B**, 80-1 (1952).—*C.A.* **47**, 4683*h*.

A thermodynamic relation involving the lowering of the free surface energy of a rigid porous solid was derived.

6305. Barrer, R. M. **A new approach to gas flow in capillary systems.** *J. Phys. Chem.* **57**, 35-40 (1953).—*C.A.* **47**, 5212*g*.

Surface areas derived from this method were greater than from steady flow because penetration took place into blind pores. *Surface diffusion coeffs.* could also be calcd.

6306. Briggs, Lyman J. **The limiting negative pressure of mercury in Pyrex glass.** *J. Appl. Phys.* **24**, 488-90 (1953).—*C.A.* **47**, 6194*a*.

Pure Hg in a clean, evacuated, degassed, tube showed a flat meniscus; when the tube was degassed, Hg adhered to the glass wall. A U-tube manometer of 5-mm bore with one leg sealed off was evacuated and degassed at 500°C with a mercury-vapor pump, and then filled with pure Hg by distn. The vertical height of the Hg column from the meniscus in the open tube to the top of the closed leg was 52 cm. When the manometer was again evacuated, the Hg column remained suspended from the top of the tube, withstanding a neg. pressure of two-thirds of an atm. Finally, freshly drawn capillary tubes with fine bores were evacuated, degassed by heating, sealed off, and filled by breaking one end under pure Hg. The neg. pressure which these Hg columns could withstand under centrifugal stress increased rapidly as the degassing improved. The highest neg. pressure observed for Hg was 425 bars at 28°C.

6307. Carman, P. C. **Properties of capillary-held liquids.** *J. Phys. Chem.* **57**, 56-64 (1953).—*C.A.* **47**, 5212*i*.

Attention was directed to (1) mode of condensation and retention of liquid in micropores, (2) the similarity of liquids in micro- and macropores, differences being as to pore radius, (3) the effect of pore radius on d., surface tension, f.p., and heat of vaporization of capillary condensates, (4) hysteresis, and (5) the flow of capillary condensates.

6308. Huckins, H. E. and Kammermeyer, Karl. **The separation of gases by means of porous membranes.** *Chem. Eng. Progr.* **49**, 180-4 (1953).—*C.A.* **47**, 5197*g*.

The permeabilities of H_2, He, CH_4, O_2, A, and N_2 were independent of av. pressure over the pressure range investigated. The permeabilities of $CH_3CH_2CH_3$ and butane, however, varied with av. pressure and temp. These data could be correlated by plotting K_1 against the ratio, P'/P_0, that is, av. pressure, P', to vapor pressure P_0. K_1 was practically independent of av. pressure of CO_2 and $CH_2{:}CH_2$. In this respect they differ from $CH_3CH_2CH_3$ and butane.

6309. NEIMARK, I. E. AND KHATSET, F. I. **The importance of capillary condensation for adsorption by adsorbents of different structures.** *Zhur. Fiz. Khim.* **27**, 50-6 (1953).—*C.A.* **47**, 5759*a*.

If a liquid mixt. of A and B contained *x* mol. % A, its satd. vapor contained *y* mol. % A, and an adsorbent in equil. with the satd. vapor contained *z* mol. % A (and 100—*z* % B), then capillary condensation was predominant when *z* was almost equal to *x*, and unimol. adsorption was predominant when *z* was almost equal to *y*. Four silica adsorbents were used and the sorption and desorption of MeOH detd. Two gels showed no hysteresis and their pore vols. were 0.20 and 0.36 cc./g. The third gel had pores of various sizes, showed adsorption hysteresis (MeOH), and had a pore vol. of 0.81 cc./g. The fourth gel had large pores, small hysteresis, and a pore vol. of 1.64 cc./g.

6310. PIERCE, CONWAY AND SMITH, R. NELSON. **Adsorption in capillaries.** *J. Phys. Chem.* **57**, 64-8 (1953).—*C.A.* **47**, 5211*c*.

Capillaries were classified in 2 categories which differed by the method in which adsorption occurred. The methods and limitations of pore-size calcns. were discussed. Discussion included the adsorption of water by carbon and the importance of surface mobility and external capillaries in the adsorption process.

6311. PIERCE, CONWAY. **Computation of pore sizes from physical adsorption data.** *J. Phys. Chem.* **57**, 149-52 (1953).—*C.A.* **47**, 7287*h*.

A method was described for calcg. the pore distribution of solids from low-temp. adsorption isotherms of N_2. It was considered reliable for pores larger than 25 A. in radius.

IV-4. Adsorption From Solutions

6312. WERGELAND, HARALD. **Surface diffusion.** *Nord. Kemikermode, Forh.* **5**, 253 (1939).—*C.A.* **38**, 1932^1.

Surface transport of materials adsorbed on crystals seemed to be an activated process. A no. of oscillating adsorbed particles about the equil. layer (potential shell) passed with a certain frequency over the energy barrier to a nearby shell, whereby the crystal surface behaved in the readiest manner as a net. An equation was given for the av. square of the displacement.

6313. TARADOIRE, F. **Reactions between solids. III.** *Bull. soc. chim.* **7**, 720-32 (1940).—*C.A.* **36**, 2198^2.

According as the salts were hydrated or not the reactions were accompanied by losses or gains of H_2O. The reactions were initiated by a min. quantity of H_2O adsorbed on the crystal surfaces which could not be considered a satd. soln.

6314. BIKERMAN, J.J. **Immobile layer at the solid-liquid interface.** *J. Chem. Phys.* **9**, 880 (1941).—*C.A.* **36**, 697^9.

No explanation has been advanced for the existence of immobile layers at surfaces. It has no place in the usual hydrodynamics or the usual electrostatic, and no mechanism has been suggested that would prevent ions or mols. from moving along a solid surface. The immobile layer was due to the roughness of the surface.

6315. KARAOGLANOV, Z. **Secondary chemical precipitation processes or adsorption?** *Osterr. Chem.-Ztg.* **44**, 149-54 (1941); *Chem. Zentr.* **1941, II**, 1585.—*C.A.* **39**, 5152^9.

A series of facts were cited that could be explained only with difficulty from the point of view of adsorption but that were explained satisfactorily from the standpoint of secondary chem. pptn. processes. The pptn. of SO_4^{--} and of Ba^{++} as $BaSO_4$, the pptn. of $BaCrO_4$, and reactions in which Pb compds. participated were discussed. The principal pptn. process was considered as a phys. process.

6316. KUHN, W. AND MARTIN, H. **Application of the temperature-dependence of adsorbability to the continuous fractionation or concentration of solutions.** *Z. physik. Chem.* **A189**, 317-26 (1941).—*C.A.* **37**, 6181^5.

The math. treatment was applied to the sepn. of substances in soln. by adsorption at two temp. A simple app. was described and its use illustrated by the sepn. of *l*- from *d*-mandelic acid by means of adsorption on wool.

6317. PALACIOS, JULIO, AND SALCEDO, RICARDO. **Fundamentals of separation methods that use surface effects.** *Anales fis. quim.* **37**, 167-76 (1941).—*C.A.* **37**, 16^1.

By assuming that particles adsorbed in a liquid behaved like a bidimensional gas, and making use of the Gibbs equation, which connected adsorbing power with variation of the capillary constant, the Freundlich empirical equation was reached. From kinetic considerations, it also followed that constant *b* of the Freundlich equation meant the ratio between the number of molecules that were associated in the solution in a single particle, and the same number referred to the surface layer.

6318. ALEIXANDRE, VINCENTE. **Adsorption of non-aqueous solutions.** *Anales fis. quim.* **38**, 378-82 (1942).—*C.A.* **37**, 4950^4.

The adsorption processes agreed rather well with the Bödecker-Freundlich equation. The quantity adsorbed was greater the lower the dipole moment of the solvent. The capillary activity of AcOH on different solvents was detd.

6319. MUTO, YOSHIO. **A simple model treatment of the adsorption of surface-active electrolytes.** *J. Phys.-Math. Soc. Japan* **16**, 104-7 (1942).—*C.A.* **41**, 7200*c*.

When surface-active ion were adsorbed, Coulomb repulsion between similar ions and the repulsion due to the jump of the dielec. const. at the interface acted to reduce the adsorption. The ions of opposite charge in soln. collected close to the adsorption layer and counterbalanced the effect.

6320. SARAVÍ, S. M. **Adsorption indicators.** *Rev. col. farm. nacl.* (Rosario, Arg.) **9**, 20 (1942); *Anales farm. bioquím.* (Buenos Aires) *supl.* **13**, 78-9 (1942).—*C.A.* **37**, 6583^3.

The use of adsorption indicators in titrimetry was discussed.

6321. VERWEY, E. J. W. **Theory of the interaction of two electrochemical double layers in combination with the forces between particles in suspensions and lyophobic sols.** *Chem. Weekblad* **39**, 563-6 (1942).—*C.A.* **38**, 2868^8.

Elec. double layers were treated as a system of immersed charged plates. The theory was compared with exptl. results.

6322. ALEIXANDRE FERRANDIS, V. **Adsorption from nonaqueous solutions.** *Anales fis. y. quim.* **39**, 414-39 (1943).—*C.A.* **42**, 6199*g*.

The adsorption of org. acids increased with the dipole moment of the solvent. The adsorbability of org. acids from liquids contg. double mols. diminished in general at the same rate as the dipole moment in the double mols. The adsorbents used (kaolin, activated Al_2O_3, charcoal) and no sp. effect on adsorption of org. acids in various solvents. The relation of adsorption powers of the various adsorbents was relatively const. with change of dissolved substance and solvent. Monochloracetic, monobromoacetic, and trichloracetic acids had a notably greater adsorbability than the AcOH from which they were derived, but phenylacetic acid less.

6323. BARRER, R. M. **Zone of activation in rate processes.** *Trans. Faraday Soc.* **39**, 237-41 (1943).—*C.A.* **38**, 909^7.

A unit transport process in the zone theory of diffusion may occur at a given point in the liquid when thermal energy fluctuations result in a local accumulation of adequate energy at that time. It was assumed that normally there was need for synchronization between certain rotations and intermol. vibrations within the zone of activation before a successful unit process occurred. Exptl. behavior was described.

6324. GAPON, E. N. **Dependence of the adsorption capacity upon the concentration of H and metallic cations.** *J. Gen. Chem.* (U.S.S.R.) **13**, 382-90 (1943). (English summary).—*C.A.* **38**, 3180^6.

The dependence of adsorption capacity of zeolites, bentonite, etc., upon the concn. of H and metallic cations was represented by: $S = \alpha + \beta$ (pH - (1/n)pM), where α and β are consts., n = cation valence and pM = neg. logarithm of cation concn. The cation adsorption from alk. soln. followed: $S = \alpha' + \beta_0$.pH; from a buffered soln. it was $S = \alpha'' + [n/(n+1)]\beta_0$ (pH - (1/n)pM).

6325. KLEBER, W. **The formation of skeletal crystals.** *Neues Jahrb Mineral., Geol. Monatsh.* **1943A**, 106-27.—*C.A.* **43**, 4070*i*.

A crit. discussion of diffusion and kinetic theory as applied to problems of crystal growth was given. Surface diffusion was an important factor.

6326. HOUWINK, R. **Migration velocity of foreign ions in synthetic resins.** *Kunststoffe* **34**, No. 2, 25-6 (1944).—*C.A.* **38**, 5449^5.

Synthetic resins were sepd. into 2 groups on the basis of cond. behavior. The migration velocity of the ions followed an equation of the type P = D.L, where P was the permeation coeff., D the diffusion coeff. and L the soly. const. D was proportional to activation energy, which was a measure of the energy with which foreign substances attached themselves to the synthetic-resin mols. and brought about their soln. The gradual decrease in migration velocity was due to obstruction by foreign ions already present.

6327. NUTTING, P. G. **Rentention of fluids by solids.** *J. Franklin Inst.* **238**, 177-84 (1944).—*C.A.* **38**, 6143^5.

The energy of vaporization of adsorbed liquid (L) was related to the retention or wt of liquid adsorbed/g of solid by a combination of the thermodynamic equation $RT \log (p°/p) = L$ with an empirical relation between retention and T at const. p or between retention and p, the vapor pressure of adsorbed liquid, at const. T. Data for the mineral deweylite were discussed. In the temp. ranges 90°-480°C and 650°-900°C there were progressive increases in L with decrease in amt. retained. Retention-p data for clays were also considered.

6328. GUGGENHEIM, E. A. **Statistical thermodynamics of the surface of a regular solution.** *Trans. Faraday Soc.* **41**, 150-6 (1945).—*C.A.* **39**, 3717^7.

A statistical-mech. treatment was given for the dependence of the thermodynamic functions of a binary regular soln. on its compn. The grand partition function was constructed with the technique described by Fowler. It was assumed that the difference in compn. of the surface from that of the bulk was confined to a unimol. layer and that the mols. in the surface were packed in the same manner as in the bulk of the soln., making the same contributions per pair of neighbors to the potential energy.

6329. WALTER, JOHN E. **Multiple adsorption from solutions.** *J. Chem. Phys.* **13**, 229-34 (1945).—*C.A.* **39**, 3990^8.

The general theory was presented of the adsorption of solutes from solns. that were treated by a process similar to that employed in chromatography. By assuming a chem. equil. between adsorbed material and the soln., the adsorption equations could be solved explicitly. The two-component problem was discussed in detail; the many-component problem and the extension of the theory to more general adsorption isotherms were considered briefly.

6330. CLAESSON, STIG. **Mathematical characteristics of adsorption isotherms in frontal analysis of several solutes.** *Arkiv Kemi, Mineral. Geol.* **A24**, No. 7, 7 pp. (1946) (in English).—*C.A.* **41**, 6834*f*.

The quant. compn. of a soln. was calcd. from a frontal-analysis diagram on the basis of the adsorption isotherms of Langmuir. When the equation for the isotherm could be written $f_i(c_1,c_2,....c_n) = k_i c_i r(c_1,c_2,....c_n)$ [where c_i was the concn. of the solute i in the presence of other solutes 1,2, ...$i-1$, $i+1$ ....n, k_1 was a const. which was characteristic for substance i, and $r(c_1,c_2,....c_n)$ was an arbitrary function], the validity of the formulas was greater than suspected. The significance of the displacement factor $r(c_1,c_2....c_n)$ was discussed.

6331. Davtyan, O. K. **Diffusion of electrolytes in capillaries.** *J. Phys. Chem.* (U.S.S.R.) **20**, 1043-7 (1946) (in Russian).—*C.A.* **41**, 2300*a*.

The diffusion potential in narrow capillaries must be different from that in wide vessels because of concn. differences created by the elec. double layer. The diffusing ions would be subject also to a streaming potential. An equation for the diffusion coeff. of ions was derived from this point of view.

6332. Defay, R. and Prigogine, I. **The lateral chemical potentials of a surface phase not in equilibrium.** *Bull. classe sci., Acad. roy. Belg.* **32**, 176-84 (1946).—*C.A.* **41**, 4351*f*.

The lateral chem. potentials were expressed in terms of the usual chem. potentials. Only at equil. were the surface chem. potentials in the Gibbs model and in the layer model equal. In the passage of a component from a bulk phase to the surface region (adsorption), the thermodynamic affinity of this process referred to different phenomena for the two models.

6333. Defay, R. and Prigogine, I. **Free energy and surface tension of surfaces not in equilibrium.** *Bull. classe sci., Acad. roy. Belg.* **32**, 335-50 (1946).—*C.A.* **41**, 4351*g*.

For a system in which adsorption equil. was not established, the surface free energy was developed mathematically in terms of the equil. surface free energy and the concns. of the bulk phases. The surface chem. potential of an adsorbed component, the lateral chem. potentials, and the surface tension were similarly expressed. The concept of an ideal surface phase was applied, and simplified expressions were obtained, for surface tension and potentials.

6334. Defay, R. and Prigogine, I. **Dynamic surface tension of a perfect surface.** *Bull. classe sci., Acad. roy. Belg.* **32**, 400-21 (1946).—*C.A.* **41**, 4351*h*.

The dynamic surface tension of a binary soln. with an ideal surface phase was expressed in terms of the surface tension of a pure component, the concns., molar vols., and molar surface areas of the components, and the thickness of the surface layer. Calcns. were given for a hypothetical system. Equations were derived that related the dynamic and static surface tensions of the same binary soln., and sample calcns. were given for a hypothetical system.

6335. Duclaux, J. **The constitution of colloidal particles and adsorption.** *Rec. trav. chim.* **65**, 514-17 (1946) (in French).—*C.A.* **41**, 2978*a*.

Inorg. colloids (hydrosols) were stabilized by condensation with multivalent neg. ions rather than by phys. adsorption. The evidence for the stabilization of As_2S_3 sol by H_2S was reviewed. Since no H_2S was liberated when As_2S_3 sol was coagulated by $BaCl_2$, the excess of H_2S necessary to form a stable colloid was assumed to be in some chem. combination as: $(SH)_2 = As\text{-}S\text{-}As(OH)\text{-}S\text{-}As(OH)_2$. Similarly $Cu_2Fe(CN)_6$ sol contained $K_4Fe(CN)_6$ in varying ratio, depending on the ratios of the original reactants. The tendency of substances to "condense" was postulated as a necessary characteristic for the formation of stable hydrosols.

6336. Levine, S. **The interaction of colloidal particles. I. Particular application to parallel plates.** *Trans. Faraday Soc.* **42B**, 102-17 (1946).—*C.A.* **42**, 7131*i*.

A general expression for the free energy of interaction of two parallel plates was developed by applying methods of statistical mechanics. An explicit formula required the mean potential at an ion and ionic d. in the double layer. An approx. method of calcg. these for small surface potentials was based on the Debye-Hückel approximation to the Poisson-Boltzmann equation. Existence of a min. in mutual free energy assocd. with the double layers of collodial particles was possible without introduction of van der Waals forces.

6337. Verschaffelt, J. E. **Adsorption.** *Bull. classe sci., Acad. roy. Belg.* **32**, 221-51 (1946).—*C.A.* **41**, 4352*a*.

The relations of the various math. quantities to exptly. measured adsorption, to surface tension, and to various thermodynamic quantities were discussed. Some mention was made of adsorption on a solid phase. Two sp examples were considered: one in which each fluid phase was a pure component, and another in which both components were present in each bulk phase.

6338. Ward, A. F. H. and Tordai, L. **Time dependence of boundary tensions of solutions. I. The role of diffusion in time effects.** *J. Chem. Phys.* **14**, 453-61 (1946).—*C.A.* **40**, 5317^7.

A general theory of diffusion to the surface was derived, which allowed for back-diffusion and which made no special assumptions of a phys. nature. Fick's equation was used to calc. the total amt. of solute that diffused from a semi-infinite bulk soln. into the surface if the concn. immediately under the surface was known at various times throughout the process. It was shown how the latter information could be deduced from the varation of surface tension with time together with final equil. values of surface tension.

6339. Born, Max and Green, H. S. **A kinetic theory of liquids.** *Nature* **159**, 251-4 (1947).—*C. A.* **41**, 3672*g*.

A general set of distribution functions for a dense assembly of particles was given which could be shown to contain the kinetic theory of gases as a limiting case for small intermol. interaction, and statistical mechanics as a limiting case for equil. distribution (no time dependence). The formulation for the equil. case suggested new math. approaches to the problem of predicting from mol. data equations of state and phase transformations characteristics, including freezing.

6340. Brewer, A. Keith; Madorsky, Samuel L.; Taylor, John Keenan; Dibeler, Vernon H.; Bradt, Paul; Parham, O. Lee; Britten, Roy J., and Reid, J. Gilman Jr. **Concentration of isotopes of potassium by the countercurrent electromigration method.** *J. Research Natl. Bur. Standards,* **38,** 137-68 (1947) (Research Paper No. 1765).—*C.A.* **41,** 3692*c*.

A flow of electrolyte was directed through a packed column in a direction countercurrent to the migration of the isotopic ions being sepd. and at a rate intermediate between the velocities of these ions. Under these conditions, the faster-moving ions would make headway against the electrolyte stream while slower ones would be carried back. Factors which detd. the efficiency of the method were described. In a series of expts. for the concn. of K^{39}, the abundance ratio $N = K^{39}/K^{41}$ was increased from its normal value of 14.2 to max. of 24 in about 500 hrs of operation.

6341. Gapon, E. N. **Effect of solvent on the adsorption of a solute.** *J. Phys. Chem.* (U.S.S.R.) **21,** 179-86 (1947).—*C.A.* **41,** 6107*a*.

If the solute is neither assocd. nor dissocd., the solvents are completely immiscible and not adsorbed at all and the adsorption layer is unimol. If the adsorption takes place according to Langmuir's mechanism, the activities (a_1 and a_2) of the solute in two solvents at a const. degree of completion of the unimol. layer are in the ratio $a_1 : a_2 = b_2$ exp. $[(U_1 - U_2)RT]/b_1$, where b_1 and b_2 are the consts. in the Langmuir equations for the two solvents, and U_1 and U_2 are the adsorption potentials of the solute in the two solvents.

6342. Hill, C.G.A.; Lovering, P. E., and Rees, A. L. G. **Electrophoretic deposition of powdered materials from nonaqueous suspensions.** *Trans. Faraday Soc.* **43,** 407-17 (1947).—*C.A.* **42,** 1783*i*.

A theory was proposed which considered the mutual interaction of particles. It was assumed that the particles were spherical, that the elec. double layer was spherically symmetrical, and that Stoke's hydrodynamic equations applied. A concentric cylindrical electrode arrangement in which the deposition always occurred on the inner electrode was used. The formation of a layer of high concn. close to the deposit was due to the interaction of the particles approaching the deposit itself. Expts. were carried out with $BaCO_3$-$SrCO_3$ (molar proportions 1:1), pptd. from a soln. of the mixed nitrates by Na_2CO_3.

6343. Kiefer, Charles. **Origin of the charge of suspensions of phyllitic minerals and its relation to their surface lattice structure.** *Compt. rend.* **225,** 1071-3 (1947).—*C.A.* **42,** 1783*g*.

Math. analysis showed that, for the dissocn. process, the charge and electrophoretic velocity increased with diln. whereas for the adsorption process both approached zero with diln. Measurements of velocity showed that suspensions of argillaceous minerals, e.g., kaolinite, owed their charge to adsorption, whereas muscovite was a case of dissocn. A sample of pyrophyllite exhibited both phenomena. These differences in behavior were related to the crystal structure of the minerals.

6344. Nieuwenhuis, K. T. **A qualitative demonstration of the Gibbs surface-tension equation.** *Rec. trav. chim.* **66,** 454-8 (1947).—*C.A.* **42,** 438*i*.

A relatively simple qual. demonstration of the Gibbs formula for the variation of the surface tension of a soln. with its concn. was developed. Two methods, applicable in one case to pos. adsorption and in the other to neg. adsorption, were developed.

6345. Temkin, M. **Logarithmic adsorption isotherm.** *J. Phys. Chem.* (U.S.S.R.) **21,** 517-19 (1947) (in Russian).—*C.A.* **41,** 6791*a*.

6346. Velasco, J. R. and Ruiz, J. Oliver. **Adsorption in solution. II. Graphical verification of the simple Langmuir equation and calculation of its constants. III. Theoretical and bibliographical. IV. Experimental errors, and results.** *Anales fís. y quím* (Madrid) **43,** 197-210, 327-56, 735-62 (1947).—*C.A.* **41,** 6106*h*, 6791*g*; **42,** 1103*d*.

A graphical method, based on projection, was used to det. whether exptl. data of isothermal adsorption complied with the Langmuir equation. The parameters could be calcd. directly. The principal advantages over previous methods were: (1) no prior or subsequent calcns., except transformation of scales, (2) C^2_{n-1} points could be obtained for the traces of the right angle which verified the equation, starting from n pairs of exptl. values, (3) the consts. of the isothermal equation were obtained directly by reading the graph.

6347. Verwey, E. J. W. **Theory of the stability of lyophobic colloids.** *J. Phys. & Colloid Chem.* **51,** 631-6 (1947).—*C.A.* **41,** 5360*i*.

The problem of the interaction of double layers was outlined. A repulsive potential due to interaction was derived from free-energy considerations. Potential-distance curves led to various correct predictions, e.g. the effect of the valency of ions upon flocculation values.

6348. Westhaver, James W. **Concentration of K^{39} by countercurrent electromigration: some theoretical aspects of the operation.** *J. Research Natl. Bur. Standards* **38,** 169-83 (1947) (Research Paper No. 1766).—*C.A.* **41,** 3692*f*.

Equations were derived which described the operations (1) for the early stages of a run, (2) after infinite time with no production, and (3) after infinite time at fixed production. The elementary sepn. factor and the max. sepn. factor were expressed in terms of various channeling factors which detd. the length of the theoretical unit cell, *h*. The optimum production conditions were calcd.

6349. Amundson, Neal R. **Mathematics of adsorption in beds.** *J. Phys. & Colloid Chem.* **52,** 1153-7 (1948).—*C.A.* **43,** 1624*d*.

A complete math. calcn. was made for adsorption by a bed from a stream of fluid for the case in which the adsorption occurred irreversibly at a removal rate that was proportional to the concn. of adsorbate in the fluid stream.

6350. Crank, J. **A diffusion problem in which the amount of diffusing substance is finite. II. Diffusion with nonlinear adsorption.** *Phil. Mag.* **39**, 140-9 (1948).—*C.A.* **43**, 3253*h*.

A method was described of evaluating approx. numerical solutions. The relation between the concns. of deposited and diffusing dye was nonlinear. The method applied to adsorption isotherms of the Freundlich or Langmuir types or to even more complicated isotherms if necessary.

6351. Davies, J. T. and Rideal, E. K. **The distribution of ions at interfaces. The concept of a surface phase.** *J. Colloid Sci.* **3**, 312-22 (1948).—*C.A.* **43**, 18*a*.

The distribution of ions at a charged surface was detd. for a surface phase of a thickness corresponding to the effective radius given by Debye-Hückel Theory. The equations that were derived from the Donnan equations by using the surface-phase concept had the limitation that they applied to ion activities (in the thermodynamic sense) only and were difficult to apply to large ions formed from proteins or dyes for which concns. were not readily convertible into activities.

6352. Fu, Ying; Hansen, Robert S., and Bartell, F. E. **Thermodynamics of adsorption from solutions. I. The molality and activity coefficient of adsorbed layers.** *J. Phys. & Colloid Chem.* **52**, 374-86 (1948).—*C.A.* **42**, 2836*a*.

Evidence for the existence of multilayer adsorption from solns was sought by the detn. of the activity coeff. of adsorbate. At equil., $\log f^s = (u_o - u^s{}_o)/2.303\,RT + \log a - \log m^s$, where s indicated values for the adsorbed state. The adsorption of butyric acid from aq. soln. up to 1 *M* on 4 graphites and 1 carbon black, with ash contents up to 0.18% and surface areas of 11 to 91 $m.^2$ was detd. With an area of 20.5 A^2 for butyric acid, adsorption data indicated that 2.07 mols. of H_2O were displaced by butyric acid. The adsorption data for butyric acid were expressed by a B.E.T. type of equation, $x/m = ((x/m)_m bc)/(c_o - c)(1 + (b - 1)(c/c_o))$, where b was a const. related to the heat of adsorption and desorption, and c_o was a const. depending on the adsorbate.

6353. Komárek, Karel. **Use of capillary phenomena in droplet reactions.** *Chemie* (Prague) **3**, 49-51 (1948).—*C.A.* **46**, 2952*g*.

Capillary phenomena accompanying reactions on filter paper were influenced by the elec. charge of the surfaces of the paper fibers. In many reactions the capillary phenomena may increase the sensitivity of a test. Test papers impregnated with reagents, dyes or indicators, bases, acids, or buffers, and dried before use have increased the sensitivity of many tests.

6354. Levine, S. **Interaction of colloidal particles II. Discussion on basis of theory.** *Trans. Faraday Soc.* 44, 833-43 (1948).—*C.A.* **43**, 3688*i*.

A theory was developed of the mutual free energy of 2 colloidal particles. The theory did not omit any terms of an elec. nature and it avoided the assumption of const. surface potential. A repulsion was obtained between the double layers of 2 colloidal particles in dil. sols.

6355. Plesch, P. H. and Robertson, R. H. S. **Adsorption onto ionogenic surfaces.** *Nature* **161**, 1020-1 (1948).—*C.A.* **42**, 7598*e*.

The adsorption of basic dyes on clays was governed by 2 different mechanisms. A quant. formulation of the theory of adsorption was given based on the equation $dx/dm = (k_1 + k_2 c^n)/[1 + (mn/v) k_2 c^{n-1}]$, where $x =$ no. of milliequiv. of dye removed from v ml of soln. of initial concn. c_o milliequiv./ml by m g of clay; k and n are consts. A theoretical adsorption curve for adsorption of methylene blue on floridin clay was given.

6356. Sheinker, N. S. **Generalized equation of diffusion through porous membranes and its practical utilization.** *Kolloid. Zhur.* **10**, 382-93 (1948).—*C.A.* **43**, 7778*e*.

Diffusion of a solute through a porous membrane followed the equation $\log E - \log (A - c/c_o) = KDt$; c and c_o were the original concns. of the solns. in contact, D was the diffusion coeff., and t was the time since establishing the contact. The consts. E, A, and K had a phys. meaning, but had to be calcd. from diffusion expts. on a compd. whose D was known. KCl was used as such compd., and the D of HCl was detd. in agreement with literature data. The membrane was a sintered-glass plate. D values were precise to within 1%.

6357. Weiser, Harry B.; Milligan, W. O., and Mills, G. A. **Zones of mutual protection against crystallization in dual-oxide systems.** *J. Phys. & Colloid Chem.* **52**, 942-9 (1948).—*C.A.* **42**, 6608*e*.

In a system of mixed oxides, there may exist a mutual protective action of the 2 oxides on each other so as to prevent crystal growth. 10-30 mol. % of BeO, ZrO_2, Bi_2O_3, or SnO_2 retarded or prevented crystn. of Al_2O_3. The action was mutual.

6358. Wilson, A. H. **A diffusion problem in which the amount of diffusion substance was finite.** *Phil. Mag.* **39**, 48-58 (1948).—*C.A.* **43**, 2839*g*.

The simplest law of adsorption of the dye that gave a nontrivial result was chosen. A complete soln. was obtained without recourse to numerical methods. Three problems were solved and two different methods, depending, resp., on an expansion in orthogonal functions and on the Laplace transform, were used. These problems were diffusion into a lamina, diffusion into a cylinder, diffusion when the rate of adsorption was infinitely rapid, diffusion when rates of adsorption and diffusion were comparable.

6359. Barrer, R. M. and Jost, W. **Interstitial diffusion.** *Trans. Faraday Soc.* **45**, 928-30 (1949).—*C.A.* **44**, 2325*a*.

In zeolitic diffusion, in which each unit diffusion process involved only a single jump from one sorption site to the next, the concn. dependence in the diffusion coeff. and the departure from ideality in the mixt. exactly compensated to give Fick's law. However, existing data showed that the product of these 2 factors decreased in some zeolites as the concn. increased, at least for smaller values of concn. This could be so if n-fold, as well as single, jumps occurred in some unit diffusion processes.

6360. CRANK, J. AND HENRY, M. E. **Diffusion in media with variable properties. I. Effect of a variable diffusion coefficient on the rates of absorption and desorption.** *Trans. Faraday Soc.* **45**, 636-50 (1949).—*C.A.* **43**, 8789*f*.

Numerical solutions of the diffusion equation in 1-dimension were detd. for a no. of diffusion coeffs. varying in different ways with the cocn. of the diffusing substance. In all the cases examd. it was found that, when the diffusion coeff. increased uniformly with increasing concn., absorption was quicker than desorption throughout; when the diffusion coeff. decreased was with increasing concn., the reverse was true.

6361. DRAKE, BIRGER. **Some factors affecting frontal sharpness in adsorption analysis.** *Anal. Chim. Acta* **3**, 452-67 (1949).—*C.A.* **44**, 10571*f*.

Filters whose length was more than 100 times the diam. gave better fronts than ones which were short and wide. The velocity of flow should be kept low in order to obtain even fronts. An adsorption analysis should take a day or longer, rather than an hr; it was possible to accomplish this without a diffusion which may destroy the frontal sharpness.

6362. FRUMKIN, A. N. **Dependence of the adsorption of electrolytes on potential and concentration.** *Doklady Akad. Nauk S.S.S.R.* **69**, 821-4 (1949).—*C.A.* **45**, 6454*i*.

Thermodynamic considerations give, for the dependence of the charge d. ϵ on the equil. potential ∂, and the concn. c of the cations, in the case of a negatively charged surface, the functional relation $\epsilon = f[\partial - (RT/nF)\ln c]$, which, when the H^+ ion was potential-detg., could be written $\epsilon = \phi([H^+]/c^{1/n})$, in terms of Gibbs' surface d. Γ of the cations, $\Gamma = -(1/nF)\phi([H^+]/c^{1/n}) = p_2[pH - (1/n)pM]$, where M = metal cation. The specific form of the functions ϕ or f_2 was not given by thermodynamics, and must be assumed. A linear relation between the amt. adsorbed and the log of the concn. need not indicate potential-detg. adsorption, but may be due to penetration of the adsorbed substance into the solid lattice, as in the β-phase of the Pd-H_2 system, and, possibly, also in the sorption of cations by zeolites.

6363. FU, YING; HANSEN, ROBERT S., AND BARTELL, F. E. **Remarks on "Thermodynamics of adsorption from solutions. I."** *J. Phys. & Colloid Chem.* **53**, 454-6 (1949).—*C.A.* **44**, 2820*i*.

Equations were compared to show that the surface activity coeff. was much less sensitive than the surface molality to the conventions adopted for calcg. the amts. of the component. The qual. conclusions held by any convention.

6364. GLUECKAUF, E. **Theory of chromatography. VII. The general theory of two solutes following non-linear isotherms.** *Discussions Faraday Soc.* **1949**, No. 7, 12-25.

The movement of solutes in an ideal adsorbing column during a chromatographic separation depended on the amounts f_1 and f_2 adsorbed in equilibrium with the concentrations c_1 and c_2 of the two solutes. The fundamental relationship was $df_1/dc_1 = df_2/dc_2$. The sequence of concentrations in the column as well as any new concentration plateaux developing spontaneously, and the occurrence of sharp or diffuse boundaries, could be predicted by the application of a few simple rules.

6365. GUASTALLA, JEAN. **Mechanisms of adsorption and the Gibbs' relation.** *Compt. rend.* **228**, 820-2 (1949).—*C.A.* **43**, 4921*h*.

An adsorption equation was derived kinetically for positively adsorbed substances. The no. of mols. entering the surface was assumed proportional to the concn. in the interior and the no. leaving the surface was proportional to the no. in the surface. The activation energy for the escape was detd. from the equation of state for the surface.

6366. OFFORD, A. C. AND WEISS, JOSEPH. **Chromatography with several solutes.** *Discussions Faraday Soc.* **1949**, No. 7, 26-34.—*C.A.* **44**, 9855*i*.

Examples of the application of the theory were given for the chromatogram formed from two solutes and developed with pure solvent, the development of a column consisting of a uniform mixt. of 2 solutes with pure solvent, and the development of an infinite column of uniformly distributed solute with a soln. of a more strongly adsorbed substance.

6367. PRASAD, MATA AND DOSS, K. D. VENKATESHA. **Scattering of light during the process of gel formation.** *J. Colloid Sci.* **4**, 349-65 (1949).—*C.A.* **43**, 7785*b*.

Gel-forming systems were studied by measuring the intensity and depolarization factors of light scattered by the system. Three types of gels were recognized: (1) Those that increased in opacity during setting (e.g. $Sn_3(PO_4)_4$, $Sn_3(AsO_4)_4$), (2) Those that did not change in opacity during setting (e.g. $Th_3(PO_4)_4$), (3) Those that set very slowly with a decrease in opacity during setting (e.g. $Ce_3(PO_4)_4$).

6368. ROMANOVSKI, VSEVOLOD. **Effect of the nature of the dispersing phase on the cohesive properties of a deposit of quartz powder.** *Compt. rend.* **229**, 871-2 (1949).—*C.A.* **44**, 5184*b*.

The forces were detd. that were necessary to start deformation of a deposit of quartz powder (5-7 μ grains) obtained from solns. of 0.001, 0.01, 0.1, and 1 *N* NaCl. The cohesion of the powder decreased as NaCl concn. increased, the greatest change being observed between 0.001 and 0.01 *N*. These effects seemed to originate in electrostatic phenomena that modified the adsorption of water mols. by the quartz grains.

6369. ALEXANDER, A. E. AND POSNER, A. M. **Method of integrating the Gibbs adsorption isotherm.** *Nature* **166**, 432-3 (1950).—*C.A.* **45**, 2285*g*.

The force (π)-area (A) relation for the adsorbed film of a sol. substance can be obtained from the equil. surface pressure (π)-concn. (c) curve by a graphic application of Gibbs adsorption isotherm. This can be applied in 2 equiv. forms: $n = (S/kT)(d\pi/dc)$ (1) and $n = (1/kT)(d\pi/d\ln c)$ (2), where n is the no. of mols./cm^2 $= 1/A$ (assuming that the activity coeff. is unity). In the region $\pi = 0$-10 dynes/cm, where the above equations can be accurately applied, the films are perfectly gaseous and obey an equation of state $\pi A = kT$. Studies on insol. monolayers and some adsorbed films show that for π greater than 15 dynes/cm many films obey a modified form of the above equation, namely, $\pi(A - A_0) = x kT$, where A_0 is the co-area of the mol. and x is a measure of the lateral adhesion of mols. in the film, being unity when there is no adhesion and decreasing as the adhesion increases.

6370. Amundson, Neal R. **Mathematics of adsorption in beds. II.** *Phys. & Colloid Chem* **54,** 812-20 (1950).—*C.A.* **44,** 9770*e*.
Exact equations were developed for adsorption and desorption in a bed of adsorbent for various assumptions as to the distribution of adsorbate on the adsorbent, the variation of the inlet soln. concn. with time, the nature of the slow step in the adsorption process, and the desorption pressure or back pressure exerted by the adsorbate.

6371. Bikerman, J. J. **Surface roughness and contact angle.** *J. Phys. & Colloid Chem.* **54,** 653-8 (1950).—*C.A.* **44,** 8133*c*.
The contact angles θ formed by air, water droplets, and stainless steel plates of 6 com. standard finished were detd. by measuring the diams. of the bases of drops of various sizes (0.008, 0.004, 0.002, and 0.001 cc.) and extrapolating to infinitely small drops which were spherical segments. The θ were almost identical (91° and 89°) for the coarsest (av. height of elevations detd. with a tracer instrument was 3.1 u) and the finest (height 0.025 μ) finish. Spreading of droplets on grooved surfaces showed that contact angles depended on the type of surface roughness rather than on its degree.

6372. Booth, F. **The cataphoresis of spherical particles in strong fields.** *J. Chem. Phys.* **18,** 1361-4 (1950).—*C.A.* **45,** 928*e*.
The problems of detg. the rate of cataphoresis of a solid spherical particle in an electrolyte when relaxation effects were neglected was solved completely. The bearing of the results on the usual methods of finding zeta-potentials from cataphoretic velocities was discussed.

6373. Brown, Callaway. **Adsorbed films from binary liquid solution.** *J. Phys. & Colloid Chem.* **54,** 1278-81 (1950).—*C.A.* **45,** 2742*b*.
Adsorption from aq. soln. of slightly sol. org. compds. by carbons was discussed. The thermodynamic treatment of Harkins and Jura, as well as the B.E.T. theory was applied.

6374. Ekedahl, Erik; Hogfeldt, Erik, and Sillen, Lars Gunnar. **Activities of the components in ion exchangers.** *Acta Chem. Scand.* **4,** 556-8 (1950).—*C.A.* **44,** 8195*g*.
A math. treatment of the subject in which the ion exchanger was regarded as a solid soln.

6375. Fu, Ying and Bartell, F. E. **Thermodynamics of adsorption from solutions. III. Adsorption at liquid-air interfaces.** *J. Phys. & Colloid Chem.* **54,** 537-46 (1950).—*C.A.* **44,** 5676*i*.
Adsorption at water-air interfaces was calcd. from surface-tension data by the exact form of Gibbs' equation. Activity coeffs., surface molalities, mol. areas, and surface pressures gave curves similar to those obtained for solid-liquid interfaces. The adsorption of BuOH, butyric acid, and phenol was of the monolayer type, whereas the adsorption of resorcinol, valeric acid, and caproic acid was of the multilayer type.

6376. Grahame, David C. **Progress and problems in the study of the electrical double layer.** *Record Chem. Progress* **11,** 93-107 (1950).—*C.A.* **44,** 7621*c*.
The kinetic theory of the double layer and its capacity and pseudo-capacity were discussed. Data were presented for double layers between Hg and various solns., and for adsorption of numerous salts.

6377. Grahame, David C. **Effects of dielectric saturation on the diffuse double layer and the free energy of hydration of ions.** *J. Chem. Phys.* **18,** 903-9 (1950).—*C.A.* **45,** 12*h*.
The theory of the diffuse double layer was developed for the case of a dielec. of variable dielec. const. The properties of the diffuse double layer which were experimentally significant were almost unaffected by the onset of dielec. satn. The Born equation for the free energy of hydration of ions was elaborated to include the effects of dielec. satn. which were negligible in the case of the alkali halide ions.

6378. Grimley, T. B. **The contact between a solid and an electrolyte.** *Proc. Roy. Soc.* **A201,** 40-61 (1950).—*C.A.* **44,** 7627*f*.
If lattice defects were present in the crystal in thermal equil., the balancing charge may reside actually inside the crystal in the form of a space charge of lattice defects whose structure was similar, in many respects, to the charged layer in the electrolyte. Equations were derived that related the potential drop in each phase and the total charge on the double layer to the phys. consts. of the system. The thickness of the crystal appeared as a parameter. The self-diffusion coeffs. of the ions in the crystal were functions of position, and this had an important effect on the rates of exchange of radioactive Ag and Br ions between the electrolyte and the crystal.

6379. Janok, Ján. **An osmometric study of cations.** *Chem. Zvesti* **4,** 299-305 (1950).—*C.A.* **45,** 3322*d*.
The rush no. of a metallic cation was greater, the greater the charge. At the same charge it was directly proportional to the square root of its at. wt and inversely proportional to the square root of the mol. wt of the alc.

6380. Lapidus, Leon and Amundson, Neal R. **Mathematics of adsorption in beds. III. Radial flow.** *Phys. & Colloid Chem.* **54,** 821-9 (1950).—*C.A.* **44,** 9770*e*.
General equations for radial-flow adsorption columns were derived and were solved for a case in which a linear isotherm is assumed and for one in which the isotherm is of the Langmuir type.

6381. Lepin, L. K. **Surface reactions. IV. Validity of the phase rule and of the law of mass action.** *Zhur. Fiz. Khim.* **24,** 224-43 (1950).—*C.A.* **44,** 6250*c*.
Ion-exchange reactions on the surface of adsorbents were governed by the phase rule. The

system of ash-free charcoal, O_2, and an aq. electrolyte soln. (KCl) had 5 independent components and consisted of 3 phases. There were 5 degrees of freedom (e.g., pressure P, temp., surface extent, the vol. concn. of OH^- (C_2), and vol. concn. of Cl^- (C_3)). If the 3 first parameters were kept const., adsorption hysteresis occurred; it disappeared if also the pH was kept const. From the law of mass action, an equation was derived for the adsorption of anion. The nonuniformity of the adsorbent surface was another source of discrepancy.

6382. Levine, S. **The interaction of colloidal particles. III. Some theorems concerning the free energy of double layers.** *Phil. Mag.* **41**, 53-65 (1950).—*C.A.* **44**, 6233*f*.

A no. of theorems relating to the free energy of the elec. double layers of colloidal particles in dil. sols were developed. In the case of 2 infinite parallel plates, the difficulty that arose due to the infinity of the surface potential, when all the ions were supposed completely discharged, was satisfactorily explained.

6383. Nagasawa, Mitsuru. **Theory of the membrane potential across films of organic polymers. I. Criticism of the theory of Meyer-Teorell. Influence of ionic radius on membrane potential.** *J. Chem. Soc. Japan*, Pure Chem. Sect., **70**, 4-7 (1949).—*C.A.* **45**, 2744*b*.

The Meyer-Teorell theory of membrane potential was corrected in 3 ways: (1) Sieve effect and ionic mobility were treated independently. (2) The characteristic permeability const. (usually denoted by A) depended on the types of electrolytes. (3) Permeation velocities of cations and anions were taken to be the same. A formula giving the cation:anion ratio in membranes as a function of ionic radius was derived and agreed well with exptl. results.

6384. Ono, Syô. **Statistical thermodynamics of critical and surface phenomena. II. Statistical theory of adsorption from regular solution.** *Mem. Faculty Eng. Kyushu Univ.* **12**, 1-8 (1950).—*C.A.* **44**, 8732*i*.

Adsorption of mols. from soln. on solids was treated statistically based on a consideration of the interacting thermodynamic energies involved.

6385. Stauff, J. **The thermodynamics of colloidal systems.** *Kolloid-Z.* **118**, 73-86 (1950).—*C.A.* **45**, 1405*i*.

Surface energy per particle, particle size and concn., chem. potential, and Coulomb and van der Waals forces were considered, and a new concept of of dispersion entropy was introduced.

6386. Todes, O. M. and Bikson, Ya. M. **Dynamics of sorption on a real granular adsorbent.** *Doklady Akad. Nauk S.S.S.R.* **75**, 727-30 (1950).—*C.A.* **46**, 18*f*.

A gas or liquid contg. the sorbable substance at a concn. c moved down a layer of sorbent at the rate u. The differential equation of the sorption was $\partial c/\partial t = -u\,(\partial c/\partial x) - (\partial a/\partial t) + D\,(\partial^2 c/\partial x^2)$, with a = concn. of the sorbable substance at the given depth x of the layer, and the conditions were, at $x = 0$, $c = c_o$ = const., $a = a_o$, $\partial c/\partial x = 0$; at $t = 0$, $c = 0$, $a = 0$, $\partial c/\partial x = 0$. If the sorption was phys. and detd. by diffusion, $\partial a/\partial t = \beta\,[c - C(a)]$, where $C(a)$ = concn. at the surface in equil. with a. With $\xi = x - vt$ (where v = rate of displacement of the sorption wave), integration over ξ gave $D(dc/d\xi) = (u - v)c - va$, and Shilov's formula for the propagation of a sorption wave, $v = c_o u/(a_o + c_o)$. Elimination of ξ gave $da/dc = -G[(a_o + c_o)/c_o]^2[c - C(a)]/[(a_0 c/c_0) - a]$, where $G = \beta D/u^2$ was a dimensionless criterion.

6387. Trillat, J. J. and Brigonnet, J. **Measurements of thicknesses of molecular layers.** *Rev. inst. franc., petrole* 5, 13-16 (1950).—*C.A.* **45**, 20*f*.

A satd. hydrocarbon lubricant contg. a polar solute such as oleic acid was passed through a column of steel balls. Before and after passage the solute content was detd. by the change of interfacial tension with time of the soln. in contact with water. From the difference in solute content the no. of mols. adsorbed on a known area could be calcd.

6388. Walling, Cheves. **The acid strength of surfaces.** *J. Am. Chem. Soc.* **72**, 1164-8 (1950).—*C.A.* **44**, 5181*e*.

A definition of the acid strength of a solid surface as the ability of the surface to convert an adsorbed neutral base to its conjugate acid was proposed. By observation of the colors of suitable adsorbed indicators the acid strengths of a no. of materials were semiquantitatively detd. Colors of the adsorbed indicators were, in every case, those of the indicator or its conjugate acid as observed in homogeneous soln. Surface acid strengths depended somewhat upon the medium from which the indicator was adsorbed, and were decreased by the presence of weak bases, e.g., Me_2CO or H_2O. Although Al_2O_3 and pure SiO_2 appeared to have neutral surfaces, SiO_2-Al_2O_3 and SiO_2-MgO were strongly acid. Several surfaces contg. strongly coordinating metal ions, e.g., $CuSO_4$, AgCl, etc., were also strongly acid.

6389. Babbitt, J. D. **A unified picture of diffusion.** *Can. J. Phys.* **29**, 427-36 (1951).—*C.A.* **46**, 8918*i*.

If the equation $(\partial p/\partial x) - Ax = 0$, where p was a pressure function and Ax a resistive or frictional force, was taken as the fundamental dynamic equation, it is possible to explain diffusion in solns., in solid solns., and in an adsorbing solid as well as the interdiffusion of 2 gases. In diffusion in both liquid and solid solns. the pressure function was the spreading pressure of the adsorbed layer.

6390. Christiansen, J. A. **Mechanism of precipitation of sparingly soluble salts.** *Acta Chem. Scand.* 5, 676-7 (1951)(in English).—*C.A.* **46**, 4329*f*.

The presence of 2 qualitatively different ionic groups is postulated. A cluster is a group of from 2 to $P - 1$ ions. A germ is a group of P ions. A cluster may gain or lose an ion but a germ will much more probably gain than lose an ion. The summation of probabilities of the cluster to gain or lose an ion reduces to the form $s = k_p C^p$ which by integration yields $T_a C_0^{p-1} = k$.

6391. Dean, Robert B. **The gibbs—a rational unit for adsorption.** *J. Phys. & Colloid Chem.* **55,** 611-12 (1951).—*C.A.* **45,** 6003*f*.

This unit, *G*, defined as 10^{-10} moles per cm^2, is proposed for use in reporting adsorption data in terms of surface concn. The relation between the surface concn. Γ and the area per mol. *A*, expressed in A^2., is $\Gamma = 166.0\ G/A$.

6392. Elton, G. A. H. **Adsorption from binary solutions of completely miscible liquids. I. Calculation of surface mole-fraction isotherms.** *J. Chem. Soc.* **1951,** 2958-61.—*C.A.* **46,** 2874*c*.

A materials balance in the surface layer led to: $x_B^s = 1 - x_A^s = Ax_B - \{a_A(n_A + n_B)\Delta x_B/[A + (n_A + n_B)(a_A + a_B)\Delta x_B]\}$, where x_B^s and x_A^s were the mole fractions of *A* and *B*, resp., in the surface layer, and the *x*'s were the equil. mole fractions in the bulk soln.; the *n*'s were the no. of moles of each component initially present in the soln., the *a*'s their corresponding effective areas per mole, *A* the area of adsorbent available, and Δx_B the change in compn. of the soln. due to adsorption. The method was applied to adsorption from MeOH-CCl_4 mixts. by charcoal.

6393. Eriksson, Erik. **pH, ion activities, and membrane potentials in colloidal systems.** *Science* **113,** 418-20 (1951).—*C.A.* **45,** 5488*d*.

The cause of the potential across an electrically charged colloidal membrane between 2 solns. of different salt activities was discussed. The difference in pH between a suspension and its filtrate was attributed to a suspension effect, which was believed to be a more satisfactory kinetic explanation than the postulate of high liquid-junction potential between a KCl bridge and a suspension.

6394. Frumkin, A. N. and Melik-Gaĭkazyan, V. I. **Determination of the kinetics of adsorption of organic substances by a.-c. measurements of the capacity and the conductivity at the boundary: electrode-solution.** *Doklady Akad. Nauk S.S.S.R.* **77,** 855-8 (1951).—*C.A.* **45,** 6909*e*.

At a metal/soln. interface with a potential difference γ, ϵ = charge per unit surface area of the soln. side of the double layer, Γ = adsorbed amt./cm^2, the c.d. was $i = C_e\,\partial\gamma/\partial t + i'$, where C_e = true electrode capacity at the given const. Γ, and $i' = (\partial\epsilon/\partial\Gamma)\gamma(\partial\Gamma/\partial t)$. At a finite rate of charging, Γ lagged behind γ, and $\partial\Gamma/\partial t$ would depend on the kinetics of the adsorption. If the rate of adsorption was detd. by diffusion, soln. of the differential equation, with the boundary conditions, leads to the addnl. c.d. If the adsorption process proper was slow as compared with the diffusion, the concn. in soln. remained const. Inhibition of the over-all adsorption process by diffusion was more marked at low frequencies, whereas inhibition by adsorption proper was more marked at high frequencies.

6395. Fukuoka, Fumio. **The rate of adsorption in the liquid phase. IV. The effects of agitation on the rate of adsorption in the liquid phase.** *J. Chem. Soc. Japan,* Ind. Chem. Sect. **54,** 203-5 (1951).—*C.A.* **47,** 2568*a*.

It has been proposed that the rate of adsorption is detd. by 2 factors: (1) the rate of diffusion inside the adsorbent particles, and (2) the resistance at the outside layer of the adsorbent particles. A formula is given for the relation between the rate of adsorption and the degree of agitation. The adsorption of I_2 (in KI soln.) by active charcoal is discussed.

6396. Gregor, Harry P. **Gibbs-Donnan equilibria in ion-exchange resin systems.** *J. Am. Chem. Soc.* **73,** 642-50 (1951).—*C.A.* **45,** 4524*i*.

The classical thermodynamic formulations were applied with particular consideration of the pressure-vol. free energy changes involved in the swelling and deswelling processes.

6397. Hansen, Robert S. **Basic concepts in surface thermodynamics.** *J. Phys. & Colloid Chem.* **55,** 1195-1200 (1951).—*C.A.* **46,** 803*g*.

In the case of inert nonswelling solid adsorbents, measured quantities of gas adsorption or liquid-soln. adsorption were related to Gibbsian surface-excesses by multiplicative experimentally determinable consts. The discussion was based on actual expt. procedures. In the case of gas adsorption, measured quantities were most directly related to surface excesses referred to a math. surface located by setting the surface excess of the solid component equal to zero.

6398. Kaneko, Seiji. **Adsorption and stability of colloidal solutions.** *J. Electrochem. Soc. Japan* **19,** 88-9 (1951).—*C.A.* **45,** 8323*h*.

A formula was derived thermodynamically which showed that a colloidal soln. was in general stabilized by dissolving any substance in the dispersion medium.

6399. Kipling, J. J. and Tester, D. A. **Adsorption from binary mixtures of nonelectrolytes.** *Nature* **167,** 612 (1951).—*C.A.* **45,** 8321*d*.

It was suggested that on theoretical grounds the math. forms of both the Freundlich and Langmuir types of equations render them inapplicable to liquid-phase results.

6400. Kobatake, Yonosuke and Nagasawa, Mitsuru. **Theory of membrane permeability. I. The permeation velocity of ions.** *J. Chem. Soc. Japan,* Pure Chem. Sect., **72,** 378-81 (1951).—*C.A.* **46,** 806*d*.

Attempts were made to derive an equation for the permeation velocity of electrolyte through a membrane in line with Eyring's theory of diffusion potential. The permeability was greatly affected by the elec. charge on the membrane.

6401. Levine, S. **Interaction of colloidal particles. IV. General mathematical theory for two identical particles.** *Proc. Cambridge Phil. Soc.* **47,** 217-29 (1951).—*C.A.* **45,** 5487*h*.

An expression for the Helmholtz free energy of the elec. double layers was obtained by the methods of statistical mechanics. The condition of equil. between the ions adsorbed on the surfaces of the colloidal particles and those dissolved in the dispersion medium was accounted for by requiring that the free energy of the whole system be a min. with respect to variation of the ionic d. on the surfaces.

6402. Levine, S. **Interaction of colloidal particles. V. Nature of repulsion between particles in dilute sols.** *Proc. Cambridge Phil. Soc.* **47**, 230-42 (1951).—*C.A.* **45**, 5488*a*.

The contributions of the Coulomb interaction of the ions in the dispersion medium added a repulsion term to the mutual free energy of the 2 particles. This correction term behaved as an inverse power and was the predominant effect at large sepns., although a second-order effect at small sepns. For parallel plates this power was the fourth; for 2 spheres, the sixth.

6403. Levine, S. **The interaction of colloidal particles. VI. Application of the Stern theory of the double layer.** *J. Colloid Sci.* **6**, 1-19 (1951).—*C.A.* **45**, 4115*i*.

A formula for the mutual free energy of the particles was derived.

6404. Levine, S. and Suddaby, A. **Free energy of the double layers of two plates at large separations.** *Proc. Phys. Soc.* (London) **64A**, 431-3 (1951).—*C.A.* **45**, 8323*h*.

An expansion for the interaction of the elec. double layers of two parallel (colloidal) plates at large sepns., when immersed in an electrolyte of the binary sym. type.

6405. Levine, S. **The free energy of the double layer of a colloidal particle.** *Proc. Phys. Soc.* (London) **64A**, 781-90 (1951).—*C.A.* **46**, 9936*i*.

Some theorems concerning the free energy of the elec. double layer of a colloidal particle in a dil. sol were developed. This free energy could be derived by using the fictitious process of charging excess ions in the double layer.

6406. Marshall, C. E. **Measurements in colloidal systems.** *Science* **113**, 43-4 (1951).—*C.A.* **45**, 3219*i*.

It was shown that the Donnan equil. existed in the membrane potential. The method of analysis for Cl must be made on a portion of the cell electrolyte which has not been constrained in any way. The results of Jenny agreed with the Donnan theory.

6407. McCabe, W. L. and Stevens, R. P. **Rate of growth of crystals in aqueous solutions.** *Chem. Eng. Progress* **47**, 168-74 (1951).—*C.A.* **45**, 4535*b*.

The rate at which $CuSO_4$ pentahydrate crystals grow in an agitated soln. at const. supersatn., was studied. The results were consistent with the view that the growth process consisted of a mass-transfer process from the soln. to the crystal surface followed by a reaction at the interface which was as yet not fully understood. In a crystallizer in which the crystals were maintained in suspension by means of an agitator, large crystals grow faster than smaller ones because the larger crystals benefited from a higher relative velocity with respect to the soln. than did smaller crystals, and the relative velocities in both cases were in the low range.

6408. Parsons, Roger and Bockris, J. O'M. **Calculation of the energy of activation of discharge of hydrogen ions at metal electrodes.** *Trans. Faraday Soc.* **47**, 914-28 (1951).—*C.A.* **46**, 2428*f*.

The rate of transfer of a proton from its solvation sheath to an adsorption position on an electrode was formulated in terms of the transition-state theory modified for charged particles. The free energy of activation of the reaction was calcd. approx.

6409. Robert, Louis. **Classification of organic compounds by the stepwise degree of adsorbability on solid surfaces.** *Compt. rend.* **233**, 742-4 (1951).—*C.A.* **46**, 2872*g*.

A partial classification of a series of org. compds. was based on the extent of adsorption on activated charcoal silica gel, and Al_2O_3. The classification was expected to be useful for predicting possible chromatographic sepns.

6410. Scott, E. J.; Tung, L. H., and Drickamer, H. G. **Diffusion through an interface.** *J. Chem. Phys.* **19**, 1075-8 (1951).—*C.A.* **46**, 806*c*.

The diffusion equation was solved for the case of two cells of finite length with an interface between the cells. The effect of an interfacial resistance to mass transfer was considered. The condition of equil. (no resistance) at the interface was special case of this solution.

6411. Tanaka, Minoru and Shibata, Muraji. **Inorganic chromatography. III.** *J. Chem. Soc. Japan,* Pure Chem. Sect. **72**, 221-3 (1951).—*C.A.* **46**, 850*b*.

The mechanism of inorg. chromatographic adsorption on alumina was discussed from the standpoint of electrostatic adsorption. The values $-Ze^2/R$, calcd. according to Bernal and Fowler, for cations and anions gave a series similar to those found experimentally.

6412. Teorell, Torsten. **Quantitative treatment of membrane permeability.** *Z. Elektrochem* **55**, 460-9 (1951).—*C.A.* **47**, 23*i*.

A general theory of permeability applied to convection-free membranes having fixed layers was presented. The theory included systems under external application of elec. current as well as those without current. Formulas were developed for (*a*) individual ionic flow, (*b*) flowing in and out of each individual ionic type, (*c*) individual ionic equiv. wt, (*d*) the flow relation between various anions and cations, (*e*) c.d., (*f*) single membrane potentials, (*g*) membrane cond., (*h*) rectification effect, and (*i*) potential changes and spatial distribution of mobile ions within the membrane.

6413. Thomas, Tudor, L. Jr. **Thermodynamics of adsorption from solution.** *Univ. Microfilms* (Ann Arbor, Mich.), *Pub.* No. **2468**, 119 pp. (microfilm $1.49, paper enlargements $11.90); *Microfilm Abstracts* **11**, No. 2, 257-9 (1951).—*C.A.* **45**, 7845*d*.

6414. Wiklander, Lambert. **Equilibria in ion exchange. I. Effect of the proportions of the exchanging ions.** *Acta Agr. Scand.* **1**, 190-202 (1951).—*C.A.* **46**, 3828*b*.

Theoretical relations between the degree of exchange of adsorbed ions and their relative concns. were derived on the basis of the Donnan equil. The effect of small successive exchange replacements on the relative release of ions as compared to the effect of a large single replacement was emphasized.

6415. BARTLETT, JAMES H. AND KROMHOUT, R. A. **The Donnan equilibrium.** *Bull. Math. Bio-phys.* **14**, 385-91 (1952).—*C.A.* 47, 4692*d*.

Beginning with the assumption that the electrochem. potential for each ionic species was (spatially) const. and that the elec. potential was given by Poisson's equation a complete solution was given for the spatial distribution of ions and potential for a simple Gibbs-Donnan equil. These quantities varied only in a region of approx. 300 A. about the membrane. Outside this region electroneutrality was an extremely good approximation.

6416. EDESKUTY, FRED J. AND AMUNDSON, NEAL R. **Mathematics of adsorption. IV. Effect of intraparticle diffusion in agitated static systems.** *J. Phys. Chem.* **56**, 148-52 (1952).—*C.A.* 46, 8460*b*.

The change in the concn. of a solute with time was calculated in a soln. contg. a porous adsorbent; both equil. and nonequil. cases were considered.

6417. FREISE, V. **Theory of the diffuse double layer.** *Z. Elektrochem.* **56**, 822-7 (1952).—*C.A.* 47, 3654*g*.

The structure of the diffuse double layer on an electrode was calcd. thermodynamically, with the assumption of ideal solns. and 1:1 electrolytes. Not only the concn., but also the pressure had to be assumed to vary locally. The equations obtained could be solved only for special cases, when the vols. of the cation and anion were equal, and the vol. of the solvent twice as large, equal, or half as large.

6418. KASTEN, P. R. AND AMUNDSON, N. R. **Effect of intraparticle diffusion. II. Analytical solution for simple systems in moving-bed adsorbers.** *Ind. Eng. Chem.* **44**, 1704-11 (1952).—*C.A.* 46, 9894*f*.

Adsorption in a moving bed was considered, based on the assumption of uniform, porous spheres as the adsorbent medium, and rodlike flow of both fluid and particles. Under equil. conditions, the relation between the adsorbate concn. of the fluid and solid followed the isotherm for that system. Under nonequil. conditions, a linear, reversible kinetic relation was assumed, solvable by analytical methods.

6419. LEVINE, S. AND SUDDABY, A. **Free energy of the double layers of two parallel plates in a 1-2 electrolyte.** *Proc. Phys. Soc.* (London) **A65**, 405-18 (1952).—*C.A.* 46, 10837*h*.

An expression was obtained for the free energy. Two cases arose depending on whether or not the bivalent ion and the surface charge had the same sign. The exact formulas were involved and simpler expansion series approximations were also given.

6420. MACKOR, E. L. AND VAN DER WAALS, J. H. **The statistics of the adsorption of rod-shaped molecules in connection with the stability of certain colloidal dispersions.** *J. Colloid Sci.* **7**, 535-50 (1952).—*C.A.* 47, 945*i*.

The previously-prepd. model for the stabilization of colloidal dispersions in liquid paraffins by long-chain alkylarenes was investigated by statistical techniques. The expression developed for the free energy of repulsion between 2 parallel planes adsorbing rod-shaped mols. was compared with the available exptl. data. This repulsion must be responsible for the stabilization of carbon black dispersions in nonpolar media.

6421. SCHLÖGL, R. AND HELFFERICH, F. **Theory of exchange-membrane potentials.** *Z. Elektrochem.* **56**, 644-7 (1952).—*C.A.* 47, 3654*e*.

A generalized equation for the membrane potential was proposed.

6422. VOUK, V. B. **Stability of lyophobic sols.** *Nature* **170**, 762 (1952).—*C.A.* 47, 3084*e*.

The Ostwald rule that coagulation takes place at approx. const. value of the activity coeff. of the coagulating ion was derived for sym. electrolytes from the Verwey-Overbeek theory.

6423. WIRTH, J. K. AND MACHU, WILLI. **Quantitative electroösmotic investigation of the structure of colored films.** *Werkstoffe u. Korrosion* **3**, 453-60 (1952).—*C.A.* 47, 4690*f*.

Tests showed that in addn. to the electrolytic soln. pressure inherent in all metals having a natural or artifical colored surface film, an addnl. force must be considered in corrosion phenomena. This force is the electrokinetic potential increase in the boundary layer: capillary wall/capillary fluidity, the so-called ζ potential or a still unknown discharging force, which brings about the potential increase. An idea of the size of this potential increase can be obtained only on the basis of the Helmholtz-Perrin equation.

6424. HANSEN, ROBERT S. AND FACKLER, WALTER V., JR. **A generalization of the Polanyi theory of adsorption from solution.** *J. Phys. Chem.* **57**, 634-7 (1953).—*C.A.* 48, 22*e*.

The Polanyi theory of the adsorption from soln. of solutes of limited soly. was corrected and generalized to nonideal solns. of complete miscibility. Necessary assumptions and their limitations were discussed. Isotherms for the adsorption of water, 1-propanol, and 1-butanol from the vapor phase at 25°C were measured.

6425. HILL, TERRELL L. **Adsorption on proteins, the grand partition function and first-order phase changes, according to approximate statistical-mechanical theories.** *J. Phys. Chem.* **57**, 324-9 (1953).—*C.A.* 47, 6215*e*.

The transition in properties that occurred as the no. B, of adsorption sites per protein mol. got very large, was examd. by the Bragg-Williams approxn. With sufficiently large attractive interactions between adsorbed mols., the usual partition function, Ω, based on an approx. theory, predicted a loop and first-order phase change for $B\rightarrow\infty$. Use of the complete grand partition function instead of Ω eliminated the loop and gave the stable equil. path even with an approx. theory.

Chapter V. REFINING OF SUGARS AND OTHER APPLICATIONS OF ADSORBENTS

The decolorization and purification of sugar liquors represents one of the oldest applications of adsorption in industry. The sugar refining industry since the early decades of the nineteenth century has offered a potential market to a newly proposed adsorbent. The competition for this field of application has contributed in no small degree to the development of adsorbents in general. The literature in this field has been divided into three sections: (1) refining of sugar liquors with bone char, (2) refining of sugar liquors with vegetable carbons, and (3) refining of sugar liquors with miscellaneous adsorbents. Section 3 is quite large and includes the noncarbon adsorbents such as bauxite, clays, ion exchange resins, filter-aid materials, phosphate defecation, and carbonate defecation. There appears to be a place for both granular and finely divided carbon adsorbents in the sugar industry, and the choice depends upon particular local problems. The ion exchange resins are staging a persistent search for their place in the sugar application. There is little doubt that some of the proposed applications are technically sound; the economic justification is the current problem.

The control of tastes and odors in municipal and industrial water supplies by the use of carbon adsorbents has become a technical accomplishment. The demineralization of industrial waters by ion exchange materials is extensively emloyed. The ion exchange resins are finding many additional applications, but the main field of application from tonnage considerations is water purification. The competition of the ion exchange process with the distillation process, which involves a comparison of the cost of regenerant chemicals with the cost of the fuel, seems to have been resolved and depends on the local conditions. There have been a number of recent papers which indicate that one imminent and important problem in this field is the disposal of radioactive contaminants in industrial water supplies.

The petroleum industry employs a considerable tonnage of solid adsorbents in the refining of the products and derivatives which are produced. Improved kilns for the regeneration of these adsorbents, and also for spent catalysts, have been the subject of many publications. Analysis of hydrocarbon mixtures by column chromatography has become a standard procedure, and a commercial-scale separation of olefins, paraffins and aromatics by the same technique has emphasized problems concerned with the physical structure of the adsorbent and catalyst. Many papers on desulfurization and dehydration of gases and liquids indicate unsolved problems on these topics. References to catalysis and to its many attendant problems dominate the adsorbent literature of the petroleum in-industry. Sections 13 and 14 concerned with catalytic processes include more than one-third of all the entries in Chapter V.

The biochemical, medical, and pharmaceutical applications of solid adsorbents (Section 7) are concerned mainly with analytical, purification, and preparation procedures. The large number of publications is a measure of both the value of adsorbents in this field and the complex behavior with which they are concerned. The Subject Index will be found useful in locating specific examples of adsorbent-adsorbate systems.

Aspects of adsorption and adsorbents of interest to agriculture (Section 8) are those concerned mainly with the soil, plant growth, and the processing of agricultural products. The number of publications concerned with soils are in the majority and for the period 1943–53 were three-fold greater than for 1900–43.

It is rarely possible to predict the behavior of an adsorbent applied to a product or process not previously studied. A specific application is sensitive to many variables which influence the adsorbility of the various components of the system and the success of the application often depends on the choice of conditions as well as the adsorbent. In spite of this requirement, the use of the commercial adsorbent appears to be the closest approach to a universal unit operation that is now available to industry.

V-1. Refining of Sugar Liquors With Bone Char

6426. ANON. **Standard specifications for bone char.** *A.S.T.M. Standards* 1942, II, 722-3.

These specifications (A.S.T.M. D 210-41) covered the use of bone char as a pigment: (a) dry pigment; (b) paste in oil; (c) paste in Japan. The color and tone were matched to a reference sample mutually agreed upon by the purchaser and the seller.

6427. ROCK, E. **Determination of the sizes of rotary kilns.** *Tonind.-Ztg.* 66, 288 (1942).—*C.A.* 37, 5287^7.

Equations were developed for the design of rotary kilns.

6428. BROWN, J. M. AND BEMIS, W. A. **Experience with a sand filter used in conjunction with a Williamson-type clarifier.** *Intern. Sugar J.* 45, 319-20(1943).—*C.A.* 38, 1135^9.

Liquor from the Williamson clarifier contained 0.1 g - 1.0 g of insol. matter per gallon. A sand filter, details of which were given, inserted between the clarifier and the char filters removed all insol. matter from the liquor. The trouble with clogging or scum formation in the char filter was entirely removed.

6429. LI, E. K.; CHANG, L. T., AND LIU, P. L. **Decolorization of Chinese crude sugar by bone char.** *Hua Hsueh Chemistry* 7, 136-41(1943).—*C.A.* 39, 3171^4.

A 50% crude sugar soln. was first decanted with egg-white and the clear liquor dild. to the required concns. The pH of the sugar soln. was adjusted by means of 0.1 *N* NaOH prior to decolorization. Bone char (Merck) was added to the sugar soln. heated (steam-bath) to the assigned temp. with const. shaking. After 10-40 min. the soln. was filtered and compared with the original undecolorized soln. in Nessler tubes, with a Duboscq colorimeter. Results showed that, for a soln. (39.2 Brix, pH 7.7) with addn. of 11 wt-% of 80-100 mesh char, optimum conditions were 80°C and a 20-min. reaction period.

6430. SALSAT, JEAN. **Bone char control in the laboratory.** *Bull. assoc. chim.* 60, 193-8 (1943).—*C.A.* 40, 2663^6.

A procedure was outlined to det. the pH of a water extract of a char. A procedure was outlined for evaluation of the color and Ca removal. The results obtained with a new bone char, a well-revivified char, and a poorly revivified char were discussed. A good char should have a pH of 9.6 or over. The sp. gr. of the H_2O ext. and the org. matter should be as low as possible. A good char gave up little Ca salts to the washings, while with a poor char the washings contained more Ca salts than that contained in the melt.

6431. SALSAT, JEAN. **Bone char: technical treatment in the refinery.** *Bull. assoc. chim.* 60, 303-9 (1943).—*C.A.* 39, 3455^6.

Regeneration, by chem. treatment with subsequent revivification in the kiln, was discussed. The char must be sweetened off with very hot H_2O at pH 7.8; the discharge should have a temp. of at least 75°C. If the pH dropped below 7.2, during the operation NaOH or Na_2CO_3 must be added to the H_2O used for further washing. The course of the revivification in the kiln was discussed on the basis of 2 temp.-time curves for the batch and continuous process, resp.

6432. ITSUMI, FUMIO AND TOMITA, HIROTAKE. II. **Preparation of fructose sirup from the rhizome of Brussels chicory.** *J. Agr. Chem. Soc. Japan* 20, 221-6(1944).—*C.A.* 43, 888*c*.

Inulin extd. from the rhizome of Cichorium intybus with H_2O (8 times the vol. of air-dried root) at 100°C 2 hrs was saccharified almost completely (96.56%) by the above mold to fructose sirup (yield 72.86%). It was refined with 0.7% bone char and filtered with diatomaceous earth. The sirup had a pH 6.2 and contained H_2O 28.13, fructose 55.04, total N 0.84, ash 5.53%, and a minute amt. of org. acids. It was yellow and transparent, very sweet without sour or bitter taste, and completely odorless.

6433. KHODOROV, E. I. **Regulating the heat of rotary kilns.** *Tsement* 10, No. 4, 14-18(1944). —*C.A.* 39, 598^9.

The temp. within a rotary kiln could be controlled by regulating the fuel and air supply and the temp. of the flue gases. Formulas were given connecting the factors having direct bearing on the heat requirements and the temp., such as moisture content of the slurry, calorific value of the coal, kiln output, and compn. of flue gases.

6434. BABCOCK, A. B. **Elimination of mineral salts in cane-sugar refining.** *Sugar Ind. Engrs. Papers* 6, 21 pp. (1945) (Separate).—*C.A.* 40, 2015^6.

The removal of ash from sugar liquors followed the form: $K(1-A)/A=(V/W)^N$, where A was % ash, V the unit vol., W the unit wt of bone char, and K and N consts. Ash in the wash water was detd. in a cond. cell. The point where the washing ceased to be economical was independent of the vol.-wt of the char; hence, all bone chars should be washed to the same cell reading (in these expts. 150). Burning of the char appreciably increased its ash-absorbing property.

6435. BABCOCK, A. B. **Aging of bone char.** *Intern. Sugar J.* 47, 128-30 (1945).—*C.A.* 40, 5589^2.

No shrinkage of bone char particles occurred due to heat; the vol. of the bed decreased because the surface of the grains wore smooth by attrition, or Ca phosphate was dissolved therefrom. Increase in wt per ft^3 during use was due to the filling up of the pores with foreign matter, mostly mineral, which was adsorbed from the liquors but not completely washed out. During subsequent heating, part of this mineral matter was made insol. and remained within the bone char as part of the permanent structure.

6436. BLAKE, A. F. **Decarbonization of service chars.** *Intern. Sugar J.* 47, 295-7(1945).—*C.A.* 40, 1338^3.

When lower-grade service chars in a cane-sugar refinery were properly decarbonized under carefully controlled conditions, the improvement in decolorizing and ash absorbing power was appreciable. The ash removal was trebled after the third decarbonization. On the intermediate grade of service char, this improvement was not so pronounced. The particle size was very slightly affected during decarbonization.

6437. DEITZ, VICTOR R. **Bone char research.** *Intern. Sugar J.* 47, 99-100(1945).—*C.A.* 39, 2898^1.

The sp. surface area of new and regenerated bone char was measured. The usual regeneration processes decreased the surface area greatly, often as much as 70%. No correlation was evident between the surface area and the decolorization power of a given char. This was probably due to the fact that equil. between the char surface and the constituents in soln. was never established during any given expt. Slight variations in the pH effects of chars changed the color removal properties and the action of colloidal and suspended matter introduced complications. Oxygen adsorbed on bone char also played an essential role in decolorization. All of these variables must be studied separately before a bone char can be evaluated accurately.

6438. LÖWY, KURT. **The adsorption of electrolytes by bone char and its effect on the decolorization of sugar liquors.** *Anais assoc. quím. Brasil* 4, No. 1, 9-24 (1945).—*C.A.* 39, 5523^6.

Filtration through bone char increased the pH of liquors free from electrolytes, the more the higher the temp. to which the bone char had been heated. The pH of liquors contg. buffer salts changed little. Anions readily adsorbed by the char, such as sulfate, caused an increase in the pH; cations readily adsorbed, such as Ca, decreased it. The pH of the liquors passing through revivified char gradually diminished with the disappearance of the CaO; after satn. the pH remained const. The anions which caused an increase in the pH of the liquors diminished the decolorizing power of bone char, while the cations that decreased the pH had a favorable effect on decolorization.

6439. RICE, WHITMAN. **Reactivation and handling of bone char.** *Sugar Ind. Engrs.' Papers* 6, 7 pp (1945); *Intern. Sugar J.* 48, 211-12 (1946).—*C.A.* 40, 1338^4, 6857^4.

A revolving-drum char revivifier was described.

6440. VICTOR, V. P. **Air recirculation in drying of unbound moisture.** *Chem. & Met. Eng.* 52, No. 7, 105-9(1945).- *C.A.* 39, 4271^2.

The drying of a material was divided into two stages: (1) const. drying rate stage--rate of moisture removal limited by the ability of the circulated air to pick up moisture; (2) falling rate stage--drying rate controlled by the ease with which the material gives up moisture. In the second stage the rate of air circulation was relatively unimportant but its temp. and humidity were very important. Above 260°F (supply-air dry-bulb temp.), the greater the recirculation, the higher will be the drying speed and the heat economy. Below 260°F (supply-air dry-bulb temp.), a compromise between heat economy and drying speed had to be made. Drier performance was often limited by inadequacy of the air supply.

6441. DEWHALLEY, H. C. S. AND ALBON, N. **Some notes on experiments with bone charcoal. Particle size and its effect on decolorizing.** *Intern. Sugar J.* 48, 125-8(1946).—*C.A.* 40, 5940^3.

The amt. of color removed from a sirup was directly proportional to the surface of the char. The rate of color removal, however, was dependent on the rate of access of the sirup to the char surface. Char of small particle size did not effect greater decolorization, but it did effect it more rapidly because the sirup was more quickly exposed to the entire char surface. Char having a mean particle size of 0.0059 in. removed as much color in 15 min. as a char of 0.047 in. particle size did in 6 hours.

6442. DEWHALLEY, H. C. S. AND DICKINSON, D. R. **Some notes on experiments with bone charcoal. Determination of the heat of wetting.** *Intern. Sugar J.* 48, 73-74 (1946).—*C.A.* 40, 3011^7.

The heat of wetting of a refinery char at 20°C with water at 20°C depended upon the temperature to which it was previously heated. A maximum was obtained (after the char was heated to 420°C) of 8.4 to 8.5 cals per g of char. The heat of wetting by 60° Brix sugar liquor was 8.41, indicating that the sugar did not affect the heat of wetting. The rise in temperature, however, was influenced by the specific heat and weight of the sugar present. A new bone char heated to 420°C and cooled to 20°C gave a heat of wetting of 14.3.

6443. KREBSER, E. E. **Washing bone char.** *Intern. Sugar J.* 48, 106(1946).—*C.A.* 42, 6560*f*.

The washing of bone char outside the filter was studied by using a Hardinge countercurrent classifier (18 in. diam., 4 ft long) having a dry char capacity of 400 lb per hr. The amt. of H_2O necessary was 0.3 gal per lb of char. It was concluded that, judged by the decolorizing efficiency and the Babcock gas test, nothing was to be gained by external washing.

6444. LÖWY, KURT. **Influence of anions in the decolorization of sugar sirups by animal charcoal.** *Anais assoc. quím. Brasil* 5, 17-20 (1946).—*C.A.* 41, 1476*h*.

When a sugar soln. (300 g in 170 ml of water) was treated with 10 ml of a *N* soln. of the anion (chloride, acetate, sulfate, tartrate, citrate) and 10 g of bone char at 90°C for 15 min., the color removal decreased regularly in that order, and the pH increased regularly. When the expt. was repeated with the sol. Ca salts in the presence of a neutral borate buffer to keep the pH const., the color removal varied with the anions: univalent 53-58; bivalent 39-43; trivalent (citrate) 3%. The percentage of removal was directly proportional to the amt. of the anion.

6445. PERKTOLD, FRANZ. **Effect of the Weber (column) packing methods upon the distribution of liquid in packed columns.** *Angew. Chem.* B19, 184-5 (1947).—*C.A.* 42, 2142*e*.

A glass column of 30-cm diam and 50-and 100-cm height was packed with 12 × 12 mm Raschig rings using "inside," "outside," and "neutral" loading corresponding to pouring the packing into the column from the periphery, the center, and in horizontal layers. The equipment permitted collection of effluent in 4 concentric zones. Exptl. data were given for central liquid feed and for liquid feed through 32 jets distributed over the column head. In all cases the two outer zones carried appreciably smaller amts. of liquid. A redistribution of the liquid part way down the column was desirable.

6446. BRINN, M. S.; FRIEDMAN, S. J.; GLUCKERT, F. A., AND PIGFORD, R. L. **Heat transfer to granular materials - settled beds moving downward through vertical tubes.** *Ind. Eng. Chem.* 40, 1050-61 (1948).—*C.A.* 42, 6176*i*.

Ottawa sand was observed to move through tubes substantially as a solid rod, and tests of heat transferred at const. wall temp. to Ottawa sand and to ilmenite confirmed the math. theory for this case. Effective thermal cond. of a bed was computed from the rate of heating of the axis of a stationary cylinder.

6447. DEITZ, V. R.; HIGGINSON, HELEN R., AND PARKER, COLA. **Determination of sulfur in bone char.** *J. Research NBS* 40, 263-74 (1948) RP1871.

The established analytical procedures in sugar technology were found to give erroneous results for the "sulfide" S and "total" S in bone char. The error was found to be caused by the presence of org. S in the carbonaceous component. Soln. of the total S in bone char was obtained in three ways. The ppt. of $BaSO_4$ was found to be contaminated with Ca and phosphate from the bone char. $BaSO_4$ was completely sol. in hot 70- percent $HClO_4$. The distribution of the total S between the carbonaceous residue and the acid filtrate of bone char was detd. after digestion in three mixtures: HNO_3 and HCl, $KClO_3$ and HCl, and HCl alone. The distribution of the total S between filtrate, residue, and evolved gases was influenced by deliberate variations in the acid leaching process.

6448. DEITZ, V. R. AND ROBINSON, H. E. **Heat transfer into cylindrical columns of bone char.** *Ind. Eng. Chem.* 40, 1070-5(1948).—*C.A.* 42, 6176*f*.

The equation for the axial temp. of particles moving in rod-like flow through a cylindrical tube of const. temp. was presented and found to describe bone char revivification in tubes 3 in. diam. Lightly compacted bone char was independently found to have a d. of about 80 lb/ft^3, sp. heat of 0.21, thermal cond. of 0.09 B.t.u. per hr ft °F, and thermal diffusivity of 0.0080 ft^2/hr over the conditions employed.

6449. LÖF, G. O. G. AND HAWLEY, R. W. **Unsteady-state heat transfer between air and loose solids.** *Ind. Eng. Chem.* 40, 1061-70 (1948).—*C.A.* 42, 6177*g*.

The heat-transfer coeff. (B.t.u. per hr per ft^2 per °F) from air at 100° to 250°F to beds of gravel with normal voids equaled $0.79\ (G/D)^{0.7}$, where G was the superficial velocity in lb of air per hr per ft^2 and D was the diam. in ft of the particle having the av. vol. This formula should hold for any solids that are not very irregular or rough.

6450. PAUL, J. **Bone char in the sugar industry. Adsorption of lime salts.** *7th Congr. intern. ind. agr., Paris* 1, Pt. 2, 18 (1948); *Sugar Ind. Abstracts* 10, No. 8, 85 (1948).—*C.A.* 43, 6445*g*.

Bone char not only decolorized, but also eliminated part of the non-sugars. The study of lime-salt adsorption curves and hydrometer measurements of wash waters of the char at different stages of filtration and regeneration may assist in detg. the optimum conditions for use and regeneration of the char.

6451. SCHNACKY, J. F. **Simplified method of figuring rotary dryer performance.** *Chem. Eng.* 55, No. 5, 143-4(1948).—*C.A.* 42, 6587*f*.

The moisture content of material as a function of temp. allowed the prepn. of a plot of heat required vs. length of dryer. Dryer requirements could then be estd.

6452. VOGT, E. G. AND WHITE, R. R. **Friction in the flow of suspensions - granular solids in gases through pipe.** *Ind. Eng. Chem.* 40, 1731-8 (1948).—*C.A.* 43, 912*a*.

The pressure differentials required to produce steady flow of suspensions of sand, steel shot, clover seed, and wheat in air through 0.5-in. com. iron pipe were presented. These values and data from the literature on the pneumatic conveying of wheat in pipe sizes ranging from 2 to 16 in. in diam. were correlated by means of an empirical equation.

6453. BABCOCK, A. B. **Tests for revivification of bone char.** *Proc. Tech. Sess. Bone Char* 1949, 19-31.—*C.A.* 43, 8650*b*.

The tests were the cond. and sp. gr. of the wash water and the cond. cell reading of an aq. ext. of the revivified bone char. The completeness of burning was shown by (1) color removal of a sugar liquor, (2) pH of an aq. ext. of the bone char, (3) amt. of color imparted to a lye soln. on boiling, and the accompanying test with Pb acetate paper; (4) the gas test to det. vol. of gas evolved on heating to a specified temp.

6454. BARRETT, ELLIOTT P. **Effects of use and reactivation on some properties of bone char and synthad C-38.** *Sugar Ind. Technicians* 1949, 21 pp.

Natural bone char showed a tendency to develop pores of relatively large radius on repeated cycling and, as a result, its B.E.T. surface decreased rapidly during the first few cycles. Synthad C-38 showed no tendency to develop large pores in use and, in contrast to bone char, gained vol. in pores smaller than 70 A.U. in radius instead of losing it as bone char did. Consequently, the Synthad deteriorated more slowly in B.E.T. surface than did bone char. The bulk density of Synthad C-38 increased more slowly in service than that of natural bone char. A sufficient correlation between "total" area and activity existed to justify, as a practical matter, the handling of chars so as to maintain the maximum possible area.

6455. Barrett, Elliott P. and Brown, J. M. **Some experiments with synthetic granular adsorbents for sugar refining.** *Proc. Tech. Sess. Bone Char* 1949, 198-240.—*C.A.* 43, 8649*e*.

The requisite properties for a bone char replacement were discussed. Some of the properties of a synthetic hydroxyapatite, developed as one component of the product, were presented and the results of a series of lab. expts. on the use and reactivation of a char made with it were described. The results of refinery-scale comparisons were summarized. N_2 adsorption and desorption isotherms at low temp. on the adsorbents were presented from which total pore areas and vols. were calcd. The pore-size distributions, detd. from the desorption branches of the isotherms, were presented.

6456. Bastone, H. J. and Babcock, A. B. **The sweetening-off of bone char.** *Proc. Tech. Sess. Bone Char* 1949, 149-64.—*C.A.* 43, 8650*d*.

The displacement with water of the sugar liquor within a char filter is called sweetening-off. The porosity of bone char, its grain size, and the purity of the liquor filtered had a very definite effect on sweet water formation. Results were shown of several series of expts. indicating the extent of these factors. Other factors also discussed were the effect of dust in the bone char and the intermittent method of sweetening-off.

6457. Beal, C. W. **Factors influencing the pH of bone char filtered liquors.** *Proc. Tech. Sess. Bone Char* 1949, 165-82.—*C.A.* 43, 8650*e*.

Volatile bases, such as NH_3 and pyridine, contributed to the high alky of the first portion of filtrate from a char filter. A second factor was the gradual decrease in Ca^{++} in the filtered liquor as the cycle progressed. This resulted from a depletion of available Ca compds. in the char. The Ca^{++} lost during filtration was restored to the bone char by the breakdown of calcium organates and calcium sulfate during revivification. The revivification temp. was also important. Some pH changes appeared to be assocd. with ion-exchange reactions operating in the H-cycle.

6458. Bemis, W. A. and Reed, W. L. **Commercial char driers.** *Proc. Tech. Sess. Bone Char* 1949, 61-93.—*C.A.* 43, 8649*g*.

A résumé of the operating characteristics of the common types of com. char driers was presented. This was based on data supplied through a questionnaire distributed to all the refineries. Data were also presented on specific drying curves for several types of char in a DeVries type of drier used at the Revere Sugar Refinery.

6459. Friedman, S. J. and Marshall, W. R. Jr. **Studies in rotary drying. I. Holdup and dusting.** *Chem. Eng. Progress* 45, 482-93 (1949).—*C.A.* 43, 8752*e*.

The holdup and dusting in a 1-ft diam. by 6-ft long rotary drier were measured for 11 different materials. Over a wide range of drier slope, rate of rotation, feed rate, air rate, and material characteristics, it was found that the holdup in a rotary drier, for both counter- and co-current air flow, could be estd. satisfactorily from equations that were presented. Although no quant. correlation was obtained, the effects of rate of rotation, slope, feed rate, and air rate on dust losses from the small rotary drier were presented.

6460. Friedman, S. J. and Marshall, W. R. Jr. **Studies in rotary drying. II. Heat and mass transfer.** *Chem. Eng. Progress* 45, 573-88 (1949).—*C.A.* 43, 8752*g*.

The effect of air rate, feed rate, rate of rotation, slope, and no. of flights on the heat transfer occurring from hot air to several different sands was studied in a 1-ft by 6-ft rotary drier; length and volumetric heat-transfer coeffs. were evaluated over 6 incremental lengths of the drier. Tests were also conducted in which sand was dried in the exptl. unit. The magnitude of the heat-transfer coeffs. and the effects of the operating variables in the drying tests were the same as those obtained in the heat-transfer tests. A method of scale-up was suggested.

6461. Knowles, H. I. **Decolorizing and ash-removal tests.** *Proc. Tech. Sess. Bone Char* 1949, 9-17.—*C.A.* 43, 8649*b*.

The function of bone char in sugar refining was discussed. The color and ash adsorption test was intended to show the capacity of the bone char for the adsorption of nonsugar impurities. Different procedures for carrying out the test were mentioned and one which has been proved satisfactory in practice was described in detail.

6462. Krevelen, D. W. van and Hoftijzer, P. J. **Drying of granulated materials. I. Drying of a single granule.** *J. Soc. Chem. Ind.* (London) 68, 59-66 (1949).—*C.A.* 43, 4906*a*.

To predict the dimensions of app. needed, a theoretical presentation was followed by the derivation of equations for granules with no sol. salts and granules with sol. salts crystg. during drying. Exptl. verification was obtained by using wet marl and nitro chalk fertilizer contg. 60% NH_4NO_3 and 40% marl.

6463. Krevelen, D. W. van and Hoftijzer, P. J. **Drying of granulated materials. II. Drying of granules in rotary dryers.** *J. Soc. Chem. Ind.* (London) 68, 91-7 (1949).—*C.A.* 43, 5648*b*.

The relationship for the residence time as a function of the environment was detd. from a study of the movement of material through the dryer. In rotary dryers, the drying rate was from 1/4 to 1/5 of the rate for freely suspended granules without sol. salts, and was equal to that for freely suspended fertilizer granules.

6464. Louviere, W. H. and Varnau, B. H. **Problems in conventional kiln operations.** *Proc. Tech. Sess. Bone Char* 1949, 94-104.—*C.A.* 43, 8648*h*.

The operation of the char house at Sugar Land, Texas, was reviewed. The construction of the combustion chamber specifically for natural gas was found to be essential for satisfactory results with chrome retorts. An arch design constructed of refractories eliminated the conventional sprung arch. Decarbonization of char in the conventional kiln with louvered single cooler pipes was practical and economical.

6465. MACTAGGART, E. F. **Drying machinery and its development.** *Trans. Inst. Chem. Engrs.* (London) 27, 23-35 (1949).—*C.A.* 46, 6871*g*.

The development of driers and the most usual forms of driers in use were described. There were only 15 different designs in industrial use in England. No drier was applicable to all problems and there was usually a considerable difference in operating costs. The steam consumption of various types ranges from 1.1 to 3.1 lb steam/lb H_2O evapd.

6466. MCDONALD, E. J. **Invert formation in sucrose solutions.** *Proc. Tech. Sess. Bone Char* **1949**, 183-97.—*C.A.* **43**, 8714*i*.

The hydrolysis of sucrose, carried out in concd. or dil. soln., is of importance to the sugar industry. In dil. soln. sucrose inversion was a first-order reaction and the well-known Clerget method for sucrose detn. depended upon the change of optical rotation of a dil. sugar soln. before and after inversion. In concd. soln. the reaction was more complex and more difficult to follow. The close relation of inversion and purity in this range make it of utmost importance to the sugar refiner.

6467. PAYNE, G. W. **The cooling of revivified bone char.** *Proc. Tech. Sess. Bone Char* **1949**, 105-18.—*C.A.* 43, 8649*i*.

Indirect contact air coolers were generally inefficient. Improvement might be effected if the char stream were broken up by passing over staggered cross-tubes through which cooling air was blown. Water as the cooling medium in an indirect contact liquid cooler on the Herreshoff furnace resulted in a cooler of small dimensions. Little use can be found in most sugar refineries for the hot water obtained. Other liquids of higher b. p. (e.g. Dowtherm) might be employed to heat air to a temp. suitable for use in the drying section.

6468. PENNINGTON, N. L. AND DEITZ, V. R. **Rapid determination of the carbonaceous residue in bone char.** *Proc. Tech. Sess. Bone Char* **1949**, 32-42.—*C.A.* 43, 8648*d*.

The method was based on a turbidity measurement. The ground sample (screened through a no. 270 sieve) was treated with a small vol. of HCl and the mixt. dild. to a known vol. with distd. water. Turbidimetric readings were taken at 2 or 3 dilns. and a plot made of the values of log of the reciprocal of the transmittance (T) against the concn. (c) of the suspension. A linear plot was found according to the relationship: $\log 1/T = S \times c$. Results were presented for a large variety of bone chars and a common calibration curve appeared to be valid.

6469. ROBINSON, H. E. **Effect of the size and shape of columnar retorts on the heating of granular materials.** *Proc. Tech. Sess. Bone Char* **1949**, 284-302.—*C.A.* 43, 8648*i*.

Theoretical relationships were derived to design columnar retorts for heating granular materials such as bone char. The relations between the shape and size of retort and the throughput, time of heating, and heat duty per ft^2 of retort surface were given for retorts of circular, sq, and rectangular cross section. The throughput capacity of circular and sq retorts was shown to be independent of their size, but that of rectangular retorts depended on the ratio of width to depth. Kilns made with small-diam. retorts with close spacing, heated entirely by a condensing vapor, were proposed to obtain a high-capacity automatically thermostated process.

6470. VAVRUCH, I. **Adsorption and chromatographic separation of sugars on bone char.** *Listy Cukrovar.* 66, 249-51(1949-50).—*C.A.* 46, 7801*e*.

The adsorption of glucose, fructose, galactose, sucrose, maltose, and lactose by a Czechoslovakian bone char (9.4% of C on dry matter, 8.7% of H_2O, ground and sieved to contain no dust or particles > 0.5 mm in diam.) was tested. The bone char (5 kg) was mixed with 5 liter of H_2O, washed for 48 hrs, and dried at 130°C. In each test, 120 g of char was packed in a glass column (3.15 cm in diam.), to 8.5 g per ml, with gauze, etc. at the bottom. The sugar soln. (100 ml) was percolated through the dry char (mostly at 20-25°C), the initial pH value being 6, and the pH value of the filtrates 8.2. Adsorption was measured by examg. the filtrates polarimetrically. Monosaccharides were more easily adsorbed than disaccharides; with increasing concn. of sucrose, the amt. adsorbed increased up to 50%, but was lower with concns. of 60% and over. The amt. of sucrose adsorbed per g of char decreased with decreasing length of column, probably owing to faster flow in the shorter column. Monosaccharides were more readily desorbed by H_2O or by aq. ethanol (7%) than were disaccharides. Ethanol gave more rapid desorption, but the differences found between the sugars with the bone char were insufficient for chromatography; active carbon was better in this respect. Similar results were obtained in tests with invert sugar, mixts. of glucose and sucrose, thick juice, raw sugar, molasses, and honey. The sucrose remaining in the bone char hastened the desorption of glucose from mixts.

6471. BEERWALD, ALEXANDER. **The reduction of magnesium sulfate by carbon.** *Z. anorg. Chem.* 261, 52-62(1950).—*C.A.* 44, 5750*b*.

The basic equation for the reduction was $2MgSO_4 + C \rightarrow 2MgO + 2SO_2 + CO_2$. S was formed by reduction of SO_2 by carbon; the yield of S being greater the more reactive the carbon used. The assumption of some investigators that the basic reaction was $MgSO_4 + C \rightarrow MgO + SO_2 + CO$ could not be supported; with types of carbon which produced small yields of S, the ratio of C to $MgSO_4$ was approx. 0.6:1.

6472. CLERIOT, J. **Calcium salts in animal black.** *Congr. intern. ind. agr., 8th Congr., Brussels* **1950**, 134-42 (in French).—*C.A.* 47, 2961*e*.

Ca salts adsorbed by animal black were divided in two groups (1) alk. salts (saccharate) and $Ca(OH)_2$ and (2) neutral and acid salts. The first showed a strong absorption and were weakly released in contact with water; the second showed the opposite results. Release in water was detd. by the hardness (*DH*) of water with a certain amt. of animal black. Revivification must try to get $DH = 0$; otherwise exchange of Ca ions took place. Heating alone resulted in changing salts of group 1 into those of group 2. This was favored by inlet of some air during heating and best followed by washing with dil. HCl soln.

6473. DEITZ, V. R. AND BROWN, J. M. **Some economic aspects of the bone char process in sugar refining.** *Intern. Sugar J.* 52, 147-150 (1950); *Ing. Intern. Industria* 9, 68 (1950).—*C.A.* **44**, 7573*i*.

A primary factor was the cost of new bone char. Values were given for the period 1905 to 1949. Large quantities of water were used and its quality and the fuel requirements for heating it were important factors. Coal, oil and natural gas have been used in the char kilns, and there is a tendency today to reduce char kiln temps. Possible improvements in the char process were mentioned.

6474. GUERIN, J. **Variations in the properties of animal black during filtration and revivification.** *Congr. intern. ind. agr., 8th Congr., Brussels* **1950**, 142-51 (in French).—*C.A.* 47, 2961*a*.

The most important detns. for reactivated char were the pH and *DH*. (*DH* was the hardness imparted to distd. water added to a sample of char in such amt. that no supernatant liquid was observed). pH must be about 9.3 and *DH* about 0. $DH > 5$ proved bad reactivation; $pH > 9.3$ showed too high a temp. during reaction. Of less importance were absorption coeffs., titration curve (buffer at pH 9.0-9.3), and detn. of carbonates and org. matter.

6475. MUKHERJI, B. K. **Modification of cane molasses. II.** *J. Indian Chem. Soc., Ind. & News Ed.* **13**, 159-62(1950).—*C.A.* **45**, 7367*f*.

Studies were made on the removal of mineral matter from molasses by dialysis, flocculation, and adsorption on chars. Approx. 50% of the ash could be easily dialyzed from molasses through 200 grade parchment paper with a concurrent loss of less than 1/3 of the sugar. Slight alky. of the water favored ash removal and depressed sugar removal. Less than 5% of the ash constituents were removed by the flocculating agents tried. The multivalent hydroxides $Ca(OH)_2$ and $Al(OH)_3$ were the best.

6476. PAYNE, G. W. **The design of pipe kilns for bone char revivification.** *Congr. intern. ind. agr., 8th Congr., Brussels* (1950) **1**, 525.

Methods to increase the efficiency of existing kilns are presented. The char ought to be uniformly regenerated to give the longest possible life in maintaining its decolorizing power and to reduce the mechanical destruction to a minimum. The retorts should have a high thermal efficiency. Results are given for a combination of a single unit of drier, retort, combustion chamber, and cooler.

6477. SPRINGUEL, J. **Estimation of the effect of regeneration of bone char by the amount of organic compounds dissolved by sodium hydroxide.** *Congr. intern. ind. agr., 8th Congr., Brussels* **1950**, 164-6 (in French).—*C.A.* 47, 2961*c*.

Bone char (50 g) was boiled for 2 min. with 100 ml of NaOH soln. (150 g/liter). Evapn. must be prevented. The soln. was filtered through a glass filter with 1 g of kieselguhr (washed with HCl soln. and calcinated). A very slight yellow color showed good regeneration; a colorless soln. showed that regeneration had been excessive. A more precise method was obtained by neutralizing 20 ml of the soln., and then adding water to 100 ml, followed by 10 ml of 2 *N* KOH soln. and 10.00 ml of 0.1 *N* $KMnO_4$ soln. This mixt. was heated to boiling and boiled for 10 min. After cooling, 25 ml of 5 *N* H_2SO_4 soln. was added with 10.00 ml of 0.1 *N* oxalic acid soln., and the excess oxalic acid was found by titration with $KMnO_4$ soln. The result was expressed in mg of O per 100 ml original soln.

6478. BARRETT, ELLIOTT P. **Trends in the development of granular adsorbents for sugar refining.** *Advances in Carbohydrate Chem.* **6**, 205-30 (1951).

The commercial requirements for granular adsorbents were outlined. Bone char, Synthad, and activated carbon were compared according to the pore vol. distribution curves (derived from low temp. N_2 adsorption isotherms), color removal, ash removal, and pH changes.

6479. BARRETT, ELLIOTT P.; BROWN, J. M., AND OLECK, S. M. **Some granular carbonaceous adsorbents for sugar refining. Bone-char replacements based on hydroxyapatite.** *Ind. Eng. Chem.* 43, 639-54 (1951).—*C.A.* 45, 5433*e*.

"Synthads" were developed by carbonizing mixts. of synthetic hydroxyapatite with an appropriate binder to increase mech. strength. They had a bulk d. of about 38-40 lb/ft^3 in 10 × 28 mesh size, and could be made to have a pore vol. and mean pore radius substantially the same as those of bone char. This material was tested in a refinery for 32 cycles of use and reactivation, in comparison with bone char. Synthad C-38 lost area more slowly in service than natural bone char. The bulk d. of bone char increased more rapidly than that of Synthad C-38. This appeared to correlate with a more rapid deterioration in color-and ash-removal power on the part of bone char.

6480. BEMIS, W. A. **Bone char test procedures. I. Preparation of test sample.** *Proc. Tech. Sess. Bone Char* **1951**, 16-23.—*C.A.* 46, 6339*i*.

6481. BLANKENBACH, W. W. AND PENNINGTON, N. L. **Bone char test procedures. II. Carbonaceous residue and insoluble ash.** *Proc. Tech. Sess. Bone Char* **1951**, 24-32.—*C.A.* 46, 6339*i*.

6482. Bosworth, R. C. L. **The revivification of bone char with superheated steam.** *Proc. Tech. Sess. Bone Char* **1951**, 348-62.- *C.A.* **46**, 6419*d*.

Spent bone char was revivified on an exptl. scale by treatment with superheated steam. The vessel contg. the char was closely lagged, and heat was supplied only in the form of the superheated steam. The steam acted as an oxidizing agent and removed the org. impurities. It also hydrolyzed the undesirable CaS present in the char. Dissocn. of the $CaCO_3$ during steam treatment could not readily be repressed by mixt. of the steam with CO_2, but the effective pH of the alk. char could be adjusted after revivification by cooling in a stream of flue gases.

6483. Cantor, S. M. **Bone char test procedures. IX. Hardness test.** *Proc. Tech. Sess. Bone Char* **1951**, 80-90.—*C.A.* **46**, 6340*a*.

6484. Carpenter, F. G.; Barrett, E. P., and Jonnard, A. **Resistance to flow of fluids through columns of bone char.** *Proc. Tech. Sess. Bone Char* **1951**, 237-58.—*C.A.* **46**, 6419*b*.

The correlation of pressure drop (Δp) with fluid viscosity (μ), flow rate (V_0), and the nature of the packing for viscous flow through beds of granular solids was expressed as: $\Delta p = (k\mu V_0 L)/(g_c D_p^2)$, where g_c is a factor for conversion of mass to force units, and L is the depth of the bed. Lab. detns. of the specific flow resistance (k) were made with air and with sugar liquor as the test fluids with equiv. results. The recommended value of k for design purposes in plant-scale bone-char filters was 700.

6485. Carpenter, F. G. and Louviere, W. **Bone char test procedures. VIII. Sieve analysis.** *Proc. Tech. Sess. Bone Char* **1951**, 71-9.—*C.A.* **46**, 6340*a*.

6486. Chapman, W. R. and Needham, L. W. **The thermal drying of coal.** *J. Inst. Fuel* **24**, 51-60(1951).—*C.A.* **45**, 4426*h*.

Descriptions were given of driers used in England, America, and on the Continent including: rotary-drum driers, vertical driers with revolving and stationary trays, cascade driers, screen-type driers, and flash driers, as well as other types still under exptl. study. Performance data were given for some of these driers, with cost data, and comments as to the suitability of driers for specific problems. Only coal drying was discussed, but the data had a wide application to problems of drying other granular materials.

6487. Conrad, George C. **Continuous countercurrent sweetening-off and washing of bone char.** *Proc. Tech. Sess. Bone Char* **1951**, 259-79.—*C.A.* **46**, 6418*i*.

The water treatment of char was investigated in a continuous extractor. The max. wt ratio of water to char was fixed in accordance with existing refinery practice. The increase in the rate of diffusion with increased flow rates indicated that rates higher than those experienced in present char-house procedure are possible in the continuous column. No specific data relative to sugar-liquor filtration were presented, but the operation was briefly outlined.

6488. Cotter, S. E. and Conrad, G. C. **Bone char test procedures. XII. pH of water extract.** *Proc. Tech. Sess. Bone Char* **1951**, 105-17.—*C.A.* **46**, 6340*b*.

6489. Cotter, S. E. and Woehrle, P. P. **Bone char test procedures. XI. Lye test.** *Proc. Tech. Sess. Bone Char* **1951**, 91-104.—*C.A.* **46**, 6340*a*.

6490. DeVries, R. P. and Bemis, W. A. **Preliminary experiments with new drier for bone char.** *Proc. Tech. Sess. Bone Char* **1951**, 363-71.—*C.A.* **46**, 6419*a*.

Efforts to redesign and improve the regular DeVries Char Drier were reported. The use of screens to contain the wet char was not practical, because plugging could not be prevented. The use of flue gases in direct contact with the char appeared to be undesirable, since these gases carried too much moisture derived from the combustion of the fuel. A heat exchanger would utilize the heat in the flue gases without the accompanying danger from moisture.

6491. DeWhalley, H. C. S. **Bone char test procedures. VI. Moisture.** *Proc. Tech. Sess. Bone Char* **1951**, 57-9.—*C.A.* **46**, 6340*a*.

6492. Gillett, E. C. **Bone char test procedures. XIII. Batch tests for color and ash removal.** *Proc. Tech. Sess. Bone Char* **1951**, 118-24.—*C.A.* **46**, 6340*b*.

6493. Gillette, E. D. **Double char filtration of high-purity sirups as practiced at Refined Syrups & Sugars, Inc.** *Proc. Tech. Sess. Bone Char* **1951**, 228-36.—*C.A.* **46**, 6417*a*.

The method applied to high-purity liquors resulted in a definite improvement in the char filtration operations. Data were presented for operations before and after the initiation of double filtration with particular emphasis on color removal. The color and ash removal, and the pH changes were presented graphically at various filter positions in the first and second stages of the system.

6494. Gillette, E. D. and Janeiro, F. **Bone char test procedures. XIV. Column test for color and ash removal.** *Proc. Tech. Sess. Bone Char* **1951**, 125-34.—*C.A.* **46**, 6340*b*.

6495. Grant, E. J. **Bone char test procedures. III. Carbon dioxide, acid-evolved.** *Proc. Tech. Sess. Bone Char* **1951**, 33-40.—*C.A.* **46**, 6339*i*.

6496. Howe, W. L. and Moult, A. M. **Reactivation of bone char.** *Gas. J.* **266**, 109-14, 119-20, 123 (1951) *Gas World* **133**, No. 3479, *Ind. Gas Suppl.*, 44-8 (1951).—*C.A.* **45**, 5433*h*.

The reactivation of bone char by direct contact with the hot products of combustion of manufd. gas in a multiple-hearth, gas-fired kiln was reported. Tests of the kiln showed that the quality of the char was good, and could be maintained at a high level of uniformity. Decolorization of the liquor, ash removal, and pH could be maintained at a level equal to that obtainable with the best retort-burned chars.

6497. Knowles, H. I. **Bone char test procedures. IV. Determination of combined sulfur in bone char.** *Proc. Tech. Sess. Bone Char* **1951**, 41-50.—*C.A.* 46, 6340*a*.

6498. Luethge, J. A. **How to scale up a rotary kiln.** *Chem. Eng.* 58, No. 12, 151-3 (1951).—*C.A.* 46, 2859*d*.

Evaluation and operation of rotary kilns were improved by the use of 4 short-cut formulas which permitted calcns. of (1) the right dimensions for equiv. fuel usage, (2) the right diam. for equiv. dust pick up, (3) the proper speed of rotation, and (4) approx. fuel consumption for extra-large kilns.

6499. McLellan, Jack H. and Wayne, Truman B. **An experimental fluidized bed for char revivification studies.** *Sugar J.* 13, No. 9, 13-15, 18-19, 27(1951).—*C.A.* 47, 3014*i*.

A pilot plant for the study of bone char revivification was proposed.

6500. Meade, G. P. **Bone char test procedures. V. Determination of heavy metals (iron, manganese, copper).** *Proc. Tech. Sess. Bone Char* **1951**, 51-6.—*C.A.* 46, 6340*a*.

6501. Muller, G. W., Jr. **Use of recording and controlling pyrometers in char kilns.** *Proc. Tech. Sess. Bone Char* **1951**, 372-5.—*C.A.* 46, 6418*c*.

Modern controller-recorder instruments were a valuable asset to char kilns. The preferred locations of the thermocouples in a char kiln were about 3-4 ft from the top of the retorts and in the center between the cold and hot rows.

6502. Owen, William L. **Development of microörganisms during sugar manufacture. Significance relative to sucrose losses.** *Ind. Eng. Chem.* 43, 606-9(1951).—*C.A.* 45, 5434*c*.

Bone char and decolorizing carbons accelerated the destructive action on sugar of thermophilic bacteria at 132°F, at concns. of 10 and 65° Brix. Part of the undetd. sugar loss was attributable to this effect. The development of microörganisms may also affect the odor and taste of the sugar, while algae in the water supply have a similar effect.

6503. Payne, G. W. and Stordy, J. J. **Plaistow wharf pipe kiln.** *Proc. Tech. Sess. Bone Char* **1951**, 307-47.—*C.A.* 46, 6418*d*.

The kiln was designed to revivify 8000 lb/hr and was divided into two sections on either side of a combustion chamber circulating hot gases. Each comprised a static louvre drier (DeVries type), 100 chrome-steel retorts (thin wall) 3-in. diam., 8.5 ft long in 5 × 20 rectangular arrangement, a cooler contg. 400 steel tubes 1-in. diam., 5 ft long. Air in multipass cross-flow arrangements cooled char to 158°F and was heated to 302°F. Decarbonizing was carried out in a chamber which divided the cooler into two sections. Draw-off gear was of new design. The retort chambers were kept at about 1112°F.

6504. Pickering, R. W.; Feakes, F., and Fitzgerald, M. L. **Time for passage of material through rotary kilns.** *J. Applied Chem.* (London) 1, 13-19(1951).—*C.A.* 45, 5980*i*.

The following expression was derived for the time of passage of a material through a kiln: $T = L \sin \theta / 2\pi r R \sin \alpha$, where T = time in min., L = length of kiln in feet, θ = flow angle between horizontal and surface of charge in plane perpendicular to axis of kiln, r = radius of kiln in feet, R = rate of rotation of kiln in r.p.m., and α = angle of inclination of kiln. The formula was compared with exptl. results and previously derived formulas.

6505. Rosenquist, Terkel. **A thermodynamic study of the reaction $CaS + H_2O = CaO + H_2S$ and the desulfurization of liquid metals with lime.** *J. Metals* 3, *Trans.* 535-40(1951).—*C.A.* 45, 6910*e*.

The reaction $CaS(s) + H_2O(g) = CaO(s) + H_2S(g)$ was studied from 750° to 1425°C. The desulfurization of liquid Cu with CaO was studied at 1200°C. The S content in the Cu was closely proportional to the H_2O/H_2 ratio in the atm.

6506. Saeman, W. C. **Passage of solids through rotary kilns. Factors affecting time of passage.** *Chem. Eng. Progress* 47, 508-14 (1951).—*C.A.* 46, 297*g*.

Equations based on theoretical considerations were developed to give time of passage, axial transport velocity, bed depth, and other characteristics related to the passage of material through rotary kilns without flights. The equations were corroborated by exptl. data, and were particularly useful for evaluating the effects of constrictions in kilns and to calc. the bed depth in Roto-Louvre driers.

6507. Shearon, Will H., Jr.; Louviere, W. H., and Laperouse, R. M. **Cane sugar refining.** *Ind. Eng. Chem.* 43, 552-63 (1951).—*C.A.* 45, 5429*i*.

The equipment and operation of the refinery, the lab control, the consumption of power and auxiliary materials, and the tech. utilization of sugar and by-products were described with flow sheets, diagrams, and photographs.

6508. Snowden, H. C. and Hurlburt, H. Z. **Bone char test procedures. VII. Bulk density.** *Proc. Tech. Sess. Bone Char* **1951**, 60-70.—*C.A.* 46, 6340*a*.

6509. Wenzel, Leonard A. and White, Robert R. **Drying granular solids in superheated steam.** *Ind. Eng. Chem.* 43, 1829-37 (1951).—*C.A.* 45, 8821*b*.

An exptl. study was reported of the use of superheated steam as compared to air as a drying medium for granular materials. Results indicated that higher drying rates and thermal efficiencies were possible when drying with superheated steam rather than air. The use of steam for drying heat-insensitive solids depended on the savings in operating costs as compared to the greater capital expenditure required by the higher temp. and pressure ranges.

6510. WING, E. AND PATTERSON, R. S. **Experiments with a plant-scale rotary char kiln.** *Proc. Tech. Sess. Bone Char* **1951**, 376-405.—*C.A.* 46, 6418*b*.

Expts. were conducted over a period of yrs with a rotary type of kiln that was originally a Weinrich decarbonizer. Changes and modifications were made to adapt the decarbonizer to revivification as well as to decarbonization. Char from regular kilns was compared with that from the rotary unit as to color removal, ash removal, pH, C-content, etc., and the rotary produced better char.

6511. BARRETT, ELLIOTT P. **The development of a synthetic replacement for bone char in cane sugar refining.** *Sugar J.* 15, No. 6, 18-28 (1952).

Evidence accumulated both in the lab. and in full-scale operation of Synthad as a refining aid was presented. Research on Synthad is being continued with the object of improving its performance and minimizing its cost.

6512. BARRETT, ELLIOTT P. **Comparison between bone char and Synthad (artificial calcium hydrophosphate).** *Sugar Ind. Technicians* **1952**, 9 pp.—*C.A.* 46, 9331*d*.

New Synthad removed 2/3 as much ash and color from refinery liquors and 1/4 as much from the sweetwater. After the 2 materials were regenerated the situation was reversed, with the advantage largely in favor of Synthad. Regenerated Synthad retained ash more tenaciously than bone char so long as the brix of the sweetwater was high, and then gave it up more readily with a saving of 2-3 hrs in the washing cycle.

6513. BARRETT, ELLIOTT P.; JOYNER, L. G., AND HALENDA, P. P. **Granular adsorbents for sugar refining - some factors affecting porosity and activity in service.** *Ind. Eng. Chem.* 44, 1827-33 (1952).—*C.A.* 46, 11727*g*.

Bone char washed with hot water gained vol. in the pore-radius range of 70-140 A. and lost vol. in the 20-70-A. range. When heated to 1000°F, the washed bone char lost further vol. in the pore-radius range of 10 to 30 A. and gained vol. in the pores of radius greater than 75 A. Comparison of fresh washed, heated bone char with a 32-cycle char showed wide differences in pore-vol. distribution. Treatment of new bone with NaOAc during the heat treatment gave a product resembling 32-cycle bone in pore-vol. distribution. The NaOAc deposited in the pores of 70-100-A. radius. A synthetic bone char (Synthad C-38) showed similar pore-vol. changes under similar treatment. If all of the mineral matter picked up by the char from the sugar liquor could be washed out before burning, the crystallite growth and the area loss would be negligible.

6514. DEWHALLEY, H. C. S. **Battery sweetening-off in the refinery and washing of char filters.** *Intern. Sugar J.* 54, 96-7 (1952.—*C.A.* 46, 6418*g*.

A battery of 5 bone-char filters was used in the tests. All liquor above 45° Brix was considered full-weight liquor. Each filter of the battery was sweetened off with lights from the preceding filter except the last filter which was sweetened off with water. Sweetening-off was thus effected with a min. of H_2O and a large amt. of the desorbed impurities were depressed to a lower degree of Brix, and eventually to H_2O and drain. The 1.8° Brix lights from the battery tests was lower purity than from H_2O sweetening off; hence lights of higher than 1.8° Brix could be sent to the drain.

6515. FETZER, W. R.; CROSBY, E. K., AND ENGEL, C. E. **Laboratory evaluation of granular carbons.** *Anal. Chem.* 24, 1558-63 (1952); *Intern. Sugar J.* 55, 222 (1953).—*C.A.* 47, 1913*f*.

The color adsorption power of bone char was compared with a reference powd. carbon. The char was first ground to pass 200 mesh and the mesh distribution of the char detd. By means of factors for each fraction, the over-all color removal power was calcd. Factors for reducing batch process figures to a percolation basis were given.

6516. HILL, S. **Channeling in packed columns.** *Chem. Eng. Sci.* 1, 247-53(1952).—*C.A.* 47, 5705*i*.

The sugar-refining operation upon which this work was based was the displacement of sugar liquors by water from columns of bone char and the reverse of this operation. The crit. velocity of flow was defined in terms of the viscosities and ds. of the 2 fluids. The least tendency to channeling was obtained when the denser of the 2 liquids was the lower one in the column for either upward or downward flow.

6517. KRAMERS, H. A. AND CROOCKEWIT, P. **The passage of granular solids through inclined rotary kilns.** *Chem. Eng. Sci.* 1, 259-65 (1952).—*C.A.* 47, 4575*i*.

Formulas were derived for the hold-up of an inclined rotary kiln, with and without end restrictions. The bulk of material in the kiln was assumed to have no relative motion with respect to it, a particle at a distant *r* from the kiln axis described a circular path in a plane perpendicular to the axis with the same angular velocity as the kiln wall. When this particle reached the surface it cascaded down along a straight path. Good agreement was found between the theoretical values and the exptl. results.

6518. MULLER, ROBERT F. AND OTHMER, DONALD F. **Ferric chloride treatment of bone char.** *Sugar* 47, No. 6, 40-3, 54 (1952).—*C.A.* 46, 11729*d*.

Various grades, ranging from new to the poorest grade of refinery bone char, were treated with $FeCl_3$, and burned and revivified at temps. from 700 to 1100°F. The resulting products were used for decolorizing in lab. char filters a 60° Brix soln. of 600 Lovibond color (Series #500), prepd. by mixing a clarified, highly colored blackstrap with a colorless 67° Brix sugar soln. of high purity. The effect of bone char treated with 1, 4, 8, and 12% $FeCl_3$ and burned at 900°F on color, Brix, pH, ash, Fe, and pol of the liquor was detd. A considerable improvement in color removal was realized.

6519. OWEN, W. L. **The role of bacteriostatic activated carbons and bone char in the sugar-refining industry.** *Sugar J.* 14, No. 9, 16, 19, 20, 36, 37, 41 (1952).—*C.A.* 46, 7350*f*.

Loss of sucrose under thermophilic conditions was the result of microbial activity. Substitution of a bacteriostatic carbon for the untreated carbon as a filter prevented this loss. The loss was accompanied by a corresponding increase in reducing sugars.

6520. BARRETT, ELLIOTT P.; JONNARD, AIMISON, AND MESSMER, J. H. **Granular adsorbents for sugar refining. Some physical properties of bone char and Synthad.** *Ind. Eng. Chem.* 45, 1524-26 (1953).

Because Synthad was used in the same way as bone char and in the same equipment, obtaining strictly comparable results for the two adsorbents, rather than absolute accuracy, was stressed in making the measurements. Heat of wetting, thermal cond., and sp heat were detd. on both adsorbents under comparable conditions. The heat of wetting of Synthad was 0.6 that of bone char. Thermal cond. and sp heat were substantially identical for the two adsorbents.

6521. BERGÉ, A. AND BAERTS, F. **The bone char station at Tirlemont Refinery.** *Proc. Tech. Sess. Bone Char* 1953, 113-33.

The flow diagram at Tirlemont changed many times a year. The char house had to filter liquors of a quality varying with the kind of raw materials, but the "liquor-off" must always be of the same high quality for making Adant as a "basic production". The char house was described and the needs and difficulties of each period were given. The char was evaluated by the quality of the char, liquor-on and -off, sweet water, general figures, losses, regeneration, etc.

6522. BLACK, R. F. AND BEAL, C. W. **Refining scale study of Synthad C-38.** *Proc. Tech. Sess. Bone Char* 1953, 77-95.

The exptl. unit consisted of one full-size kiln and drier, four char filters (1600 ft^3 each), storage bin for the revivified char, screen, and the usual conveying equipment. The av. particle size and boundary surface area of the 6 to 20 mesh Synthad were somewhat different from any of the stock chars. After 28 cycles of service, the Synthad was sepd. into two fractions: (1) remaining on No. 12 and (2) passing No. 12 sieve. This fine fraction had a boundary surface area about the same as the better stock char. At the 40th cycle the fractions were recombined (coarse fraction reduced in particle size) to form a single stock of 10 to 28 mesh material. There was a definite dependence of color removal on the particle-size distribution of the Synthad and the total boundary surface area was shown to be an important contributing factor. There was also an indication that Synthad C-38 was harder than regular bone char. Synthad appeared to hold more water than bone char and has required somewhat different handling in the drier and kiln.

6523. BROWN, J. M. **Washing of char filters and status at various refineries.** *Proc. Tech. Sess. Bone Char* 1953, 5-20.

Details were presented of procedures used to wash plant-scale bone char filters. The discussion was based on replies to a questionnaire submitted to various sugar refineries. The variables involved were the type of available water, the vol. used, rate of washing, and temp. of the water. The many variations were described without reference to the underlying reasons, either economic, physical, or chem. Some data were given for the analysis of the ash for Ca, Na, and K and the ash balances detd. It was concluded that the wide variations now prevalent could not all be justified.

6524. CARPENTER, FRANK G. **Sampling and abrasion hardness of bone char.** *Proc. Tech. Sess. Bone Char* 1953, 257-72.

Sampling heterogeneous granular solids was treated from a fundamental point of view. It was possible to calc. the min. wt of sample which should be used in a test (if sampling were free from bias) from a knowledge of the desired precision, the av. value of the property being tested, the distribution of this property among the particles, and the wt of the individual particles. Known sampling procedures were evaluated and examd. for possible bias due to variations in particle sizes and particle d. The construction and performance of a multiple sample-divider, which reduced a batch of material into eight subsamples, were illustrated and described. The different types of hardness tests were discussed.

6525. CHAPMAN, F. M. **Thermal economy in the char house.** *Proc. Tech. Sess. Bone Char* 1953, 51-55.

Means were discussed for reducing the heat demand in the bone char process. Some of the direct methods were the use of waste heat to dry the washed char, washing char with water at min. temp., and the max. use of capillary drainage before the char driers. Indirectly, heat could be saved by improving the efficiency of the entire process. Attention was directed especially to improving the quality of liquor sent to char, use of more reactive char, use of char of smaller particle size, and sweetening-off slowly or in battery.

6526. DOMINGUES, LOUIS P. **Sulfur in bone char.** *Proc. Tech. Sess. Bone Char* 1953, 307-12.

Char revivified in the presence of SO_2 increased in total S. The extent depended upon the initial concn. of SO_2, the time, and the temp. The increase was in the inorg.-S, the reducible-S, and that combined with the carbonaceous residue. The SO_4-content imparted to char liquors could increase greatly without forming a "sulfate haze." Analyses of test liquors for Ca and SO_4 were given before and after passing through a service char, through a mech. mixt. of char and $CaSO_4$, and through a char regenerated in the presence of SO_2.

6527. DUFFY, J. P. **Rates of drying in tray and rotary driers.** *Chem. & Process Eng.* 34, 49-51, 62 (1953).—*C.A.* 47, 6711*i*.

The efficiency of a tray or rotary drier could be assessed on the basis of the rate of drying. This was a complex function of the phys. properties of the material being dried and the operating variables predetd. by the type of drier and the state of the drying medium. Rotary driers were more efficient than tray driers.

6528. FREEMAN, H. P. **Surface area and oxygen chemisorption.** *Proc. Tech. Sess. Bone Char* 1953, 297-305.

The quantity of chemisorbed-O on bone chars was proposed as one measure of chem. activity in the removal of color from sugar liquors and the B.E.T. area as a measure of the total surface. The O chemisorbed on various service chars was shown to vary approx. in the same order as known color-removal capacities. The surface area, the chemisorbed-O, and the color removal were discussed as a function of the residual carbonaceous residue upon decarbonization of a service char.

6529. HOWE, W. L. AND MOULT, A. M. **Reactivation of bone char in a gas-fired kiln.** *Intern. Sugar J.* 55, 8-10(1953).—*C.A.* 47, 3015*g*.

The operation of a Nichols-Herreshoff kiln was described. Its advantages were: uniformity of burning, production of char with good color and ash removal, uniformity of char over long periods of time, low dust formation, closer control of carbon content of the char, greater sterility of char, and use of waste heat for drying wet char.

6530. KNOWLES, H. I. **Continuous versus intermittent washing of bone char filters.** *Proc. Tech. Sess. Bone Char* 1953, 25-31.

After sweetening-off the char filter was drained and then repeatedly filled with hot water and drained. The comparison with continuous washing was made on the basis of total solids and ash in the wash water and in that extracted subsequently from the char. A more uniformly washed char might be obtained by continuously washing if the flow of water is reversed one or more times during the washing period. The intermittent method may lead to entrapped air with the bed of char and thus decrease the contact boundary between the char and water.

6531. LOEBENSTEIN, W. V. **Adsorption wave applied to char columns.** *Proc. Tech. Sess. Bone Char* 1953, 285-95.

The removal of color from sugar liquors passing through a char column might be represented by a wave front progressing through the column. Mass transfer considerations of a highly simplified model for this complex process resulted in the well-known Mecklenburg equation. The scope of this equation was limited to the comparison of different chars of the same grist under identical conditions.

6532. LÖWY, KURT. **Ash adsorption by bone char and its desorption by chemical treatment.** *Proc. Tech. Sess. Bone Char* 1953, 241-53.

Ash adsorption by bone char was of ionic type in aq. and of mol. type in nonaq. solns., but it was always accompanied by exchange reactions. A mutual influence of cations and anions in the adsorption process was observed. SO_4 could be desorbed by treatment with hydroxide, carbonate, or Na- or NH_4-citrate. Good results were obtained for Ca desorption with salts of monovalent org. acids (sodium or ammonium acetate) at pH 4.5. At lower pH a decomph. of the bone char structure was observed. Na- or NH_4-citrate at pH 4.5 could be used for both anion and cation desorption, but the great quantities required and the high price of these products make such a process uneconomical. A two-bath process with Na_2CO_3 and Na acetate gave best results.

6533. MACDONALD, R. J. G. AND DEWHALLEY, H. C. S. **British bone char manufacture and decolorizing power measurements of chars by column test.** *Proc. Tech. Sess. Bone Char* 1953 59-69.

Specifications of new bone char supplied to British Refineries was presented including the methods of sampling and analysis. The column method for testing the decolorizing power of new and stock chars was described. Results were given for the change in decolorizing power of new char through fifteen cycles.

6534. PENNINGTON, NEIL L. **Color removal by bone char.** *Proc. Tech. Sess. Bone Char* 1953, 273-83.

The detn. of color removal in lab. test procedures was a difficult problem because of the many variables influencing the results. Some of these difficulties were pointed out and discussed with special reference to the measurements of "color" of sugar liquor.

6535. SWINTON, E. A. AND WEISS, D. E. **Countercurrent adsorption separation processes. I. Equipment.** *Australian J. Appl. Sci.* 4, 316-28 (1953).—*C.A.* 47, 9062*i*.

The adsorbent flowed across a no. of horizontal decks, each made of wire screen and arranged one above the other in a tower. The liquid, to which pulsations were applied through a diaphragm at the base of the tower, flowed up through the adsorbent, and the adsorbent, introduced at the top of the tower, made its way downwards to its discharge point. The pulsating flow fluidized the adsorbent bed on each stroke, thus permitting high fluid capacities but avoiding channelling. The adsorbent was immobilized on each downstroke, thus avoiding turbulence within the bed.

V-2. Refining of Sugar Liquors With Activated Carbons

6536. BRETSCHNEIDER, R. **Some practical comments upon filtration conducted with filtering aids.** *Listy Cukrovar.* 59, 59-64 (1940).—*C.A.* 42, 781*b*.

An equal mixt. of diatomaceous earth (Hyflo, Speedex, Calofilter) and activated charcoal (Carboraffin) produced a cake which functioned well 1-3 days before it began to loss its decolorizing powers. In com. operation the 50% addn. of a diatomaceous earth began to clog the filter cake rather soon, but the presence of only 25% accomplished the desired effect of reducing the time of sedimentation and of prolonging the service of the filter cake.

6537. RAO, A. N. AND JAIN, N. S. **Use of activated carbons in white-sugar factories.** *Proc. Sugar Tech. Assoc. India* 10, 239-48 (1941).—*C.A.* 37, 6485[3].

"B-" and "C-" sugars were well cured to yield products of not less than 96-8 polarization, after which they were melted to give a sirup of about 50° Brix. After raising the temp. to about 85°C, 0.4.-0.6% (on solids) of activated carbon with about 0.2-0.4% of filter-aid were added, the liquor being well mixed for 15-20 min. It was then filtered, later to be boiled to grain.

6538. BAILLEUL, GUSTAV AND AEHNELT. **Decolorization of sugar solutions with activated carbon.** *Centr. Zuckerind.* 50, 325-6 (1942).—*C.A.* 38, 1898[1].

Differences in color removal by activated carbon depended on the process of their manuf. One color component could not be adsorbed completely without removing some of another color.

6539. NOSSEN, E. **Determination of the activity of decolorizing agents.** *Chem. Weekblad* 39, 581-5 (1942).—*C.A.* 38, 4466[8].

The activity of active carbons and "Collactivits" used in the sugar industry was detd. with methylene blue in highly acid solns. The results of these detns. were related directly to the decolorization of molasses with these materials. The effect of particle size on the activity of the "Collactivits" was tabulated.

6540. MIDUNO, SHIGERU AND KATO, YOGORO. **Active carbon. II. Application of hydrated active carbon in the plantation white-sugar factory.** *J. Soc. Chem. Ind. Japan* 46, 961-6 (1943).—*C.A.* 42, 6517*d*.

About 0.1, 0.5, and 2.0% of hydrated active carbon was required to replace the 2nd sulfitation, the whole sulfitation, and the whole carbonation and sulfitation, resp. In all cases a smaller quantity was required of $ZnCl_2$-activated carbon with less clogging of the filter cloth.

6541. MITI, KIMIYO. **Aconitic acid monoethyl ester from sugar-cane molasses.** *Bull. Inst. Phys. Chem. Res.* (Japan) 22, 671-3 (1943).—*C.A.* 41, 6742*h*.

A sirup was obtained by treating Java molasses, acidified to pH 2, with activated carbon, extg. the carbon with 90% EtOH, and distg. This sirup was dissolved in water at pH 1.6 and repeatedly extd. with ether. After distg. the ether the residue was sepd. into $CHCl_3$-insol. and $CHCl_3$-sol. portions. From the insol. portion trans-aconitic acid was obtained. The $CHCl_3$ was distd. from the sol. portion, the residue dissolved in water, clarified with $Pb(OAc)_2$, concd., extd. with ether, crystd., and recrystd. from ether and petr. ether. Monoethyl aconitate was obtained.

6542. TISELIUS, A. AND HAHN, L. **Adsorption analysis. II. Analytical separation of the products formed in the breaking down of starches.** *Kolloid-Z.* 105, 177-82 (1943).—*C.A.* 38, 3921[4].

Mono- to tetra-saccharides could be adsorbed on charcoal and removed selectively with the aid of ephedrine. Losses during the process were prevented by treating the charcoal 2-10 times with the dil. displacement soln. of ephedrine. before attempting to adsorb the desired compds. In this way, the differences in adsorption tendencies of the various products became more pronounced and their sepn. from mixts. was facilitated.

6543. MACDONALD, J. CAMPBELL. **Sugar refining in the beet-sugar factory using decolorizing carbon.** *Intern. Sugar J.* 46, 294-7, 318-21 (1944).—*C.A.* 39, 1309[4].

Very little change was required to adapt a sugar factory to refinery use. Details of the refining process were given with typical charts of recoveries. The daily refining capacity of the plant was about one-fifth of the beet-working capacity. For a 500-ton plant this required 4 white, 1 high raw, 2 low raw, and 1 after product pans, each of 900 ft^3 capacity and 1800 ft^2 heating surface. Centrifugals should be divided into 8 for white, 2 for high raw, 3 for low raw, 2 for after-product, and 6 for affination.

6544. MACDONALD, J. CAMPBELL. **Refining raw cane sugar in the factory using decolorizing carbon.** *Intern. Sugar J.* 47, 40-4 (1945).—*C.A.* 39, 2663[6].

The cane-sugar factory could be used successfully as a refinery during the interim period. Little addnl. equipment was necessary. Addnl. filters and a carbonation plant were required. The refining capacity was one-eighth the cane capacity of the factory. Care must be exerted to keep the temp. and pH within very narrow limits to prevent inversion of the cane sugar and destruction of the invert sugar.

6545. COALSTAD, S. E. **The influence of adsorption on the crystallization of sucrose from impure solutions.** *J. Soc. Chem. Ind.* 65, 206-8 (1946).—*C.A.* 41, 609*h*.

The failure of sucrose to crystallize further from molasses (a highly supersatd. soln.) was due to the presence of surface-active impurities which were adsorbed by the surfaces of the crystals and thus inhibit their growth. When these impurities were removed by the addn. of excess adsorbent carbon, the sucrose crystallized out almost completely. The ratio of sucrose to surface-active impurities was much more fundamental and valuable in appraising the purity of molasses than the older criterion, the reducing sugar-ash ratio.

6546. MENA VAILLANT, ARTURO DE. **Sugar refining in Cuba.** *Intern. Sugar J.* 48, 148-50 (1946).—*C.A.* 40, 5587[6].

The modern methods included decolorization of a 56° Brix remelt at 80°C with vegetable carbon.

The temp. rise was obtained by passing the sirup through tubular heaters. $Na_2S_2O_4$ was used in all strikes, the amount varying with the type of strike. The presence of nonsugars often presented serious difficulties in practice. The best results were obtained by defecation with phosphoric acid and calcium hydroxide followed by air agitation, which brought the floc to the surface, where it could be skimmed off.

6547. Smirnov, V. A. and Goncharenko, S. E. **Adsorption of coloring substances on Collactivite carbon.** *J. Applied Chem. (U.S.S.R.)* 20, 449-53 (1947) (in Russian).—*C.A.* 42, 2489*g*.

Color removal was detd. with the Stammer colorimeter on 50-ml samples of a 6% soln. of tech. xylose, d. 1.03, initial color 557.1° Stammer treated with 0.25 g Collactivite (made from hydrolytic cellolignin) at 80°C for 1 hr. Acidification of the soln. decreased the color which was again restored on neutralization; hence, the coloring substance was a weak org. acid with colored (yellow) anion, formed in the decompn. of xylose. Collactivite could be considered to be a H^+ zeolite, exchanging its H^+ with the cations of the coloring substance and thus converting the colored anions into the colorless undissocd. org. acids. After 10, 20, 30, 60 min. Norit produced 68.6, 87.2, 94.7, 96.7% color removal, resp.; Collactivite 28.2, 46.2, 55.2, 60.0%.

6548. Wickenden, Leonard. **The Percofil process.** *Sugar* 42, No. 1, 32-5 (1947).—*C.A.* 41, 1859*g*.

In the Percofil process the color was distributed over the surface of an inert carbonaceous carrier in granulated form, which was hard, resistant to abrasion, very porous, and could be used in existing bone-char cisterns. Since irreversible colloids were adsorbed better by bone char, and reversible colloids better by vegetable char, a combination of the 2 gave best results. Tests in a sugar refinery have shown that 0.05% of vegetable carbon used as indicated could replace 30% of the normal amt. of bone char.

6549. Freed, B. and Hibbert, D. **Some aspects of the decolorization of sugar juices.** *Intern. Sugar J.* 50, 263-5 (1948).—*C.A.* 43, 887*b*.

Data were given to show that (1) high temp., approx. 80°C, was an important factor in promoting color removal: (2) there was no interaction between the carbon and SO_2, which were independently acting factors; (3) color removal was a linear function of amt. of carbon added at all pH values; (4) whereas color removal was more complete at low pH values, the amt. of color removed by a given quantity of SO_2 was greater in the initial stages of pH lowering.

6550. Bevenue, Arthur. **Determination of sugars in plant materials. Use of decolorizing carbon in the ferricyanide method.** *Anal. Chem.* 21, 586-7 (1949).—*C.A.* 43, 6542*a*.

Treat 100 ml of solns. of dextrose, levulose, or sucrose (contg. 0.2-1% of the individual sugars) with 500 mg of animal charcoal (325 mesh) without loss of any of the sugars by adsorption. With sugar concns. of 0.05% there was a small loss of sucrose (about 4%) but no significant loss of the monosaccharides. Carbons other than animal charcoals gave sucrose recoveries varying from 43 to 87% with 0.1% sucrose solns. The addn. of neutral $Pb(OAc)_2$ followed by pptn. with a slight excess of Na_2HPO_4 for the removal of nonsugar-reducing material did not influence the results.

6551. Goncalves de Lima, Oswaldo; Magalhães Neto, B.; Leõncio de Albuquerque, Ivan, and Simõnes Filho, Sebãstiao. **Citric acid production from cane-sugar molasses in Pernambuco.** *Anais assoc. quím. Brasil* 8, 264-7, (1949); *Rev. quím. ind.* 19, No. 216, 19-20 (1950).—*C.A.* 45, 305*f*.

The addn. of saline mixt. or adsorbent clay to molasses did not improve the yield of citric acid by fermentation with *Aspergillus niger 198*. Activated charcoal improved the yield of citric acid to 44.7% at pH 2.3 and 6.5. The production of oxalic acid was increased to about 4% at the higher pH.

6552. Heertjes, P.M. and Haas, H. v.d. **Studies in filtration.** *Rec. trav. chim.* 68, 361-83 (1949) (in English).—*C.A.* 44, 2289*g*.

Tests were carried out on suspensions of puritine (an active carbon) or glass spheres in water (small concns. 0.001-4 g/liter) with either duck or nylon cloths. It was found that for each system, two types of filtration may occur-blocking filtration or cake filtration, depending on the concn. of the solids in the feed. Blocking changed to cake filtration as the concn. of the suspension increased. Under const. pressure, the specific resistance of the cake decreased with increasing concn.

6553. Kastner, Frantisek. **An attempt to prepare pure sucrose by an industrial method.** *Listy Cukrovar.* 66, 39-41 (1949).—*C.A.* 44, 2775*f*.

With a spodium filtration 50-kg batches of sugar were prepd. on 11 different occasions which contained 0.003% ash detd. by the elec. cond. method and 30 mg of interfacially active substances. Attempts to produce large batches of sugar having a "polarographic zero" were not successful either in the lab. or in the refinery. The use of Carboraffin improved the quality of the prepd. sugar.

6554. Meloun, Bedřich. **The adsorption of reducing sugars by Carboraffin and Norit.** *Listy Cukrovar.* 66, 75-81(1949).—*C.A.* 44, 4699*i*.

In solns. contg. 50 mg of sugar per 100 ml of water, 2 g of Carboraffin adsorbed 14% of the glucose, 10.5% of the fructose, and 10.7% of the invert sugar; Norit adsorbed 28% of the invert sugar. Ten g of Carboraffin adsorbed 26% of the glucose, 22% of the fructose, and 23% of the invert sugar; 10 g of Norit adsorbed 53% of the glucose, 49% of the fructose, and 50% of the invert sugar. The adsorption was complete in 5 min. at 20°C. Norit showed a definite selectivity for reducing sugars.

6555. Ohira, Toshihiko and Kobayashi, Kohei. **The preparation of sugar sirup from Jerusalem artichoke.** *Agr. Chem. Soc. Japan* 23, 103 (1949).—*C.A.* 44, 3727*g*.

The crushed tubers of fresh Jerusalem artichokes were boiled with an equal quantity of 1% $Ca(OH)_2$ for 30 min. Colloidal substances such as pectin were pptd. and filtered off. The filtrate was made to pH 5-5.5 with H_2SO_4. Then active carbon 0.5% was added to the filtrate. Five-min. boiling was suitable to remove bad odor and taste. The filtrate was concd. to 1/2 vol. and then hydrolyzed with H_2SO_4. The hydrolyzate after half-hr boiling was neutralized, filtered, and concd. One kg of fresh tubers gave 139 g of sirup of Be. 41°. It contained fructose 30.27, glucose 14.95, and ash 3.56%.

6556. Pavlas, Petr and Häuslerova, O. **The influence of activated carbon on the determination of invert sugar in molasses according to Ofner.** *Listy Cukrovar.* 65, 115-18 (1949).—*C.A.* 43, 8715*a*.

Four brands of molasses collected from different sugar mills and from different seasons were analyzed for invert sugar with the addn. of 0.5, 2, 4, and 6 g of carbon (Carboraffin and Norit) per 20 g of molasses in 200 cc. of soln. The results showed that the 4 g of charcoal recommended by Ofner satisfied the conditions which he specified for the detn.

6557. Rogge, Robert H. **Dextrose from corn starch.** *Ind. Eng. Chem.* 41, 2070-5 (1949).—*C.A.* 43, 8716*e*.

A pilot plant to handle 5000 lb of dextrose per day was designed and operated to study improved methods of dextrose production. Starch was converted in a continuous converter coil at a concn. of 8° to 10° Bé. for approx. 17 min. at 315°F and 1.9 pH. Insol. and colloidal material were removed by filtration with bentonite. The filtrate was refined in ion-exchange columns, decolorized with activated carbon and evapd. to 72% dry substance. The heavy liquor was crystd. for 72 hrs while cooling from 120° to 70°F. The cryst. dextrose was filtered in centrifuges and dried. The mother liquor was carbon-refined, concd., and crystd. in a second set of crystallizers. Yields of 82% were obtained.

6558. Zaleski, J. **Activated carbons.** *Gaz. Cukrownicza* 89, 21-30 (1949); *Sugar Ind. Abstracts* 11, 67 (1949).—*C.A.* 45, 3625*c*.

The properties and uses of active carbons of the Carboraffin and Norit types for sugar decolorization were reviewed. Investigations were carried out with two carbons made in Poland: "Eponal 3," prepd. by steam activation of charcoal, and "Glukonit 4," produced by treatment of Eponal with 2% of SO_2. Both were of the Norit type. Decolorization results were compared with those obtained with Carboraffin.

6559. Doss, K.S.G. and Singh, Adjit. **Evaluation of decolorizing carbons.** *Proc. Intern. Soc. Sugar Cane Technol.* 7, 620-3 (1950).—*C.A.* 46, 3241*c*.

The carbon suspended in 10 ml of a NaOAc-HOAc buffer soln. of 4.5 pH and ionic strength of 0.2 *M* was moderately boiled 30 min. under reflux and examd. with a Lovibond tintometer or a Kober-Klett colorimeter.

6560. Honsch, W. and Lorner, W. **Condition of juices of starch sirup during boiling-down and during treatment with activated charcoal under factory conditions.** *Die Starke* 2, 195-8 (1950).—*C.A.* 44, 11139*b*.

In boiling down juices of starch sirup, the pH value increased 0.3 to 0.4 units, without change of ash or Ca content. When activated charcoal was added, the pH of the juices remained unchanged or increased slightly, the ash content also remained practically unchanged, but the Ca content increased slightly. To get best results, quality and quantity of activated charcoal to be used must be selected carefully.

6561. Sorgato, Ippolito. **Chemical factors determining the coloration of the intermediates in sugar production.** *Ricerche sez. sper. zuccheri, Univ. studi Padova, Ist. chim. ind.* 5, 43-56 (1950-1951).—*C.A.* 46, 766*c*.

The chem. reactions causing the formation of colored products in sugar juice and sirup processing due to the decompn. of the sucrose and the reaction of decompn. products with N compds. were discussed. The methods for measuring the color, the adsorption equilibria, and the decolorizing effect of adsorbents were given.

6562. Tullin, V. **Color formation in various stages of the manufacture of beet sugar.** *VIII° Congr. intern. inds. agr., Brussels* 1950, 227-40 (in English).—*C.A.* 45, 6405*i*.

Coloring substances were divided into 4 groups: caramel, melanoidins, polyphenols-Fe compds., and melamines. Electrophoresis and ultracentrifugation showed that the dark color of press juice was carried by the main protein compd. This could be sepd. by centrifugation. It showed the reactions of melamines. Tyrosinase was responsible. The coloring was absent when H_2S was added but appeared again after addn. of Cu ions. CaO gave irreversible bleaching. In thick juice melanoidins and polyphenols-Fe compds. were the main coloring substances.

6563. Vavruch, I. **Estimation of refined sugar by the polarographic method.** *Collection Czechoslov. Chem. Communs.* 15, 217-31 (1950) (in English).—*C.A.* 45, 2693*h*.

The amt. of surface-active substance was estd. by the decrease in the O max. in 0.002 *N* K_2SO_4. Methyl orange was used as a reference. A standard sugar was prepd. by treating 200 g sugar plus 200 g H_2O with charcoal and adding 3 liter of EtOH also treated with charcoal and filtering through sintered glass.

6564. Whistler, Roy L. and Durso, Donald F. **Chromatographic separation of sugars on charcoal.** *J. Am. Chem. Soc.* 72, 677-9 (1950).—*C.A.* 45, 1839*h*.

A modification of the Tiselius technique was developed whereby a mixt. of mono-, di-, and trisaccharides could be resolved by chromatographic adsorption on charcoal and displacement by water, 5% EtOH, and 15% EtOH in succession. Neither the adsorption nor the desorption was affected by the degree of diln. of the sugar mixt., or by the presence of salts such as NaCl, $NaHCO_3$, or NaOAc in various concns. Other developers such as MeOH, EtOH, AcOH, and Me_2CO for monosaccharides, and PhOH, citric acid, and HCl for disaccharides were studied.

6565. YOSHIDA, YUJI. **The caking and coking properties of coal.** *J. Fuel Soc. Japan* **29**, 173-82 (1950).—*C.A.* 45, 2180*b*.

The caking and coking properties of coal were reviewed from the viewpoint of the manuf. of coke. Caking property essentially depended on the aggregating power or the type of linkage by which the fundamental units of coal were bound to each other rather than on the amt. of caking constituents. As regards coking property, however, the behavior of the humin substance, especially its affinity with bitumen, was considered to be more important than in the case of caking phenomena.

6566. BERGDOLL, MERLIN S. AND HOLMES, ELIZABETH. **Heating of sucrose solutions. I. Relationship of 5-(hydroxymethyl) furfural to color formation.** *Food Research* **16**, 50-6 (1951).—*C.A.* 45, 4951*c*.

The estn. of 5-(hydroxymethyl) furfural in heated sucrose solns. was improved when the solns. were chromatographed on charcoal. The production and accumulation of 5-(hydroxymethyl) furfural increased in heated sucrose solns. Color formation in heated sucrose solns. was simultaneous with hydrolysis of the sucrose and 5-(hydroxymethyl)-furfural formation. The addn. of 5-(hydroxymethyl) furfural in quantities equiv. to those produced in heated sucrose solns. did not affect color formation. More color was produced by the substitution of invert sugar than by the addn. of 5-(hydroxymethyl) furfural.

6567. CHADWICK, D.W.; THOMASON, A.F., AND WIGGINS, L.F. **Lactic acid and certain of its derivatives from molasses by chemical means.** *Proc. Brit. West Indies Sugar Technol.* **1951**, 135.—*C.A.* 46, 11729*b*.

Molasses (500 g) contg. 37.7% of sucrose was dissolved in 700 ml of H_2O and heated with agitation in an autoclave to 230-35°C for 2 hrs with 147 g of CaO. The cooled mixt. was treated with H_2SO_4 to remove $CaSO_4$ and filtered. The filtrate was treated with active charcoal; $ZnCO_3$ was added to form Zn lactate which was recrystd. from 50% alc.

6568. COTTON, ROBERT H.; NORMAN, LLOYD W.; RORABAUGH, GUY, AND HANEY, H.F. **Semipilot production of sucrose from sorghum.** *Ind. Eng. Chem.* 43, 628-35(1951).—*C.A.* 45, 5433*i*.

Small-scale factory expts. were made with sorghum, variety Rex, as raw material, during 2 seasons. The diffusion process, at or below 70°C, was found to be superior to milling. First carbonation at 55°C, and 2nd carbonation at 70°C, with a final pH of 8.3, removed the greater part of the remaining starch. After sulfitation and treatment with vegetable carbon the juice was carbonated and boiled to sugar. Treatment of the juice with pancreatin at 55-70°C for 1.5 hrs removed the starch effectively, but this may be found not to be necessary. Removal of the *aconitic acid* from the thick juice as the Ca-Mg salt facilitated crystn. of the sucrose.

6569. MCDONALD, EMMA J. AND PERRY, ROGER E., JR. **Corn-Sirup analysis involving selective adsorption.** *J. Research Natl. Bur. Standards* 47, 363-6 (1951) (Research Paper No 2263).—*C.A.* 46, 8399*e*.

The sepn. of corn sirups into the components dextrose, maltose, and dextrins was done chromatographically by adsorbing the carbohydrates on a column consisting of equal wts of Darco G-60 and Celite. Dextrose was eluted with H_2O, maltose with 5% EtOH, and dextrins with 30% EtOH. By passing the eluting agents through the column under 30-50 lb pressure the sepn. could be performed in approx. 1.5 hrs. Recoveries on mixts. averaged 96.45% dextrose and 97.12% maltose.

6570. BRONSHTEĬN, D.G. **The application of activated carbon of the Carboraffin type in sugar refineries.** *Sakharnaya Prom.* **26**, No. 12, 20-2 (1952).—*C.A.* 47, 6688*a*.

Description of different methods of application of Gluconite, a vegetable carbon similar to Carbonaffin.

6571. CAROLAN, ROBERT. **The manufacture of table sirup in Ireland.** *Intern. Sugar J.* **54**, 106 (1952).—*C.A.* 46, 6417*g*.

Imported raws were remelted. A portion of the melt was completely inverted and then added back to the remainder of the melt and the whole decolorized with active carbon. Better results were obtained by filtering before inversion. Although Peruvian sugar was superior in lab. tests, Cuban sugar was used in actual production because of its greater availability.

6572. RINEHART, THOMAS M. AND FORTIER, RIVERS. **Activated carbon in cane-sugar refining.** *Sugar* 47, No. 3, 35-8(1952).—*C.A.* 46, 4825*i*.

The Darco process of refining, either in conjunction with a raw-sugar factory or as a sep. refining unit, was described and illustrated by flow sheets. It was particularly adaptable to refining units of 200-500 tons capacity.

6573. WITTENBERGER, WALTER. **Rules for the application of activated carbon as decolorizing agent.** *Chem.-Ztg.* 76, 88-9 (1952).—*C.A.* 46, 4700*i*.

Activated carbon decolorized chiefly by adsorption. The amt. used should be as low as possible. The effect of the purification with activated carbon depended furthur on the nature of the solvent, the pH concn., and the concn. of the soln. The temp. had a less pronounced effect. Easily oxidizable substances could be protected through the addn. of a reducing agent, such as $Na_2S_2O_4$ or SO_2.

6574. KITAGAWA, MUTSUO AND KAZAI, HATSU. **Decolorizing test on caramel solution with active carbon. I.** *Sci. Ind.* 27, 20-3(1953).—*C.A.* 47, 5706*f*.

Charcoal, activated by $ZnCl_2$, decolorized caramel solns. far more rapidly and to a greater extent than charcoal activated by steam.

6575. MUKHERJEE, S. AND SRIVASTAVA, H. C. **Aconitic acid from molasses.** *Proc. 20th Conv. Sugar Tech. Assoc. India,* **1951**, Part II 77-79. *Intern. Sugar J.* **55**, 136 (1953).

Molasses, acidified with H_2SO_4 to Congo Red after dilution to 40° Brix, formed a heavy precipitate which was filtered off on a bed of kieselguhr. The filtrate was continuously extracted with ethyl acetate until it gave no reaction for aconitic acid with pyridineacetic anhydride (no reddish-purple color). The extract was decolorized with charcoal and evaporated under reduced pressure, giving a residue crystallized from glacial acetic acid, m.p. 184-186°C (decompn.).

6576. OWEN, W. L. **Sugar Refining under Bacteriological Control.** *Sugar J.* (La.), 1952, 14, No. 10, pp. 26-34. *Intern. Sugar J.* **55**, 222 (1953).

Application of bacteriological control to a vegetable carbon refinery resulted in the consistent production of a sugar free from mould fugi, yeasts and mesophilic bacteria. Any outbreak of mesophilic or thermophilic contamination could be quickly traced to its source by constant vigilance in appraising the number of bacteria which were dust-borne, in the water supply, and in the spent carbon. There were valid grounds for suspicion that a high concentration of thermophilic bacteria in the once-used carbon was correlated with undetermined losses in sucrose during refining.

V-3. Refining of Sugar Liquors With Miscellaneous Products

6577. DUBOURG, J. AND GOLDSTEIN. **Studies on saturation.** *Chem. Zentr.* **1938**, **II**, 2358.—*C.A.* 34, 5691[3].

CO_2 gave a sol. compd. with dissolved Ca saccharate which rendered the soln. viscous and, when present in sufficient concn., formed an amorphous ppt. which was able to assume a gel form. When all the saccharate had been converted into this compd. the latter decompd. and formed a cryst. ppt. of calcite. The amorphous ppt. appeared much sooner when the soln. was hot than in the cold; it also decompd. more rapidly.

6578. KUTSEV, S. S.; GOROVITS, T. L., AND SERGEEV, P. S. **Purification of raw [sugar] juice with colloidal $CaCO_3$.** *Rept. Sci. Inst. Sugar Ind.* (U.S.S.R.) *Sbornik Trud.* TSIN-Sa **1939**, 35-51.—*C.A.* 38, 6122[7].

Colloidal $CaCO_3$ obtained by partly carbonating a mixt. of diffusion juice and CaO, was added to the main raw juice, which was then filtered. To the filtrate was added a further quantity of Colloidal $CaCO_3$, and then the mixt. was heated, carbonated to the optimum alky. of a 2nd carbonated juice, and again filtered. The purifying action of colloidal $CaCO_3$ was much greater than that of $CaCO_3$ as ordinarily formed in carbonation. Filtration was slower, but this was compensated by the much smaller vol. of ppt. to be handled.

6579. HEINEMANN, B. **The regularity of alkali discoloration of certain sugars.** *Centr. Zuckerind.* **48**, 469-71, 493-6, 509-11 (1940).—*C.A.* 36, 6036[4].

The discoloration at 100°C of glucose and of sucrose-glucose mixts. by NaOH and Na_2CO_3, glucose by CaO, $Sr(OH)_2$, and MgO, sucrose-glucose mixts. by MgO and CaO, and glucose and sucrose-glucose mixts. by CaO + 0.02% NaOH and CaO + Na_2CO_3 were studied. The effect of the subdivision of CaO was also investigated. The main cause of discoloration of the raw beet juice was the reaction of CaO with aldo- and keto-sugars.

6580. KAISLER, JOSEF. **An attempt to determine the influence of potassium sulfide upon the color of saturated sugar juices.** *Listy Cukrovar.* **59**, 34-6 (1940).—*C.A.* 42, 780*b*.

Sugar juice (14.5%) and K_2S were mixed in increments from 0.0228 to 0.228 g K_2S per 200 g of juice and CaO (3.32 g) added. The mixts. were heated to 89°C and CO_2 added to produce an alky. of 0.007% CaO. The control juice without any K_2S showed 12.52° Stammer units, the addn. of 0.0228 g K_2S raised the color to 14.11° St., and the addn. of 0.228 g of K_2S raised the color to 18.52° St.

6581. KOPECKY', RUDOLF. **Where does the sediment from sugar juices belong?** *Listy Cukrovar.* **59**, 66 (1940).—*C.A.* 42, 779*f*.

Sediments from filter presses contained 0.04% K salts, 0.25-0.30% N, 1.0% P_2O_5 besides CaO which should return to the soil. When cakes were dried according to the Rema-Rosin method they could be distributed evenly over field and serve as an effective fertilizer.

6582. OPLATKA, G. AND BARCSAY, J. **Juice purification.** *Centr. Zuckerind.* **48**, 760-2; 783-6 (1940).—*C.A.* 35, 1659[8].

When the amt. of lime was reduced from 75 to 50% of the amt. usually used in the clarification and satn. of thin juices, the purity of the thin juices and subsequent molasses was higher. These thin juices required less carbonation, filtered more readily, and less sugar was lost in the carbonation sediment. Juice purification at lower alky. was more rapid and required less equipment.

6583. PAVLAS, P. AND VOTAVA, J. **The effect of different methods of clarification on the foaming of the juice during saturation.** *Z. Zuckerind. Böhmen Mähren* 64, 1-16 (1940).—*C.A.* 37, 277[7].

A foaming-time curve was obtained for the whole period of saturation under different conditions. Foaming was reduced by the use of higher clarification temperatures and by the addition of larger amounts of lime. Prolonging the clarification had no appreciable effect on foaming.

6584. CLELAND, J. E. AND FETZER, W. R. **Use of filter-cel for corn sirup.** *Ind. Eng. Chem., Anal. Ed.* 13, 858-60 (1941).—*C.A.* 36, 925[8].

Acid-washed filter-cel (25 g) was dried in a 250-ml weighing bottle, 5-10 g of corn sirup added and incorporated with the filter-cel to form a friable damp mass; drying was effected for 15 hrs at 60°C in a vacuum oven. A rapid method, with precision of 0.1%, was to dil. 5 g of sample with 5 g of H_2O, mix with 10 g of filter-cel in an Al weighing dish and dry *in vacuo* at 100°C.

6585. HAMOUS, J. **The use of resinous exchange absorbents.** *Z. Zuckerind. Böhmen Mähren* 64, 241-2 (1941).—*C.A.* 38, 1898[7]:

Preliminary expts. have shown that Wofatite removed Ca from sugar solns. to such an extent that the filtrates gave no ppt. with $(COONH_4)_2$. The application to the sugar industry was pointed out.

6586. PERRUCHE, LUCIEN. **Aids to filtration.** *La Nature* 1941, 70-2.—*C.A.* 38, 1917[7].

The advantages and properties of kieselguhr as an aid to the filtration of difficultly filterable liquids was discussed for large-scale manuf. of chemicals.

6587. SPENGLER, O. AND TÖDT, F. **Deliming with phosphate in juice purification without primary defecation.** *Z. Wirtschaftsgruppe Zuckerind.* 91, 87-102 (1941).—*C.A.* 37, 1291[4].

Deliming with 0.02% KH_2PO_4, and in unfavorable conditions with 0.04%, led to the preparation of juices, without primary defecation with 0.3-0.4% total lime additions, which contained as much and in many cases less dissolved lime salts than the same juices normally defecated with 2% CaO. In the primary defecation 3-4 g and in the preliminary defecation alone about 2-3 g of nonsugar materials on 100 g of sugar were removed from the juices.

6588. SUZUKI, KAKUO. **Influence of manganese salt on sugar manufacture. II. Influence of NaCl on evaporation of sugar solutions.** *J. Soc. Chem. Ind. Japan* 44, 1081-4 (1941).—*C.A.* 42, 6558*e*.

Sugar solns. contg. a very small amt. of $MnSO_4$ and various amts. of NaCl were evapd. at 50° and 60°C. The presence of NaCl had no effect on the rate of evapn. In the absence of Mn salt, a small amt. of NaCl favored the formation of large crystals, but in presence of Mn salt the addn. of NaCl had no effect.

6589. SUZUKI, KAKUO. **Influence of manganese salt on sugar manufacture. III. Drying of sugar.** *J. Soc. Chem. Ind. Japan* 44, 1081-4 (1941).—*C.A.* 42, 6558*e*.

Concd. sugar solns. contg. various amts. of $MnSO_4$ were dried. The crystals thus obtained were of larger sizes when more than 0.001% of the salt was present. The time required to dry was shortened also by the addn. of $MnSO_4$.

6590. ALVAREZ, ALEJANDRO S. **Processes for reducing the lime salt content of clarified juice.** *Rev. ind. agr. Tucuman* 32, 127-41 (1942).—*C.A.* 37, 2207[7].

In order to reduce incrustations in the evaporators and other difficulties caused by Ca salts, the clarified juice should be left neutral or slightly acid, 0.001-0.005% expressed as equiv. CaO. If Na_3PO_4 were added to such juices, a large part of the Ca salts was removed. As the acidity increased, the effect of the Na_3PO_4 decreased and became negligible at an acidity of 0.021-0.03%. The best results were obtained by adding 300 mg of Na_3PO_4 per liter of juice before treatment with SO_2.

6591. ENGLIS, D. T. AND FIESS, H. A. **Production of a palatable artichoke sirup.** *Ind. Eng. Chem.* 34, 864-7 (1942).—*C.A.* 36, 4620[2].

The aq. ext. from the dried material was treated with a cation org. exchanger, in the H cycle, and the pH lowered to near 3.5. The drawn-off soln. was treated under a pressure of 15-20 lb for 30 min. and decolorized with an active carbon. The acid content was reduced with an anion exchanger, and the soln. concd. to a sirup of 80% solids, the quality of which was superior to that produced by former methods. The flocculation of impurities, caused by the lowering of the pH of the ext., slowed down the rate of flow in the cation exchanger, making the column method of treatment impracticable. The batch method of operation was satisfactory.

6592. GUNDERMANN, ERICH. **The use of electric current for the purification of juices and sirups in the sugar industry.** *Centr. Zuckerind.* 50, 315-17, 323-5 (1942).—*C.A.* 38, 1657[8].

Elec. current removed the inorg. and org. impurities from sugar solns. by electrolysis and electrodialysis. Salts were decompd., proteins pptd., and colors removed. Elec. current had little effect on the lime salts, decompd. a small amt. of the org. acid, produced CO_2 and caused the hydrolysis of the sugar.

6593. IWATA, YOSHI; SUZUKI, SHIN-ICHI, AND KAWAI, YUTAKA. **Some properties of the cane molasses produced by the sulfitation process.** *J. Agr. Chem. Soc. Japan* 18, 289-96(1942).—*C.A.* 45, 2694*h*.

Cane molasses produced by the carbonate and sulfitation methods were analyzed, and had, resp., Brix. 90.84, 87.46 , 92.90; sucrose 18.52, 22.81, 23.74; reducing sugars 23.00, 22.98, 22.33; total sugars 42.50, 46.99, 47.32%; gravity purity 20.39, 26.08, 25.55; total N 0.56, 0.52, 0.62%; ash 9.60, 6.21, 7.21%; and SO_2 trace, 8.30, 81.80 mg/100 g. On diln. the molasses by the ordinary and sulfitation methods formed a large ppt.

6594. KNOWLES, H. I. **Filtration of phosphate-defecated affination sirup.** *Ind. Eng. Chem.* 34, 422-4 (1942).

The filtration may be accomplished by means of Vallez filters using inexpensive paper pulp to precoat the filter leaves. The av. operating filtration rate was approximately 0.4 gallon per ft² per hr for a cycle period of about 4 hrs. The most influential factor affecting the filtration rate, was the matter adsorbed and occluded by the phosphate ppt.

6595. KORTSCHAK, HUGO P. **The calcium phosphate precipitate in limed cane juice.** *Hawaiian Planters' Record* 46, 105-9 (1942).—*C.A.* 37, 2207⁵.

The Ca phosphate ppt. in limed sugar-cane juice was not a definite compd. After pptn., the Ca content of the ppt. was increased by absorption of $Ca(OH)_2$ from the juice. When the juice and ppt. were heated, the pH value dropped. The 3 major reasons for the high Ca content of clarified juice were the original Ca concn., replacement of pptd. MgO by CaO, and the reduced activity of the Ca ion.

6596. MAFFEI, FRANCISCO J. **Utilization of bauxite as an absorbing agent in the clarification of sugar.** *Anais assoc. quím. Brasil* 1, 11-15 (1942); *Rev. brasil. quím.* 18, 113-14 (1944).—*C.A.* 37, 1619⁹.

Bauxite dehydrated at various temps. was used in granular form to percolate an 18% soln. of a 2nd sugar. A reduction of 4/5 in color and 2/3 in ash was obtained with bauxite dehydrated at about 400°C. The spent decolorant was regenerated at the same temp. without loss of substance. There was little difference in the decolorizing efficiency of 2 grades when freshly dehydrated, but the efficiency of the more impure grade was not completely restored by regeneration.

6597. MENA VAILLANT, ARTURO DE. **Filterability and color of sugars.** *Mem. 16th conf. anual, Asoc. tec. azucar. Cuba* 1942, 161-6.—*C.A.* 37, 6485².

A 1:1 soln. of the raw sugar was heated to 85°C and poured onto a paper filter contained in a funnel that was enclosed in an oven maintained at a temp. of 85°C; 3 min. later the flask contg. the filtrate was removed and weighed. The wt of the filtrate, calcd. as percentage of the wt of the filtrate from a similarly treated soln. of pure sucrose, represented the filterability of the raw sugar; sirups were treated analogously. Color was detd. by colorimetric comparison with a standard soln. of caramel.

6598. MIYAKE, SUGURU; HAYASHI, KANEO, AND SANO, YASUICHI. **Formation of lactic acid from cane sugar and molasses by the action of alkali.** *J. Soc. Trop. Agr., Taihoku Imp. Univ.* 14, 291-7 (1942).—*C.A.* 42, 2792*d*.

A 25% sucrose soln. contg. 5 mols. CaO was heated at 197°C for 3 hrs. Ca lactate with a highest yield of 61.5% was obtained. Under the same conditions except for adding 6 mols. instead of 5 mols. of CaO, a molasses gave Ca lactate with the highest yield of 61.3%.

6599. PARASHAR, D. R. **Clarification of juices. IV. Settling and filtration with reference to pH and juice colloids in sulfitation plants.** *Proc. 11th Ann. Convention Sugar Tech. Assoc. India* 1942, I,.99-113.—*C.A.* 37, 6149⁶.

Pptn. of colloids and rate of settling were governed by the nature of the juice and the degree of liming. The nonrefractory juices did not give much trouble when treated at high Brix, but refractory juices were best treated at lower Brixes. Fractional liming (cold or hot) gave good results if the optimim conditions of time of sulfitation and time of contact of the juice with lime were observed, and if the pH was kept within a fixed range. With the refractory juices the hot process was desirable, but in this process the color, pH, content of lime salts and colloid content tended to increase. To counteract the disadvantage of the higher temp., use was made of oxalic acid to reduce the pH.

6600. PARASHAR, D. R. AND SHANKAR, KRIPA. **The clarification of cane juices.** *Intern. Sugar J.* 44, 184-5 (1942).—*C.A.* 36, 6830².

Fractional liming was applied to sulfitation plants with considerable success. Method (1): The raw juice was limed to 8.0 pH in the cold, heated to 50°C and then sulfited until the pH fell to 5.1 to 5.3. It was then relimed to neutrality, heated to boiling and boiled as usual. Method (2): The juice was limed to 8.0 pH cold and heated to 71°C. The juice was sulfited to a pH of 6.2 to 6.4. Then the remainder of the SO_2 and lime were added simultaneously until at the end of the addn. the juice was neutral.

6601. RAWLINGS, F. N. AND SHAFOR, R. W. **Ion exchangers: Their application in cane- and beet- sugar juice purification.** *Sugar* 37, No. 3, 30 (1942).—*C.A.* 36, 2749².

The ion exchangers used in this work were Amberlite IR-1 and IR-4.

6602. REICH, GUSTAVE T. **Molasses elaboration.** *Trans. Am. Inst. Chem. Engrs.* 38, 1049-66 (1942); *Can. Chem Process Inds.* 27, 2-6 (1943).—*C.A.* 37, 1292⁶.

Lime up to 88% was removed by H_2SO_4, the inverting agent, and by control of the time of reaction, and concn. of the molasses. The lime removal increased production of alc. and eliminated scale formation in the beer stills and evaporators. Recovery of yeast of low ash content was realized. Pilot-plant experimentation promised the recovery of a decolorizing carbon, potash, and various chemicals from the tar obtained by the retorting of the nonsugars.

6603. SPENGLER, O. AND TÖDT, F. **The use of base-exchange substances for deliming and demineralizing sugar juices.** *Z. Wirtschaftsgruppe Zuckerind.* 92, 152-9 (1942).—*C.A.* 37, 6923⁵.

The synthetic ion-exchanger, Wofatit KS, was used in these lab. expts. The cation exchange in sugar juices at 80-90°C was accompanied by a strong lowering of the pH which inverted some of the sugar. Very encouraging results were obtained in deliming thin juices, especially from poor beets. A contact time of 30 seconds reduced the lime content of the juice to 0.01% CaO per 100 Brix, and for a contact time of 90 sec the lime content was reduced to 0.0036% CaO.

6604. SUZUKI, KAKUO. **Sugar manufacture by manganous sulfate method. IV.** *J. Soc. Chem. Ind. Japan* 45, 641-4 (1942).—*C.A.* 42, 6558*f*.

A 50% sugar soln. was evapd. in a test pan with the addn. of $MnSO_4$. The result showed that the addn. of the salt shortened the time of evapn. about 10% and saved elec. power for heating by about 9%.

6605. Vašátko, J. **The darkening of saturated sugar juice.** *Z. Zuckerind.* 66, 70-5 (1942).—*C.A.* 38, 5426^9.

The darkening of the satn. juices of Moravian sugar factories was due to the invert sugar remaining in the juices. The amt. of unaltered invert sugar left in the juices depended on the defecation time, temp. and the nature of the lime addn. and not the lime addn. only. Predefecation had no influence on the darkening of juices. The decompn. of invert sugar at the alky. of the 1st or 2nd satn. juice produced the greatest discoloration. Discoloration continued as long as the invert sugar decomposed. More color was formed when the decompn. of the invert sugar was accompanied at atm. oxidation.

6606. Werquin, V. **A liming and saturation process for juices.** *Bull. assoc. chim.* 59, 226-33 (1942).—*C.A.* 38, 3506^1.

The quantity of CaO necessary for predefecation was detd. by adding to several 2-liter portions of the cold raw juice increasing quantities (2-5 g CaO per liter) of milk of lime in steps of 0.5 g CaO per liter. The mixt. was stirred for 10 min. and then heated to 85°C. The alky., in terms of CaO, of the unfiltered and filtered samples was detd. by titration, with phenolphthalein as indicator. The optimum quantity of CaO was that where the 2 titrations showed the max. difference which max. varied from 0.8 to 1.2, av. 1.0 g, per liter of juice. Generally, 3-6 g of CaO per liter was found to be required for the predefecation.

6607. Böttger, St. **Brief consideration of the newer defecation saturation processes.** *Centr. Zuckerind.* 51, 59-60 (1943).—*C.A.* 38, 5100^2.

The following defecation processes were compared: (1) partial addn. of lime and heating, preliminary satn. addn. of residual lime as the defecation satn. with the alky. above 0.01% CaO; (2) alternating between slight super- and undersatn. until the optimum 1st satn. was reached; (3) partial addn. of lime under rigid control until the optimum 1st satn. was reached, great supersatn., before addn. of residual lime; (4) quick addn. of lime and the simultaneous introduction of CO_2 which allowed the pH to remain at 12 for a long period and slowly changed to 10.9.

6608. Eguchi, Tadashi; Morita, Shigeru, and Aoto, Eijiro. **Occlusion of impurities by growing cane-sugar crystals. I. Occlusions of dyes. II. Quantity of dyes occluded by cane-sugar crystals. III. Occlusion of coagulated particles of different dyes.** *J. Soc. Chem. Ind. Japan* 46, 689-94 (1943).—*C.A.* 43, 2003*i*, 2004*i*, 2005*a*.

Supersatd. solns. of cane sugar contg. various dyes were set to crystallize and the occlusion of dyes in the crystals was studied. Some dyes were occluded uniformly on all surfaces, but many of the direct cotton dyes and some of acid dyes were occluded only on definite crystal faces. Such a localized occlusion was likely to occur at the left pole of the crystal. The amt. of dyes occluded by cane sugar crystals was detd. by colorimetric analysis of the soln. of the colored part of the crystals. The larger the size of the colloidal particle, the greater the amt. occluded.

6609. Kröner, Waldemar and Wegner, Hans. **The purification by neutralization of sugar liquors obtained by converting starch with hydrochloric acid.** *Vorratspflege u. Lebensmittelforsch.* 6, 76-84 (1943).—*C.A.* 38, 6122^5.

Upon neutralization a ppt. began to form at pH 4, and pptn. was complete at pH 9. The ratio of bases to P_2O_5 indicated that there were no stoichiometric proportions; the filtrate from the ppt. obtained at pH 9 still contained 16% of the CaO and 75% of the P_2O_5. Fractional pptn. showed that the components were distributed irregularly among the various fractions.

6610. Löwy, Kurt. **Defecation with phosphates.** *Rev. brasil. quím.* 15, 105-6 (1943).-*C.A.* 37, 6921^7.

In the clarification of sugar solns. with $Ca(H_2PO_4)_2$ and $Ca(OH)_2$ a high concn. of phosphate (0.2%) gave a ppt. which filtered readily, but had a low decolorizing power. Low concns. of phosphate (0.05%) gave a gelatinous ppt. which was very difficult to filter off but had a superior decolorizing action.

6611. McCleery, W. L. **Juice clarification with bentonite.** *Repts. Ann. Meeting Hawaiian Sugar Planters Assoc.* 61, 114 (1943).—*C.A.* 37, 5267^3.

When bentonite in aq. suspension was added in pilot-plant test to limed juices at two different factories, both the rate of filtration and the clarity of the raw sugars were considerably improved; there was also an increase in the purity value, sufficient, it was estd., to pay for extra costs.

6612. McCleery, W. L. **Sugar technology.** *Hawaiian Sugar Planters' Assoc. Printed Repts, Ann. Meeting, Rept. Committee in Charge Expt. Sta.* 63, 60-9(1943) (Pub. 1944).—*C.A.* 38, 4465^5.

The reaction of juices and sirups at their usual operating temps., as detd. at those temps. with the glass electrode, ranged from 0.25 to 0.65 pH lower than when the reaction was detd. on a cooled portion. There was strong evidence that to avoid inversion losses the pH value of the juice entering the Dorr clarifier should be maintained at such a level (about 7.7) that the pH value of the clarified juice does not fall below 6.8. The pH value of the clarified juice entering the evaporators should preferably be held above 6.75 to prevent inversion losses at that stage of operations.

6613. Meyer, Walter. **The use of base-exchange materials to free sugar juices from salts.** *Centr. Zuckerind.* 51, 37-8 (1943).—*C.A.* 37, 6484^7.

Base-exchange materials prepd. from resins were preferable because of their higher capacity, lower sp. gr. and unlimited regeneration.

6614. SUZUKI, KAKUO. **Sugar manufacture with manganous sulfate. V. Crystalline form of sucrose.** *J. Soc. Chem. Ind. Japan* 46, 32-6 (1943).—*C.A.* 42, 6558*g*.

Sucrose crystals obtained by evapg. a 60% sucrose soln. to which 0.002-0.003% $MnSO_4$ was added were examd. and compared with crystals obtained without such addn. When the concn. of $MnSO_4$ was more than 0.0008%, the development of certain faces of the crystals was quite different from that observed in ordinary cases.

6615. SUZUKI, KAKUO. **Sugar manufacture with manganous sulfate. VI. Test-pan experiment of boiling sugar solution.** *J. Soc. Chem. Ind. Japan* 46, 32-6 (1943).—*C.A.* 42, 6558*g*.

With a test pan white-sugar boiling with and without the addn. of 0.0001% $MnSO_4$ was carried out with 3 kg of sample and 0.5 kg of seed. The results of several runs showed that by the addn. of $MnSO_4$ the time intervals required up to seeding and to completion of boiling were shortened by 12.68% and 6.10%, resp.

6616. SUZUKI, KAKUO. **Sugar manufacture with manganous sulfate. VII. Lowering the viscosity of the solns. of cane sugar, glucose, massecuite, and molasses.** *J. Soc. Chem. Ind. Japan* 46, 695-7 (1943).—*C.A.* 42, 6558*i*.

Addn. of 0.0001-0.1% $MnSO_4$ to 50-80% solns. of cane sugar, glucose, last massecuite, refinery molasses, and plantation white sugar molasses, and its effect on the viscosity of the solns. at 50-80°C were examd. A lowering in viscosity was observed in some cases.

6617. WEITZ, F. W. **Juice purification by ion exchange as applied at the Isabella Sugar Company.** *Sugar* 38, No. 1, 26-31 (1943).—*C.A.* 37, 1290[9].

The 2nd carbonation juice, cooled to 20°C, was passed through a bed of Catex, an organic cation exchanger (14-60 mesh). The cations were replaced by H, and the pH of the juice fell to 2. When it reached 3 the juice was sent through a bed of Darco, directly below the Catex tank. This decolorized the juice and removed colloids. Finally, the juice was passed through a bed of Anex, below the Darco tank. Anex (10-60 mesh) replaced the acid radicals in the juice. The effluent had at the beginning a pH of 11, which gradually dropped to 7 or below. The pH was adjusted to 8.5 by mixing the effluents in a storage tank, from which the juice goes to the evaporators. After sweetening off, the filter beds were washed in reverse direction. The Catex bed was revivified with 2.5% H_2SO_4, the Anex bed with a 1% NaOH. The runoff from the Anex bed was used for revivifying the Darco.

6618. ZIMMERMAN, B. **Attempts at improving the function of pressure filters.** *Listy Cukrovar.* 61, 83-5 (1943).—*C.A.* 42, 3601*b*.

Compressed air was used for blowing sediment out of filters. A const.-pressure pump set at some crit. value ranging from 150 to 210 atm. avoided pressures which might tear the fibers of the cloth.

6619. ALVAREZ, ALEJANDRO S. **Purification of the juice of the new cane varieties.** *Bol. estac. exptl. agr. Tucumán* 1944, No. 49, 25 pp.—*C.A.* 39, 1771[2].

The juice from 50-kg samples of the cane, extd. in a lab. mill was sulfured cold with 3 different quantities of SO_2, limed to pH 6.5-6.8, boiled for 2 min., 1 portion filtered and the other settled. Both raw and clarified juice were analyzed and the filterability, rate of settling and vol. of mud detd. The results were shown in tables and discussed in detail.

6620. ANON. **Filtration in the chemical process industries.** *Chem. Met. Eng.* 51, 117-24 (1944).

Some of the factors affecting filtration rates, product quality and related matters were evaluated. Filtration was limited to the separation of solids from a liquid by passing the liquid through a porous medium, either by vacuum, gravity or pressure.

6621. EGUCHI, TADASHI AND MORITA, SHIGERU. **Occlusion of impurities by growing cane-sugar crystals. IV. Occlusion of caramel. V. Occlusions by sugar crystals of dyes in coexistence with caramel.** *J. Soc. Chem. Ind. Japan* 47, 20-21, 289-91 (1944).—*C.A.* 43, 2005*b*, 2005*c*.

Occlusion of caramel by growing cane-sugar crystals was studied as in the previous exts. with dyes. Localized occlusion was observed. The amt. occluded varied with the conditions of crystal growth, concn. of caramel in mother liquor, etc., but the distribution of the occlusion was quite independent of the concn. of caramel, temp., pH, or concn. of inorg. salts. The occlusion of dyestuffs by growing cane-sugar crystals in the presence of caramel was detd. Localized occlusion occurred as in the case of dyes and acid dyes, but the amt. occluded was markedly higher when caramel was also present.

6622. GUTLEBEN, D. **From the log of experience.** *Chem. & Met. Eng.* 51, 152 (1944).

The activities of Henry Valley were recorded in the purification of beet sugar liquor by an ion exchange process. The acid exchanger Catex and the base exchanger Anex were used. Activated carbon was used to remove the color and colloidal matter.

6623. LIU, TOH. **The utilization of asbestos as a filter aid in sugar refining.** *J. Chinese Chem. Soc.* 11, 142-54 (1944); *Ind. Eng. Chem.* 38, 521-4 (1946); *Intern. Sugar J.* 48, 262-4 (1946).—*C.A.* 40, 483[2].

Locally produced asbestos was used as a satisfactory substitute for filter aids previously imported from abroad. The asbestos was recovered and reused.

6624. MENA VAILLANT, ARTURO DE. **A system for refining cane sugar.** *Mem. Asoc. tec. azucareros Cuba* 18, 59-67 (1944).—*C.A.* 39, 5107[7].

The melt of affined sugar was treated in a continuous operation in the cold with P_2O_5 to produce a pH of 5.4-5.6, limed, heated to 80°C, and agitated with air to a pH of 6.8-7.0; this dropped to 6.2 in the decanted liquor, which was then treated with a sufficient amt. of activated carbon, filtered, and grained in the pan. At the moment of graining a sufficient amt. of $Na_2S_2O_4$ was added to assure final decolorization.

6625. SALINAS, J. G. **Effect of clarification of molasses on filterability of raw sugars made therefrom.** *Proc. Ann. Conf., Asoc. tecnicos azucar Cuba* 15, 127-30 (1944).—*C.A.* 38, 5684^5.

If the A- and B-molasses were pre-clarified by addn. of H_3PO_4 or Na aluminate, the refining value of the raw sugar was favorably influenced. A considerable improvement was shown in the figures for color, insol. matter, ash, dye value, and filterability.

6626. SRIVASTAVA, R. S. **Utilization of carbonation press mud. I. Preparation of filter aids.** *Proc. Sugar Tech. Assoc. India* 13, 1, 69-79 (1944).—*C.A.* 39, 4248^2.

Dry carbonation press mud from a cane-sugar factory contained 41.92% of org. substance and 58.08 of ash (including 43.45% of $CaCO_3$). Samples were heated in an open iron tube at 500°-900°C until no more fumes were evolved. The best product, obtained at 800°C, was slightly inferior in rate of filtering, but better as regards clarity of filtrate than Hyflo Super-cel.

6627. STAUB, SERGE. **Chemical control notes: lead acetates.** *Rev. agr. Maurice* 23, 14-15 (1944).—*C.A.* 40, 2659^9.

The use of 1 g of Horne's dry Pb subacetate per 100 ml of juice was advocated for clarification and preservation, instead of 2 g of solid neutral $Pb(AcO)_2$, as practiced in Mauritius. The neutral salt diluted the juice through its H_2O content, and had no antiseptic properties. If the juice clarified with 1 g of Horne's dry Pb subacetate was to be used for the detn. of reducing sugar, the Pb must be removed with $(COOH)_2$.

6628. SUZUKI, KAKUO, **Sugar manufacture with manganous sulfate. VIII. IX. Manganese method of sugar manufacturing. X. Change in the amount of reducing sugar in sugar solutions.** *J. Soc. Chem. Ind. Japan* 47, 173-7, 286-8 (1944).—*C.A.* 42, 6559*a*, 6559*b*.

Various sugar solns. were prepd. from granulated sugar and molasses. Evapn. was carried out with or without the addn. of $MnSO_4$. The rate of increase in the amt. of reducing sugar in the soln. with time was smallest when 0.0001-0.001% of $MnSO_4$ was added. In some cases the content of reducing sugar was only 35-50% of that produced in the sugar soln. contg. no $MnSO_4$ after standing for 20 days.

6629. VENKATESWARHALU, D. AND VENKATARAO, C. **Clarification of cane juices. I. High-purity juices.** *Proc. Sugar Tech. Assoc. India* 13, I, 33-41 (1944).—*C.A.* 39, 4246^7.

Raw cane juice of the variety Co. 313 was subjected to the following treatments: (1) limed to pH 7.2 boiled, and cooled (simple defecation); (2) limed to pH 8.5, sulfured to pH 7.2, boiled, and cooled (preliming); (3) heated to 50°C, limed, and sulfured to pH 7.2, boiled, and cooled (Java sulfitation); (4) sulfured in the cold to pH 3.5, boiled, and cooled (cold sulfitation); (5) limed with 10% of 20°Bé. milk of lime, heated to 50°, carbonated to pH 7.2 boiled, and cooled (single carbonation); (6) limed as in (4), lime content reduced by carbonation to 400-500 mg/liter, filtered, recarbonated to pH 7.2, boiled, and cooled (double carbonation); (7), filtered juice from (6) was neutralized by SO_2, boiled, and cooled (acid thin juice process).

6630. WEBRE, ALFRED L. **Filterability of sugars.** *Mem. asoc. tec. azucareros Cuba* 18, 133-6 (1944).—*C.A.* 39, 5108^4.

The general poor filterability of Cuban raw sugars was ascribed to the presence of cane wax. Since cane wax melts at about 150°F the maceration water at the mill should be kept below this temp. so that most of the wax may pass out with the bagasse; most of the remainder may be removed by filtering the defecated juice below the crit. temp.

6631. ALVAREZ, ALEJANDRO S. **The clarification of cane juice from the varieties more difficult to clarify than P.O.J. 36.** *Bol. estac. exptl. agr. Tucumán* 51, 11 pp. (1945).—*C.A.* 39, 5108^7.

Phosphates should be added to the juice only in those cases where lab. expts. have shown it to be beneficial. The same applied to the use of filter aids, such as dried blood, fuller's earth, Super-Cel, or filter clay. If there were difficulties in settling and filtration it was advisable to sulfur and lime at 48-50°C rather than at ordinary temp., to use more SO_2, or both.

6632. BANERJEE, T. AND BHATTA, B. **Hydrolysis of cane sugar in presence of an acid sol.** *J. Indian Chem. Soc.* 22, 327-30 (1945).—*C.A.* 40, 3970^1.

The sol was prepd. by mixing x cc. of Na tungstate soln. of definite concn. with an equal vol. of HCl of definite concn. This was mixed with $2x$ cc. of sucrose soln. of known concn. The hydrolysis expts. were made at 60° and 70°C and at known pH values between 2 and 3. The presence of the sol was found to increase the velocity of hydrolysis. This increase became greater as the pH of the system increased, other factors remaining const. As the sol concn. increased, the velocity const. of hydrolysis increased.

6633. BARBER, DON J. **Removing sulfites and organic nonsugars from juices.** *Sugar* 40, No. 6, 36-8(1945).—*C.A.* 39, 3953^8.

The high SO_2-content of beet molasses prevented its economic use in the fermentation industry. In the new process the thick juice and remelt were heated together to 95°C and intimately mixed with a $CaCl_2$ soln. of 25° Be., sufficient to reduce the SO_2 to 0.04-0.06%. The SO_2 can be reduced still further, but then the Ca salts in the juice increased. The ppt. was filtered through a plate and the frame press coated with Filter-Cel; addnl. filter aid can be added to unusually bad juices.

6634. Belval, Henri. **Localization of the saccharides in the tubers of the Jerusalem artichoke, and the refractive indexes of the juices.** *Bull. assoc. chim.* 62, 282-90 (1945).—*C.A.* 40, 6855[9].

The total sugar content of the tubers varied with the variety, the size, and shape. It could not be detd. by simple polarization because the inulin present in the autumn was converted into other saccharides during the winter, the levorotation gradually decreasing and even changing to dextrorotation. The refractometer could not be used either upon samples secured with a beet borer because the sol. solids were unevenly distributed throughout the tuber and accumulate in the outer portion.

6635. Black, R. F. **Miscellaneous problems of filtration with metal filter cloth.** *Sugar Ind. Engrs.' Papers* 6, 8 pp. (1945) (Separate); *Sugar* 41, No. 5, 38-40 (1946).—*C.A.* 40, 1337[9].

Monel-covered filter leaves were subject to serious *electrolytic corrosion* if left "painted" with its own liquor during bi-weekly shutdown to prevent rusting of the cast iron filter body; remedy: wash and dry the metals.

6636. Blann, W. A. **Direct-consumption sugar from raw cane juice.** *Louisiana State Univ. Eng. Expt. Sta., News* 1, No. 2, 7-8(1945).—*C.A.* 40, 4235[7].

Pilot-plant tests were made during the 1944 season at the Audubon Sugar Factory. Raw juice of 76.75% sucrose, 14.81% non-sugar solids, and 3.14% ash was ion-exchanged to yield values of 88.4, 1.7 and 0.064, resp. The sirup was light colored, and mildly flavored, suitable for table use or for blending with strongly flavored Louisiana sirups.

6637. Buck, R. E. and Mottern, H. H. **Apple sirup by ion-exchange process.** *Ind. Eng. Chem.* 37, 635-9 (1945).—*C.A.* 39, 3599[8].

A palatable apple sirup, free from bitter aftertaste due to Ca malate formed in the usual liming process, was produced by passing the juice through a bed of anion-exchange resin. This treatment removed 80 to 90% of the malic acid and variable amts. of As derived from spray residues. Treatment with a cation- and then an anion-exchanger removed 50 to 80% As, while a 3-step (anion-cation-anion) exchanger removed 96% As. The use of a cation-exchanger removed 90% of the ash. A final liming step freed the juice of pectin and nearly all Pb.

6638. Cotter, S. E. **Vallez filter operations and recovery of kieselguhr mud.** *Sugar Ind. Engrs.' Papers* 6, 5 pp. (1945); *Intern. Sugar J.* 48, 178-9 (1946).—*C.A.* 40, 1338[1]. Manipulations were described.

6639. Deerr, Noel. **Precipitation of magnesia as an aid to settling and its possible application to the sugar industry.** *Intern. Sugar J.* 47, 269-71 (1945).—*C.A.* 40, 1337[8].

The rate of settling of a suspension of $CaCO_3$ in water could be greatly increased if a small quantity of $Mg(OH)_2$ was pptd. within the body of the suspension. The rate of settling and mud vol. in juice clarification was dependent on the natural Mg content of the juice. When a deficiency occurred, requisite quantities of Mg may be added.

6640. Gayle, F. L. **Production of sugar, sirup, molasses, and bagasse from cane in Louisiana.** *La. State Univ. Eng. Expt. Sta. News* 1, No. 3, 11-17 (1945).—*C.A.* 40, 755[5].

Material balance data were given for 1935-44. Juices treated with ion-exchange materials gave a mild-flavored, edible molasses and 10-14 lb more of sugar per ton of cane.

6641. Gutleben, Dan and Harvey, Frank. **Report on the Vallez zeolite process at Mt. Pleasant, Michigan.** *Intern. Sugar J.* 47, 11-13 (1945).—*C.A.* 39, 1771[7-9].

The juice goes to tank A contg. the cation exchanger, then to tank B contg. carbon, and finally to tank C contg. the anion exchanger. The juice comes from tank A at a pH of 2.5 and so must be kept cool (20°C) to prevent excessive inversion. The juice from tank C had a pH of 11. When the pH of the juice from tank A rose above 3 regeneration of the exchanger was necessary; when the pH of the juice from tank C fell to 7, that exchanger needed regeneration. Regeneration in tank A was accomplished with 0.5 *N* H_2SO_4 and in tank C with 1% NaOH soln. The cation exchanger could be regenerated indefinitely with little loss in capacity. The anion exchanger did not maintain its efficiency after several hundred cycles. However, its capacity was 12 kilograins per ft^3 or about twice that of the cation exchanger. The cost of equipment to remove 1000 kilograins of ash between regenerations would be $15,000.

6642. Naugle, John J. **Purifying cane juice with Elguanite.** *La. State Univ. Eng. Expt. Sta. News* 1, No. 3, 17-18 (1945).—*C.A.* 40, 7554.

Juice treated with Elguanite could be filtered rapidly without settling after the primary and secondary defecation. Sirup from this juice had better color, flavor, and odor than the sirup from the usual lime defecation, and gave sugars very light in color and superior molasses.

6643. Salinas, J. G. **Importance of the pH of crude juice and its effect of the filterability of the sugar.** *Meml. con. anual, Asoc. técnicos azucar., Cuba* 19, 206-11(1945).—*C.A.* 40, 5588[8].

The increasingly bad filterability of Cuban raw sugars was ascribed to a progressive deficiency of P_2O_5 in the cane juice, which in turn was due to progressive depletion of the reserves of P_2O_5 in the soil and failure to use sufficient phosphate fertilizer. Enlargement or change of design of the clarifying equipment would not change the situation. The ratio between percentage of P_2O_5 in the juice and percentage of nonsugars referred to 100 parts of Brix should not be less than 10; the added P_2O_5 as liquid H_3PO_4, should produce or be accompanied by a pH of 5.0-5.2.

6644. STEWART, C. W. **Sugar research.** *Louisiana State Univ. Eng. Expt. Sta. News* 1, No.1, 2 (1945).—*C.A.* 40, 4235^6.

Research at the Audubon Sugar Factory, included an investigation of ion exchange and removal to produce a high-grade sirup and direct-consumption sugar without conventional lime treatment, and a defecation process at lower temps. than usual without clarification. Effect of trash on grinding rate and on purity drop between crusher juice and mixed juice was observed.

6645. SUZUKI, KAKUO. **Crystallization of cane sugar in the presence of manganese sulfate.** *J. Soc. Chem. Ind. Japan* 48, 39-40 (1945).—*C.A.* 42, 6557*i*.

The presence of 0.002% of $MnSO_4$ promoted the crystal growth of cane sugar.

6646. WEYMOUTH, L. E. AND MILLER, M. C. **A Tyndallimetric study of refinery liquors.** *Intern. Sugar J.* 47, 325-7(1945).—*C.A.* 40, 1336^9.

Studies were made on 2.5-hr filtration cycles of washed sugar and raw sugar. The Tyndall effect decreased in intensity during the first hr but no improvement was observed from then to the end of the 2.5-hr period. In one run a 13.2-foot candle turbidity at the start decreased to a 4.0-foot candle turbidity. The latter stages of the filtration were most efficient in turbidity removal.

6647. YEARWOOD, R. D. E. **Experiments in deliming clarified juice.** *Intern. Sugar J.* 47, 102-4 (1945).—*C.A.* 39, 2895^9.

Tri-sodium phosphate was a cheap and efficient deliming agent. There was considerable variation in the efficiency of the deliming (wt of ppt. obtained expressed as percentage of theoretically precipitatable Ca) of various juices with identical conditions. Efficiencies between 28% and 120% occurred. The low results were believed to be due to overripeness of the cane at the time of processing.

6648. ALVAREZ, ALEJANDRO S. **Methods of purification of cane juice.** *Bol. estac. exptl. agr. Tucumán* No. 56, 13 pp. (1946).—*C.A.* 40, 6277^4.

With hot sulfuring (48-50°C) followed by a single liming and heating as a standard of comparison the following procedures were studied: (1) hot sulfuring (equiv. to 0.10-0.16% as CaO) followed by fractional liming and double heating, (2) cold sulfuring followed by fractional liming and double heating, (3) high sulfuring (equiv. to 0.16-0.19% as CaO) followed by a single liming and heating. Best results were obtained by high sulfuring in the cold, liming to pH 6.3-6.4, heating to 85°C, liming further to 6.8-6.9, and boiling for 1-1/2 min. High sulfuring in the cold followed by a single liming and heating was recommended.

6649. ALVAREZ, ALEJANDRO S. **Does clarification increase or decrease the purity of the cane juice?** *Bol. estac. exptl. agr. Tucumán* No. 57, 3-11 (1946).—*C.A.* 41, 609*f*.

Clarification with SO_2 and CaO raised the purity of the juice of some varieties, but lowered that of the juice of others. The most satisfactory results of clarification were obtained by high sulfitation in the cold followed by single liming and heating, the next best results by sulfitation in the cold with fractional liming and double heating.

6650. ARVIDSSON, MARTA. **Leaching of Jerusalem-artichoke slices and purification of artichoke juice.** *Socker Handl.* 2, 349-55 (1946).—*C.A.* 41, 1476*g*.

Only part of the sugar was extd. in the cold; the rest was obtained after heating to 80°C. The residue contained a small amt. of insol. inulin. The juice contained no true proteins of high mol. wt; Pb acetate, lime, alc., and activated carbon removed only about 0.1 of the N.

6651. BALEZIN, S. A. **Solubility of lime in sugar solutions in the course of the condensation of formaldehyde into sugar.** *Bull. acad. sci. U.R.S.S., Classe sci. chim.* 1946, 355-61.—*C.A.* 42, 7135*g*.

The soly. of $Ca(OH)_2$ in solns. of sugars increased with concn. of the sugar without any appreciable change of pH. Concurrent volumetric and gravimetric detns. gave for the soly. of CaO, with 0, 0.25, 0.5, 1.0, 2.0, 5.0, 15.0, and 20.0 g glucose/100 ml soln., resp., 0.112, 0.118, 0.142, 0.185, 0.264, 0.710, 2.157, and 2.400 g CaO/100 ml, corresponding to 0, 48.0, 28.0, 18.0, 15.0, 14.0, 14.0, and 12.0 g CaO/100 g glucose. In the course of condensation of HCHO to sugar in the presence of $Ca(OH)_2$, the soly. of the latter increased with the progress of the condensation reaction.

6652. BLACK, R. F. **Mechanical filtration with metal filter cloths.** *Intern. Sugar J.* 48, 207-8 (1946).—*C.A.* 40, 6856^9.

Washed raw sugar was filtd. with regenerated kieselguhr and the presses partially sweetened-off. The sluicings from the Sweetlands were recovered and further sweetened-off on an Oliver filter, and this kieselguhr again used in the affination sirup filtration. The affination sirup Sweetlands were similarly partially sweetened-off, the heavy sluicings going to a thickener Oliver and from the thickener Oliver to two other Olivers where the cake was further sweetened-off and sent to the regenerating kiln. A monel metal-cloth filter leaf for the Sweetlands and metal-cloth cover for the Oliver filters has been developed.

6653. COALSTAD, S. E. **The filtration of subsider muds and the effect of bagacillo as a filter aid.** *J. Soc. Chem. Ind.* 65, 175-80 (1946).—*C.A.* 40, 6853^9.

The most important constituents of subsider mud at Kalamia mill were CaO, 9.18%; P_2O_5, 8.62%; cane wax, 12.92%; and fiber (bagacillo), 40.15%. The filterability of filter mud with varying percentages of bagacillo as filter aid was studied. The effect of the filter aid was estd. by computing the sp resistance of the cake for different amts. of bagacillo added at 60°, 75°, and 90°C. The reciprocal of the sp resistance was employed as a measure of the permeability of the filter cake.

6654. Coppin, C. A. **Preparation of lime for juice clarification in Barbados.** *Intern. Sugar J.* **48**, 40-1(1946).—*C.A.* 40, 3011^6.
Freshly slaked lime was much more active for clarification than air-hydrated lime. Lime hydrated with a large excess of water in one dose gave by far the most reactive product. It had a very low settling rate. This colloidal lime gave a better clarification and a lower Ca content in the clarified juice.

6655. DeWhalley, H. C. S. and Gray, P. E. **Invert sugar determination in refined white sugar.** *Intern. Sugar J.* 48, 212(1946).—*C.A.* 40, 6855^4.
Difficulty in using the methylene blue method is probably accounted for by the fact that two commercial prepns. of methylene blue are available. One is Zn-free and the other contains 13 to 15% $ZnCl_2$. Only the Zn-free product will give consistent results.

6656. Doss, K. S. Gururaja and Jain, N. S. **Mechanism of demineralizing action of calcined bauxite on cane juices.** *J. Sci. Ind. Research* (India) 5B, 4-5 (1946).—*C.A.* 41, 3643*i*.
The use of calcined bauxite to produce high-purity, low-ash low-phosphate, and low-viscosity sirups was discussed. Very little Ca ion was adsorbed from pure $CaCl_2$ soln. by bauxite, but the adsorption was induced by phosphate ion. Its addn. to juices deficient in adsorable anions was recommended.

6657. Fitzwilliam, C. W. and Yearwood, R. D. E. **Suitability of ion-exchange processes for use in the manufacture of raw sugar.** *Imp. Coll. Trop. Agr., Trinidad, Sugar Technol. Circ.* No. 60, 8 pp. (1946); *Intern. Sugar J.* 49, 69-73 (1947).—*C.A.* 43, 4499*h*; 41, 4665*d*.
The cation-exchange process operating in the Na cycle was effective in removing objectional Ca ions from clarified cane juice. The process did not cause inversion. Cost of NaCl alone was greater than the av. expenditure on labor and chemicals for cleaning evaporators in Trinidad. A heavy capital outlay was involved and labor of a fair standard of intelligence would be required for its operation. The yield of sugar would be slightly less.

6658. Haagensen, E. A. **Ion exchange applied to sugar-juice purification.** *Sugar* 41, No. 4, 36-41 (1946).—*C.A.* 40, 3632^4.
A 10-day exptl. run treating 20,000 gal of 2nd carbonation beet juice per day with ion exchangers was described. The treatment removed 72.6% of the total nonsugars, 92.5% of the ash, 90.8% of the N. The invert sugar increased from 0.05% to 0.34%. From the juice analyses before and after treatment it was calcd. that the sugar recovery increased 10.5% and the molasses production decreased 20.8%, but the molasses was free from impurities that caused a bitter taste.

6659. Haagensen, E. A. **Ion exchange applied to beet-juice purification.** *Intern. Sugar J.* 48, 240-2(1946).—*C.A.* 41, 303*c*.
In a pilot-plant operation using ion exchangers, recoveries of 95-96% of the sugar were obtained without the use of Steffenizing. In order to avoid inversion at the low pH obtained in the cation exchanger, a very large bed was used and the rate of flow adjusted so that the juice never remained longer than 3-1/2 min. at the low pH. The temp. was maintained at 20°C.

6660. Halvorsen, Gordon G. and Bollaert, A. R. **Defecation of refinery sirups.** *Ind. Eng. Chem.* 38, 385-9 (1946); *Intern. Sugar J.* 48, 264-5 (1946).—*C.A.* 40, 3632^7; 41, 301*h*.
The addn. of H_3PO_4 and lime to refinery sirups between the centrifugal (line) pump and the filter minimized the mech. breakdown of the Ca phosphate flock and produced defecated sirups with excellent clarity with an adequate rate of filtration. Sirups with better clarity, less color, lower content of lime salts and longer filtration cycles were obtained by the addn. of the H_3PO_4 before the lime.

6661. Helmer, N. Arthur. **Pressure settling in clarification.** *Sugar* 40, No. 7, 37-8(1946).—*C.A.* 40, 5940^1.
Settling of limed juice was speeded up by the use of a closed vessel under pressure. The scums were reduced in bulk by the pressure, formed larger aggregates, and sank rapidly to the bottom. The app. could be operated at high temp.

6662. Manoff, Isaac. **The filter press cake produced in some sugar factories of the province.** *Rev. ind. y agr. Tucuman* 36, 105-12 (1946).—*C.A.* 41, 6425*b*.
The cane variety ground appeared to have little effect of itself, but the juice from some of the newer varieties required larger quantities of SO_2 and CaO for clarification. This increased the muds. The most important factor has been the use of juice strainers with larger perforations, 2 mm instead of the usual 1-1.2 mm, which allowed a large quantity of bagacillo to pass into the juice.

6663. Pedrosa, Puertas Rafael. **Automatic instrumentation in the sugar industry.** *Mem. asoc. técnicos azucar. Cuba* 20, 277-83 (1946). —*C.A.* 41, 7781*i*.
Discussion of appliances for controlling juice clarification, d. of juices and sirups, the multiple-effect evaporators, condensers, vacuum pans, furnaces and boilers, steam consumption, and the grinding mills.

6664. Perlman, David; Dorrell, Wm. W, and Johnson, Marvin J. **Effect of metallic ions on the production of citric acid by** ***Aspergillus niger.*** *Arch. Biochem.* 11, 131-43, (1946).—*C.A.* 40, 7508^3:
Optimim amts. of citric acid were obtained with 100-140 g sucrose and 0.1-10 mg Fe per liter, depending on the strain of *Aspergillus niger* used. Good yields were obtained with com. grades of glucose and sucrose if the cations were first removed and the soln. fortified with Fe.

6665. Salinas, J. G. **Influence of the system of cane culture on the clarification.** *Mem. asoc. técnicos azucar. Cuba* 20, 269-72 (1946).—*C.A.* 41, 7781*f*.
If the index of clarification is less than 10, the clarification of the juice will be medium or

poor; if greater than 10, the clarification will be good or excellent. In case the index is less than 10, H_3PO_4 should be added to the juice in appropriate amt., but it will be more rational and profitable to add it as fertilizer on the cane field where it becomes a constituent of the juice.

6666. SILIN, P. M. **Purification of beet juice by ion exchange.** *Sakharnaya Prom.* 19, No. 3, 19-20 (1946).—*C.A.* 41, 2919*h*.

The use of cation and anion exchangers for the purification of beet-sugar juice as practiced at the Mount Pleasant, Mich., refinery was described.

6667. SMART, S. GORDON. **Centrifugal clarification of sugar liquors.** *Intern. Sugar J.* 48, 293-6 (1946).—*C.A.* 41, 1125*b*.

Molasses dild. 50/50 with water was run to an Alpha-Laval type centrifuge rotating at 8000 r.p.m. The mud removed was 5% of the molasses. The polarization was raised from 13.0 to 13.8 and the purity from 27.7 to 29.5. Rates up to 15 gal per hr in the small centrifuge gave complete clarification.

6668. VENTRE, EMIL K.; AMBLER, J. A.; HENRY, H. C.; BYALL, S., AND PAINE, H. S. **Extraction of aconitic acid from sorgo.** *Ind. Eng. Chem.* 38, 201-4(1946).—*C.A.* 40, 2016².

The recovery of aconitic acid from sorgo juices was increased from 42.9% (by usual lime defecation) to 81.7% of the available aconitic acid by defecation with lime and $CaCl_2$. The acid was pptd. as tricalcium aconitate (contg. 13-14% of the Mg Salt) in the optimum pH range of 6.5-6.7. Juices defecated with lime and $CaCl_2$ gave sirups with slightly greater purity than the usual lime defecation.

6669. VERMA, T. N. **Clarification efficiency.** *Indian Sugar* 9, 47-8 (1946).—*C.A.* 40, 6277³.

The use of purity-rise from mixed juice to to clear juice as a measure of clarification efficiency was criticized. This rule made no distinction between removal of nonsugar and pol lost in press mud.

6670. VOLOKHVYANSKIĬ, V. M. **Exchange-sorption method of purifying sugar solutions.** *Sakharnaya Prom.* 1946, No. 10, 20-3.—*C.A.* 43, 6444*b*.

A sugar soln. (pH 6.8) was colored with the decompn. products of invert sugar. A 2nd soln. of the same concn. and pH was colored with caramel. Both were treated with Norit C. The soln. colored with caramel, in which the colored substances were present in the form of free acids, was decolorized 4.8 times more effectively than the other soln., in which the coloring matter was present as Na salts. Thus cations must first be removed by the use of a H-cation exchanger. In the tech. method developed the sugar soln. was first treated with such a sulfocarbon obtained by treating mineral coal with H_2SO_4 and then with an adsorbent (a carbon from peat or bone char). A tech. sugar soln. of 11-16° Brix was filtered first through sulfocarbon, then through carbon. The sulfocarbon was regenerated with H_2SO_4 or HCl and the carbon with NaOH or Na_2CO_3. The consumption was about 1% sulfocarbon and 1.5% carbon.

6671. YAPASKURT, V. V. **Techological processes for obtaining sugar of high purity in sugar factories.** *Sakharnaya Prom.* 19, No. 12, 9-13 (1946).—*C.A.* 44, 357*i*.

Detailed description was given of 4 processes, whereby the raw sugar was converted to one of high purity by special treatment of the different centrifugal sirups.

6672. AMBLER, J. A. AND ROBERTS, EARL J. **Determination of aconitic acid in sugarhouse products.** *Anal. Chem.* 19, 877-8(1947).—*C.A.* 42, 780*d*.

The decarboxylation method was applied to sugarhouse and refinery products. SO_2 was the only interfering compd., and it could be removed from the decarboxylation gases by washing with a satd. soln. of $K_2Cr_2O_7$ acidulated with H_2SO_4.

6673. ANGELESCU, E.; NICOLESCU, I. V., AND TIGOIU, A. **Kinetic studies on the extraction of sugar from molasses.** *Natl. Cercetari Tehnol.* 2, 64-71(1947).—*C.A.* 42, 9212*h*.

The sugar was retained on the surface of the lime by a reaction between the primary OH groups and CaO. A secondary reaction of CaO with H_2O reduced its ability to retain saccharose on the surface. Expts. were made to study the behavior of the system in the case of molasses. The general behavior of the system was identical with that of a sugar soln.-CaO system.

6674. BENIN, G. S. AND SHNAIDER, E. E. **Application of ion exchanger in beet-sugar industry.** *Sakharnaya Prom.* 20, No. 6, 9-13 (1947).—*C.A.* 42, 5696*i*.

Expts. with different brands of ion exchangers demonstrated that they could be successfully applied in the beet-sugar industry. Duolite C-3 and A-2 did not lose their efficiency on regeneration. Absorption of inorg. matter varied between 98 and 99%, organics 73-79%, N 80-88%, and coloring matter 98.3-98.6%.

6675. BINKLEY, W. W. AND WOLFROM, M. L. **Recovery of sucrose from cane blackstrap and beet molasses.** *J. Am. Chem. Soc.* 69, 664-5 (1947).—*C.A.* 41, 3645*d*.

When either cane blackstrap or beet molasses was adsorbed on a suitable clay and the chromatogram so obtained developed with 95% EtOH, a high-purity cryst. sucrose was recoverable from the effluents. The yield was 74% of the sucrose present for blackstrap molasses and 93% for beet molasses.

6676. BLOCK, EMANUEL AND RITCHIE, RICHARD J. **Ion exchange—operation of a commercial-scale plant for demineralization of cane sirups and molasses.** *Ind. Eng. Chem.* 39, 1581-4 (1947).—*C.A.* 42, 1441*a*.

The demineralizing system consisted of a cation-exchange unit, a granular carbon bed, and an anion-exchange unit. Capacity losses of the exchange materials offered a serious problem. Catex lost 11% of its capacity in 223 cycles. The Anex loss was much greater. Deacidite lost

8% of its capacity in 123 cycles. The loss was greatest with the poorly defecated molasses. A 75° Brix sirup must be dild. to 33° Brix to go to the exchanger beds. There were required per battery 13,000 gal regenerating solns., 10,000 gal rinse water, and 40,000 gal back-wash water. The battery consisted of a 610 ft^3 cation-exchange bed and a 370 ft^3 anion-exchange bed. It was doubtful that blackstrap molasses can be economically converted to an edible sirup by this method.

6677. Brueniche-Olsen, H. **The physical chemistry of the second carbonation in the beet-sugar industry.** *Sugar* 42, No. 10, 34-6 (1947).—*C.A.* 41, 7783*h*.

A new term, *"effective alky.,"* was defined as the difference between the alky. on titrating to pH 9.25 and the CaO content, both detd. on 1st carbonation juice. The effective alky., but not the natural alky., plotted against the min. CaO content or against the optimum alky., gave well-defined curves. The min. CaO content found for actual beet juices was somewhat greater than that of artificial juices of similar compn. This was due to a supersatn. phenomenon, which could be eliminated by longer contact of the carbonated juice with the filter cake.

6678. Buck, R. E. and Mottern, H. H. ***l*-Malic acid as by-product in apple sirup manufactured by ion exchange.** *Ind. Eng. Chem.* 39, 1087-90 (1947).—*C.A.* 41, 7563*i*.

l-Malic acid can be obtained as the sol. Na salt in the effluent of Na_2CO_3 soln. used as a regenerant for the anion exchanger in the manuf. of apple sirup. The effluent was acidified to pH 5.5 to remove excess carbonate, exapd. to 15-20% malate content, and adjusted to pH 6.0. The Ca salt of 97% purity was pptd. and this was converted to the free acid with H_2SO_4.

6679. Cheng, C. P. and Chang, K. T. **Middle juice carbonation.** *Taiwan Sugar J. Quart.* 1, No. 1, 137-45(1947).—*C.A.* 44, 5127*c*.

The lime consumption could be reduced by 35% without affecting the filterability of the carbonated juice if the crude juice, after the addn. of milk of lime, was concd. to 40 Bé. before the first carbonation. The procedures were illustrated by the expts. performed in the Tsung-yeh factory in 1942, which were, however, not successful. The failure was discussed.

6680. Crespin, Irene. **A study of Australian diatomites with special reference to their possible value as filter media.** *Australia, Bur. Mineral Resources, Geol. and Geophys. Bull* No. 7, 40 pp (1947).—*C.A.* 42, 3103*c*.

Most of the deposits described were small and of low grade, but could probably fill many local needs.

6681. Denisov, P. I. **Apparatus for determining the rate of filtration of clay suspensions.** *Azerbaidzhanskoe Neftyanoe Khoz* 26, No. 11, 23(1947).—*C.A.* 43, 3665*d*.

The app. comprised a manual air pump, and a metal funnel closed with a cover. The funnel cover carried a pressure gage and an inlet which was connected by a rubber tube to the pump.

6682. DeWhalley, H. C. S. and Scarr, M. P. **Microörganisms in raw and refined sugar and intermediate products.** *Chemistry & Industry* 1947, 531-6.—*C.A.* 41, 7781*b*.

Organisms capable of acid production can destroy sugar and lower the yield of white sugar. Inversion of sugar by invertase produced by bacteria can cause inversion of sugar. Frequently acetic or butyric acid is formed and causes bad odors in the finished products. Organisms found include *B. subtilis*, *B. mesentericus vulgatus*, *B. aerogenes*. Troubles have arisen from mesophiles in bag water filtration of liquors from char washing, and dust-collector water. The elimination of bacteria from these steps in the operation is described. The effect of heat and chemicals is also discussed.

6683. Dormal, E. **Treatment and reutilization of waste sugarhouse waters.** *Sucr. belge* 66, 172-82(1947); *Chimie & industrie* 59, 47 (1948).—*C.A.* 42, 7908*b*.

The waste waters at the Raffinerie Tirlemontoise were discussed. The drainage water was first sepd. from the pulp, and the latter then pressed; the drainage and press waters were subjected separately to parellel treatments, sent to holding tanks where they were sterilized with HC10, passed through "Vibro" screens to remove suspended pulp particles, and then decanted to remove org. matter.

6684. Geidelman, M. M. **The operation of lime kilns (of the sugar industry) with low-grade fuels.** *Sakharnaya Prom.* 20, No. 3, 26-9 (1947).—*C.A.* 43, 5979*g*.

The methods described produced lime of sufficient quality to meet the demands of sugar refineries even when low-grade coals were used. Low-grade fuels could be burned in ordinary shaft kilns if the fuel was coarse (65-80 mm) and the supply of air was increased. However, in this case both the flue gases and the milk of lime produced must be purified for use in sugar refineries.

6685. Inglesent, H. and Storrow, J. Anderson. **Corrosion of filters in sugar refineries. I. Investigations using plant liquors.** *Ind. Chemist* 23, 291-7 (1947); *Intern. Sugar J.* 49, 233-6 (1947).—*C.A.* 41, 7785*e*.

A Vallez filter leaf made of phosphor bronze weave on a brass wire backing gave good service with cane-sugar liquors but soon failed when changed to glucose filtration. Expts. showed that the corrosion was due to greater potential differences between the backing wire and the weave in the glucose liquors than in the cane-sugar liquors (0.10 to 0.24 in the one and 0.03 in the other). Monel was strongly cathodic to Fe and may act similarly to the Cu leaves.

6686. Inglesent, H. and Storrow, J. Anderson. **Corrosion of filters in sugar refineries. II. Investigations on prepared liquors.** *Ind. Chemist* 23, 373-9 (1947).—*C.A.* 41, 7785*i*.

Solns. of known concns. of sucrose and NaCl at pH 7 were prepd. with distd. H_2O; glucose refinery liquor (39° Bé., pH 4.6 - 4.7) was dild. to vary its chloride content. Measurements were made at 65°F of p.d. between an Fe anode and cathodes of various other metals. The order of p.d. in sucrose was monel, stainless steel, brass, Cu, phosphor bronze, Fe; in glucose the order was brass, Cu, monel, phosphor bronze, stainless steel, Fe. With increasing contents of sugar, p.d. decreased, but the relative effect varied considerably for the various metals, stainless steel showing comparatively little dependence on sugar concn.

6687. INGLESENT, H. AND STORROW, J. ANDERSON. **Corrosion of filters in sugar refineries. III. Investigation on hot liquors.** *Ind. Chemist* 23, 827-34 (1947).—*C.A.* 42, 4773*e*.

Faults in specifications for filter leaves revealed by the earlier tests at room temps. were generally confirmed for 70°C. Monel metal rapidly became more anodic to bronze as the temp. was raised. In a 30° Bé. glucose sirup stainless steel alone showed a much lower *dE* value. A Vallez filter with a stainless steel Hollander weave handling sugar liquors contg. chlorides failed completely in approx. 2 months. Phosphor bronze, which was more anodic in glucose liquors at lower temps., had a strong tendency to become cathodic at higer temps,

6688. MACADAM, W. T. **Ion-exchange process makes sugar sirup.** *Food Packer* 28, No. 10, 34, 36-7 (1947).—*C.A.* 42, 3100*e*.

The industrial use of ion-exchange systems for recovery of sugars from waste liquors was described.

6689. MAUDRY, EDWARD. **Report on ion-exchange pilot plant-Alvarado, 1946 campaign.** *Proc. Am. Soc. Sugar Beet Technol. Intermountain and Eastern Slope Div.* 1947, 161-71.—*C.A.* 42, 2792*a*.

Raw sugar beet juice was deionized in an anion-cation exchange; av. removal of nonsugars was 89.7 and of ash 98.5%; av. purity of the deionized juice was 96.8, invert sugar 2.09% per 100° Brix (invert in raw juice 0.7%). The process required about 900 gal of water per ton of beets, but a large amt. of this water was recovered as soft water.

6690. MCCLEERY, W. L. **Bentonite secondary clarification of sugar juice in Hawaii.** *Hawaiian Sugar Planters' Assoc. Repts.* 65, 62-3; *Intern. Sugar J.* 49, 49(1947).—*C.A.* 43, 2797*a*.

Used as a secondary clarifying agent, i.e., one which would follow the usual liming stage, bentonite on flocculation was particularly efficacious in removing colloidally dispersed fine material from the clarified juice.

6691. MORRISON, W. S. **Recent industrial applications of ion exchange (on sugar-beet juice)** *Proc. Am. Soc. Sugar Beet Technol. Intermountain and Eastern Slope Div.* 1947, 156-60.—*C.A.* 42, 2791*h*.

In a pilot plant 2nd carbonation juice was deionized in a double cation-anion operation; high purities were obtained but inversion was excessive in spite of low temps. In a single cation-anion exchange there was low inversion and a 9-point increase of purity with 0.001% of ash. The high green sirup, sepd. from the 1st strikes, when concd. and crystd. gave an intermediate ash-free white sugar. The calcd. gain of sugar was 29 lb per ton of beets (82.5 lb per $1.55 investment for regeneration).

6692. PEDROSA PUERTES, RAFAEL. **Error in filter-cake analysis.** *Proc. Assoc. Sugar Technol. Cuba* 21, 177-83(1947).—*C.A.* 42, 9212*d*.

The fine bagassè used as a filter aid with Oliver filters contained about 2.87% of sucrose which had already been accounted for as sucrose in bagasse per 100 cane. Since the amt. of the filter aid was about 10% of the wt of the cake, the apparent loss of sucrose in cake per 100 cane was appreciably too high.

6693. PORTER, LYLE B. **Beet-juice purification by ion exchange.** *Sugar* 42, No. 5, 22-3(1947). —*C.A.* 41, 4665*h*.

In pilot plant tests with 2nd carbonation beet juice, the treated juice had 11.0-12.2 Brix, 99.0-99.5 purity, and a pH of 7.9-6.0. At an operating temp. of 22° the invert sugar rose to 0.48-0.61%, but this could be reduced to 0.13% by working at a lower temp. A large amt. of dark colored colloidal material accumulated in the resin beds, particularly in the cation exchanger. This was removed effectively by backwashing with water of 160° F. Two strikes of white sugar with very low ash content were made Insufficient data were obtained, but the results were encouraging.

6694. RAMONDT, D. **The use of ion exchangers in the sugar industry.** *Inds. agr. et aliment.* (Paris) 64, 269-70(1947).—*C.A.* 42, 2790*i*.

Preliminary tests with the cation exchanger Dusarit and the anion exchanger Asmit upon beet diffusion juice resulted in a colorless effluent. The purity rose from 90.3 to 99.5, the ash % Brix fell from 3.06 to 0.45, but the reducing sugar % Brix rose from 10.6 to 29.3.

6695. RILEY, F. R. AND SANBORN, W. E. **The ion-exchange process has matured.** *Sugar* 42, No. 7, 24-9 (1947).—*C.A.* 41, 7783*e*.

Sugar recoveries of 95-96% were reported from beet juice, without Steffenizing. The purity of the juice was raised to 96-98, with the removal of 95-98% of the ash, and 90% of the org. nonsugars. The treated juice was light colored or water white, and free from Ca salts and colloids.

6696. SALINAS, J. G. **The pH value of mixed juice as a guide to clarification.** *Intern. Sugar J.* 49, 129-31 (1947).—*C.A.* 41, 6071*a*.

Cane juice must contain 0.03-0.035% H_3PO_4 expressed as P_2O_5 based on the weight of normal juice if it is to defecate properly. When the P_2O_5 of a juice is less then 0.03, the pH will exceed 5.4 and defecation will be very difficult. It was recommended that all juices be adjusted to a pH of 5.0 or 5.2 with H_3PO_4 before defecation to improve clarification.

6697. SAVOEI, CHARES C. **Automatic temperature regulation solves problem for Louisiana sugar mill.** *Southern Power and Ind.* 65, No. 11, 72-3(1947).—*C.A.* 42, 781*d*.

The cane juice was heated in closed clarifiers by means of low-pressure exhaust steam, so as to raise the temp. above boiling and below 219°F. This was secured by means of a special temp. control using an invar steel rod in a stainless steel case.

6698. Silin, P. M. and Silina, Z. A. **Solubility of lime sugar solutions during defecation.** *Sakharnaya Prom.* 20, No. 12, 33-4 (1947).—*C.A.* 42, 8501*b*.

A comparison of the soly. of CaO in the form of milk of lime, freshly slaked lime, or dry lime in pure and impure sugars solns. at 80°C was given. The soly. varied considerabley, being the highest when dry lime was dissolved in a juice of about 85% purity.

6699. Smit, P. **Development of the refining of sugar juice with the aid of ion exchangers and synthetic resins.** *Chem. Weekblad* 43, 42-4 (1947); *7th Congr. intern. inds. agr.:, Paris* 1948, Q4, D1-9.—*C.A.* 41, 3644*e*; 44, 9171*d*.

Reactivation of the exchangers was only effective at high temp. while agitating the mass, and adding the reactivating soln. intermittently. The use of SO_2 was the most economic process. The quality of anion exchangers was not yet satisfactory.

6700. Sudzuki, Shimichi; Su, Gon Tinn, and Lin, Suei Fa. **Accelerating effect of defecation filter muds on the alcoholic fermentation of cane molasses.** *Rept. Taiwan Sugar Expt. Sta.* (Formosa) No. 1, 92-100(1947).—*C.A.* 42, 1377*g*.

The filter cake or an aq. ext. therefrom markedly stimulated the fermentation; this effect was not produced by cake obtained in the carbonation process of juice purification, wherein the active substance was evidently pptd.

6701. Ulrich, Edward A. **New filter introduced to sugar industry.** *Sugar* 42, No. 4, 22-6 (1947).—*C.A.* 41, 3643*g*.

The "Niagara" filter consists of a vertical cylindrical vessel with removable cover. The filter frames are tubular in section and rectangular in shape, have metal filter screens, and are inserted in the tank by means of horizontal slotted spacers secured to the tank shell. The leaf outlet nozzle is at the bottom and makes connection with the manifold pipe header. The liquor enters at the bottom of the tank which is provided with a steam or hot-water jacket to maintain the temp. The filter was compared with plate and frame presses.

6702. Ventre, Emil K.; Byall, S., and Furse, R. J. **Crystallization of sorgo juices purified by ion exchange.** *Sugar J.* 10, No. 3, 9-12 (1947); *Louisiana State Univ., Eng. Expt. Sta. News* 3, No. 1, 2-6 (1947).—*C.A.* 41, 7145*f*; 42, 7072*g*.

Centrifuged sorgo juices purified by ion exchange could be concd. and crystd. without the heating, liming, and settling steps which were required in the standard method. Juices purified by ion exchange and crystd. to molasses of 30 purity can yield approx. 4 lb more sucrose per 100 lb of raw juice than the standard method. The final molasses was edible and contained fewer nonsugar solids than the original juices.

6703. Verma, T. N. **One hundred degree mark on the scale of precipitation efficiency.** *Proc. Ann. Conv. Sugar Technol. Assoc. India* 16, Pt. I, 94-99 (1947); *Sugar Ind. Abstracts* 10, No. 8, 82 (1948).—*C.A.* 43, 6847*g*.

Pptn. efficiency could be expressed as the fraction $(P_{cj} - P_{mj})$ 10,000/(100 - $P_{mj})P_{cj}$, where P_{cj} and P_{mj} were the purities of the clarified juice and mixed juice, resp. Raw juice (200cc.) of known Brix was treated with 10 cc. of basic Pb acetate soln. (or 5 cc. for last mill juice), and made up to 220 cc. with distd. water. Polarization and purity were detd. The filtrate contained Pb which made the rise in purity. The Brix of the basic Pb acetate was calcd. for various dilns. of pycnometer detns., and a graph given.

6704. Willcox, O. W. **New developments in sugar techniques.** *S. African Sugar J.* 31, 133, 135, 137, 139 (1947); *Sugar* 43, No. 6, 21-5 (1948).—*C.A.* 41, 4325*e*; 42, 5695*g*.

Progress in field and factory work during 1946 and 1947 was reviewed.

6705. Alvarez, Alejandro S. **The purity of cane juices after clarification.** *Intern. Sugar J.* 50, 16-18(1948).—*C.A.* 42, 2792*b*.

The cane varieties POJ 36, POJ 213, TUC 472, TUC 1316, and TUC 1406 showed purity increases of their juices on clarification. Other varieties, Co 270 and 290, TUC 1376, TUC 2645, TUC 2680, POJ 2725, POJ 2878, and CP 29/230, exhibited a fall. The method of clarification which gives the most satisfactory results with raw cane juices in Argentina is that based on intense cold sulfitation (0.185 CaO per 100 cc.) with liming and single heating at 6.9 to 7.1 pH.

6706. Austerweil, G. **Role of anion exchangers in the industrialization of processes of sugar-juice purification by ion exchange.** *7th Congr. intern. ind. agr., Paris* 1, Pts. 3/4, 22 (1948); *Sugar Ind. Abstracts* 10, No. 8, 87 (1948).—*C.A.* 43, 6443*b*.

To reduce the danger of inversion in the cation exchanger, it was recommended that the juice first be passed through anion exchangers. The amts. of ion-exchange material required for such a process were calcd.

6707. Badollet, M. S. **Research of asbestos fibers—results of recent investigations.** *S. African Mining & Eng. J.* 59, II, 15-17 (1948).—*C.A.* 43, 1125d.

Methods of mech. testing to obtain a more abs. rating of asbestos fiber qualities and of processing the raw material were described. Characteristics of ''soft'' and ''harsh'' fibers and filtration properties were explained.

6708. Barry, E. F. and Gaddie, Robert S. **Ion-exchange purification of low-grade beet sirup.** *Proc. Am. Soc. Sugar Beet Technol.* 5, 674-80 (1948).—*C.A.* 43, 6442*b*.

The plant handled 1/4 of the factory's output of intermediate green sirup from the high raw centrifugals, with cation C3 and anion A2 resins of the Chem. Products Co. The green sirup was dild. to 30 Brix with factory thin juice, cooled, and pumped through the exchange battery. The general result was a reduction of the amt. of low raw massecuite in percentage of beets from the previous 5-year av. of 9.9 to 7.7%, with a net increase of 4.7% in extn. of sugar from the juice and a reduction of 1.22 in molasses percentage on beets. The av. increase of invert sugar as a result of ion-exchange was 1.12%, the molasses contained about 0.5% of invert on dry substance.

6709. Binkley, W. W. and Wolfrom, M. L. **Chromatography of Cuban blackstrap molasses on clay; some constituents of an odor and pigment fraction.** *J. Am. Chem. Soc.* 70, 290-2 (1948).—*C.A.* 42, 2793*d*.

Cuban cane blackstrap (1 kg) was dild. with 250 ml H_2O, made into a paste with 400 g clay, the paste mixed with 3.6 liters abs EtOH and 2.4 liters acetone, the ppt. washed with 3 liters acetone, the liquors were concd. to approx. 1 liter at 50°C, the concentrate dild. with 1 liter H_2O, and extd. with petr. ether (24 hrs), giving 0.41% of a viscous green liquid. On heating 4.1 g of this at 100-10°/0.03 mm, there resulted 4 g undistd. residue and a distillate which had a strong odor of molasses and gave a ppt. with $2,4\text{-}(O_2N)_2C_6H_3NHNH_2$. The residue (2 g) in 40 ml C_6H_6, passed through 150 g of a mixt. of 5 parts (by wt) of Silene-EF and 1 part Celite, and the chromatogram developed with 1250 ml 500/1 C_6H_6-EtOH gave 5 fractions.

6710. Binkley, W. W. and Wolfrom, M. L. **Chromatography of sugars and related substances.** *Sugar Research Foundation Sci. Rept. Ser.* No. 10, 29 pp (1948).—*C.A.* 43, 425*i*.

A review of the recent developments of chromatography as applied primarily to the sugars. The selection of the proper adsorbents, prepn. of the chromatogram its detection and elution of the various fractions were discussed. Partition chromatography was discussed as a method of end-group assay. Finally, the relation between the adsorption and the functional groups of sugars was presented.

6711. Biswas, H. G. **Manufacture of milk sugar from confectioners' waste.** *J. Sci. Ind. Research* 7, No. 8 B, 130(1948).—*C.A.* 43, 1119*e*.

Fresh confectioners' waste (Whey discarded after sepg. the casein from milk for the prepn. of edible products) was found to yield 2% lactose by wt. The whey (sp. gr. 1.02) was heated in an enamel pan (50 gal) until no more surface scum was formed, filtered through twill cloth, concd. to the consistency of molasses, and allowed to crystallize overnight. The brown cryst. mass was purified by dissolving in water (1:6) in a 25-gal double-jacketed steam pan after adding $MgSO_4$ (0.75%), glacial AcOH (7 cc./liter), and decolorizing charcoal (3%), boiled for a short while, and filtered through cloth bags. The clear filtrate was concd. in a vacuum pan and allowed to crystallize in shallow enamel pans.

6712. Bliss, Lesmoir R. **The routine control of phosphates in juice clarification.** *Intern. Sugar J.* 50, 205-7(1948).—*C.A.* 42, 8502*i*.

The liming process formed hydrated $Ca_3(PO_4)_2$ which adsorbed the colloids. If the phosphate was below the min. level, poor clarification resulted. The routine control involved the detn. of the phosphate requirement for a given juice and the total phosphate in the juice. H_3PO_4 was then added in sufficient amt. to fulfill the requirements.

6713. Challinor, S. W.; Kieser, Margaret E., and Pollard, A. **Effect of ion-exchange treatment on the stability of apple juice.** *Nature* 161, 1023-5 (1948).—*C.A.* 42, 6953*g*.

Depectinized and pulp-filtered apple juices were passed through columns of the Permutit ion-exchangers De-Acidite *B* and Zeo-Karb *H* 1. Ash was reduced to 1% of its original value by two passages through Zeo-Karb with intermediate passage through De-Acidite to reduce acidity. Yeasts that grew well on the original juice showed little or no growth in the treated juice adjusted to the original pH. After addn. of salts considerable growth was noted.

6714. Chamberlin, R. C. **Ion exchangers in the manufacture of sirups.** *7th Congr. intern. ind. agr., Paris* 1, Q4-G (1948); *Sugar Ind. Abstracts* 10, No. 8, 90 (1948).—*C.A.* 43, 6442*a*.

Since 1945 colorless sirups, free from ash, have been prepd. from raw cane sugar by dissoln. to 65% soln. in water, filtration through used vegetable carbon, ion-exchange purification, inversion if necessary, evapn. to 75% sugar soln., and filtration through fresh vegetable carbon. The process was described in detail.

6715. Cheng, C. P. and Loo, S. H. **Experimental results of middle juice carbonation.** *Taiwan Sugar J. Quart.* 1, No. 3/4, 1-8(1948).—*C.A.* 44, 5127*a*.

The mixt. of crude cane juice and milk of lime was concd. to 35°-38° Brix before subjecting to the first carbonation. The two isoelec. points of crude cane juice ($pH = 7$ and $pH = 11$) were thus both utilized for the pptn. of non-sugar impurities. Expts. carried out in Sing-yin Factory for 53 days indicate: (1) 19.03% more nonsugar impurities removed, (2) 2.22% more sugar and 15% less molasses produced, (3) 43.39% less limestone and coke and 71.43% less soda ash consumed, and (4) higher filterability achieved.

6716. Chugunov, I. G. **Role of cold defecation.** *Sakharnaya Prom.* 22, No. 10, 10-20 (1948); *Sugar Ind. Abstracts* 10, No. 12, 140-1 (1948).—*C.A.* 43, 6847*i*.

Cold defecation was important with unripe, defrozen, or rotted beets; with subsequent heating to 85-90°C before satn., very good results were obtained. The effect was greatest in first satn., the color being much improved. The soly. of lime during cold defecation was, owing to semisaccharate formation, 4 to 5 times that in hot defecation; on heating before satn., the saccharate hydrolyzed and the lime dissolved (1.2-1.3% CaO). With CO_2 there was then a large formation of fine $CaCO_3$. With cold defecation, the lime used was 0.5-0.8%, against 1.5-1.8% for hot defecation.

6717. Clendenning, K. A. **Copper corrosion and its control in starch-sirup manufacture.** *Can. J. Research* 26F, 277-83(1948).—*C.A.* 43, 889*b*.

Whereas water at 1.9 pH will dissolve 306 mg of Cu per cm^2 at 100°C in 16 hrs, 16° Bé. starch sirup will dissolve only 13.2 mg. The amt. of Cu in the sirup can be lessened markedly if the acid is added to the starch slurry instead of the prime water. Cu removal at the neutralization stage was promoted by protein impurities, high pH, and hot filtration. At a level of 200 p.p.m. of Cu, activated carbon will remove only about 20% of the Cu, while bone char will remove 99%.

6718. Clendenning, K. A. and Wright; D. E. **Production of sirups from wheat, potato, tapioca, and waxy cereal starches.** *Can. J. Research* 26F, 284-96 (1948).—*C.A.* 43 888*i*.

Wheat, corn, and waxy corn slurries hydrolyzed at approx. the same rate with 0.2% HCl, whereas potato starch hydrolyzed less rapidly. All sirups decolorized completely with 0.5% activated carbon at 14° or 30° Bé. Contamination with 1.6% protein did not affect the hydrolysis rate but it did promote foaming, turbidity and a bitter taste. Color and fluorescence development in stored sirups was also promoted by proteins. Acid-extd. carbon or bone char gave most efficient decolorization.

6719. Dědek, J. **Chemistry of lime salts in sugar-beet juices.** *Proc. Am. Soc. Sugar Beet Technol.* 5, 595-610 (1948).—*C.A.* 43, 6443*i*.

Review of the most important practical experience bearing on the behavior of lime salts.

6720. Dědek, J.; Ivancenko, D., and Zerkalej, V. **Ion exchangers in sugar-beet technology.** *Listy Cukrovar.* 65, 69-72(1948).—*C.A.* 43, 4500*g*.

Satd. juices, filtered through artificial ion exchangers, lost 72% of the apparent nonsugars, 59% of the org. nonsugars, 87% of the ash, 98% of the CaO, 85% of the K_2O and Na_2O, 75% of the total N, 65% of the tannin-pptd. N, 65% of the W-pptd. N, 62% of the N detd. by the Van Slyke method, 80% of the unspecified N, 70% of the CO_2, and 84% of the coloring substances.

6721. Devillers, R. **Chromatography and the Sugars.** *J. fabr. sucr.* 1948, 177-9; *Sucr. belge* 69, 168(1949).—*C.A.* 43, 4033*h*.

Chromatoraphy and its utilization in sugar purification was discussed. A detn. of the exact compn. of the juice in different stages of refinement, even that of molasses, was possible.

6722. Dickinson, B. N. **Ion exchange in beet-sugar refining.** *Chem. Eng.* 55, No. 7, 114-17 (1948).—*C.A.* 42, 8002*i*.

A general description of the use of ion exchange was given for three plants.

6723. Dolinek, A. **Experiences with continuous Russian saturation.** *Listy Cukrovar.* 65, 99-102 (1948-9); *Sugar Ind. Abstracts* 11, 36 (1949).—*C.A.* 45, 3627*i*.

Limed juice entered in countercurrent over a distributor plate in a continuous process. Very even gas distribution is attained, and the consumption much less than that required for discontinuous satn. Difficulties were encountered in 1947/8 owing to the poor quality of beets, necessitating a higher degree of liming, and greater care to ensure complete satn. Gas must be introduced before the juice fills the vessel, to obviate excessive foaming. Satn. was controlled on a basis of the color and alky. of the juice. Temps. were 85-88°C for 1st satn., 95-100°C of 2nd satn. Alky. could be controlled to 0.056-0.102% CaO, and 0.010-0.024% CaO, resp.

6724. Doormaal, J. J. van. **Manufacture of sugar from molasses by the use of an ion exchanger.** *7th Congr. intern. ind. agr., Paris* 1, Q4-G (1948); *Sugar Ind. Abstracts* 10, No. 8, 90 (1948).—*C.A.* 43, 6442*e*.

Beet molasses, dild. to 40° Brix, was passed through a cation exchanger, neutralized with lime, concd., and crystd; 60 to 70% of the sugar was recovered. Lime salts were not melassigenic.

6725. Dubourg, J. **Ion exchangers in the sugar industry.** *J. fabr. sucre* 89, 48-50 (1948); *Sugar Ind. Abstracts* 10, No. 4, 39 (1948).—*C.A.* 43, 4034*h*.

Ion exchange was applied to beet juice after 2nd carbonation. The exchangers were exhausted in 1 hr; regeneration took 1 hr. The juice, cooled to 20-25°C to prevent subsequent inversion, was treated first with the cation exchanger, coming out with a pH about 2.5, and then with the anion exchanger, after which the pH was about 6.7. Air bubbling eliminated most of the H_2CO_3 produced by the process, and after heating the pH was nearly 7.0. The re-heating unit also acted partially as a cooling unit for incoming juice.

6726. Dubourg, J. and Lemaitre, A. **Peculiarities of the precipitation of calcium carbonate in sucrose solutions.** *Inds. agr. et aliment* 65, 273-8(1948).—*C.A.* 43, 3221*e*.

The ppt. produced by batch carbonation of a clear soln. contg. 12% of sucrose and 1.2% of lime settled most rapidly when the final alky. was 0.4, but the ultimate vol. of the ppt. was about the same at a final alky of 1.2, 0.4, or 0.0. With the final alky. at the optimum point the ppt. settled more rapidly the higher the initial alky. Batch carbonation yielded a flocculent conglomerate of $CaCO_3$ particles which occupied a much larger vol. than the well-formed crystals produced by continuous carbonation.

6727. Efron, Aaron and Blom, R. H. **Production of maltose sirup from granular wheat flour.** *Ind. Eng. Chem.* 40, 412-15(1948).—*C.A.* 42, 3903*g*.

The wheat flour must be extd. with water to remove the sol. protein. Either malt or fungal amylases can be used for the conversion, and the finished sirups were equally good with respect to protein content, color, and clarity. The process involved 4 steps: (a) cooking the grain to render the starch accessible to the enzyme; (b) enzyme conversion of the cooked mash; (c) clarification of the mash; and (d) refining and concn. of the thin liquor. Bentonite greatly reduced the sol. protein in the sirup.

6728. ELLISON, HAROLD E. AND PORTER, LYLE B. **First campaign results of de-ionization at the Layton Sugar Company.** *Sugar* 43, No. 3, 30-4 (1948).—*C.A.* 42, 3599*i*.

The de-ionizing plant (1350 tons of beets daily) consisted of 4 cation units, 10×14 feet, with an 8-foot resin bed, 4 anion units, 10×11 feet, with a 5.5 foot resin bed, and the resin-regenerating equipment, completing a service cycle in 1.75 hrs. The operations were described in detail. Second carbonation juice, cooled by means of heat exchangers, was used as raw material. The extn. was 92.03%, against 85% by straight house operation.

6729. FITCH, E. B. AND MICHENER, J. W. **Nonsugars in beet juices removable by ion exchange.** *Proc. Am. Soc. Sugar Beet Technol.* 5, 696-704 (1948).—*C.A.* 43, 6442*f*.

Thick juice was dild. and passed through a lab. cation unit. Ionized ash constituents and simple amino acids, including betaine, were 99.9% removed until a certain percentage of the exchange capacity of the bed was used up. However, this was accomplished only when the bed had been exhaustively regenerated (9 vols. of HCl and upward flow in regeneration). An exhaustively regenerated anion bed (30 vols. of ammonia soln.) can remove from the decationized juice all anions whose acids have an ionization const. of about 10^{-7}. This includes SO_4^{--}, Cl^-, NO_2^-, and NO_3^-, and apparently all org. nonsugars passed by the cation bed, including pyrrolodone carboxylic acid, browning-reaction products, org. nitrates or nitrites, polypeptides, and perhaps some org. N compds.

6730. FORT, C. A. **Comment on the use of ion-exchange resins in demineralizing sugar-beet juices.** *Proc. Am. Soc. Sugar Beet Technol.* 5, 704-8 (1948).—*C.A.* 43, 6442*i*.

The cost of ion-exchange operation depended on the concn. of minerals in the beets and the effect of the compn. of these minerals on the amt. of addnl. sugar recovered. The range of sulfated ash in U.S. beets was 0.4-0.8%, which meant a 100% range in required capacity and operating cost.

6731. GARINO, MARIO. **Ion exchange in the purification of sugar juices.** *Ind. saccar. ital.* 41, 103-6 (1948).—*C.A.* 42, 8003*i*.

Preliminary expts. with Amberlite cation and anion resins gave prospects of industrial success. To eleminate 1 g of nonsugar substance, it was necessary to use 15.5 g of resin.

6732. GOLOVIN, P. V. AND SUSHKOVA, A. S. **Solubility of lime in sugar solutions.** *Sakharnaya Prom.* 21, No. 5, 25-6(1948).—*C.A.* 42, 8501*c*.

Soly. of CaO in pure sugar solns. increased when lime was added to a cold soln. which was then heated. Addn. of lime to a hot sugar soln. decreased its soly. Non-sugars in diffusion juices have little if any effect on the soly. of lime.

6733. GUNDERMAN, ERICH. **The colloidal materials of technical sugar solutions.** *Kolloid-Z.* 111, 111-22 (1948).—*C.A.* 44, 6177*f*.

The colloidal properties of diffusion juice, press juice, filtered thin juice, sulfured juice, and molasses were investigated. Acids coagulated more than 92% of the colloidal material, bases only about 77%. Some of the color of impure beet juices was due to the colloid content, which was chiefly electroneg. and irreversible in character. Normal purified beet juice appeared clear, but always contained finely-dispersed colloidal material. This consisted of "organic Ca salts", N compds. which were largely albuminous in nature, silicic acid, Fe oxide, and clay. Only a small part of the coloring matter of molasses was retained on the ultrafilter. Some org. Ca salts were also found in molasses, as well as in tech. sugar solns.

6734. HAAGENSEN, E. A. **Full-scale ion-exchange operations in a beet-sugar factory.** *Proc. Am. Soc. Sugar Beet Technol.* 5, 690-5 (1948).—*C.A.* 43, 6441*h*.

A short test run with beets of low quality gave a nonsugar removal of 82.5%, with 56% N removal. It seemed feasible to produce 60-purity molasses. Chem. consumption was 25 lbs of 93% H_2SO_4 and 6 lbs of anhyd. NH_3 per ton of beets.

6735. HANDELMAN, M. AND ROGGE, R. H. **Ion-exchange refining of dextrose solutions.** *Chem. Eng. Progress* 44, 583-90 (1948).—*C.A.* 42, 8501*e*.

The acidified raw dextrose soln. regenerated ash from the partially exhausted cation bed in the first position of the triple-pass system. This trouble was corrected by placing the anion-exchange resin ahead of the cation-exchange material. On continued service, the anion resin was modified by the process liquor to such an extent that a substantial quantity of the alkali regenerant was held by the resin despite excessive rinsing. Acidified process liquors liberated this ash and increased the ash content of the process liquor.

6736. HÄUSLEROVÁ, O. **Changes in the composition of heavy liquors during storage.** *Listy Cukrovar.* 64, 133-5(1948).—*C.A.* 42, 3601*c*.

Ten samples of heavy liquors from raw-sugar factories and 5 samples from mixed factories, analyzed before and after a 6-month storage, showed an av. decrease in the quotient of purity from 94.91 to 93.12, an av. decrease in alky. from +0.045% CaO to -0.011%, an av. rise of invert sugar from 0.067% to 0.268% per 100° Bg. and an av. rise in color from 21.66° St. per 100° Bg. to 40.08.

6737. HENRY, JOSSE. **Ion exchangers in the beet-sugar industry.** *Sucr. belge* 68, 84-95(1948).—*C.A.* 43, 1589*b*.

A resumé was given of the use of ion exchangers in U. S. sugar-beet refineries, and of the semi-industrial trials during the last 6 months at Tirlemontoise.

6738. Hruska, Josef. **The refining of raw sugar from cane.** *Listy Cukrovar.* 64, 233-7(1948).—*C.A.* 42, 8002*f*.

Raw cane sugar called gur imported from India into Iran was refined in one of the refineries for beet sugar. A better brand of gur showed an apparent dry substance 94.5, polarization 74, ash 2.33, invert sugar 1.13%; the poor brands showed an apparent dry substance 93.8, polarization 68.8, ash 2.28, and invert sugar 1.30%. Because of much caramelization of the gur the decolorization of the sugar was difficult.

6739. Kaganov, I. N. **Chemical theory of molasses formation.** *Sakharnaya Prom.* 22, No. 3, 21-3 (1948); *Sugar Ind. Abstracts* **10**, No. 8, 94 (1948).—*C.A.* 43, 6848*c*.

The theory based on the "rendement" concept, 1 part of "ash" to 5 parts of sugar, was considered faulty. In final molasses, the sugar/ash ratio (ash coeff.) = about 13; after ion exchange, the ash coeff. = nearly 50. Therefore, the ash was not melassigenic. Molasses formation was considered partly a temp. effect; extn. increased with temp., and the latter must be 90°C for fodder molasses. In an artificially prepd. concd. mixt. of sucrose, fructose, glucose, and maltose, in which the satn. coeff. for sucrose was 1.5-1.7, the sucrose should have crystd. easily; it was, however, found to be impossible. The effect could not be due to chem. compds. between the sugars, and a chem. theory cannot apply to such artificial molasses.

6740. Kats, V. M. **Decrease of lime in beet-sugar production.** *Sakharnaya Prom.* 22, No. 12, 14-16 (1948).—*C.A.* 43, 7243*e*.

Through the first of 2 parallel troughs, diffusion juice was pumped at 40°C; through the other, the unsatd. juice from the first carbonatation at 90°C with an alky. 0.4% CaO. The unsatd. juice overflowed into the diffusion juice all along the trough. Pretreated juice was defecated with 1.5% lime and pumped to two first carbonatation tanks. Since the overflow was continuous all along the troughs, the increase of alky. from 0.05 to 0.2% CaO and from 40° to 70°C was progressive. Economy of lime was 25% and filter cloth 50%.

6741. Kloppenburg, C. A. **Sugar recovery from cane molasses.** *Indian Sugar* 11, 285-7(1948).—*C.A.* 43, 4502*d*.

Molasses was dild. with 3.5 times its wt of 70% alc., filtered, treated with 15% of powd. CaO (on molasses) and stirred for several hrs at 45-70°C. Dextrose and levulose were pptd. as Ca glucosate, filtered, and decompd. with CO_2; the freed glucose was fermented to alc. The cooled filtrate was treated with 10% (on molasses) of CaO that had been slaked in 70% alc. which pptd. the sucrose as monosaccharate. The process was economic for Indian conditions.

6742. Konn, Václav. **Recent transformations in the sugar industry.** *Listy Cukrovar.* 64, 196-7 (1948).—*C.A.* 42, 6557*e*.

Ten years ago the aim of the sugar technologist was to produce more sugar and less nonsugars per unit area of soil; the aim today is more sugar per unit of man power. The mechanization of the sugar factory presents the problem of preserving the chem. constituents of stored sugar beets during a prolonged campaign.

6743. Konn, Václav. **Transformations in the sugar industry. II. The preparation of sugar.** *Listy Cukrovar.* 64, 226-7(1948).—*C.A.* 42, 7071*e*.

Recent developments were: replacement of the diffusion processes by better extn. devices, recovery of edible amino acids from slices, permutoids for removing the ions of sol. salts in sugar juices, conversion of diffusion juice into bricks which when stored can supply a refinery for an entire year, the prepn. of aromatic or fragant molasses, the purification of disposal waters so that they will not be injurious to fish.

6744. Kröner, Waldemar and Hönsch, Werner. **Decolorizing starch hydrolyzates with synthetic resins.** *Kolloid-Z.* 110, 178-83 (1948).—*C.A.* 43, 5980*d*.

A mixed resin was used to decolorize starch hydrolyzates contg. 30-85% total solids. The resin was regenerated without removing it by washing successively with 5% alkali, warm H_2O, 5% HCl soln., and water at pH 5.

6745. Lassèchère, M. **Ion exchangers in the sugar industry.** *7th Congr. intern. ind. agr., Paris* **1**, Q4-N, 2 (1948); *Sugar Ind. Abstracts* **10**, No. 8, 87 (1948).—*C.A.* 43, 6441*g*.

Tests at Dompierre sugar factory in 1947 were reported on the continuous purification of 2nd carbonation beet juice at the rate of 600 liters/hr, with 2 preliminary filters, 4 pairs of exchangers, and regenerating with H_2SO_4 or HCl, and Na_2CO_3. Full details of losses, purities, costs, etc. were recorded.

6746. Lewon, J. and Dobrowolski, J. **Calcium saccharate or "semi-saccharate."** *Gaz. Cukrownicza* 88, 117-19 (1948).—*C.A.* 43, 4035*e*.

$Ca(C_{12}H_{21}O_{11})_2$ was expected to hydrolyze back to $Ca(OH)_2$ and sucrose. For this compd., CaO soly. in 13% sugar soln. should be 1.06%. In pure water at 80°C, 0.072% CaO dissolved; then, if there was 0.24% CaO in defecated juice, 0.168% would combine CaO, and sucrose present as disaccharate would be 2.05% (or 15.8% of the total sucrose). With cold defecation at 40°C, CaO soly. was 0.99%, free CaO was 0.11%, and hence combined CaO was 0.88% and sucrose as disaccharate equaled 10.8% (83% of the total sugar).

6747. Libkind, L. I. **Application of methods for the purification of beet juices in the cold.** *Sakharnaya Prom.* 22, No. 8, 32-3 (1948).—*C.A.* 46 7800i, 43, 6444*a*.

The diffusion juice at 30-5°C was continuously subjected first to preliminary defecation in one tank and then to the regular defecation. The juice, first warmed to 40-5°C by the addn. of hot milk of lime, went to the first carbonation and then, at a temp. of 50-60°C to the filter presses and the mech. filter. The filtered juice from the first carbonation goes to the reactor of the 2nd carbonation and from there to the filter presses as degassed juice. Retarded crystn. of $CaCO_3$ prevented successful purification of beet juices at low temp. However, this could be overcome if the juices, after the second carbonation before filtration, entered a reactor tank equipped with a heater and agitator.

6748. MARBAIX, M. DE. **Improvement of the defecation of diffusion juice in the calcocarbonic processes.** 7th *Congr. intern. ind. agr., Paris,* **1**, Pt. 2, 15 (1948); *Sugar Ind. Abstracts.* **10**, No. 8, 84-5 (1948).—*C.A.* 43, 6444*f*.

The usual methods of introduction of CO_2 formed eddies and caused loss of unused gas. In a cylindrical carbonator, the gas underwent a rotary movement, giving complete homogenization. The plant handled 2000 tons of beets per day.

6749. MARIANI, EUGENIO. **Possibility of the use of ion-exchange resins in the manufacture of sugar.** *Ind. saccar. ital.* 41, 107-13, 192-213 (1948).—*C.A.* 42, 9211*f*, 8002*h*.

The expts. were made with resins of the type "Amberlite" on molasses. Treatment increased the purity of the juice from 60 to 90. The molasses ash contained, before and after the treatment, resp.: SiO_2 2.33 and 0.75, CaO 3.56 and 0.27, and $Fe_2O_3 + Al_2O_3$ 1.65 and 0.39%. Amberlite IR-100 (cation) and IR-4B (anion) raised the purity of beet molasses from 60 to 99 when the molasses was dild. 1:15; with dilns. of 1:10 and 1:5 the purity was raised to only 87 and 83, resp. The 1st fraction of liquor passing over IR-100 had pH 2.3; it increased to 5-7 at the end of the run. Passage over IR-4B left the pH of the liquid at 5.6 (16-20°C).

6750. MCGINNIS, R. A. **Studies on continuous carbonation.** *Proc. Am. Soc. Sugar Beet Technol.* 5, 573-94 (1948).—*C.A.* 43, 6445*h*.

The optimum settings for the various variables in a Dorr system of continuous first carbonation in a Calif. beet sugar factory were reviewed.

6751. MINDLER, A. B. **Demineralization of sugar-cane juice - pilot-plant study.** *Ind. Eng. Chem.* 40, 1211-15 (1948).—*C.A.* 42, 6559*g*.

From 90 to 95% of the ash and 70 to 75% of the nonsugar solids were removed from Cuban and Louisiana cane juices. The purity rise was 4.7% for Cuban cane and 6.5% for Louisiana cane. The increased sugar yield was 3.8% for the former and 6.2% for the latter. Lime-defecated juice cooled to 30-35°C was passed through a 10 ft^3 bed of Zeo-Karb H at the rate of 6 $gal/min./ft^2$ and then through a similar bed of De-Acidite. Regeneration of the resin required 2 to 6 lb H_2SO_4/ft^3 of Zeo-Karb and 2.6 to 7.6 lb of Na_2CO_3/ft^3 of De-Acidite.

6752. MÜLLER-BRIEGHEL, A. **Problem of structural physics in sugar technology.** *7th Congr. intern. ind. agr., Paris* **I**, Pts. 3/4, 17(1948); *Sugar Ind. Abstracts* **10**, No. 8, 93 (1948).—*C.A.* 43, 6845*g*.

Morphological phenomena during defecation and carbonation were examd. The microscopic structure of limed juices were studied in varied conditions.

6753. NARULA, B. L. AND CHAWLA, B. L. **Calcium lactate from cane molasses.** *Indian Sugar* **11**, 115-18(1948).—*C.A.* 43, 2366*d*.

Molasses dild. to contain 42.7% of total sugars was mixed with 46 parts of pulverized $CaCO_3$ and fermented with stirring at 45°C with a culture of *B.delbruckii* until the lactic acid reached about 25%. The crude Ca lactate was sepd. by filtration and concd., converted with $FeSO_4$ into Fe lactate which was reconverted into Ca lactate with milk of lime. The soln. was finally decolorized with activated carbon, crystd., and the crystals washed with 95% alc. and dried in hot air.

6754. OPLATKA, GYORGY. **Purifying sugar juices by ion-exchanging synthetic resins.** *Mezögazdaság és Ipar* 2, No. 11, 1-9(1948).—*C.A.* 44, 5127*f*.

Experiences in the sugar mill at Sarkad, Hungary were described in the season 1947-48 with ion exchangers. Inorg. salts were removed up to 97%, org. substances up to only 36%. Anion removers were exhausted relatively quicker than cation exchangers.

6755. POLAK, FELIKS. **Adsorption on calcium carbonate.** *Roczniki Chem.* 22, 181-90 (1948).—*C.A.* 43, 8791*h*.

The adsorption of the color of molasses and of a dye ("Ponceau 4 R") on $CaCO_3$ was found to obey Freundlich's law. While excess Ca^{++} increased adsorption, CO_3^{--} had the opposite effect, and Ca salts were found to be greatly adsorbed. This explains why excessive carbonation of molasses during refining gives an inferior product.

6756. PONIECKI, J. **Addition of lime in defecation.** *Gaz. Cukrownicza* **88**, 66-8(1948); *Sugar Ind. Abstracts* **10**, No. 5/6, 50(1948).—*C.A.* 43, 4035*i*.

After withdrawal of the diffusion juice at 36-40°C, an addn. of 0.018% of CaO gave pH 10.8-11. After this preliming, the juice flowed by gravity, slowly enough to provide some waiting period before main liming, during which the colloids pptd. Main liming was cold with 1-1.1% CaO. The juice was then preheated to 83°C, and satd. by a continuous process. Excellent decolorization results were obtained.

6757. PORTER, L. B. **Deionization and beet-sugar production at the Layton Sugar Co.** *Proc. Am. Soc. Sugar Beet Technol.* 5, 714-21 (1948).—*C.A.* 43, 6443*c*.

Av. pilot-plant results were: Brix of influent juice 12.95, effluent juice 11.81; sugar in influent juice 12.13%, in the effluent 11.61; influent purity 93.76, effluent 98.60; pH influent 8.14, effluent 7.13; invert influent 0.13%, effluent 0.39; overall diln. 4.28%; total sugar extn. 92.03%; ash of deionized sugar 0.006-0.008%. Chemicals for regeneration were: 20.44 lb of 66 Bé. H_2SO_4 and 11.81 lb anhyd. NH_3 per ton of beets.

6758. PORTER, L. B. **Ion exchange in the beet-sugar industry.** *7th Congr. intern. inds. agr., Paris* 1948, Q4, B1-8.—*C.A.* 44, 9171*e*.
The advantages of ion exchange purification, a description of the installation used, and the favorable effects on the bacteriol. conditions were considered.

6759. PORTER, RICHARD W. **Ion exchange finds new uses.** *Food Inds.* 20, 691-702 (1948).
Ion exchange has produced demineralized water cheaply, but has roused the greatest interest as a means of purifying sugar solns. Other applications were the recovery of sugar from waste fruit juices, reduction of the Ca content of milk for infant feeding, recovery of lactose from whey, of tartrate from winery wastes, and of pectin from grapefruit peels. The technology of ion exchange was explained, the equipment described, and the applications discussed. Ion exchange treatment is substantially the same for refining all types of sugar: beet, fruit, cane or corn.

6760. RAMÍREZ SILVA, FRANCISCO J. **Colloidal bentonite as a clarifying agent.** *Sugar J.* 11, No. 5, 3-4, 14-18 (1948); *Intern. Sugar J.* 51, 85-6 (1949).—*C.A.* 43, 1587*h*, 5613*i*.
Bentonite in sugar refining was discussed.

6761. RAWLINGS, F. N.; JACOBS, R. T., AND COLE, E. B. **Ion exchange in the beet-sugar industry.** *7th Congr. intern. ind. agr. Paris* 1, Q4-A, 1-11 (1948); *Sugar Ind. Abstracts* 10, No. 8, 89 (1948).—*C.A.* 43, 6440*i*, 9171*e*.
Ion exchange removed most ash constituents, except silica, and over 90% of the org. acids and N-compds., with some decolorization and removal of unpleasant taste. The temp. must be kept at 20-25°C. Advantages to be expected from ion-exchange purification were: increased sugar yield (92-96%), 2 or 3 high-quality white sugar strikes, elimination of evaporator scale, and the possibility of direct liquid sugar, "soft sugar" or brown sugar production, and by-product recovery. By ion-exchange treatment of thin juice without special precautions, N removal may drop to 35-50%; by flushing the cation bed every 1-3 days with *N* NH_4OH, 50% N removal may be obtained when cutting off the beds at the pH break-through point; if earlier cutting-off is applied, 65% N removal may be possible. Use of a second cation bed, as a scavenger for N, was also effective.

6762. ROBERT, M. **Ion exchangers in the sugar industry.** *7th Congr. intern. ind. agr., Paris* 1, Q4-C (1948); *Sugar Ind. Abstracts* 10, No. 8, 87 (1948).—*C.A.* 43, 6441*e*.
A semi-industrial installation for treatment of 2nd carbonation cane juice with Zeo-Carb cation exchanger and Deacidite anion exchanger was described, with graphs of the results obtained.

6763. ROSINSKI, LADISLAS. **Notes on the working of filter presses.** *Chimie & industrie* 59, 17-21, 131-43 (1948).—*C.A.* 42, 3980*g*.
Some general equations of filtration were compared with the practical results obtained in sugar-house operation. Optimum operating conditions were discussed from the standpoint of economy and improvement of the process.

6764. SEIP, JOHN J. AND KELLER, ARTHUR G. **Causes of the declining sugar recovery in Louisiana, 1943-1947.** *Louisiana State Univ. Eng. Exptl. Sta., Bull. Ser.* No. 14, 23 pp. (1948).—*C.A.* 43, 7243*b*.
A year-by-year plot showed a parallelism between the no. of mech. harvesters in operation and the decline. Mech. harvesting, by increasing the burden of trash, was the most significant factor in the reduction of sugar recovery. Attempts to correlate yield deficiency to amt. of trash gave uncertain values, depending on the basis used, the effect per 1% of trash on gross cane being equiv. to 0.26-9.33 lb of 96° sugar per ton of cane. The increased loss of sucrose in bagasse, determinable with reasonable accuracy, was calcd. as 0.46 lb of 96° sugar in bagasse per 1% of trash.

6765. SHRIKHANDE, J. G. **Recent developments in sugar chemistry and by-products research.** *Indian Sugar Suppl.* (1948), 87-93; *Sugar Ind. Abstracts* 10, No. 11, 138 (1948).—*C.A.* 43, 6439*f*.
Com. levulose production, sucrose synthesis, ion-exchange purification, fiber-board and plastics production from cane fiber, the dehydration of molasses, food-yeast production, and the extn. of sugar-cane wax from press mud were reviewed.

6766. SOLANO, JORGE A. AND VILLALOBOS, VALENTIN. **Practices for increasing efficiency in the cane sugar factory.** *Sugar* 42, No. 8, 32-5 (1948).—*C.A.* 42, 8001*d*.
The prime requisite for efficiency was clean cane, grown under the best possible conditions, and with the proper P_2O_5-gum balance. If fractional liming and double heating do not yield clarified juice of the desired quality, P_2O_5 must be added before liming, and with refractory juices, such as those from POJ 2878, sulfitation must be applied. An improved 3-boiling system was described in detail.

6767. SUSSMAN, S. **Ion exchange in the sugar industry.** *7th Congr. intern. ind. agr., Paris* 1, Q4-E, *1-7* (1948); *Sugar Ind. Abstracts* 10, No. 8, 86-7 (1948).—*C.A.* 43, 6441*f*.
A review was given of recorded results for the treatment of beet sugar, cane sugar, molasses, glucose, sorgo juice, agricultural by-products, pineapple and citrus wastes, apple juice, artichoke juice, and wood-sugar soln.

6768. SYCHEV, N. A. AND SHMATOVA, M. I. **Decoloration of solutions containing xylose with calcium oxide.** *Zhur. Priklad. Khim. (J. Applied Chem.)* 21, 655-8 (1948).—*C.A.* 43, 8714*h*.
Ca salts of the coloring lignosulfonic acids were coagulated by cold treatment of 10-20% sugar solns. with 10% lime milk, with subsequent immediate satn. with CO_2. The process used 2% CaO with respect to the amt. of the sugar.

6769. TÖDT, FRITZ. **The utilization of the sugar in molasses, with special consideration of the removal of salts by exchange materials.** *Branntweinwirtschaft* 2, 49-50(1948).—*C.A.* 45, 7809*d*.

Processes for the removal of the sugar by the use of $Ca(OH)_2$ and $Sr(OH)_2$ were discussed. The zeolite-like montmorillonite and permutit were not as satisfactory for this purpose as the exchange adsorbents having an artificial resin base.

6770. VAN HOOK, ANDREW. **Some chemical problems and prospects of the sugar industry.** *J. Chem. Education* 25, 49-51(1948).—*C.A.* 42, 2789*i*.

Agricultural and field improvements, ion-exchange agents in purification, synthesis of sucrose, by-products, and crystn. and molasses theories were outlined.

6771. VAN HOOK, ANDREW. **Kinetics of sucrose crystallization: real massecuites.** *Ind. Eng. Chem.* 40, 85-9(1948).—*C.A.* 42, 2791*c*.

Data in the literature, as well as addnl. information about crystn. rate, for both cane and beet sirups, conform to the linear semilogarithmic theoretical pattern. Sirups may be assigned a relative melassigenic value according to the slope of this rate vs. impurity plot.

6772. WERQUIN, V. **Rational use of lime and carbon dioxide.** *Inds. agr. et aliment* 65, 209-11(1948).—*C.A.* 43, 1587*g*.

The process reduced the sucrose loss in molasses from 2.51 to 2.04%, and other losses from 1.35 to 0.92%. The sugar production per day increased 20%.

6773. WILLCOX, O. W. **New developments in ion exchange.** *Sugar* 43, No. 12, 27-9(1948).—*C.A.* 43, 2475*d*.

Amberlite IRA-400 and Amberlite IRC-50 were of particular interest to the sugar industry because the pH of the solns. never fell below 7, and inversion was avoided. The possibility of operating a mixed-bed process with countercurrent flow was discussed.

6774. ZANUSO, E. AND SPETTOLI, O. **Calcium carbonate, calcium oxide, and carbon dioxide in the sugar factory.** *Ind. saccar. ital.* 41, 159-65(1948).—*C.A.* 42, 9211*e*.

A temp. of 1200-1300°C was required for complete dissocn. of limestone contg. 94% $CaCO_3$. A scheme of calcns. was presented for apportioning limestone and coke to obtain max. vol. of CO_2 and wt of lime and the appropriate dimensions of the kiln.

6775. ABRAM, I. M. AND DICKINSON, B. N. **Color removal in sugar liquors by synthetic resins.** *Ind. Eng. Chem.* 41, 2521-3 (1949).—*C.A.* 44, 2778*b*.

Decolorization and the ion-exchange treatment of industrial sugar liquors were independent of each other. Two different types of anion exchangers designated as resin A and resin B were run simultaneously. Resin A was a nonporous, translucent, gel type and resin B was highly porous and opaque. The two resins did not differ markedly in their effects on second carbonation sugar juice although A had a somewhat higher acid capacity and B a somewhat higher color capacity. The color break-through and the pH break-through occur at approx. the same time and color and the pH curves roughly paralleled each other.

6776. AFFERNI, ERNESTO. **The action of metals on the inversion of sucrose.** *Ann. chim. applicata* 39, 381-92 (1949).—*C.A.* 46, 3779*b*.

A 10% aq. soln. of sucrose was heated at a const. temp. or refluxed for various periods of time with the metal in the form of sheets of 1 mm thickness and 12 cm surface. The tests with 9 samples of steel alloys contg. various amts. of Si, Mn, S, P, and Ni, and with pure Fe showed that the inversion was inhibited by the Fe and was independent of the other elements present; the resulting solns. had a pH 3-4.2. The strongest effects were given by Fe, Pb, Sn, and Zn; the solns. obtained with these metals deposit small amts. of the metal acetates. The inversion was catalyzed and completed in 3-4 hrs at 70° in the presence of Mo.

6777. AHMAD, QAIYUM. **Purification of carbon dioxide in carbonation factories.** *Intern. Sugar J.* 51, 341(1949).—*C.A.* 44, 2778*f*.

Wood charcoal was found to be a possible substitute for coke in the production of CO_2. To avoid choking of the gas pipes and valves with the tarry smoke from the charcoal, an extra scrubber was placed in the line and the gas bubbled through kerosene and then through a layer of hard coke pieces. This extra scrubber might be used effectively even in factories using coke for CO_2 production.

6778. APEL, ALFONS. **Grape sugar from wood.** *Holz* 3, 186-8 (1949).—*C.A.* 44, 324*f*.

The hemicelluloses were dissolved and hydrolyzed with dil. HCl. The sugars thus obtained were fermented to EtOH. The wood residues were dried and hydrolyzed with cold concd. HCl. The HCl was evapd. *in vacuo*, and the residual sugar "inverted" and purified by an undescribed procedure. The crude sugar soln. when evapd. yielded cryst. D-glucose (80-85%) which, on recrystn., gave a chemically pure product. Mother liquors were also fermented.

6779. BENIN, G. S. AND SHNAIDER, E. E. **Method of estimation of ion exchangers.** *Sakharnaya Prom.* 23, No. 1, 16-23 (1949).—*C.A.* 43, 7729*i*.

A 0.1*N* soln. of CH_3COOK was advisable for detn. of adsorption by a cation exchanger. Ca adsorption was higher than K and N in sugar products. N substances in nonsugars were adsorbed in the H-cycle. A decrease of pH in the original material decreased the capacity of the cation. For complete evaluation of the quality of the cation exchanger an artificial or standard molasses soln. was recommended.

6780. BLANN, W. A. **Ion exchange and cane-sugar manufacture.** *Bol. mensual asoc. téc. Azucar. Puerto Rico*, 1949, 13 pp.; *Sugar Ind. Abstracts* 11, 56(1949).—*C.A.* 45, 3623*i*.

Ion exchange was capable of performing the main part of sugar purification, a final defecation being needed only to eliminate impurities not affected by the resins. The production of refined sugar direct from cane juice was considered to be practical.

6781. BORGHI, MARIO. **The use of ion exchangers in the sugar industry.** *Ind. saccar. ital.* 42, 78-91 (1949).—*C.A.* 43, 9503*e*.
The use of ion exchangers in the purification of raw and diffusion juices had some drawbacks; albuminoids were coagulated in acid medium and disturbed the regular behavior of the cycle. To purify highly concd. refinery sirups with ion exchangers it was necessary to treat the sirups previously by filtration with bone char.

6782. BRIEGHEL-MÜLLER, A. AND BRUENICHE-OLSEN, H. **The physical chemistry of the second carbonatation in the beet sugar industry.** *Sugar* 44, No. 4, 36-9 (1949).—*C.A.* 43, 5217*f*.
The unexpectedly high content of Ca salts in the 2nd carbonatation juice was reduced to the theoretical by digesting it with 1% of cryst. $CaCO_3$ for 15 min. at 85°C. The supersatn. of the $CaCO_3$ was caused by crystn. inhibitors, probably colloids which were adsorbed on the $CaCO_3$ crystals. Addn. of 2nd carbonatation sludge was not as effective as that of cryst. $CaCO_3$. The relation between effective alky. and Ca salts was studied.

6783. CHOW, T.-Y. **Middle-juice carbonation** *Taiwan Sugar J. Quart.* 2, No. 2, 1-19 (1949).—*C.A.* 44, 9706*c*.
The filterability of the limed juice increased with the amt. of lime used; 6-7% (based on the vol. of the middle juice) of milk of lime contg. about 15% of available CaO was optimum. Higher coloration in the purified juice was observed when the lime was less than 6 vol. %. Diln. of the juice was not affected when the amt. of lime varied between 5.5 to 8 vol. %. The water content of the filter cake decreased with the increasing amt. of lime used.

6784. CHOW, T.-Y.; CHANG, P. K., AND CHENG, C.-P. **Experiments on phosphates used for clarifying cane juice.** *Taiwan Sugar J. Quart.* 2, No. 2, 31-43(1949).—*C.A.* 44, 9703*f*.
Expts. on the clarification of the mixed juice of Da-ling factory (av. phosphate content 302 p.p.m.) by the addn. of standard KH_2PO_4 soln. indicated that in the cold liming process, the optimum phosphate content was 400 p.p.m. and the optimum pH value 7.6. In the hot liming process the optimum pH value was 7.3. Clarification of the mixed juice was studied upon the addn. of 20 Bé. H_3PO_4 and different kinds of Ehrmannite and calcium superphosphate.

6785. COOK, H. A. **Sirup clarification.** *Repts. Hawaiian Sugar Technol. 8th Ann. Meeting* 1949, 66-9.—*C.A.* 44, 3727*d*.
Improvement of sirup filtration rate can be obtained with H_3PO_4 and CaO in a frothing process with concns. between 0.03 and 0.10% P_2O_5 on sirup solids. This required approx. the same quantity of CaO. The treatment resulted in a decrease in turbidity but produced little improvement in sirup color, little change in % sirup ash, slight reduction in insol. ash, and a fair improvement in refining quality of sugar.

6786. CRUICKSHANK, G. A. AND BRAITHWAITE, D. G. **Sterilization of cation-exchange resins.** *Ind. Eng. Chem.* 41, 472-3(1949).—*C.A.* 43, 3952*i*.
The contamination of exchanger beds by bacterial growth was due to the presence of filtered suspended org. material supplying the necessary food requirements. Sterlization by 0.25% HCHO for 3 hrs was effective, inexpensive, and non-deleterious to sulfonated phenol-formaldehyde resins.

6787. DĚDEK, J. **Fundamental conditions affecting the filterability of first carbonation juices.** *Sucr. belge* 69, 73-83 (1949); *Sugar* 46, No. 5, 21-5 (1951).—*C.A.* 45, 8277*i*.
Optimum conditions were discussed for the formation of a ppt. by a reaction between added chalk and the nonsugar-contg. portion of the juice, and its sepn. by sedimentation or filtering. Large particles were obtained by maintaining a very low supersatn. of $CaCO_3$ and of substances precipitable by lime, which was secured by lowering the soly. of the CO_2 through carbonation at high temp. and keeping the pH during the whole carbonation at as low a figure as possible, compatible with good purification. An efficacious method from the standpoint of filterability was simultaneous liming and carbonation. The same result could be achieved by progressive preliming of the diffusion juice. The influence of the hydrated protein and pectin substances on the filterability was effectively reduced by slow preliming.

6788. DEWHALLEY, H. C. S. **Pure sucrose - its preparation for use in analysis.** *Intern. Sugar J.* 51, 223 (1949).—*C.A.* 43, 9502*b*.
Affined raw sugar melter liquor, after carbonatation and filtration, was treated with char in the usual way. The liquor was boiled to granulated, and spun in a Roberts machine (1250 r.p.m.) on a 5 min. cycle with a wash of 45 lb water instead of the usual 3.5 lb. A typical analysis: invert sugar 0.001%, ash 0.001%, org. non-sugar (ash × 1.5)0.0015%, sucrose (by difference) 99.996%.

6789. DICKINSON, B. N. **Commercial ion-exchange purification of sugar-containing solutions.** *Food Technol.* 3, 48-51(1949); *Sugar* 45, 28-30 (1950).—*C.A.* 44, 5127*e*.
The use of ion exchangers in the purification of cane, corn, and beet-sugar products and by-products were discussed.

6790. ELLISON, H. E. **Sugar-end operations on ion-exchange juice.** *Proc. Am. Soc. Sugar Beet Technol.* 5, 557-62 (1949).—*C.A.* 43, 6441*i*.
Discussion of some tentative procedures.

6791. FELTON, GEORGE E. **Use of ion exchangers in by-product recovery from pineapple waste.** *Food Technol.* 3, 40-2 (1949).—*C.A.* 44, 5031*c*.
When pineapple juice was passed through cation exchangers, capacity fell off rapidly because acid regeneration did not remove all adsorbed matter; alk. solns. desorbed the impurities more effectively. Some brands of anion exchangers were unsatisfactory because the exchanger was not stable toward reducing sugars.

6792. Fonseca, Manoel M. E. **Continuous refining of cane sugar by ion exchange in vacuum.** *Anais assoc. quím. Brasil* **8**, 293-302(1949).—*C.A.* 45, 885*i*.

6793. Goncalves de Lima, Oswaldo; Magelhães Neto, Bento, and Gomes de Matos, Antônio Jr. **New observations on citric fermentation of cane molasses from Pernambuco with Aspergillus niger 198.** *Anais soc. biol. Pernambuco* **9**, 19-26(1949).—*C.A.* 45, 4878*c*.

In the pH range of 6.36-4 the percentage both of oxalic acid and of citric acid from a given amt. of sugar decreased with lowering of pH. At pH lower than 4 there was no reproduction of the fungus and no production of acid. Purified molasses gave lower yields of acids than did the crude molasses. The following inorg. constituents were detd. for both crude and purified molasses and the ash from each: SiO_2, Fe_2O_3, Al_2O_3, CaO, MgO, K_2O, Na_2O, Cl, SO_3, and P_2O_5.

6794. Hamous, J. and Mudrák, O. **Sugar-manufacture experiments with activated bauxite, Porocel.** *Listy Cukrovar.* **65**, 151 (1949).—*C.A.* 43, 6848*g*.

Porocel (200 g) reduced the color in 1 liter of beet juice at 80°C from 8.25° to 6.58°St. The filtered juice was still turbid and lacked luster. Addns. of 0.01, 0.02, 0.04, and 0.08% of Porocel to beet juices digested for 15 min. at 80°C reduced the color 7.9, 12.0, 23.2, and 27.2%, resp. Equal addns. of carboraffin removed from 77 to 95.9% of the color in corresponding expts. Addns. of diatomaceous earth to the Porocel improved the quality of the filtered juice.

6795. Hinton, C. L. **The buffer power of sugars.** *Intern. Sugar J.* **51**, 222 (1949).—*C.A.* 43, 9499*g*.

The buffer power of sugars was defined as the vol. of 0.1 *N* HCl which must be added to 1000 ml of a 25% (wt/vol.) aq. soln. of the sugar to bring the pH to 4.0. The detn. can be made directly by an electrometric titration. An alternative colorimetric method was suggested.

6796. Huttl, John B. **Diatomite: Its mining and processing.** *Eng. Mining J.* **150**, No. 8, 75-7 (1949).—*C.A.* 43, 7651*c*.

The operations were outlined at the Johns Manville Products Corp.'s plant, Lompoc, Calif.

6797. Jacobs, Ray T. and Rawlings, Frank N. **Nitrogen removal in ion-exchange treatment of beet sugar juices.** *Ind. Eng. Chem.* **41**, 2769-74 (1949).—*C.A.* 44, 2777*e*.

Of the total N removable by resins from double-carbonated sugar-beet juice, 70-80% was removable by the cation bed and 20-30% by the anion bed. When an anion bed vol. equal to the cation bed was used, the anion bed gave a complete removal of anion-removable N up to the titration break-through of the cation bed. If the cation bed was operated for a sustained no. of cycles without special regeneration, it exhibited a gradual loss of 20% of its N removal capacity. A special treatment of the cation bed every three days (25 to 30 cycles) with 0.7 lb of NH_3 (as 1.0 *N* NH_4OH) per ft^3 of resin was recommended to maintain max. N removal.

6798. Jermyn, M. A. and Isherwood, F. A. **Improved separation of sugars on a paper partition chromatogram.** *Biochem. J.* **44**, 402-7 (1949).—*C.A.* 43, 8312*a*.

The detn. of sugars in mixts. of simple hexoses and pentoses on a paper chromatogram showed that a 3-component system ($EtOAc-AcOH-H_2O$, or $EtOAc-pyridine-H_2O$) was more satisfactory. Some details of the procedure were discussed critically.

6799. Khanna, K. L. and Chacravarti, A. S. **Studies in the clarification of sugar-cane juice in gur manufacture.** *Indian J. Agr. Sci.* **19**, 137-61 (1949).—*C.A.* 45, 5430*g*.

Various electrolytes were studied in relation to their efficiency in juice clarification, but none was any better than the commonly used clarifying agent, bhindi mucilage (*Hibiscus esculentus*). The superior clarifying property of castor seed and groundnut exts. might be attributed to their relatively high content of protein and phosphate.

6800. Maier, E. A. and Handcock, J. M. **Settling of cane juice by addition of calcium carbonate.** *Sugar J.* **II**, No. 8, 13 (1949).—*C.A.* 46, 9874*g*.

Ground oyster shells (2-4 lb per ton or more for exceptionally dirty cane) aided clarification of raw juice. The treatment was most effective if applied before hot-clarification followed by hot liming.

6801. Mariani, E. **Kinetics of sucrose inversion by ion-exchange resins.** *Ann. Chim. Applicata* **39**, 283-290(1949).—*C.A.* 45, 3625*f*.

Tests were carried out to det. the rate of inversion of sucrose by cation-exchange resins (Amberlite IR-100 and Montecatini GS) at 20°, 35°, 40°, 50°, and 60°C for times of contact from 30 min. to 24-30 hrs; the tests were made with 1 or 2 g of resin and 25 cc. of sucrose solns. of 10 and 20% concn. The reaction velocity const. of invert formation corresponded with a first-order reaction: $K = 2.303/t \log 10(a/a-x)$ where x = initial sucrose concn., and t = time in min.

6802. Meads, P. F. and Gillett, T. R. **Preparation of sugar liquors and sirups for color determinations.** *Anal. Chem.* **21**, 1949-7 (1949).—*C.A.* 44, 2777*i*.

The product was dild. with H_2O, rather than with heavy colorless sucrose sirup, to 30-40° Brix for washed raw sugar and 2-5° Brix for affination sirup. Filtration through uncalcined kieselguhr (1 g/250 ml) gave the lowest turbidity readings based on the Tyndall effect. The suspension was filtered through coarse filter paper and the first 50 ml of filtrate discarded. After filtration, the pH was adjusted to 7 by titration with 0.0357 *N* NaOH or H_2SO_4. The color was measured in terms of -log T.

6803. MIRČEV, ATANAS. **The course of the crystallization of sugar followed by means of electrical conductivity during the 1948-49 season.** *Listy Cukrovar.* 66, 27-8 (1949).—*C.A.* 44, 2775*i*.

A molasses-forming coeff. may be useful for predicting the yield of sugar. Studies indicated that the yield may be predicted from the mineral content of the molasses. K and Na bound large quantities of sugar but Ca salts and the injurious N did not bind any sugar.

6804. MUHAMMAD, SARDAR. **Mineral matter and its effect on the recovery of white sugar.** *Pakistan J. Sci.* 1, 108-10(1949).—*C.A.* 45, 5429*h*.

High mineral matter content in cane juice lowered the recovery of white sugar.

6805. MUKHERJI, B. K. **Modification of cane molasses.** *Intern. Sugar J.* 51, 141-2(1949).—*C.A.* 43, 5615*e*.

The modification was the removal of K and Ca ions. K was removed as the insol. K dipicrylaminate. As high as 97% removal was possible. The recovery of the dipicrylamine was difficult and the high cost and low recovery of the reagent made the process commercially unfeasible. Ca was removed as $CaSO_4$ at pH 4.1 and at a diln. of 1:1.

6806. NEISH, A. C. **Production and properties of 2,3-butanediol. XXX. Determination of the fermentation acids by partition chromatography.** *Can. J. Research* 27B, 6-20(1949).—*C.A.* 43, 4807*i*.

The acids sep. into bands in the column and were eluted with C_6H_6-BuOH mixts. contg. 5-25% BuOH. The acids were eluted in the order given above and were detd. by titration with NaOH with phenol red. The acids were identified by the amt. of solvent required to bring them through the column.

6807. NEWKIRK, T. H. AND HANDELMAN, MORTON. **Triple-pass countercurrent ion-exchange system.** *Ind. Eng. Chem.* 41, 452-7 (1949).—*C.A.* 43, 4882*b*.

Six columns of alternately placed anion and cation units (polyamine phenolic resin and sulfonated phenolic resin, resp.) operated continuously to produce 5000 lbs of dextrose per day from the hydrolysis of starch. The removal of ash, acid, color, Cu, Fe, N, turbidity, and 5-hydroxymethyl-furfural were followed. Partial recovery of lost cation exchange capacity was accomplished in lab. studies by treatment of the bed with 4% NaOH at 155°F. Color and nitrogen removal properties of the anion exchanger were improved by treatment with 10% H_2SO_4 at 140°F.

6808. OTHMER, DONALD F. AND LULEY, ARTHUR H. **Refining sugar by solvent.** *Food* 18, 81-3 (1949); *Sugar* 44, No. 7, 26-9 (1949).—*C.A.* 43, 4035*h*, 7729*f*.

Raw sugar was extd. countercurrently with hot MeOH. The resulting sugar was light yellow, practically sterile and had a max. polarization of 99.7. The MeOH passed through a settling tank and was recovered by distn. About 1 lb of MeOH was required per lb of sugar. The process could be operated alone or in conjunction with a bone char refinery.

6809. PARASHAR, D. R. **Behavior of coloring matter in refining khandsari sugar.** *Proc. Sugar Technol. Assoc. India* 18, Pt. I, 72-5 (1949).—*C.A.* 44, 5623*g*.

Reworking crude sugar obtained by boiling cane juice directly under atm. pressure offered no difficulty when it was added to the factory raw juice. In off-season operations when khandsari sugar was melted alone, limed, heated, and filtered, there was a reduction of ash content, but an increase in reducing sugar. In such case a 4-massecuite was necessary to exhaust the final molasses to 38-34 purity.

6810. PIERCE, J. **Defecation studies.** *Brit. Sugar Corp. 2nd Tech. Conf.* 1949, 28 pp.—*C.A.* 46, 4826*h*.

In lab. expts., 2 methods were compared: return of the unfiltered 1st carbonation juice to the raw juice, followed by single liming and carbonation; and simultaneous liming and carbonation, without or with return of the 1st carbonation juice to the raw juice. The latter was better than other processes tested in respect to filtration, content of Ca salts, purity, and color of the thin juice.

6811. RAMANAIAH, S. V. AND NARASINGARAO, C. **Potassium chromate as a deleading agent for the determination of Clerget's sucrose.** *J. Sci. Ind. Research* (India) 8B, 99-103 (1949).—*C.A.* 43, 8311*f*.

The removal of Pb^{++} by treatment with K_2CrO_4 did not cause error in the subsequent polarization and the results agreed well with those obtained by the use of $Al(OH)_3$. It was preferred to the use of alk. phosphate, oxalate, or carbonate and recommended in the analysis of molasses and distillery waste.

6812. REDMAN, C. C. **Observations on juices from Dorr clarifiers.** *Sugar* 44, No. 7, 37-9 (1949).—*C.A.* 43, 6846*i*.

Analyses of juices from the different compartments of Dorr clarifiers showed an increase in both Brix and purity from the top to the bottom compartment for 2 older models, but not for a modern multifeed unit. This observation, supplemented by lab. clarification expts. indicated that the increases were due to resoln. in the juice of optically active nonsugars that had been adsorbed by the ppt.

6813. RUBEŠ, E. **Physical properties of affined solutions.** *Listy Cukrovar.* 65, 145-7(1949).—*C.A.* 43, 6847*d*.

The elec. cond., polarization, and *ns* of the washings from a centrifuge were detd. in min. intervals for 7 min. The elec. cond. reached a max. at 3 min. and dropped rapidly.

6814. SCHLEICHER, JORGE AND SIMONETTI, A. LEONIDAS. **The purification of refinery molasses by demineralization.** *Bol. soc. chilena quim.* 1, 45-65 (1949).—*C.A.* 44, 9707*g*.

Refinery molasses, dild. with 2 parts of H_2O, was pretreated in lab. expts. by filtration with Filter-Cel, by liming followed by Filter-Cel filtration, by clarification with lime and acid phosphate and the reverse. The effluent after purification with acid phosphate and lime was dild. to various ds. from 1 to 25.7 Brix and treated with ion-exchange resins at 10°, 20°, 40°, and 60°C. Another sample of the same molasses of 27° Brix, without pretreatment, was passed through ion exchange resins at 14°C. Decolorization expts. were also made with bone char, a com. activated carbon, and a carbon prepd. by dry distn. of the washings from the resins. At 10°C, 0.84% invert sugar was formed by the resin treatment, 0.96% at 20°C, 5.43% at 40°C, and 24.6% at 60°C. The decolorizing efficiency of the carbon prepd. from the resin washings was 69% of that of bone char.

6815. SEN, H. D. AND SRIVASTAVA, H. C. **Edible sirup from cane molasses.** *Proc. Sugar Technol. Assoc. India* 18, Pt. I, 60-1(1949).—*C.A.* 44, 3727*e*.

Sucrose and invert sugars were pptd. from clarified molasses; the washed Ca saccharate was decompd. with CO_2. Excess CO_2 was boiled off and traces of Ca removed by Na_3PO_4. In a second method SO_2 was substituted for CO_2. The purity rise was from 31.8 to 57.9% with CO_2 and 31.8-61.2% with SO_2. Recovery of total sugars was 48.2% and 42.3%, resp.

6816. TEICHNER, STANISLAS. **Kieselguhr as support for Fischer catalysts.** *Compt. rend.* 228, 1644 (1949).—*C.A.* 43, 8830*i*.

The surface of kieselguhr (Filter-Cel) samples, measured by N_2 and CO_2 adsorption, was not affected by alkali treatment (5% Na_2CO_3) unless the sample had been given a previous treatment with $HNO_3.HCl$, in which case the surface was reduced. The efficiency of kieselguhr in a Fischer catalyst was believed proportional to the quantity of reactive silica.

6817. VAŠÁTKO, JOZEF. **Carbonation of the sugar-beet juice.** *Chem. Zvesti* 3, 137-45 (1949).—*C.A.* 44, 7575*a*.

Two principal conditions were necessary in progressive preliminary carbonation: (1) the optimum quantity of added lime and (2) the speed at which lime is added.

6818. VENTRE, EMIL K. AND BALCH, R. T. **Powdered calcium carbonate (oyster shell flour) in processing of sugar cane.** *Sugar J.* 12, No. 6, 10-11 (1949); *Sugar Ind. Abstr.* 12, 186 (1950).

The oyster shell flour should have a fineness such that 99% passes a 200-mesh screen (wet test). An amt. of 2-4 lb per ton cane was to be used. The $CaCO_3$ may be mixed with the lime before addn., or it may be added as a sep. suspension after the lime, the suspension being prepd. in lime water. Sufficient agitation to prevent settling out of the $CaCO_3$ was needed. No trouble was experienced in the usual filters, and no increase in scale formation was found.

6819. VISSER, W.; VLIES, G. S. VAN DER, AND WATERMAN, H. I. **Extraction of juice at low temperatures and use of ion exchangers in the beet-sugar industry.** *Chimie & industrie* 61, 337-44 (1949).—*C.A.* 43, 7243*g*.

Beets could be extd. at a lower temp. than ordinarily used, if an agent such as SO_2 was used to suppress the semipermeability of the cellular walls. At 35-40°C and in the presence of 0.3% SO_2 (by wt of beets), the resulting juice could be purified better with ion exchangers than could normal crude juice. Dusarit (carbon base) and Asmit (amine-formaldehyde base) were used. Regeneration of the ion exchangers was not entirely effective.

6820. WIKLUND, OLOF AND LINDBLAD, LARS. **Beet-juice purification.** *Socker Handlingar* 5, No. 9, 157-96 (1949); *Intern. Sugar J.* 52, 69-71 (1950).—*C.A.* 44, 5125*e*.

Overcarbonatation of beet-sugar juice repeptized the colloids giving a cloudy juice. By adding this overcarbonated juice to raw juice before defecation it was possible to obtain carbonatation scums that settled and filtered easily.

6821. WILLIAMS, KENNETH T.; POTTER, EARL F.; BEVENUE, ARTHUR, AND SCURZI, WARREN R. **A study of clarification methods in the determination of sugars in white potatoes, use of ion-exchange resins.** *J. Assoc. Offic. Agr. Chemists* 32, 698-706 (1949).—*C.A.* 44, 770*f*.

Agents for the clarification of exts. of raw potatoes and dehydrated potatoes to remove nonsugar reducing substances were (1) neutral lead acetate, (2) combination of (1) with decolorizing carbon, and (3) a set of ion-exchange columns, cation- and acid-binding resins. Nonsugar reducing materials in raw potatoes which interfered with the micro methods of analysis, were not completely removed by neutral lead acetate or decolorizing carbon.

6822. WISE, LOUIS E.; GREEN, JOHN W., AND RITTENHOUSE, RUTH C. **Paper partition chromatography of the simple sugars.** *Tappi* 32, 335-6 (1949).—*C.A.* 43, 9433*g*.

Paper partition chromatography was applied to the qual. sepn. of simple sugars obtained by partial hydrolysis of aspen and sprucewood, of holocellulose, spruce α-cellulose, various pulps, and such beater additives as guar and Iles mannane. Limitations of the chromatographic method are discussed.

6823. ZERO, W. **Utilization of nonsugars in diffusion juice.** *Gaz. Cukrownicza* 89, 147-156, 209-212 (1949); *Sugar Ind. Abstracts* 11, 180 (1949).—*C.A.* 45, 3623*g*.

Juice satd. in 2 stages had a better color and purity than juice satd. to final alky. in one stage. It was found that some re-peptization of the nonsugars occurred after preliminary defecation, if contact with juice was prolonged. Removal of the ppt. after preliminary defecation was advised. When the sludge was not needed for fertilizer, the nearly pure $CaCO_3$ in 1st satn. sludge could be regenerated (to lime) about 20 times. The simplest and cheapest method of sepn. of the ppt. was by decantation alone; good decantation results were dependent on accurate liming in the pre-defecation, and a slight excess was best.

6824. ALBON, N. AND GROSS, D. **Chromatographic determination of raffinose in raw sugars.** *Analyst* 75, 454-7(1950); *Intern. Sugar J.* 53, 12-13(1951).—*C.A.* 44, 11135*d*.

Make up a 40% soln. of the raw sugar and prep. standards from a sugar that is free of raffinose by adding weighed quantities of raffinose hydrate. Draw a pencil line parallel to, and 12 cm from, the top of a sheet of Whatman's No. 1 paper and mark the points of application for each sample and standard, 3 cm apart. Apply from a micropipet 0.005 ml of each soln. to the appropriate mark. Allow to dry a few min., and add another drop of the same size at the same place, making 4 mg of sugar. Dry 30 min., fold the top of the paper around a strip of glass 3 cm wide and place it in a trough contg. a solvent mixt. of 5 parts BuOH, 3 parts pyridine, 3 parts water, and 1 part benzene. After 24 hrs at 15-25°C remove the chromatogram from the tank, avoiding spillage of surplus solvent down the sheet. Hang in the drying cabinet and remove the solvent by a stream of air at 90°C. About 1 ml of reagent was required for 25 cm^2 of filter paper. Remove and compare the colors that have developed; 0.05% of raffinose can be detected.

6825. ANGELESCU, E.; NICOLESCU, I. V., AND TIGOIU, A. **Thermochemical investigation of the adsorption of sucrose on calcium oxide.** *Acad. Rep. Populare Române, Bul. Stiint., Ser.: Mat., Fiz., Chim.* 2, 189-98(1950) (French summary).—*C.A.* 45, 8279*c*.

The increase of temp. which took place when distd. H_2O and sucrose solns. were mixed adiabatically in a Dewar flask with CaO was measured. Although only qual. tests were carried out, a definite parallel between the extnd. yield and heat of reaction was observed: each factor which increased the extn. yield of sucrose on CaO resulted in a decrease of the total heat of reaction and inversely.

6826. BADOLLET, M. S. **Processing asbestos fibers: effects on physical properties.** *Trans. Can. Inst. Mining Met. Engrs.* 53, (in Can. Mining Met. Bull. No. 461, 487-91) (1950).—*C.A.* 45, 3531*i*.

Asbestos fibers usually required re-processing before they could be used to best advantage. Any fiber-reprocessing method produced a lowering of fiber strength, loss in strength, formation of fines, different degrees of buoyancy, changes in d., increase in surface area, and a tendency to become more difficult to filter.

6827. BALASUNDARAM, S.; HIRANI, R. K., AND SUBRAHMANYAN, V. **Calcium gluconate from cane sugar.** *Science and Culture* 15, 483-4(1950).—*C.A.* 45, 4951*i*.

Hydrolyzed cane sugar was electrolyzed with 1% KBr, 1% NaCl, and 5% suspended $CaCO_3$. Ca gluconate crystd. when the glucose was oxidized. Fructose could be removed by recrystn. and repeated washings.

6828. BECKER, DIETRICH. **Advantages of juice purification by Wiklund's method.** *Zucker* 3, 513-16(1950).—*C.A.* 45, 3175*h*.

6829. BENIN, G. S. AND SHNAIDER, E. E. **Selection of the place for ion-exchange installation in the technological scheme of a beet-sugar factory.** *Sakharnaya Prom.* 24, No. 10, 14-19 (1950).—*C.A.* 45, 4069*e*.

The most rational place for ion exchangers in a beet-sugar factory was after second carbonation. The present system of diffusion and other treatment of the juices must remain unchanged. However, less lime must be used. Since purities of the juices increased after ion-exchange treatment, the no. of boilings must be increased to four.

6830. BINKLEY, W. W. AND WOLFROM, M. L. **Chromatographic fractionation of cane blackstrap molasses and of its fermentation residue.** *J. Am. Chem. Soc.* 72, 4778-82 (1950).—*C.A.* 45, 2694*f*.

Fractionation of 100 g Cuban molasses on clay gave 4 fractions. A residue which was acetylated and chromatographed on Magnesol gave D-fructose, and D-mannitol as the acetates. Control expts. with pure sugars by the above procedure gave above 90% recovery of D-glucose and sucrose as acetates and 50% D-fructose as acetates in several zones.

6831. BORGHI, MARIO. **Application of ion exchangers to crude (beet) juice.** *Ind. saccar. ital.* 44, 21-8(1950).—*C.A.* 45, 5956*b*.

The raw juice was limed with enough CaO (0.2-0.3%) to flocculate the org. colloids, heated to 90-100°C, and cautiously treated with just enough gaseous SO_2 to produce a pH of 7.0. The completely neutral, turbid juice with a min. content of $CaHSO_3$ and other lime salts was cooled to 50°C, filtered, and passed through the ion-exchange process without fouling either of the 2 resin beds. Three types of resin, Wofatite, Amberlite, and Duolite, were used.

6832. BÖTTGER, ST. AND MENSCHEL, H. **Effective juice purification and continuous filtration.** *Zucker* 3, 508-13(1950).—*C.A.* 45, 3175*h*.

The optimum coagulation occurred at a pH of 10.9 and 35-45°C.

6833. BOZZA, GINO AND PEZZOTTA, ANGELO. **Carbonation velocity of magnesium oxide.** *Chimica e industria* (Milan) 32, 317-23(1950).—*C.A.* 45, 2756*c*.

CO_2 was introduced at const. rate into aq. suspensions of Mg oxides and carbonates. The amt. of Mg reacted vs. time under varying conditions of rate of CO_2 input, temp., and MgO content was detd. The mechanism of the reaction was an initial formation of $Mg(OH)_2$ at low CO_2 concns., followed by its gradual dissolving at higher CO_2 concns. Below a concn. ratio of Mg/CO_2 of 0.62-0.64, an equil. was set up with $MgCO_3.3H_2O$.

6834. BRIEGHEL-MÜLLER, A. AND BOLLERUP, J. **Some color problems relating to juice purification.** 8th *Congr. intern. inds. agr., Brussels* 1950, 219-26 (in English).—*C.A.* 45, 6406*h*.

An amethyst color was formed in beets during ripening. Beet juice was treated with lime to pH = 11, filtered, and measured by extinction coeffs. at 436 and 579 mμ. The color was isolated by removing all other colors by addn. of H_3PO_4, to pH = 2; filtration; addn. of Norit 1%; filtration; addn. of NaOH (50% soln.) to pH 11 and filtration. The colorant was probably the complex, 8 $Fe(C_6H_4O_2)_3$. It seemed to be greatly absorbed by sugar crystals.

6835. Brooks, R.; Clark, L. M., and Thurston, E. F. **Calcium carbonate and its hydrates.** *Trans. Roy. Soc. London* A243, 145-67, (1950).—*C.A.* 45, 3744*f*.

The tendency for metastable phases of $CaCO_3$ to be pptd. from aq. solns. was increased by raising the pptn. rate or by increasing the concn. of addn. agents as Calgon or Mg ion. Spherulitic crystals of $CaCO_3.H_2O$ could be prepd. by adding simultaneously and at uniform rates 60 ml of 12% $MgCl_2$ soln., 126 ml of 25% $CaCl_2.6H_2O$ soln., and 91 ml of 25% Na_2CO_3 soln. to 400 ml satd. NaCl soln. with stirring at a temp. of -3°C; the reaction product was filtered and the moist cake allowed to stand. $CaCO_3.H_2O$ was moderately stable, could be dried at 100° with very little decompn. and decompd. slowly at room temp.

6836. Carruthers, A. **Aspects of second carbonatation.** *Brit. Sugar Corp. 3rd Tech Conf.* **1950**, 13 pp.—*C.A.* 46, 7799*i*.

The contents of Ca salts in the 1st carbonatation juice, filtered, and gassed to the optimum alky., were decreased appreciably on digestion with 1% of $CaCO_3$ at 85°C for 15 min. Brieghel-Müller's results as to the effect of press cake in this respect were confirmed by analyses of juice from the lab. and factory presses, and of raw juice defecated in the lab.; the Ca salts were further reduced by digestion with $CaCO_3$ so that the cake was not fully effective.

6837. Ché León, Marcelino and Cerdan Rios, Ernesto E. **Clarification of cane juice with carbonate and oxide of calcium.** *Anales asoc. peruana technol. azucar.* 1, 153-8(1950).—*C.A.* 45, 1797*f*.

Utility of the "Louisana method" of defecating cane juice with a mixt. of 7 Bé. milk of lime and powd. $CaCO_3$ was demonstrated. Fractional liming with this mixt. with intermediate boiling was more effective than single liming.

6838. Chow, Ta-Yao and Cheng, Che-Pin. **Middle-juice carbonatation in Taiwan.** *Sugar* 45, No. 9, 34-5(1950).—*C.A.* 44, 9706*i*; 47, 6687*i*.

In factory trials, middle-juice carbonatation was satisfactory as regards saving in fuel, CaO, and other chemicals, reduction of scale formation; and improvements in clarification, filtration, over-all recovery, and rise in purity of the juice. The process was especially adaptable for juices of low purity and having high contents of sulfate.

6839. Chow, T. Y.; Chang, P. K., and Cheng, C. P. **A preliminary study of sulfate scale in evaporators and middle-juice carbonation.** *Taiwan Sugar J. Quart.* 3, No. 1, 10-15 (1950).—*C.A.* 45, 1798*c*.

The sulfate scale in the evaporators was traced to 3 major sources. (1) Water. (2) Milk of lime. (3) Cane juice. In a no. of factories in Taiwan the sulfate content of 15° Brix cane juice may vary from 295 to 1260 mg/liter. In ordinary carbonation process the sulfate removal was very little, while in the middle-juice carbonation process it was about 50% or more.

6840. Chow, J. C. and Lo, Y. F. **The efficiency of clarification by middle-juice carbonation.** *Taiwan Sugar J. Quart.* 3, No. 1, 34-42(1950).—*C.A.* 45, 1797*e*.

If the carbonation in the middle-juice process was carried out at a juice concn. of 40-45° Brix, the saving of lime was about 50% and the juice about 10% purer, contained about 25% less CaO, but three times the color value. However, if the juice concn. was 31° Brix, the saving of lime was about 40%, but the purified juice had about the same purity and CaO content, and twice the color value.

6841. Cotton, Robert H.; Rorabough, Guy, and Harris, W. A. **Recovery of waste ammonia in ion-exchange operations.** *Proc. Am. Soc. Sugar Beet Technol.* 6, 544-8(1950).—*C.A.* 45, 5956*g*.

The spent anion-exchanger regenerant contg. 0.5-1.0% of NH_3 was treated with 1.5% of CaO and distd.; recovery was 82%. Only about 15-20% of the liquid need be distd. off.

6842. Cramer, Fr. **Paper chromatography of sugars.** *Angew. Chem.* 62, 73-5(1950).—*C.A.* 44, 4699*b*.

A review with diagrams.

6843. Dědek, J. **Some aspects of ionic exchange (in sugar manufacture).** *Socker Handl.* 6, No. 2, 49-51(1950).—*C.A.* 44, 11136*g*.

The best prepn. of a beet diffusion juice for ionic exchange was by application of the Brieghel-Müller and Wiklund methods of progressive pre-liming and stablization. Proteins and pectins were combined with Ca^{2+} and removed by filtration before reaching the exchangers.

6844. Dědek, Jaroslav; Henry, Josse; Lange, Simon, and Rens, Georges. **The capacity of ion-exchange agents.** *Sucr. belge* 70, 145-68 (1950); 8th *Congr. intern. ind. agr., Brussels*, 1950, 70-96 (in French).—*C.A.* 45, 3177*c*; 47, 2909*c*.

The capacities of a resin were specific for different ions and depended drastically on the pH. The capacity decreased with repeated use. Flow methods must be used rather than static in order to evaluate exchange agents for use. The reversible exchange of glutamate ion was probably via the formation of a complex ion.

6845. Deschamps, Pierre and Charreton, Berthe. **Stability of basic lead chloride.** *Compt. rend.* 231, 1228-30(1950).—*C.A.* 45, 2806*h*.

The effect of NaOH on 0.01*M* $PbCl_2$ was studied by pH measurements. The time for equil. was reduced from several months to 30 hrs as the temp. was increased to 92°C. Et_2NH required less time than NaOH for equil. $PbO.PbCl_2$ and $3PbO.PbCl_2$ explain the pH changes found in the plot of pH *vs.* OH-added divided by OH-needed to form $Pb(OH)_2$.

6846. DeWhalley, H. C. S. **Raffinose—its estimation by a paper chromatographic method.** *Intern. Sugar J.* 52, 127-9, 267 (1950); 53, 247 (1951).—*C.A.* 44, 7575*c*, 9705*e*.

A drop of the soln. to be tested was measured from a micropipet onto a spot on the top edge of a piece of filter paper. At intervals across the same filter paper drops of solns. contg. known amts. of raffinose were also spotted. After drying the chromatogram was developed for 16 hrs at room temp. by using butanol 50, water 30, and pyridine 30 vol. The paper was then dried and sprayed with 0.25% 1-naphthol in EtOH contg. 10 ml H_3PO_4 per 100 ml. On redrying spots appeared to mark the positions of the sugars and their relative amts. Over 400 samples were analyzed. The sugars at the Plaistow refinery showed an av. of 0.25% and at the Thames refinery an av. of 0.31%.

6847. DOORMAAL, J. J. VAN. **Separation of sugar from molasses by ion exchange.** *Inds. agr. et aliment.* (Paris) 67, 143-4(1950).—*C.A.* 45, 5956*f*.

Dild. cold molasses was passed through a strongly acid cation exchanger. The percolate neutralized with lime and concd. gave better sugar yields, and the resulting feed improved because of the Ca content.

6848. DOUWES-DEKKER, K. **Some notes on the principles of our manufacturing processes.** *South African Sugar J.* 34, 297-305(1950).—*C.A.* 44, 9704*g*.

The turbid mixed juice was concd. to 40-45° Brix, carbonated, and filtered. Scaling of the evaporator tubes did not occur and filtrations were satisfactory. In a second modification (Bach process) the removal of suspended matter by centrifugal sepn. from first and second molasses resulted in smoother boiling, more regular grain, and better centrifugal efficiency. It was concluded that advantages were gained by making a thorough second clarification at higher d.

6849. DUVALL, ALLAN. **Some present-day considerations on Hawaii's sugar-mill filtration problems.** *Rept. Hawaiian Sugar Technol., 9th Ann Meeting*, 1950, 101-5.—*C.A.* 45, 7807*d*.

Filtration problems and possible remedies were discussed.

6850. ELLISON, HAROLD E. **Simplified sugar-end operations on deionized (beet) juices.** *Proc. Am. Soc. Sugar Beet Technol.* 6, 554-7(1950).—*C.A.* 45, 5956*a*.

When the temp. of the juice was not allowed to exceed 70°C after deionization and kept below 75°C during crystn., it was possible to hold good color for 2 white pans. Good elimination of invert sugar was obtained by returning the 2nd sirup to the beet end for liming and carbonation.

6851. GERSHGORN, A. D. **Progressive predefecation at Yangi-Yul'skiĭ (U.S.S.R.) sugar factory during 1949/50.** *Sakharnaya Prom.* 24, No. 9, 12-15(1950).—*C.A.* 45, 2245*h*.

Predefecation consisted in returning unfiltered carbonated juice to the diffusion preheated juice with addn. of milk of lime in a 5-section predefecator. This system permitted decreased temp. of juices at filter stations by 10-15°C with increased rate of filtration by 40-50%.

6852. GILLETT, EUGENE C. AND KENDA, W. **Development of the Gillett process of sugar crystallization.** *Intern. Sugar J.* 52, 365-8, 394-6 (1950).—*C.A.* 45, 2694*c*.

6853. GUZMAN, V. V. **Economy of reagents in manufacture of refined sugar.** *An. 1st conv. asoc. peruana tecnól. azucar* 1950, 141-3.—*C.A.* 46, 5345*i*.

By boiling 3rd raw sugars with a footing of final refinery sirup, the sugar obtained was good enough, after affination, for direct boiling in the refinery, with only a small addn. of bleaching agent ($CaOCl_2$ after an initial addn. of 0.025% (on solids) of P_2O_5).

6854. HADORN, H. AND JUNGKUNZ, R. **Basic lead acetate, an unsatisfactory clarifying agent for gravimetric sugar determinations.** *Mitt. Lebensm. Hyg.* 41, 430-5 (1950).—*C.A.* 45, 2694*i*.

Better results were obtained by using $K_4Fe(CN)_6$ + $(AcO)_2Zn$ or $CaCO_3$ + $(AcO)_4Pb$ which gave almost theoretical values.

6855. HAYDEN, J. V. **Ash removal by electrolysis.** *Proc. Intern. Soc. Sugar Cane Technol.* 7, 561-4(1950).—*C.A.* 46, 3780*d*.

In a 3-compartment vessel where the middle cell was flanked on one side by a cell contg. NaOH soln. and on the other side by a cell contg. HCl with canvas partitions between, passage of d.c. brought about reduction of molasses purity and a substantial decrease of ash content.

6856. HOFFING, E. H. AND HAAGENSEN, E. A. **Optimum conditions for sugar filtration.** *Sugar* 45, No. 11, 32-3(1950).—*C.A.* 45, 886*h*.

The max. sugar through-put at 25° to 80°C was at a concn. of 25-30° Brix. It dropped rapidly with an increase to 70° Brix, and considerably also with a decrease to 10° Brix. The length of the filter cycle changed correspondingly, in a reverse direction. The calcd. values were confirmed by expts. with raw sugars, filtered with the aid of 1.25% Dicalite Speedflow at const. pressure drop.

6857. HONIG, PIETER. **Middle juice carbonation.** *Sugar* 45, No. 2, 39(1950).—*C.A.* 44, 4272*h*.

The process required only 0.5 of the lime used in the de Haan process, and the filterability of the carbonated juice was much better. Addn. of small amts. of phosphate to the juice sent to the evaporators practically prevented scale formation.

6858. HONIG, PIETER. **Removal of nonsugars in the carbonation process.** *Sugar* 45, No. 9, 35-7(1950).—*C.A.* 44, 9707*a*.

Carbonation of washed raw sugar liquors of over 99 purity at a Brix of 60-62° resulted in the lowest concn. of the different ash constituents per 100° Brix, ranging from 0 for Al_2O_3 to less than 7 mg for CaO and SO_4. For middle-juice carbonation at 40-45° Brix the corresponding figures were from less than 1 mg for Al_2O_3 to less than 70 mg for CaO, and for carbonation of mixed mill juice according to de Haan from 2 mg of Al_2O_3 to 200-400 mg of SO_4. Middle-juice carbonation gave better results at 40° Brix than at the 28-31° Brix used in Taiwan.

6859. HONIG, PIETER. **Clay in the cane sugar industry.** *Chronica Naturae* 106, 101-4(1950).—*C.A.* 44, 11135*f*.

Filtered molasses (60° Brix, pH 7.4-7.5) were agitated with 1% Bavarian acid clay and Montana clay at 70°C for 30 min. and 2% Hyflocel added before filtration. Filtration was poor. Some Si(4.5-5%) was removed by the treatment but little else.

6860. JONES, E. LLOYD. **The correlation of laboratory filter tests and rotary vacuum filter performance.** *J. Roy. Tech. Coll.* (Glasgow) 5, 148-60(1950).—*C.A.* 45, 3201*c*.

In tests conducted on a suction leaf filter and on a rotary vacuum filter with the same filter cloth, and with a similar cake being built up in each case, it was found that the vols. of filtrate per unit area per unit filtering time for the 2 types of filters were related as follows: $V_R:V_L = \sqrt{P_R}:\sqrt{P_L}$, where V_R = vol. of filtrate of rotary filter, V_L = vol. of filtrate of leaf filter, P_R = pressure drop across rotary filter, and P_L = pressure drop across leaf filter.

6861. KLEĬMAN, B. M. **Manufacture of pressed refined sugar with greater hardness.** *Sakharnaya Prom.* 24, No. 11, 24-8(1950).—*C.A.* 45, 6405*g*.

The moisture of refined sugar before pressing must be increased to 3% or higher. Prior to drying, the pressed sugar must be heated and cooled. Also, the hardness of pressed lumps will be greater when the sugar was washed in centrifugals with sugar liquor instead of water. Intermittent vacuum drying produced a much harder-pressed lump sugar.

6862. KLEVSTRAND, ROLF AND NORDAL, ARNOLD. **A spraying reagent for paper chromatograms which is apparently specific for keto heptoses.** *Acta Chem. Scand.* 4, 1320(1950) (in English).—*C.A.* 45, 3282*h*.

The following compn. was used in filter-paper chromatography: orcinol, 0.5 g; CCl_3COOH, 15 g; butanol (water-satd.), 100 ml. Keep in a cold place and do not use more than 6-8 days after prepn. After the paper has been dried, spray it and heat at 105°C for 15-20 min. Sedoheptulose and mannoheptulose gave a bluish green color reaction, fructose and sucrose gave yellow, and no color was produced with glucose, galactose, arabinose, xylose, ribose, rhamnose, and glucuronic acid.

6863. KOOIJ, J. N. **The use of ion exchangers in the beet-sugar industry. Purification of sugar juices by means of ion exchange.** *Chem. Weekblad* 46, 795-801 (1950); *Chimie & industrie* 64, 704-7 (1950).—*C.A.* 45, 2245*e*, 4951*e*.

Several methods and the results were given of 9 lab. purification processes.

6864. MALLEA, O. S.; BLAISTEN, R. J., AND TAMARGO, H. J. **Utilization of molasses for citric acid fermentation.** *Rev. asoc. bioquím. argentina* 15, 280-7(1950).—*C.A.* 45, 8200*a*.

Filtration of cane-sugar molasses through cation and anion exchangers diminished its salt concn. by 98.6%. This purified material yielded upon fermentation with *Aspergillus niger* 42% of the theoretical amt. of citric acid while pure sucrose gave 48%.

6865. MARIANI, EUGENIO. **The possibility of recovering amino acids from molasses solutions by ion-exchange resins.** 8th *Congr. intern. inds. agr., Brussels* 1950, 275-83(in Italian).—*C.A.* 45, 4952*g*.

Molasses was filtered through a device consisting of 3 ion-exchange columns, 2 cation and 1 anion. After elution with NH_4OH and HCl, resp., total N and ammonia N were detd.

6866. MARIANI, EUGENIO. **Kinetics of sucrose inversion by ion-exchange resins. II.** *Ann. chim.* (Rome) 40, 500-11(1950).—*C.A.* 45, 9903*a*.

Expts. were made with 25 cc. of 20% aq. sucrose and 1 g ion-exchange resins (Amberlite IR-100 and Montecatini G.S.) at temps. between 20° and 50°C, and the reaction rate constants calcd. by following the inversion with time. These resins were less active catalysts than HCl but could be used repeatedly without loss in activity or in available acidity.

6867. MAUDRU, J. E. **Ion-exchange operations—Hardin, 1949 campaign.** *Proc. Am. Soc. Sugar Beet Technol.* 6, 558-60(1950).—*C.A.* 45, 5956*d*.

Flow of juice to ion exchange was restricted to 80-85% to obtain the benefit of the buffering effect of the 15-20% of untreated juice. This greatly diminished the loss of pH and the use of soda. Addn. of SO_2 to ion exchangers eliminated bacterial troubles.

6868. MICHENER, JOHN W.; FITCH, BRYANT, AND ROBERTS, ELLIOTT J. **Ion exchange in beet sugar factories.** *Ind. Eng. Chem.* 42, 643-7 (1950).—*C.A.* 44, 5125*d*.

In the sugar recovery process the earlier the ion exchange treatment was applied, the greater the apparent potential advantages. However, operation ahead of a defecation step involved problems relating to the elimination of colloidal impurities. Operation on green sirups, where only a portion of the juice was treated, minimized the amount of adaptation required in the remainder of the process.

6869. MONDRIA, H. **Continuous filtration. Influence of some variables on filtration rate and cake quality.** *Applied Sci. Research* A2, 165-83(1950).—*C.A.* 45, 2270*b*.

Rate of filtration and rate of cake washing was related to rotational speed of a rotary-drum filter. A formula was derived to calc. changes in cloth resistance with time from measurements of the filtration rate as a function of time.

6870. Mott-Smith, R. H. and Smith, W. E. Jr. **Elguanite clarification at Grove Farm Company, Ltd.** *Rept. Hawaiian Sugar Technol., 9th Ann. Meeting*, 1950, 84-9.—*C.A.* 45, 7807*g*.

Elguanite, consisting mostly of magnesium oxide with smaller amts. of other materials was proposed for clarification of cane juice.

6871. Murray, J. A.; Fischer, H. C., and Sabean, D. W. **The effect of time and temperature of burning on the properties of quicklime prepared from calcite.** *Proc. Am. Soc. Testing Materials* 50, 1263-77, discussion 1278-82 (1950).—*C.A.* 47, 4561*d*.

The porosity, surface area, and activity of quicklimes prepd. from calcite were closely related; high values of porosity were assocd. with high values of surface area and with high activity. With equal retention times in the kiln, higher temps. of burning produced limes with lower porosity and activity.

6872. Novellie, L. **Improved method of detecting sugars on paper chromatograms.** *Nature* 166, 745(1950).—*C.A.* 45, 2370*c*.

Paper chromatograms of sugars were developed by spraying with a soln. contg. 50 ml EtOH, 50 ml BuOH, 0.4 ml 3.8 *N* HCl, 0.2 ml H_2O, 0.1 g pure B-naphthylamine, and 1 drop 10% $Fe_2(SO_4)_3$ and drying at 160-170°C for approx. 10 min. A bright yellow spot changing to yellow-brown was characteristic of fructose and those oligosaccharides which yield fructose on hydrolysis.

6873. Ongaro, Dante. **The application of ion exchangers in the sugar industry.** *Ricerche sez. sper. zuccheri, Univ. studi Padova, Ist. chim. ind.* 5, 83-106(1950-1951).—*C.A.* 46, 763*i*.

Fractionated exchange by passing dil. molasses (1:10) through a battery of 3 units contg. cationic GS, Cecation, and anionic Deacidite E in a vol. ratio of 1:1.5:05 resulted in practically complete demineralization, removal of 95% of the total N, a pH of 7-8 for the anionic percolate, complete decolorization, and higher yields than by simple exchange.

6874. Powers, H. E. C. **The effect of relative humidity of the atmosphere on sugar.** 8th *Congr. intern. ind. agr., Brussels*, 1950, 128-33 (in English); *Ind. Sacc. Ital.*, 1950, 43, 335-38.—*C.A.* 47, 3589*f*.

The vapor pressure of a satd. soln. of pure sucrose at 20°C and 760 mm pressure was 15 mm Hg corresponding to a relative humidity (R.H.) of the air in equil. with the sugar soln. of 86%. As the syrup became less pure, the R.H. would be lower, dropping to 60 or much lower in some cases. The Factor of Safety as applied to raw sugar storage was closely assocd. with R.H. A study of R.H. gave a logical answer to the problems of how much moisture should be present in refined sugar.

6875. Ramírez Silva, Francisco J. **The Silva process of clarification.** *Sugar* 45, No. 2, 40-1 (1950).—*C.A.* 44, 4271*h*.

The addn. of colloidal Volclay KWK, dispersed in soft water, at the rate of 0.3-2 lb per ton of cane, to the mixed juice continuously before liming, greatly improved the clarification of refractory juices from the newer varieties. The process was recommended for juices that were not refactory.

6876. Ramos, Ramon. **Notes on the new process ''Elguanite''.** *El Crisol* 4, 70-3(1950).—*C.A.* 45, 9903*h*.

Addn. of Elguanite to the extent of 2.5-3% of the total solids to crude cane-sugar juice, followed by heating to 79-95°C for 5-15 min., gave better clarification than lime treatment.

6877. Reents, A. C. and Stromquist, D. M. **Ion-exchange purification of sugar solutions.** *Sugar J.* 13, No. 3, 18-21 (1950).—*C.A.* 45, 1363*f*.

The com. adaptation of this method of sugar purification was discussed.

6878. Rohrlich, M. and Tödt, F. **Fructose from cane sugar and molasses.** *Chem.-Ztg.* 74, 750-1, 758-62 (1950).—*C.A.* 45, 5953*i*.

Recovery in good yield of both glucose and fructose from inversion of sucrose required: (1) inversion be done with a small amt. of acid; (2) Ca fructosate must be gradually pptd.; (3) proportion of added lime to fructose could not be less than 1; (4) sepn. of Ca glucosate and Ca fructosate must be carried out within 30 min. after pptn.; (5) the Ca glucosate and Ca fructosate must both be promptly decompd. (with CO_2) after the sepn.; (6) pptn. of Ca fructosate was best carried out in the cold (near 0°C).

6879. Rounds, Hugh. **Second carbonation operations based on the effective alkalinity concept.** *Proc. Am. Soc. Sugar Beet Technol.* 6, 561-4(1950).—*C.A.* 45, 5955*i*.

A factory procedure was established to regulate the effective alky. by addn. of soda. Lime salts in filtered 2nd carbonation juice were reduced 34%, evaporator boil-outs were reduced 46%, residual lime salts in the juice were held practically const. from hr to hr, whereas formerly they varied as much as 0.100% in 1 hr.

6880. Selyatitskiĭ, V. A. **Automatic distributor of milk of lime for the primary defecation.** *Sakharnaya Prom.* 24, No. 7, 34-7(1950).—*C.A.* 45, 2245*d*.

The incoming diffusion juice raised the level of a float, which in its turn raised a sepg. knife. This admited a certain amt. of lime into the overflow box for the diffusion juice.

6881. Shu, Ping. **Estimation of reducing sugars in starch hydrolyzates by paper chromatography.** *Can. J. Research* 28B, 527-34 (1950).—*C.A.* 45, 4175*a*.

Glucose, maltose, and reducing dextrins were detd. colorimetrically with alk. Cu and arsenomolybdate reagents after sepn. by EtOAc-AcOH-H_2O on paper. An app. was described for the sepn. of many samples simultaneously. With 65-200 γ of glucose, the recovery was 95% with a probable error of 2%.

6882. Smit, P. **Ion-exchange agents in the sugar industry.** *Sucr. belge* 70, 97-107 (1950).—*C.A.* 45, 2693*e*.

The advantages and disadvantages of ion-exchange agents in cane and beet processing, and some practical results were given. Raw juice was opaque and difficult to filter after treatment with these agents. This difficulty may be obviated by coagulating at the optimum pH, addn. of a filter aid, or combination of the two treatments.

6883. Smit, P. **Cation-exchange catalysis in the sugar industry.** *Sucr. belge* 70, 108-13 (1950); **8th** *Congr. intern. inds. agr., Brussels* **1950**, 257-68 (in French).—*C.A.* 45, 2693*d*, 4951*b*.

Sugar juices may be inverted with cation-exchange agents in the H-ion cycle. This process yielded products with higher purity than those obtained by other methods, and the process was appropriate for continuous operation.

6884. Smit, P. **Cation exchangers as catalysts in sugar industry. 8th** *Congr. intern. inds. agr., Brussels* **1950**, 269-74(in French).—*C.A.* 45, 4951*a*.

Inversion of sugar solns. in contact with cation exchangers may be caused by (*a*) direct contact, (*b*) H ions produced in the soln., (*c*) both actions. Use in the glucose process was mentioned.

6885. Solano, Jorge A. and Insúa, Enrique. **Lead nitrate versus lead subacetate in clarifying sugar solutions for polarization.** *Anales asoc. peruana technol. azucar.* **1**, 159-64 (1950).—*C.A.* 45, 1798*e*.

The NO_3^- of $Pb(NO_3)_2$ in a modified Herles' reagent and the AcO^- of Horne's dry subacetate of Pb had no differential effect on the polarization of pure solns. of sucrose, glucose, and levulose or their mixts., and hence either can be used with such solns. With Horne's lead the polarization sugar was 0.3 higher than with the other reagent.

6886. Solano, Jorge A.; Mindreau, Carlos, and Insúa, Enrique. **Clarification of sugar solutions by substituting Herles' reagent for lead subacetate.** *Sugar* **45**, No. 2, 37-9 (1950); *Intern. Sugar J.* **52**, 214-15 (1950).—*C.A.* 44, 4271*i*, 9172*f*.

Herles' reagent was recommended for the clarification of juices and other products from refractory cane varieties. The dry mixt., added to the sugar soln. after making up to vol., gave the same results as Horne's dry basic lead. Darkening could be avoided by adding Herles' NaOH soln. to the sugar soln., making up to vol., and then adding dry $Pb(NO_3)_2$, at the rate of 0.5 g per ml of NaOH soln. With some molasses Horne's dry basic lead must be used in large excess to secure readable filtrates, while normal amts. of Herles' reagent gave satisfactory results.

6887. Sorgato, Ippolito and Donà, Edoardo. **Determination of glutamic acid and its anhydride in the products of the sugar industry.** *Ricerche sez. sper. zuccheri, Univ. studi Padova, Ist. chim. ind.* **5**, 73-82(1950-1951); *Ind. saccar. ital.* **44**, 288-92(1951).—*C.A.* 46, 765*h*.

The glutamine, glutamic acid and its anhydride were detd. by a combination of the methods available for the detn. of amido, amine, and imino N.

6888. Stark, J. B.; Goodban, A. E., and Owens, H. S. **Organic acids in sugar diffusion juice.** *Proc. Am. Soc. Sugar Beet Technol.* **6**, 578-83 (1950).—*C.A.* 45, 5955*h*.

By use of an ion-exchange resin and paper chromatography, glycine, alanine, leucine, isoleucine, valine, threonine, glutamic and aspartic acids, glycolic, glutaric, and pyrrolidonecarboxylic acids were identified. Chem. methods showed the presence of oxalic, citric, lactic, succinic, and malic acids.

6889. Stromquist, Donald M. **Ion-exchange behavior in a two-boiling system.** *Proc. Am. Soc. Sugar Beet Technol.* **6**, 549-53(1950).—*C.A.* **45**, 5956*e*.

In the deionization operations with 2nd carbonation juice there was excessive build-up of color in the dild. returned green sirup from the 2nd white pan, and from deionized molasses. This was overcome by use of a sep. small high-speed app. filled with a regenerable granular phenolic resin, with dild. NaOH soln. as regenerant; this increased the efficiency of the regular exchangers.

6890. Stromquist, Donald M. and Ellison, Harold E. **Ion-exchange results at Layton.** *Sugar* **45**, No. 2, 27-31(1950).—*C.A.* 44, 4271*f*.

During the first 2 campaigns the anion exchanger was damaged by oxidation and by irreversible combination of org. constituents of the juice with the reactive resin groups. These difficulties have been overcome by changes in operating practice. It was also found necessary to change from the 3-boiling to a 6-boiling system. The process increased the extn. to 92.88%, the sugar recovery by 25.15 lb per ton of beet.

6891. Tan, L. P. **Middle-juice carbonation—investigation of the pre-defeco middle-juice carbonation process.** *Taiwan Sugar J. Quart.* **3**, No. 1, 16-33 (1950)(English summary).—*C.A.* 45, 1797*h*.

The mixed juice, after being heated to 65-70°C, was adjusted to pH 7.2 with 38° Brix milk of lime. Sixty % of this predefecated juice, after passing through a sedimentation tank, was filtered and the filtrate was combined with the 40% unfiltered predefecated juice. The combined juice was concd. in the evaporator to 40-45° Brix and 5-6 vol. % of 38° Brix milk of lime was added. The carbonation was then carried out as usual. Advantages of this process over the ordinary carbonation process were given.

6892. Thielipape, Ernst. **Beet juice purification by the method of Wiklund and Lindblad.** *Zucker* **3**, 420-6 (1950).—*C.A.* 45, 885*i*.

The purification scheme of Wiklund and Lindblad was successful on a large scale during the 1948 campaign in a 2000 tons per day factory.

6893. Ventre, Emil K. **A method of juice clarification for the manufacture of sulfitation sugars, sirups, and fancy molasses.** *Sugar J.* **13**, No. 2, 20-1 (1950).—*C.A.* 45, 1363*h*.

Finely divided $CaCO_3$ (lab. scale) was added to juice up to 5% of juice solids and SO_2 added until the pH was brought back to the original value (5.0-5.2). The juice was then heated to 70-80°C to prevent supersatn. with $CaSO_3$. Lime was added to bring to desired pH (6.4), the juice heated to defecation temp. and settled. This method permitted the addn. of higher concns. of CO_2 and resulted in less haze in the final product than with conventional com. procedures.

6894. VLIES, G. S. VAN DER. **Ion exchangers for the purification of sugar-beet juice. I. II.** 8th *Congr. intern. ind. agr., Brussels*, 1950, 62-5, 65-9, (in French).—*C.A.* 47, 3591*b*.

Sugar was extd. at 35-40°C by addn. of SO_2. Ion exchange in this low-temp. juice was more efficient than in ordinary juice. Some expts. were described to remove colloids with both low-temp. and normal juice.

6895. VOGGS, L.; CUENDET, L. S.; EHRENTHAL, I.; KOCH, R., AND SMITH, F. **Separation and identification of sugars using paper chromatography.** *Nature* **166**, 520-1(1950).—*C.A.* 45, 1839*i*.

Blackening of the paper in the chromatography of sugars with a $PhOH$-H_2O mixt. and ammonical $AgNO_3$ as a developer was avoided if the paper was extd. with Et_2O before developing. Another method was to use malonic or propionic acid together with BuOH and H_2O as solvents. For highly methylated sugars the salt of an aromatic base was used as developer.

6896. BALASUNDARAM, S.; HIRANI, R. K., AND SUBRAHMANYAN, V. **Calcium gluconate. II. Preparation from cane sugar.** *J. Sci. Ind. Research* (India) **10B**, 22-4 (1951).—*C.A.* 45, 9901*i*.

Cane sugar was studied as a source for Ca gluconate. An aq. soln. contg. 1.5 lb per liter was boiled 10-15 min. with 1.5 ml concd. H_2SO_4. The electrolytic oxidation of the hydrolyzate on the exptl. scale was carried out under conditions similar to those for dextrose. The yield was about 27%. On the semi-large-scale, 30 exptl. cells were connected in series; each cell contained 20 liters of 40% invert sugar, 200 g NaCl, 200 g NaBr, and 3 lb marble powder; c.d. was 1 amp./$dm.^2$ and temp. 27°. Sucrose was a satisfactory source when glucose was not available.

6897. BENIN, G. S. AND SHNAǏDER, E. E. **Decolorization of sugar solutions with an anion-exchange resin.** *Sakharnaya Prom.* 25, No. 7, 11-15(1951).—*C.A.* 46, 3778*g*.

The removal of coloring matters from sugar solns. by a cation-exchange resin depended on pH, adsorption, and partly coagulation. Alk. treatment restored the adsorptive power. An anion-exchange resin, TM (made in USSR), was capable of decolorizing sugar solns. without previous treatment. The decolorization varied between 68 and 96%. Regeneration was effected by treating with H_2SO_4 and soda ash.

6898. BIENENSTOCK, B. AND POWERS, H. E. C. **Introducing the "Equilibrium Relative Humidity" of a sugar.** *Intern. Sugar J.* 53 254-5(1951).—*C.A.* 45, 10629*c*.

Knowledge of the percentage of H_2O in the sugar as sampled, together with the percentage of H_2O in the sugar at equil. at 75% relative humidity, will enable one to det., by reference to a chart, the relative humidity of the atm. in equil. with it, here termed "Equil. Relative Humidity".

6899. BLACK, R. F. **Major developments in mechanical filtration at the California and Hawaiian Refinery at Crockett.** *Proc. Tech. Sess. Bone Char* **1951**, 173-84; *Intern. Sugar J.* 55, 71-2 (1953).—*C.A.* 46, 6418*a*; 47, 5705*h*.

Particular emphasis was placed on the kieselguhr regenerating plant. Metal-fabric filter leaves increased the filtering capacity. The value of phosphate defecation along with mech. filtration was indicated.

6900. BLACK, W. A. P.; DEWAR, E. T., AND WOODWARD, F. N. **Manufacture of algal chemicals. II. Laboratory-scale isolation of mannitol from brown marine algae.** *J. Applied Chem.* 1, 414-424, (1951).—*C.A.* 46, 4145*c*.

D-Mannitol could be obtained from certain forms of seaweed. Mannitol was isolated by (1) the use of ion exchange resins, (2) precipitation as a water-insoluble derivative, or (3) solvent extraction. Ion exchange method was employed to demineralize the mannitol-salt mixture after solvent extraction. This was accomplished by passing the solution through columns of cation and anion exchange resins resp. The demineralized material was sufficiently pure to permit immediate crystallization from water.

6901. BODAMER, GEO. AND KUNIN, ROBERT. **Heterogeneous catalytic inversion of sucrose with cation-exchange resins.** *Ind. Eng. Chem.* 43, 1082-5(1951).—*C.A.* 45, 7421*f*.

The resins examd. were of the sulfonated styrene type similar to Amberlite IR-120 and the carboxylic type similar to Amberlite IRC-50; the resins were converted to the H-form. Measurements were made at 25°, 50°, 75°, and 100°C and the inversion was followed by optical rotation with a polarimeter. The reactions were 1st order and more effectively catalyzed by the sulfonic acid resin than by the carboxylic exchanger, although neither resin was as effective as was an equiv. amt. of strong acid.

6902. BOON, E.; BRAMMEIJER, J. J.; DOORMAN, F. A.; VERHAART, M. L. A.; VLIES, G. S. VAN DER, AND WATERMAN, H. I. **The purification of sugar-beet juice by its treatment during the diffusion process with sulfur dioxide at low temperature.** *Chimie & industrie* 65, 488-95 (1951).—*C.A.* 45, 8277*f*.

Expts. were made with a small-scale diffusion battery. Expts. were carried out by treating normal juice and low-temp. extd. juice with small quantities of CaO, the latter also with SO_2. The SO_2-treated diffusion juice was much easier to purify with small amts. of lime than normal juice. Juice having received such prepurification treatment lends itself very well to further purification by means of ion exchangers. Three tenths per cent of SO_2 is sufficient if the length of contact is 80 min.

6903. Borghi, M. and Maurandi, V. **Determination of invert sugar, based on the recent theory of sexivalency. II.** *Ind. saccar. ital.* 44, 339-45(1951).—*C.A.* 46, 11727*c*.

Dissolve 26 g molasses to 100 cc.; to 50 cc. of this soln. add exactly 50 cc. of $Pb(NO_3)_2$ soln. (53.0 g in 1000 cc.), shake, and filter; to 50 cc. of the filtrate add 25 cc. of $Al_2(SO_4)_3 \cdot 18H_2O$ (35.6 g in 1000 cc), shake, and add 25 cc. of NaOH (12.3 g in 1000 cc.). Formation of the gel takes place slowly. After 10 min. add 0.5 g of a mixt. (1:1) of anhyd. Na_2HPO_4 and $Na_2C_2O_4$. The soln., which is now 0.25 *N* in regard to the original wt of molasses, is treated with the Luff reagent, and Cu is then titrated iodometrically.

6904. Brown, Robert J. **Nitrogenous compounds in sugar-beet juices.** *Ind. Eng. Chem.* 43, 610-14 (1951).—*C.A.* 45, 5431*h*.

After passing the waste water through a cation exchange and washing out the carbohydrates and acidic compds., the amino acids were released by treatment with NH_4OH and recovered by evapn. and crystn. under suitable conditions. About 90% of the nitrogenous constituents consists of nitrates, amino acids, and betaine.

6905. Brueniche-Olsen, H. **Physical chemistry of the second carbonation in the sugar-beet industry.** *Proc. 11th Intern. Congr. Pure and Applied Chem., London 1947* 3, 37-43(1951)(in English).—*C.A.* 45, 9901*h*.

An increase in the buffer content during carbonation caused a shift toward lower pH values and produced a change in the relation between carbonate and bicarbonate; hence there was no unequivocal relation between natural alky. and the deliming of the juice. Only the alky. liberated up to pH 8 was active in converting Ca to $CaCO_3$. The "effective alky." was the difference between alky. at pH 9.25 and the lime content, both detd. in the 1st carbonation juice.

6906. Bryson, J. L. and Mitchell, T. J. **Improved spraying reagents for the detection of sugars on paper chromatograms.** *Nature* **167**, 864(1951).—*C.A.* 45, 8408*b*.

A 0.2% ethanolic soln. of naphthoresorcinol acidified with an equal vol. of 0.25 *N* HCl showed only levulose, sorbose, sucrose, and raffinose, whereas with a 0.1 vol. of H_3PO_4 (1.85 sp. gr.), rhamnose, xylose, arabinose, dextrose, galactose, mannose, maltose, and lactose could be detected in a chromatogram carrying all twelve sugars.

6907. Chang, Lie Tien. **Sugar-liquor defecation with soybean flours.** *Ind. Eng. Chem.* 43, 654-9(1951).—*C.A.* 45, 5432*g*.

Soy flour, defatted by solvent extn., was a good agent for defecating sugar juices and liquors, except affination sirup. About 0.2-0.3% of flour on total solids in the liquor was mixed with 9 parts by wt of water. The dispersion was limed to pH 10 and mixed with washed raw sugar liquor of 60-70 Brix and a pH of 7.5-8.0 at 70°C in a blow-up tank with mech. stirrer. The mixt. was heated to 90°C, and then without stirring to 100° for 30 min. The scum rose to the top and was skimmed off and washed to a mud tank for sweetening off. The clear liquor was drawn from the bottom. Still better results were obtained by treating sugar liquor with a mixt. of soy flour and vegetable carbon in the ratio of 2:5.

6908. Chow, T. Y. and Chang, P. K. **Inorganic nonsugar removal in middle juice carbonation.** *Taiwan Sugar J. Quart.* 3, 119-37 (1951)(English summary).—*C.A.* 46, 1275*h*.

The chief inorg. constituents in the mixed juice were CaO and SO_3 (300 mg/100 g Brix and 750 mg/100 g Brix, resp.). Up to second carbonation, about 40% of the SO_3 was removed, but the CaO content increased by 85%. Addn. of Ermanite (a kind of phosphate added to help the clarification of the juice) did not change the results significantly.

6909. Cunningham, W. A. **Fundamentals of lime burning.** *Ind. Eng. Chem.* 43, 635-8 (1951).—*C.A.* 45, 4906*g*.

Excessive temps. and long retention periods caused overburning, and at the same time exposure to gases contg. CO_2 at temps. below that required for calcination resulted in recarbonation of the CaO. The operating conditions to avoid both of these difficulties with rock of various sizes and of varying compn. are outlined.

6910. Dahlberg, H. W. and Bennett, A. N. **Effects of nonsugars on solubility of sucrose in sugar-beet sirups.** *Ind. Eng. Chem.* 43, 660-2(1951).—*C.A.* 45, 5432*a*.

A sirup high in N and another high in ash was prepd., and their effect on the soly. of sucrose was detd. At a ratio of 100 parts of impurities to 100 of H_2O, the second increased the soly. 5.5% at 40° and 6.6% at 50°C. At a ratio of 150:100 the increases amounted to 5.6 and 6.5%, resp. At a ratio of 100:100, high-N slightly decreased the soly. of sucrose. At the 150:100 ratio, it increased the soly., but less than did high-ash. At about equal raffinose content, the soly. of sucrose increased with the ash content of beet sirup.

6911. Daniels, R. M. and Cotton, Robert H. **Reburning of defecation lime cake.** *Ind. Eng. Chem.* 43, 624-7(1951).—*C.A.* 45, 5433*b*.

Waste lime cake was reburned in a multiple-hearth furnace (illustrated) of the Skinner type, installed in a Steffen beet factory. The furnace produced lime of excellent quality for Steffen house operation. Lime lost as dust, etc., was replaced by introducing fresh lime rock in each cycle. The Ca saccharate from the Steffen process was used for defecation of the diffusion juice.

6912. DeWhalley, H. C. S. **Carbonation in the refinery.** *Proc. Tech. Sess. Bone Char* **1951**, 185-200; *Intern. Sugar J.* 55, 39-41 (1953).—*C.A.* 46, 6419*f*; 47, 5705*f*.

A continuous carbonation process was developed which used a train of satn. tanks with separate gassing. The low gas absorption was limited to the final tank. The elimination of nonsugars and lime depended on final pH, but the optimum pH did not coincide with a practical rate of filtration. The present installation at 3 English refineries was described.

6913. DEWHALLEY, H. C. S.; ALBON, N., AND GROSS, D. **Application of paper chromatographic methods in the sugar and allied industries.** *Analyst* 76, 287-99; discussion, 299-300(1951).—*C.A.* 45, 7807*e*.

Sugars of industrial interest can be sepd. rapidly and quantitatively by paper chromatography. They were identified by comparison with controls of pure sugar, run on the same piece of paper. Sepn, of the heat-degradation products were shown to be identical with the nonfermentable products in cane molasses; some of the supposed compds. were shown to be mixts. Raffinose can be detd. in raw beet sugar with precision and certainty.

6914. DORFMÜLLER, G. **The influence of lime and carbon dioxide on the ternary system lime-sucrose-water.** *Zucker* 4, 407-9(1951).—*C.A.* 46, 1785*f*.

6915. DOUWES-DEKKER, K. AND LAUBSCHER, P. J. **The effect of removing bagacillo from mixed juice on sugar manufacture.** *Proc. Ann. Congr. S. African Sugar Technol. Assoc.* 25, 57-62 (1951).—*C.A.* 46, 5347*c*.

Fine screening of mixed juice through a Peck strainer or vibrating screen reduced the content of bagacillo in Natal mixed juice from 0.2 to 0.7% on the av. When the Peck strainer was not used at Umfolozi, the sucrose of filter cake was higher; some inconvenience was also experienced by the factory staff in running the various operating processes.

6916. DUBOURG, J. **Purification with calcium carbonate formation.** *Sucr. belge* 70, 237-40 (1951).—*C.A.* 45, 4951*i*.

Many of the peculiarities observed upon carbonating Ca saccharate were explained by the formation of a Ca sucro-carbonate in which the Ca to carbonate ratio was in the neighborhood of 2.

6917. FINKE, OTTO. **Chemical composition of suspended particles in raw sugar-beet juice.** *Zucker-Beihefte* No. 4, 45-8(1951).—*C.A.* 46, 3305*c*.

The suspended material contained 78-82% albumin, 6-8% ash, and 8-11% cellular material. Aspartic acid, glycine, glutaminic acid, valine, leucine, and isoleucine were identified in the albumoid fraction by means of paper chromotography.

6918. HOLZAPFEL, L.; ENGEL, W., AND RUDZINSKI, R. **Organic compounds of silicic acid. XIX. Adsorption experiments on asbestos.** *Gummi u. Asbest.* 4, 200-2(1951).—*C.A.* 45, 9991*f*.

Two g finely divided asbestos was shaken with 50 cc. H_2O and 1 g sugar for 24 hrs. The asbestos was then washed with distd. H_2O, and the soln. and the asbestos were tested for sugar. In serpentine asbestos about 10 times as much galactose and lactose were adsorbed as glucose.

6919. HONIG, PIETER. **The chemistry of the carbonation process applied to raw sugar liquors.** *Sugar* 46, No. 4, 37-9 (1951).—*C.A.* 45, 5431*c*.

The raw liquor was treated with 0.3-0.5% of CaO, satd., and filtered, and further treatment with bone char or decolorizing carbon was required. In another method, 1.5-2% of CaO was added, followed by 1st carbonation to about pH 9.5, filtration, 2nd carbonation to pH 8.5-9, refiltration, and sulfitation to pH 7.2-7.5. No further treatment was required if the raw sugar was of fair quality. The best criterion for the effect of a purification process was the change in the compn. of the nonsugars.

6920. HONIG, PIETER. **Fluctuations in pH readings in the liming of mill juices.** *Sugar* 46, No. 9, 30-4 (1951).—*C.A.* 45, 10627*i*.

Liming technique was best controlled by the use of pH recorders. The recorded values were classified in groups of intervals of 0.1 to 0.2 pH for equal time intervals of 3 or 4 min. each. On probability paper, the range of 6.0 to 9.5 pH was entered as abscissae, and the percentage of the total observations above and below a given pH value as ordinates. The ideal distribution curve was a straight vertical line. As variations in the pH became greater, the curve was more inclined, as shown by the 3 examples. If the curve was abnormal it could be improved by a change in operating equipment and conditions.

6921. KARTASHOV, A. K. AND GLUKHOVSKIĬ, I. E. **The control of predefecation with return of unfiltered juice from the first carbonation. The effect of main defecation.** *Sakharnaya Prom.* 25, No. 10, 10-11 (1951); 22, 11-18 (1948).—*C.A.* 46, 6417*c*; 43, 5614*g*.

To obtain reproduceable analytical results when diffusion juices were predefecated with unfiltered juices from the 1st carbonation, the alky. must be detd. on filtered juices and the alky. of the mixt. detd. after the ppt. had settled. When the lime was added as a whole before the satn., a pH of about 12 was attained for several min. before it was gradually reduced by the CO_2 to about pH 11; with continuous lime addn. and satn., a pH of about 11 could be maintained throughout. The recommended method was that of hot progressive pre-liming, with hot main liming when there were no vacuum filters, but without main liming and with continuous lime addn. to the saturators when vacuum filters were employed.

6922. KHANNA, K. L. AND CHACRAVARTI, A. S. **Nonsugars in sugar cane juice and their bearing on clarifying properties; a study in relation to the open-pan industry.** *Proc. Indian Acad. Sci.* 33B, 204-20(1951).—*C.A.* 45, 10627*e*.

Mineral matter in colloidal form was positively correlated with color, acidity, and ash, and negatively with size of grain (pore space). SiO_2, Fe_2O_3 + Al_2O_3, and CaO were positively correlated with turbidity of the sugar soln. due to greater amts. of insol. impurities. Characteristics assocd. with superior clarifying properties were: low nonprotein and high protein N, the former constituting not more than 40% of total N; a content of colloidal mineral matter (in the alc.-Et_2O ppt. from the juice) not exceeding 6% of total mineral matter; the content of sol. SiO_2, Fe_2O_3 + Al_2O_3, and CaO not more than about 6, 60, and 30 mg per 100 ml, resp.

6923. KHYM, JOSEPH X. AND ZILL, LEONARD P. **Separation of monosaccharides by ion exchange.** *J. Am. Chem. Soc.* 73, 2399-400(1951).—*C.A.* 46, 64*f*.

Fructose, glucose, mannose, and galactose, dissolved in weak Na borate solns. were quant. adsorbed on strong base anion exchangers. Elution was carried out with dil. Na borate solns. and the effluent fractions were analyzed for sugar. Identification of the sugars was made by paper chromatography.

6924. KRAUSE, A. AND WITKOWSKA, A. **Catalytic decoloration of colored natural juices.** *Bull. soc. amis sci. lettres Poznań* B11, 100-15 (1951)(in English).—*C.A.* 46, 7414*h*.

The decoloration of red beet juice at 37°C by H_2O_2 in the presence of $Fe(OH)_3$ and Cu compds. as catalysts was studied spectrophotometrically with $\lambda = 520$ mμ. The rate of the reaction with $Fe(OH)_3$ corresponded to a 1st-order reaction. Moist gel catalysts were strongly active, since they had more surface. In this case, 10^{-13}g Cu as $Cu(OH)_2$ contained in $Fe(OH)_3$ (corresponding to 8×10^{-5} g Fe) accelerated the decoloration of the juice at 37°C. The combined catalyst of a compn. corresponding to an at. ratio Fe:Cu $1:10^{-9}$ caused the decoloration in 9 hrs, whereas $Fe(OH)_3$ alone needed 9 hrs 20 min.

6925. MALLEA, OSCAR S. **Colloidal fractions of Argentine bentonite for clarification of refractory cane juices.** *Bol. estac. esptl. agr. Tucuman* No. 67, 15 pp.(1951).—*C.A.* 46, 8400*i*.

Argentine bentonites were studied and the one most similar to KWK Volclay was selected for trial in clarifying refractory sugar cane juices. Results with the Argentine product compared favorably with those with Volclay.

6926. MARIANI, EUGENIO AND TORRACA, GIORGIO. **Chromatographic analysis of amino acids of molasses and other beet-sugar industry by-products.** *Ind. saccar. ital.* 44, 234-44, 245-50 (1951); *Nature* 168, 959 (1951).—*C.A.* 45, 10628*f*; 46, 3781*b*.

In the juices, molasses, residual waters of Ba treatment, etc., the following amino acids were identified chromatographically with paper: aspartic, glutamic, and γ-aminobutyric acids, glycine, serine, alanine, valine, leucine, tyrosine, threonine, phenylalanine, proline, arginine, and asparagine.

6927. MARTIN, L. F. **Utilization of by-products of Louisiana sugar cane.** *Sugar J.* 13, No. 12, 26-7, 46, 48, 50, 52(1951).—*C.A.* 47, 3013*g*.

Processes for better recovery of aconitic acid and for the sepn. of bagasse into fractions were discussed.

6928. MAUDRU, J. E. **Ion exchange in beet-sugar manufacture.** *Ind. Eng. Chem.* 43, 615-18(1951).—*C.A.* 45, 5432*c*.

The main advantage of the ion-exchange process was increased yield of sugar, decreased yield of molasses, and less scaling in the heaters, evaporators, and pans. The economy of the process can be improved by the manuf. of fertilizer from the NH_4OH used for regeneration and the K_2O and other constituents removed by the process, by the recovery of NH_4OH as such, or by defecating with only 0.2-0.3% CaO on beets.

6929. MCFARREN, EARL F.; BRAND, KATHLEEN, AND RUTKOWSKI, HENRY R. **Determination of sugars on filter-paper chromatograms by direct photometry.** *Anal. Chem.* 23, 1146-9(1951).—*C.A.* 45, 10141*f*.

Glucose, galactose, and lactose were resolved; solvent used was the org.-rich phase of the 2 made by mixing EtOAc, pyridine, and H_2O (2.5:1:3.5 by vol.) plus $AgNO_3$. The spots were dried, exposed to NH_3, and heated in an oven. The max. d. of each spot was detd. by a photoelec. densitometer. Values for spots contg. various dilns. of standard and unknown gave linear curves of log concn. *vs.* d., from which the concn. of each sugar can be calcd. with a max. error of 5%.

6930. MEADE, G. P. **Defecation preliminary to char filtration with Williamson clarifiers.** *Proc. Tech. Sess. Bone Char* 1951, 163-72; *Intern. Sugar J.* 55, 68-70 (1953).—*C.A.* 46, 6418*b*; 47, 5705*e*.

Details of various modifications of the Williamson clarifier, the operation, advantages, and disadvantages were discussed.

6931. MEKHEDA, V. AND BALYURA, V. **Predefecation with unfiltered juice from the first carbonation.** *Sakharnaya Prom.* 25, No. 10, 11-12 (1951).—*C.A.* 46, 6417*d*.

Lime or defecated juice was added to unfiltered carbonated juice from the 1st carbonation and the alky. rose to 0.25% CaO. The alky. on predefecation was brought up to 0.10% CaO in order to coagulate all colloids in the diffusion juice.

6932. MITCHELL, E. AND SOMMERFELD, C. A. **Laboratory experiments with ion-exchange resins.** *Proc. Queensland Soc. Sugar Cane Technol.* 18, 111-20(1951).—*C.A.* 46, 3778*f*.

With Zeo-Carb 215 and De-Acidite (Permutit Co.) the elimination of ash material from sugar-cane juice was above 91%.

6933. MULVANY, P. K.; AGAR, H. D.; PENISTON, Q. P., AND MCCARTHY, JOSEPH L. **A chromatographic study of sulfite waste liquor sugars.** *J. Am. Chem. Soc.* 73, 1255-7(1951).—*C.A.* 45, 6840*e*.

Sepn. of the recovered sugars and of known sugar mixts. by partition chromatography on starch columns with a BuOH-water system was studied. The sugars in a paper pulp sulfite waste liquor derived from 85% western hemlock and 15% white fir were: mannose 48, glucose 15, xylose 15, galactose 10, arabinose 2, and fructose less than 2; unaccounted for 4%.

6934. ONGARO, DANTE. **The problem of the ion exchangers in sugar manufacture.** *Ind. saccar. ital.* 44, 293-308(1951).—*C.A.* 46, 1785*e*.

6935. Owens, H. S.; Rasmussen, C. L., and Maclay, W. D. **Production and utilization of sugar beets.** *Econ. Botany* 5, 348-66(1951).—*C.A.* 46, 1275*f*.

Diffusion, purification, crystn., Steffens process, and ion-exchange treatment were reviewed.

6936. Quentin, Gerhard. **Ion-exchange agents. Performance of cationic agents on limed thin juice.** *Zucker* 4, 342-4 (1951).—*C.A.* 46, 765*a*.

Expts. on contact time, differing ions, and varying concns. indicated that each exchange agent and each exchange reaction had their particular characteristics.

6937. Ramondt, D. **Ion exchangers for glucose (sirups).** *Stärke* 3, 194-6(1951).—*C.A.* 45, 10630*d*.

The life of an anion-exchange resin in starch sirup manuf. was estd. by treating the resin with an excess of H-exchanged strongly acid starch conversion liquor at 95°C for 100 hrs and measuring the change in dry substance and exchange capacity of the resin. Some resins disintegrated during this test.

6938. Rao, P. S. and Beri, R. M. **Analysis of sugars with paper chromatography (capillary ascent).** *Current Sci.* (India) 20, 99(1951). —*C.A.* 45, 7471*b*.

The following sugars and uronic acids were analyzed by the ascending method D-glucose, D-galactose, D-mannose, D-xylose, D-arabinose, L-rhamnose, lactose, maltose, D-galacturonic acid, D-glucuronic acid. Perpendicularly hung filter paper strips (10 × 36 cm) were used which were irrigated with solvent (water-satd. phenol or water-satd. collidine) to a height of 28 cm. The spots were developed by spraying with aniline hydrogen phthalate.

6939. Rorabaugh, Guy and Morris, V. I. **Beet-juice defecation.** *Ind. Eng. Chem.* 43, 619-24 (1951).—*C.A.* 45, 5432*e*.

The rise in purity from the diffusion juice to the evaporator thick juice was greater during cold predefecation, but the difference may be due to better quality of the beets during that period. The Teatini process gave a greater drop in purity from massecuite to green sirup, but a smaller drop from low raw massecuite to molasses. The final granulated sugar was better with cold predefecation.

6940. Rüggeberg, H. **Glucose manufacture with ion exchangers.** *Stärke* 3, 34-8(1951)(English summary).—*C.A.* 45, 7807*h*.

The starch hydrolyzate was passed over H^+, Na^+-charged Dusarite exchange resin, filtered, thence passed over an Asmite bed, and finally concd. Dusarite was regenerated with 6% NaCl in 0.74% HCl. Asmite was regenerated with 6% NaOH at 80°C followed after washing by 0.7-0.9% HCl.

6941. Rüggeberg, H. **Paper chromatography and its use in starch hydrolysis.** *Stärke* 3, 150-5(1951).—*C.A.* 45, 8280*f*.

Acid hydrolysis of wheat starch produced initially glucose, maltose, and higher oligosaccharides; at intermediate stages a second disaccharide (reversion product?) appeared and higher saccharides diminished; finally glucose and a small amt. of maltose remained.

6942. Saha, J. M. and Jain, N. S. **A new technique of clarification.** *Sugar* 46, No. 8, 32-5 (1951).—*C.A.* 45, 9285*g*.

About 1% of milk of lime (15° Bé.) was added under stirring to raise the pH to about 10.5, and the whole juice filtered through presses, giving a firm cake which washed easily. The filtrate, of very light color, was quickly neutralized with SO_2 to a pH of about 7.2, heated to near the b.p., and refiltered. The 2nd cake was wholly cryst., small in quantity, and could be returned to the alk. juice prior to the 1st filtration. If middle juice of about 45° Brix from the defecation or sulfitation process was to be used, it was withdrawn from the penultimate body of the effect. It was simultaneously limed and sulfured, with 4% by vol. of milk of lime, heated to 80-90°, and then a 2nd dose of about 4% of milk of lime was added under efficient agitation to raise the pH to 10.5. It was quickly filtered, if necessary, with a small amt. of filter aid. The filtrate was neutralized with SO_2 to pH 7, refiltered, and sent to the last body of the effect for further concn.

6943. Saha, J. M.; Jain, N. S.; Saxena, K. S., and Nigam, G. M. **New technique of clarification by sulfitation. White sugar production at high alkalinities and temperatures.** *Intern. Sugar J.* 53, 192-4, 196(1951).—*C.A.* 45, 8278*h*.

The raw juice was first heated to 70°C and then limed and sulfited simultaneously with 1% by vol. of 15° Bé. $Ca(OH)_2$. It was then heated to boiling and treated with another unit of $Ca(OH)_2$ under stirring, filtered quickly under vacuum or pressure, the filtrate neutralized with SO_2, boiled, settled, and filtered. The color of the juice was much lighter, had an extra purity rise of 2 units and a lower sol. ash. The process dispensed with settlers or clarifiers, but the filter-press capacity would have to be doubled.

6944. Saha, J. M.; Jain, N. S.; Saxena, K. S., and Nigam, G. M. **A new technique for clarification (of cane juice) by the sulfitation method.** *Sugar J.* 13, No. 10, 16-22(1951).—*C.A.* 47, 3014*g*.

The main feature was the filtration of the juice at high alky. and high temp., which gave a clarified juice with a light color, and showed a high rise in purity. The mixed juice was heated to 70°C, limed with 1-2% by vol. of 15° Bé. lime, and sulfited.

6945. Semenyuk, V. A. **Difficulties in filtration of juices from first carbonation.** *Sakharnaya Prom.* 25, No. 1, 22-3 (1951).—*C.A.* 45, 6407*b*.

Considerable decrease in filterability of juices from first carbonation was observed when a large amt. of withered sugar beets were processed.

6946. SILINA, N. P. **Control on defecation station when unsaturated juice from first carbonation is returned on pre-defecation.** *Sakharnaya Prom.* 25, No. 1, 24-5(1951).—*C.A.* 45, 6407*c*.

The detn. of the amt. of CaO in the defecated juice or unfiltered juice from the first carbonation was made by titration of 10 ml of juice plus 10 ml *N* HCl with NaOH and phenolphthalein as indicator. The amt. of returned juice could be detd. by the formula, $X = 100(a_3 - a_2)/a_2 - a_1$, where X was the amt. of returned juice per 100 liters of defecated juice; a_1 was alky. of returned defecated juice (% CaO); a_2 was alky. of mixed defecated juice, and a_3 was the amt. of lime (% CaO) used for clarification.

6947. STARK, J. B.; GOODBAN, A. E., AND OWENS, H. S. **Composition of sugar-beet liquors. Effect of processing.** *Ind. Eng. Chem.* 43, 603-5(1951).—*C.A.* 45, 5431*f*.

Diffusion juice, thick juice, and molasses from 4 factories were analyzed. Org. acids other than amino acids were fractionated by ion-exchange resins and titrated, and sepd. also by paper chromatography. The carbonation process removed most of the colloids, oxalates, citrates, and phosphates, but not the amino acids and other acid radicals which remain in the thick juice and accumulate in the molasses.

6948. STEINMANN, C. **Filtration with drum filters.** *Zucker* 4, 72-3(1951).—*C.A.* 45, 4951*f*.

Application of continuous rotary filtration in beet-sugar continuous purification process was described.

6949. TAN, L. P. **Report of the modified middle juice carbonation.** *Taiwan Sugar J. Quart.* 3, 139-43(1951)(English summary).—*C.A.* 46, 1275*g*.

The filterability of the first carbonated middle juice (40-45° Brix) was about 36% better than that of the unmodified method. The efficiency of clarification was about 10.5% better than that of the De Haan method, as compared to the 4.5% improvement obtained by the unmodified method. The total amt. of cake was about 5% of the weight of the sugar cane.

6950. TETERIN, V. A.; REVENKO, V. V., AND SHEPTUN, M. S. **Continuous predefecation with installation of "adsorbent" by a system of Yu. F. Bogatzkii.** *Sakharnaya Prom.* 25, No. 7, 7-10(1951).—*C.A.* 46, 3780*c*.

An "adsorbent" was an app. in which a preheated diffusion juice was continuously mixed with unsatd. juice from the first carbonation before this predefecated juice entered a defecation station. A considerable improvement in the quality of the juice and sugar was obtained and lesser filtering area is required.

6951. THIELEPAPE, ERNST. **Ion exchange agents in the American beet-sugar industry.** *Zucker* 4, 73-6(1951).—*C.A.* 45, 4951*e*.

6952. VAJNA, SÁNDOR AND PICHLER, EMILIA. **Behavior of nitrogen-containing components of sugar-beet juices against ionic exchangers.** *Acta Chim. Hung.* 1, 196-206(1951)(in Russian). —*C.A.* 45, 10008*d*.

Solns. of betaine and glutamic acid were examd. in closed systems to test their affinity toward synthetic-resin cation exchangers. On the basis of dynamic ionic exchange expts. the max. satn. and hydrolysis limits were calcd. for betaine and glutamic acid. The max. concn. was also detd. in the case of hydrolysis. The use of the total capacity of ion exchangers was hindered by hydrolysis.

6953. VAŠÁTKO, J.; KOHN, R., AND ZÁVODSKY, L. **Progressive liming of sugar-beet juice with return of first over-carbonated muddy juice.** *Chem. Zvesti* 5, 402-25(1951).—*C.A.* 46, 8883*f*.

By returning 1st carbonation, muddy juice, excessively carbonated, to the raw juice further subjected to a progressive liming by addn. of a reduced amt. of CaO, the negatively charged non-sugar colloidal particles (pectins) formed easily filterable aggregates with positively charged $CaCO_3$.

6954. VINOGRADOV, N. V.; ZIL'BERMAN, I. I., AND LOMOV, F. O. **Economical advantages of beet-juice clarification with ion exchangers.** *Sakharnaya Prom.* 25, No. 12, 27-9(1951).—*C.A.* 46, 9874*h*.

The economic aspect of purification of beet juices with ion exchangers was discussed.

6955. WERNER, ERICH. **Plant experiences with thin juice incrustations.** *Zucker* 4, 467-70, 484-7(1951).—*C.A.* 46, 3305*f*.

The results of preventing incrustations by means of previous ion-exchange treatment in the 1950 campaign were compared with the phosphate treatment practiced in the 1949 campaign. The former method was vastly superior in this regard.

6956. WHALLEY, T. G. **Bagacillo in rotary filtration—pneumatic separator described.** *S. African Sugar J.* 35, 575, 577, 579, 581, 583, 585 (1951).—*C.A.* 46, 3780*g*.

Bagacillo of fineness 87 to 472 was added as a filter aid at the rate of 1% to sugar-cane mud and the effect of fineness on filtration efficiency detd. Fineness = Σ (% retained on each sieve/length of opening of sieve in mm). No. 14, 20, 28, 35, 48, and 65 standard Tyler sieves were used. Increasing the fineness from 180 to 290 resulted in 100% increase in the permeability of the filter cake and only a small % decrease in retentiveness.

6957. WIGGINS, L. F. AND WILLIAMS, J. HAWORTH. **Quantitative examination of the amino acids in cane juice.** *Proc. Brit. West Indies Sugar Technol.* 1951, 40-5.—*C.A.* 46, 8400*h*.

By chromatographic techniques, the following amino acids were found in cane juice (variety B. 34104): glycine, alanine, valine, leucine, aspartic acid, glutamic acid, glutamine, lysine, asparagine.

6958. WIKLUND, OLAF; ANDERSON, GUNNAR, AND ASK, WM. **Beet-juice purification.** *Socker Handl.* 7, 7-24(1951)(in English).—*C.A.* 45, 9903*e*.

When an aliquot of 1st carbonated juice was made into overcarbonated juice (*C*) and recycled to the raw juice (*R*), the ratio *C*/*R* influenced purification. As *C*/*R* increased, the vol. of the sludge decreased and its rate of settling increased. There was an inverse relation between juice color and vol. of sludge; light colored juice and poor filtrability of the sludge go together.

6959. WILLIAMS, KENNETH T. AND BEVENUE, ARTHUR. **Use of ion-exchange resins for the removal of nonsugar reducing substances in the analysis of fresh leafy plant materials for sugars.** *J. Assoc. Offic. Agr. Chemists* 34, 817-21(1951). —*C.A.* 46, 2962*h*.

Selected ion-exchange resins were equal or superior to neutral $Pb(OAc)_2$ for removing nonsugar reducing substances and color in the analysis of the fresh leafy portion of plant materials for sugars.

6960. ZAGRODZKI, STANISLAW. **Separation of organic and inorganic nonsugars in residues of fermented (beet) molasses.** *Roczniki Chem.* 25, 242-50 (1951)(English summary).—*C.A.* 46, 5255*d*.

The dehydrated residue was sepd. into inorg. material and nonsugar org. material by acidifying with H_2SO_4 and extn. with an azeotropic aq. pyridine mixt. or by concn. to 70-80° Balling and treating with anhyd. pyridine. The cations of the residue can be sepd. by ion exchange.

6961. ALSTON, P. W. **Notes on symposium on carbonatation.** *Proc. Amer. Soc. Sugar Beet Tech.*, 7, 773-4 (1951).

(1) Split lime addition gave improvement in the carbonatation filtration. (2) While batch carbonatation gave better juice with lower lime salts and color, continuous Dorr carbonatation saved so much labor and material on the filter-press station that poorer quality juice had to be accepted in return for the reduction in costs. The standard Dorr and various European systems of carbonatation were compared.

6962. ALSTON, P. W. AND MCGINNIS, R. A. **Recent developments in beet sugar factory technology.** *Sugar* 47, No. 1, 33-7, 54(1952).—*C.A.* 46, 1785*e*.

6963. AUSTERWEIL, GÈZA V. **Reduction of the inversion of sucrose by ion-exchange agents.** *Compt. rend.* 234, 1289-91 (1952).—*C.A.* 46, 7350*c*.

Mixed ion-exchange agents (mono-bed) reduced the losses because of hydrolysis at low pH.

6964. BALYURA, V. I. **More about predefecation.** *Sakharnaya Prom.* 26, No. 9, 24-5(1952).—*C.A.* 47, 3013*f*.

An increased amt. of unfiltered first carbonation juice, prelimed and returned on predefecation decreased the amt. of Ca salts, colloids, and color in juices of the second carbonation.

6965. BECKER, DIETRICH. **Comparison of old and new methods of juice purification.** *Zucker* 5, 45-9, 68-74(1952).—*C.A.* 47, 3014*h*.

6966. BLACK, RALPH F. AND ZEMANEK, LYLE. **Continuous lime-phosphate process for defecating refinery liquors.** *Sugar Ind. Technicians* **1952**, 9 pp.(mimeograph).—*C.A.* 46, 8399*g*.

The liquor was screened through an 80-mesh vibrating screen to remove fiber and bagacillo, and then through a Sweetland filter fitted with an 80 × 80-mesh twilled Monel screen to remove dirt and silt. The usual H_3PO_4-CaO treatment then followed continuously.

6967. BROWN, ROBERT J. **Determination of raffinose in mother beets and raw-beet juices.** *Anal. Chem.* 24, 384-8(1952).—*C.A.* 46, 5347*d*.

The procedure included clarification of the beet juice, treatment by mixed-bed ion exchangers, and a modification of de Whalley's paper-chromatography method for detn. of raffinose in raw-beet sugars.

6968. CHACRAVATI, A. S.; PRASAD, KAMTA, AND KHANNA, K. L. **Role of clarifying agents in open-pan boiling of sugar-cane juice.** *J. Sci. Ind. Research* (India) 11B, 305-7(1952).—*C.A.* 47, 4637*h*.

An investigation was made with castor seed, ground-nut ext., and bhindi mucilage as clarifying agents in open-pan boiling of cane juice. Treatment with the first two removed a major part of colloidal matter and of org. and non-protein nitrogenous constituents at all stages of boiling.

6969. CHOU, J. C. **The removal of sulfur trioxide by carbonation.** *Taiwan Sugar J. Quart.* 4, No. 1/2, 67-78(1952)(English summary).—*C.A.* 47, 1414*i*.

The amt. of lime used varied from 5 to 15 vol. % of 38 Brix milk of lime or 1-3% of lime. The amt. of SO_3 removed increased with the amt. of lime used up to 10 vol. % of 38 Brix milk of lime; after that the increase became gradual. K_2O strongly hindered and Na_2O slightly hindered the removal of SO_3; while Al_2O_3 strongly promoted and P_2O_5 slightly promoted the removal of SO_3.

6970. CHOU, T. T. AND CHANG, P. K. **Comparative study in a pilot plant of various operation conditions in the middle-juice carbonation process.** *Taiwan Sugar J. Quart.* 4, No. 1/2, 1-27 (1952)(English summary).—*C.A.* 47, 1414*f*.

For middle-juice carbonation the max. saving in lime consumption was 35-40% of the lime used in ordinary carbonation process. No definite conclusion can be drawn on the optimum satn. time, satn. temp., and end point pH and no definite proof has been obtained on the benefit of mud removal prior to concn. and carbonation to filtrability and clarification efficiency. The CaO content of the juice increased after carbonation, but the SO_3 content of the juice decreased.

6971. CLAIRE, A. G. **Clarification of cane juices with Herles' reagent.** *Proc. Queensland Soc. Sugar Cane Technol.* 19, 72-3(1952).—*C.A.* 46, 8400*g*.

A normal wt of juice was placed in a 100-ml flask, 1.5 ml of Herles' reagent B (100 g NaOH in 2 liters H_2O) added, dild. to 100 ml, and shaken with 0.73 g of dry $Pb(NO_3)_2$. In all cases the filtrate was clearer and filtered more freely than in the original Herles' method; errors due to vol. of ppt. were eliminated and results agreed within the exptl. error.

6972. Crosier, H. E. and Brownell, L. E. **Washing in porous media.** *Ind. Eng. Chem.* 44, 631-5 (1952).—*C.A.* 46, 5898*e*.

The mechanism of washing of filter cakes could be divided into 3 stages: a primary displacement stage which was terminated by the break-through point, when the wash first emerged from the cake, a secondary stage during which the concn. of filtrate in the stream leaving the bed was continuously decreasing, and a final stage in which the filtrate removal by diffusion was controlling.

6973. DeWhalley, H. C. S. **Kestose and sugar losses.** *Intern. Sugar J.* 54, 127(1952).—*C.A.* 46, 7801*b*.

Kestose, a trisaccharide consisting of 1 glucose and 2 fructose units, was synthesized during invertase inversion of sucrose and was formed when microörganisms were present in cane products. Clerget molasses, however, showed a fictitious sucrose content of 0.8 for every 1% of kestose present. Refineries showing unusual sucrose losses should examine input and output items for kestose.

6974. DeWhalley, H. C. S. **Raffinose in molasses and low beet products.** *Intern. Sugar J.* 54, 158(1952).—*C.A.* 46, 7803*b*.

Kestose in beet molasses interfered with the chromatogram of raffinose and made its detn. difficult by paper chromatography.

6975. DeWhalley, H. C. S.; Gardner, S. D., and Runeckles, R. E. **Determination of sucrose in beet molasses, raw beet sirup, and other sirup containing raffinose.** *Intern. Sugar J.* 54, 244(1952).—*C.A.* 46, 11726*h*.

When raffinose was present in sirup, the sucrose content could not be obtained directly by the chem. method with invertase. Since raffinose was easily detd. by a paper chromatographic method, a correction for raffinose can now be made. Sucrose = 19/20 ((total sugars as invert) — (invert) — (0.648 raffinose hydrate)).

6976. Dimler, R. J.; Schaefer, W. C.; Wise, C. S., and Rist, C. E. **Quantitative paper chromatography of D-glucose and its oligosaccharides.** *Anal. Chem.* 24, 1411-14 (1952).—*C.A.* 46, 11730*f*.

The app. previously described was used to sep. the products of starch hydrolysis; BuOH: pyridine: H_2O, 6:4:3 by vol., or fusel oil (b. 121-9°): pyridine: H_2O, 1:1:1 are employed as solvents. Guide strips were sprayed to locate the band for each sugar, and the band was cut out and the eluted carbohydrate was detd. with anthrone.

6977. Dupont, J. and St. Antoine, R. de. **Experiences with the Oganesoff process. Production of sugar without previous chemical purification of the juice.** *Rev. agr. ile Maurice* 31, 221-5(1952).—*C.A.* 47, 4637*f*.

The process consisted of treating the raw juice at pH 6.8 in the Superstat or Cepi electronic equipment before evapn. Liming, decantation, and filtration were eliminated. Satisfactory results have been reported with beet juice, but the present single experience, with the Superstat on cane juice, was not the same on account of the higher content of impurities.

6978. Eis, F. G.; Clark, L. W.; McGinnis, R.A., and Alston, P. W. **Floc in carbonatated beverages.** *Ind. Eng. Chem.* 44, 2844-48 (1952); *Intern. Sugar J.* 55, 160 (1953).

Floc, isolated from beverages, granulated sugars, factory liquors and diffusion juice by filtering and precipitating from NaOH solution with acid, gave fractions: 26.8% pectins, etc; 9.7% oleanolic acid; 17.7% sugar beet glycoside, hydrolysing with HCl to glucuronic acid and oleanolic acid, 45.8% of a glycoside-salt complex, hydrolysing to glucuronic acid, oleanolic acid; and salt. The elimination of the floc was complete either by treatment with activated carbons, with synthetic resins ("Duolite S-30" and "Permutit DR") and with a color adsorbing resin between the cation and anion exchange resins.

6979. Gairola, B. B. **Saha-Jain process vs. carbon(ation) process.** *Sugar* 47, No. 6, 53 (1952).—*C.A.* 46, 7349*i*.

Calcns. showed that carbonation was more profitable than the Saha-Jain process.

6980. Ghosh, Dhirendra Nath. **A new sugar technology: electrical coagulation of cane-juice colloids.** *Indian Sugar* 1, 383-9(1952).—*C.A.* 46, 8399*i*.

Raw juice was filled into a rectangular cell in which were hung wrought Fe plates insulated from one another; the 2 end ones are connected with a source of d.c. at 0.9-5.0 v. and 0.04 amp. per in^2; each plate functions as a bipolar electrode. Pectins were decompd. and org. acids removed. The K contained in these acids was converted into KOH which raised the alky. of the fluid to pH 7.2. The proteins were removed partly as Fe compds. and partly by deposition on the anodes but mostly by flotation as the gas-juice interfaces. The surface of the cell became covered with froth which was skimmed off. The electrolyzed juice was drawn off from below, filtered, and treated with Ca superphosphate to remove traces of Fe.

6981. Haruni, M. M. and Storrow, J. Anderson. **Hydroextraction. IV. Radial distribution of permeability in cakes.** *Chem. Eng. Sci.* 1, 154-64(1952).—*C.A.* 46, 10701*b*.

The permeability of maize starch, pptd. chalk, and kieselguhr cakes was studied in a 9 in. diam. basket centrifuge running at 1050 and 1400 r.p.m. There was a gradual decrease in permeability with position of increasing radius in the cakes.

6982. Heinrich, Kurt. **Filtration laws.** *Zucker* 5, 465-73 (1952).—*C.A.* 47, 3014*f*.

Filtration equations were reviewed and applied to sugar liquors, with several specific examples.

6983. Hewlett, Allen M. **Continuous clarity recorder (the "clarimeter").** *Sugar J.* (La.) 15, No. 4, 23-8 (1952); *Intern. Sugar J.* 55, 164, (1953).

Continuous recording of the direct transmittancy, rather than the Tyndall beam intensity, was made. The precision was entirely adequate for station operational control.

6984. HOBBS, J. E. **The drying of granulated sugar.** *J. Inst. Fuel* 25, 65-6(1952).—*C.A.* 46, 4825*e*.

Three types of granulators were described, and data presented for the latest design in use at a British refinery.

6985. HONIG, PIETER. **The clarification of cane sugar juices.** *Sugar* 47, No. 6, 31-6(1952).—*C.A.* 46, 7349*b*.

The optimum pH varied with the compn. of the mill juice. If the juice was low in P_2O_5 and sesquioxides, it may be limed advantageously to a pH of 6.9-7.2 in the clarified juice; if the P_2O_5 and SiO_2 were high and the nitrogenous non-sugars low, a pH of 7.6-7.8 may be recommended. But the optimum pH should be detd. in each case by lab. expts. and analysis of the juice before and after treatment.

6986. KAYSER, FERNAND AND BLOCH, JEAN MICHEL. **Some catalytic properties of montmorillonite.** *Compt. rend.* 234, 1885-7 (1952); *Bull. soc. chim. France* **1951**, *M 488*.—*C.A.* 46, 7859*f*.

Montmorillonite catalyzed the inversion of sucrose. Sucrose in contact with an aq. suspension of H-montmorillonite for a few hrs was heated, after adding Fehling soln. and Cu_2O was formed immediately at the surface of the clay particles. From an aq. suspension of H-montmorillonite contg. NH_3 + C_6H_6, aniline forms, and was identified by color reactions in both the soln. and in the clay. The aniline was strongly adsorbed by the clay and could not be eluted by the usual methods.

6987. KHYM, JOSEPH X. AND ZILL, LEONARD P. **Separation of sugars by ion exchange.** *J. Am. Chem Soc.* 74, 2090-4(1952).—*C.A.* 47, 2090*b*.

Sugars were sepd. by elution of their borate complexes from Dowex-1 with boric-borate buffers. Disaccharides were easily sepd. from monosaccharides, and hexoses from pentoses. The results were consistent with current concepts of the structures of sugar-borate complexes and the reactions of free sugars in aq. solns.

6988. KORTSCHAK, HUGO P. **Filtration rates and impurities in raw sugar crystals.** *Hawaiian Planters' Record* 54, No. 2, 65-75 (1952); *Intern. Sugar J.* 55, 163 (1953).—*C.A.* 46, 10651*g*.

Insoluble material in the raw sugar retarded filtration, present not only in the film of molasses surrounding each crystal, but inside the crystal itself. Poor clarification undoubtedly caused low rates, and the use of phosphate often resulted in the production of raw sugars no longer causing difficulty in filtration in the refinery. Low rates of filtration were due mainly to inclusions of solid particles whose dimensions were of the order of 1μ.

6989. LU, P. Y.; YUAN, H., AND TSAI, H. W. **The control of first carbonatation in middle-juice carbonatation.** *Taiwan Sugar J. Quart.* 4, No. 1/2, 28-42 (1952) (English summary).—*C.A.* 47, 1413*h*.

Before first carbonatation of pH of the mud juice was 9.5-9.8 and the CaO content 410 mg/liter; after 8-11 min. the pH and the CaO content remained as above; during the last 3-4 min. the pH changed to 10.0-10.3 and the CaO content increased to 800 mg/liter; and at the final point (15 min. after the start of carbonatation) the pH was 9.9-10.1 and the CaO content 800 mg/liter. A pH of 9.5-9.8 during carbonatation gave better filtrability and a pH of 9.9-10.1 at the end point gave greater sugar yield.

6990. MAGEE, J. H. **Modernizing the Redpath Refinery.** *Sugar* 1952, 47, No. 12, 39-41; *Intern. Sugar J.* 55, 158 (1953).

An affination and carbonatation plant was designed which would take in raw sugar at the top of the 11-floor building by conveyor belt. By gravity flow, the top five floors contained the affination equipment and the floors below the carbonatation. Installation of the new building has increased the refining capacity to 2,500,000 lb per day, and effected a marked reduction in char and kieselguhr consumption.

6991. MALLEA, OSCAR S.,; VARAS, DAVID, AND BLISS, LESMOIR R. **Clarification of cane juice with colloidal sodium bentonite. I. Colloidal sodium bentonite. II. The use of colloidal bentonite in Argentina. III. Experience with "clarigel" in La Corona.** *Bol. estac. exptl. agr. Tucuman* No. 68, 7-13, 15-24, 25-36 (1952).—*C.A.* 47, 11773*a*.

Clarification was complete with colloidal sodium bentonite ("clarigel"), the juices being clear and showing a purity rise up to 3 points above that of the mixed juices. With 125 g S and 350 g bentonite per ton of cane, it was possible to obtain the same degree of clarification as with 500 g of S alone; but, in order to attain the same standard of decolorization as in the latter case, the S must be increased to about 200 g, leaving the essentially clarifying function to the bentonite.

6992. MARIANI, EUGENIO. **Chromatography of amino acids present in exhausted cossettes.** *Sucr. belge* 71, 373-6(1952).—*C.A.* 46, 6420*a*.

The following were identified: aspartic, glutamic, and α-aminobutyric acids; serine, glycine, alanine, valine, leucines, tyrosine, threonine, proline, phenylalanine, lysine, arginine, and glucosamine.

6993. MARIANI, EUGENIO. **Chromatographic investigations on the distribution of amino acids in the products of sugar manufacture.** *Ind. saccar. ital.* 45, 189-93(1952).—*C.A.* 47, 2521*g*.

In the press juice, diffusion and carbonation juice, molasses, and exhausted beets, the following amino acids were chromatographically detected: aspartic acid, glutamic acid, serine, glycine, alanine, threonine, arginine, lysine, α- and γ-aminobutyric acids, proline, oxyproline, valine, leucine, phenylalanine, tyrosine, glucosamine, asparagine, and glutamine.

6994. MÉTAYER, MAURICE. **Purification studies in a sugar refinery. II. The behavior of some amino acids in the presence of chalk, carbon dioxide, and chlorine ion.** *Inds. agr. et aliment* (Paris) 69, 307-10 (1952).—*C.A.* 47, 3591*a*.

The behavior of different amino acids under the usual conditions of the sugar refinery was studied. All the acids studied except aspartic and glutamic acid existed after the carbonation in the form of the acid amine.

6995. NAVEAU, GEORGES. **Preliming and purification of juice.** *Sucr. belge* 71, 437-51(1952).—*C.A.* 46, 8399*c*.

Improvement in filtration rate resulted from a combination of progressive preliming, liming at 80°C for 6 min. and carbonation. However, the decantation rate was definitely inferior to the Dorr and Wiklund standards. The improved filtration rate suggested the advantage of continuous filtration without previous settling.

6996. NESVADBA, L. **Progressive separation and continuous saturation in sugar manufacture.** *Mitt. chem. Forsch. Insts. Wirtsch. Österr.* 6, 5-8(1952).—*C.A.* 46, 6415*i*.

The purification processes, especially with lime and CO_2 in continuous operation were described.

6997. PAYNE, J. H.; KORTSCHAK, H. P., AND GILL, R. F. JR. **Ion-exchange resins in sugar-cane juice processing. Practical life and capacity.** *Ind. Eng. Chem.* 44, 1411-21(1952).—*C.A.* 46, 8884*a*.

The procedure for evaluating resins consisted of prepg. the resin sample for use, measuring the vol. and dry matter, detg. the capacity for inorg. ions and for clarified cane juice, and recycling the resins in a semiautomatic app. The relative performance characteristics of 17 resins were measured for the treatment of sugar-cane juice, and several performed up to 1500 cycles. The anion-exchange resins lost their capacity much more rapidly than the cation.

6998. POLLMANN, K. P. **Clarification of filtrates from rotary filters.** *Sugar* 47, No. 9, 37-8 (1952).—*C.A.* 46, 9873*e*.

The filtrate was heated to 200° F in a heater and passed through a subsider of the Deming type with a conical bottom and an inverted conical baffle attached to the cover plate. The juice traveled upward at a speed of less than 1 in/min., the clarified juice overflowed at the top, and the settlings discharged from the bottom to the filter feed tank. The pH was regulated so that the clarified filtrate was neutral.

6999. PRICE, J. F. **First carbonatation at Moorhead, Minnesota.** *Proc. Amer. Soc. Sugar Beet Tech.*, 7, 678-680 (1952); *Intern. Sugar J.* 55, 219 (1953).

Improved filtration and washing qualities of lime sludge were shown on the adoption of split liming during 1950 and 1951, a further benefit being decreased lime salts in the juice in spite of a decrease in soda ash addition. The fastest settling rate and clearest juice were obtained by liming in the primary tank to a figure of 0.005 alkalinity lower than that in the secondary tank.

7000. ROSEMAN, SAUL; ABELES, ROBERT H., AND DORFMAN, ALBERT. **Behavior of carbohydrates toward strongly basic ion-exchange resins.** *Arch. Biochem. Biophys.* 36, 232-3 (1952).—*C.A.* 46 5656*e*.

Reducing sugars were retained by a column of Amberlite IRA-400 or Dowex 1, but sorbitol, mannitol, and Me-α-D-glucopyranoside were not retained. Sucrose was partially retained. The retained carbohydrates could be eluted by solns. of AcOH, Na phosphate, and NaCl.

7001. SAHA, J. M. **Further comment on the Saha-Jain process.** *Sugar* 47, No. 2, 44 (1952).—*C.A.* 46, 9285*g*.

Certain details of the process which have been questioned were fully explained.

7002. SAHA, J. M. AND JAIN, N. S. **White sugar without sulfur.** *Sugar* 47, No. 11, 44-7(1952).—*C.A.* 47, 897*g*.

The raw juice was heated to 45-50°C and limed to pH 10.5. $CaCO_3$ was added in the form of a slurry with filter-press wash water, the mixt. stirred thoroughly for a few min., reheated to 55°C and filtered. The filtrate was neutralized with a soln. of superphosphate, the mixt. heated to boiling and refiltered. Refractory juices were first prelimed to pH 6.4-7.4, heated to 45-50°C, and treated as described above. The used $CaCO_3$ could be revivified by heating to 500°C, and the press mud reconverted to superphosphate.

7003. SALANI, RENATO; D'ORAZI, GIOVANNI, AND TEATINI, DARIO. **Purification of the raw juices by the lime-carbonatation process. I. Defecation. II. Carbonatation.** *Ind. saccar. ital.* 45, 431-7, 437-52 (1952).—*C.A.* 47,5705*f*.

A method of pre-defecation and those of gradual pre-defecation of Dedek-Vasatko, Wiklund, and Brieghel-Müller, together with the processes of carbonatation were theoretically discussed. A simple and rapid means to avoid foams, completely utilize CO_2, and to produce regular and compact crystals of $CaCO_3$ were discussed.

7004. SAMUELSON, OLOF AND SJÖSTRÖM, EERO. **Utilization of ion exchangers in analytical chemistry. XXIV. Isolation of monosaccharides.** *Svensk Kem. Tidskr.* 64, 305-14 (1952).—*C.A.* 47, 4248*e*.

A mixt. of fructose and mannose was sepd. by adsorption on Amberlite IRA-400 column, followed by elution with H_2O, frustose being eluted first. It was shown that the adsorption of sugars from H_2O-EtOH solns. increased with the EtOH concn. within the range 75-95% EtOH, and that the uptake was much greater than in case of H_2O. A mixt. of fructose, glucose, and mannose in EtOH (<95%) was adsorbed on the column in the bisulfite state (9 by 150 mm; particle size <0.12 mm) and sepd. by step-wise elution with 99.5% EtOH (fructose), 95% EtOH (glucose) and H_2O (mannose).

7005. Schneider, F.; Emmerich, A., and Schneider, H. G. **Cation-exchange action in the alkali-calcium cycle. The softening of thin juice.** *Zucker-Beihefte* No. 5, 57-70(1952).—*C.A.* 47, 3589g.

K was removed from high-K thin juices by the Na form of an exchange agent, which was displaced in turn by Ca. The working capacity depended upon the conditions of regeneration, best by high temp., with larger amts. and higher purity of the regenerating agents. The difference in capacity observed in the lab. and in the plant was probably due to lower temp., lower purity of reagents, and variable state of the resins. The residual hardness of white juice was due to the formation of a Ca complex. Nitrogenous components were only slightly removed by adsorption, but 90% of the color was removed.

7006. Schneider, F.; Reinefeld, E.; Grove, H.; Müller, H., and Zenker, B. **Nitrogenous nonsugar constituents. I. Investigation of amino acids, particularly in beet molasses.** *Zucker-Beihefte* No. 6, 79-89(1952).—*C.A.* 47, 3590*h*.

Amino acid components were isolated by combining ion-exchange treatment, electrodialysis, and extn. New equipment for continuously extg. these components with BuOH was described.

7007. Streuli, Hans. **The polarometric determination of sucrose in chocolate.** *Rev. intern. chocolaterie* 7, 14-15 (1952).—*C.A.* 46, 6283*a*.

Contrary to some earlier reports, the clarification of chocolate with lead acetate did not give a ppt. retaining sucrose.

7008. Streuli, Hans and Stesel, Marianne. **Clarification in sugar determinations in chocolate.** *Mitt. Lebensm. Hyg.* 43, 417-44 (1952).—*C.A.* 47, 3490*d*.

Somogyi's and Carrez' clarifying agents and basic and neutral Pb acetate were compared in their effectiveness, and the influence of pH and concn. of the clarifying agent examd. Somogyi's agent was effective without introducing foreign ions into the sugar soln., whereas buffering foreign ions may occur when basic Pb acetate or Carrez' agent were used.

7009. Verhaart, M.L.A. **The application of ion-exchange agents in the sugar industry.** *Chem. Weekblad* 48, 365-9 (1952).—*C.A.* 46, 8884*a*.

A general discussion of the advantages of ion-exchange treatment.

7010. Vitte, G.; Boussemart, E., and Guichard, C. **Chromatographic identification of traces of sucrose mixed with larger amounts of glucose and fructose.** *Bull. soc. pharm. Bordeaux* 90, 93-100(1952).—*C.A.* 46, 9020*c*.

Sucrose (0.1 g) was sepd. from glucose (100 g) and fructose (100 g) on a two-dimension ascending paper chromatogram developed with a mixt. of 50 parts Bu OH, 45 parts water, and 5 parts NH_3 followed by a mixt. of 50 parts PhOH, 50 of 1% NH_3 soln., and a trace of HCN. Spots of fructose and sucrose were obtained with naphthoresorcinol, and of glucose with aniline oxalate. The detd. *Rf* values with the respective solvent mixts. were: glucose 0.07, 0.39; fructose 0.1, 0.51; sucrose 0.03, 0.39.

7011. Waale, J. and Waterman, H.I. **Preparation of pure fructose sirups from cane sugar.** *Chimie & industrie* 68, 889-95(1952).—*C.A.* 47, 5706*h*.

A 40% sucrose soln. was inverted at 70-80°C by means of HCl (pH 2) or cation exchange. Calcium fructosate was then isolated at 0-5°C.

7012. Weber, J. and Becker, D. **Suitability of molasses for bakers' yeast after deliming thin juice with base-exchange agents.** *Zucker* 5, 508-12(1952).—*C.A.* 47, 3016*b*.

Two different beet molasses, from juices exchanged with sulfonated coal and phenol-aldehyde resins, were found to be suitable for yeast fabrication.

7013. Weymouth, L.E. and Montgomery, R.S. **Precoat filter filtration of phosphate-defecated affination sirup.** *Ind. Eng. Chem.* 44, 430-4 (1952).—*C.A.* 46, 4826*i*.

The advantages of color removal, filter-aid economy, and long cycles with precoat filtration appeared of real importance and warranted consideration for plant trial. A favorable operating condition to be recommended for larger-scale runs would be the use of 0.20% P_2O_5 with Hyflo taking a 0.0025-in. cut and no body feed. Filtration rate increased in proportion to drum speed from 115 to 80 sec per revolution, then somewhat more slowly to a speed of 60 sec per revolution.

7014. Wolfrom, M.L.; Binkley, W.W., and Martin, L.F. **Molasses: important but neglected product of sugar cane.** *Sugar* 47, No. 5, 33-5 (1952).—*C.A.* 46, 6856*e*.

The compn. of final cane molasses was reviewed.

7015. Yu, H.C. **Comparison of clarifying effect of dry lead with that of other clarifying agents.** *Taiwan Sugar J. Quart.* 3, 243-55(1952) (English summary).—*C.A.* 46, 9331*c*.

Effectiveness of agents for clarifying sugar solns. prior to polarization decreased in the order: Herles' liquid reagent ($Pb(NO_3)_2$ soln. and NaOH soln.), Herles' semidry reagent (NaOH soln. and solid $Pb(NO_3)_2$), basic Pb acetate soln., dry lead (basic Pb acetate), Herles dry agent (basic Pb nitrate), $Pb(OAc)_2$ soln.

7016. Yu, H.C. **Experiment on comparison of Herles' reagent with dry lead subacetate.** *Taiwan Sugar J. Quart.* 4, No. 1/2, 202-11(1952) (English summary).—*C.A.* 47, 1413*f*.

Dry lead was superior to Herles' dry reagent in the clarification of sugar soln. For sugar soln. of high purity or very dil. sugar soln. of low purity, the color and the clarity of the filtrate when treated with dry lead were comparable to that when treated with Herles' liquid reagent or semidry reagent. For more concd. sugar soln. of low purity, dry lead was slightly inferior to Herles' liquid reagent and semidry reagent but was still better than Herles' dry reagent.

7017. YUROV, A.T. **Predefecation.** *Sakharnaya Prom.* **26,** No. 3, 27-9(1952).—*C.A.* 46, 9874*c*.
Hot, progressive predefecation of diffusion juice with unsatd. juice from the first carbonation and with addn. of milk of lime to 0.15% CaO after predefecation improved operation and quality of juices.

7018. ZHUKOV, K.S. KATS, D.I. **Nomographs for control of defecation and predefecation with return of unfiltered first carbonation juices.** *Sakharnaya Prom.* 26, No. 9, 17-20(1952).—*C.A.* 47, 3014*i*.
Two nomographs were presented for detn. of the amt. of unfiltered juice returned on predefecation and for calcn. of the amt. of lime used for defecation in percentage on defecated juice and on the wt of beets.

7019. ASCHE, THEO. **Sedimentation of muddy juices.** *Zucker* 6, 100-1(1953).—*C.A.* 47, 5706*e*.
The rates of settling of first satn. juice at 46, 54, 67, and 73°C were 4.0, 5.5, 8.3, and 9.3 cm/min., resp. A temp. of about 80°C was recommended.

7020. ASCHE, THEO. **Filterability of muddy juices.** *Zucker* 6, 191(1953).—*C.A.* 47, 7243*i*.
Since rapid settling and good filterability go hand in hand, a rapid filtering test was proposed for both operations. The stirred suspension was passed, at 60°C, through a 2 cm^2 microfilter which was maintained at 400-mm Hg. The times of passing of the 2 to 4-, 6 to 8-, and 10 to 12-ml portions were noted as v_1, v_2, and v_3, resp. The av. F_k was designated as the filtration coeff., where $F_{k1} = (v_2 - v_1)/2$ and $F_{k2} = (v_3 - v_2)/2$.

7021. BLANKENBACH, W.W. **An ion adsorbing resin for the control of iron in sugar products.** *Proc. Tech. Sess. Bone Char* **1953,** 167-74.
Bone char was inefficient in the adsorption of iron compds. in the removal of the undesirable green colors in some soft sugars which were due to ferric polyphenols. An ion-exchange resin was developed at the British Columbia Sugar Refinery which had a very definite iron adsorbing capacity. Soft sugars made from syrups treated with such a resin had excellent bloom and bright colors and had a permanence not obtained by any other known means.

7022. DEVILLERS, P.L. **Analysis of sugars with ion-exchangers.** *Sucr. franc.* 94, No. 3, 58-61 (1953); *Intern. Sugar J.* **55,** 223 (1953).
The sugar solution first passed through a cation-exchange resin to absorb the cations and basic compounds and then through an anion exchanger to adsorb the anions and acidic materials, leaving an effluent which contained the neutral non-sucrose impurities. The amino acids and basic nonsugars were eluted by ammonia. The acidic components were eluted with normal HCl. The columns were well rinsed to remove sugar before elution, and a blank run simultaneously to allow for materials dissolved from the resins. In practice, 50% sugar solns. were used, with 1 kg for refined and good whites, while 500 g were used for ordinary white sugars.

7023. DÖRFELDT, W. AND STARKE, S. **Dry liming.** *Zeitsch. Zuckerind.* **78,** No. 7, 263-266 (1953).
The use of dry lime eliminated the advantages of the cold pre-defecation process and residual liming in the cold with milk-of-lime. If the residual liming was carried out partly with milk-of-lime and subsequently with lump lime, the color of the thick juice improved with the proportion of milk-of-lime. With the other methods of pre-defecation and residual liming under varying temp. conditions, there was little difference between the use of dry lime or milk-of-lime. Even with very badly deteriorated beet, cold defecation with milk-of-lime in both stages showed the best results. Calcium salts were higher where dry lime was used.

7024. FINKE, OTTO. **The fate of pectin during beet-sugar production, and its influence on filtration.** *Zucker-Beih.* No. 1, 8-14(1953).—*C.A.* 47, 7244*h*.
Three % of the original pectin came through in the diffusion juices, and 77% of this was eliminated as calcium pectate in the purification. The remaining 23% carried through to final molasses, undergoing considerable thermal degradation throughout the process. From an original number av. mol. wt of 92,000, a drop to 62,500 in the raw juice, and about 20,000 in the thin juice, thick juice, and molasses, was typical.

7025. FORT, C.A. AND SMITH, B.A. **Reverse-cycle demineralization of sugar-cane juices with ion-exchange resins.** *Sugar J.* **15,** No. 9, 16, 18, 22-5 (1953).—*C.A.* 47, 10878*h*.
Clarified sugar-cane juices and synthetic model juices were ion-exchanged by the reverse demineralization cycle. The use of a strongly basic anion exchanger followed by a weakly acidic cation exchanger caused satisfactory demineralization with 0.16% inversion of sucrose. When the cation exchanger was strongly acidic, there was a 2.8% inversion. With direct demineralization with a strongly acidic cation exchanger only, there was a 4% inversion.

7026. FORT, C.A.; SMITH, B.A., AND MARTIN, L.F. **Comparison of the effectiveness of selected ion-exchange resins for the purification of clarified sugar cane juice.** *Proc. Tech. Sess. Bone Char* **1953,** 179-98.
Several strongly-basic anion exchangers varied in their capacity for removal of N-compd. and colors, in addn. to mineral from sugar cane juices. Generally, less than 60% of the mineral satn. capacity of the basic anion exchanger could be utilized if reasonable N and color removal were to be obtained. Demineralization by the reverse cycle, utilizing the strongly basic anion exchangers, produced no inversion of sucrose and through removal of non-sugar reducing substances, resulted in an apparent decrease in reducing sugars. Temporary retention of reducing sugars by this type of anion resin made possible a fractionation of effluent juices into high and low purity products.

7027. GEE, ALLEN. **Some studies on basic calcium phosphates of interest in sugar refining.** *Proc. Tech. Sess. Bone Char* **1953,** 337-52.

Three aspects concerned with basic calcium phosphates were the nature of the solid, the apparent soly., and the behavior upon ignition. A review was supplemented by some preliminary original results. Some remarkable differences were found in the cryst. forms in which basic calcium phosphates could be pptd. from water under a variety of conditions. Some information on soly. measurements was also presented. Pyrophosphate probably formed when basic calcium phosphates were ignited to 400-800°C.

7028. HULL, WILLIAM Q.; KEEL, HARVEY; KENNEY, JOHN JR., AND GAMSON, BERNARD W. **Diatomaceous earth.** *Ind. Eng. Chem.* 45, 256-69 (1953); *Intern. Sugar J.* 55, 164 (1953).—*C.A.* 47, 7137*b*.

The production of the filter-aid "Dicalite" in Lompoc, Cal. was reported. The crude earth was fluxed in a rotary kiln with 5% of ash, the bag-house products obtained being 5-20% of pure air-floated filter-aid. The final product contained 87.9% of SiO_2, 5.9% of Al_2O_3 and 1.1% of Fe_2O_3 and has proved to be a most remarkable filter-aid in the sugar, wine and other industries.

7029. HULME, A. **An action of strongly basic anion exchanger resins and solutions containing sugars.** *Nature*, 171, 610-611 (1953).

The decomposition of sugars when treated with strongly basic exchangers in the hydroxyl form led to lactic acid formation, which may confuse an analysis for acids in fruits and other foods. It was suggested that the acids to be determined be absorbed on a weakly basic exchange resin, and then fractionated by displacement and subsequent chromatographic separation on a strongly basic exchanger.

7030. NEUBERT, A.M.; GRAHAM, D.W.; HENRY, J.L.; BREKKE, J.E., AND BEARDSLEY, C.L. **Recovery of sugars from pear-canning wastes.** *Agr. Food Chem.* 2, 30-36 (1953).

In a pilot-plant operation, sugars and other sol. solids from peelings, cores, and trimmings normally wasted in canning pears, were converted into a calcium pectate gel from which a clear, pectin-free juice was easily pressed. Excess calcium was removed by treatment with cation exchange resins; color was removed by precipitation and adsorption on activated carbon. The purified juice, when employed as a sirup base for canning pears, may replace as much as one-third of the refined sugar customarily used.

7031. OWENS, HARRY S.; GOODBAN, ALAN E., AND STARK, J. BENJAMIN. **Fractionation of organic acids in sugar beets by means of ion exchange resins.** *Proc. Tech. Sess. Bone Char* 1953, 221-32.

Most of the acids in sugar beet processing liquors were sepd. by adjusting the pH of the top portion of a column to pH 2.5 to 4.2 with HCOOH and the bottom portion to pH 2 to 2.5 with HCl or oxalic acids. The following acids have been identified in the liquors: lactic, glycolic, glyceric, succinic, pyrrolidone carboxylic, malic, citric and possibly, fumaric. Two other acids have not been identified. The exptl. details were given leading to the optimum conditions and the factors considered were: the nature of the resin, the capacity of the resin for various acids, the titration curves of the resins, and the concn. of the eluting agent.

7032. PHILLIPS, J.D. AND POLLARD, A. **Degradation of sugars on ion-exchange columns of Amberlite IRA 400 (OH^-).** *Nature* 171, 41-2 (1953).—*C.A.* 47, 4637*e*.

Upon passing neutral, av.-cider apple juices, contg. sugars in the proportions of fructose 10, sucrose 2, and glucose 1.5%, through exchange columns, it was found that (1) there was no retention of any of these 3 sugars by Amberlite IR 120; (2) all these sugars were retained by IRA 400 (OH^-); (3) there was considerable degradation of fructose and glucose with the production of org. acids; (4) sucrose was relatively little attacked by the resin; and (5) sugar which had not been degraded could be removed from the column by elution with *N* ammonium carbonate.

7033. RAO, N.S.; RAMCHANDRAN. K., AND ZAHEER, S.H. **Levulinic acid from cane molasses.** *Indian Sugar* 3, No. 2, 63-64, (1953).

Molasses from Nizam factory containing 55-56% total sugars was diluted with water and HCl to acid concentration of 6.5% and a sugars content of 27-42% for different samples. It was then heated for 1 hr in an autoclave at 100-175 p.s.i. and 167-185°C, producing a dark brown liquid and a dark bulky residue. The liquid was drained off and the solid broken up and washed free of keto-compounds, testing with 2,4-dinitrophenyl hydrazine. The liquid and washings were distilled at atmospheric pressure, interrupting to filter when fairly concentrated, and re-distilling to give a dark viscous liquid. Levulinic acid was recovered as calcium levulinate, as methyl or ethyl levulinate, by ether extraction, and by direct vacuum distillation.

7034. SMIT, P. **Use of weakly acid selective ion exchange resins for sugar juice purification.** *Zeitsch. Zuckerind.* 78, No. 4, 151-154 (1953).

A weakly acid selective cation exchanger was used to remove as much as 25 g CaO per liter of product. Besides Ca ions, other cations and organic impurities were removed by such treatment.

V-4. Purification of Water and Sewage

7035. BEHRMAN, A.S. AND GUSTAFSON, H. **Effect of low-pH waters on zeolites.** *Ind. Eng. Chem.* 28, 1279-82(1936).—*C.A.* 31, 2325^9.

Reduction in exchange capacity was not due to any disintegrating effect on the zeolite (in the absence of true mineral acidity), but simply to new equil. conditions at and with the increased pH concn. in the water. This new equil. at a lower level of base-exchange capacity was established quickly; and the active life of the zeolite at this lower level was no shorter than that of the zeolite when used for softening waters of a more favorable pH range.

7036. SIGWORTH, E.A. **Experiences with application of activated carbon in reservoirs.** *Taste and Odor Control J.* 3, No. 2, October (1936)

About 2 p.p.m. of activated carbon were required on the av. There was little likelihood of the carbon entering the supply pipes. It was claimed that 8 p.p.m. of activated carbon in water were barely perceptible in a glass of water. The carbon must be added as a thin slurry to prevent floating on the surface.

7037. COLLINS, LEO F. **A study of contemporary zeolites.** *J. Am. Water Works Assoc.* 29, 1472-1514(1937).—*C.A.* 32, 277^3.

The classification, prepn. and compn. of contemporary zeolites, the base-exchange reaction and certain characteristics limiting their industrial utility were reviewed.

7038. ABRAHAMCZIK, E. **Determination of small quantities of heavy metals in waters.** *Mikrochemie* 25, 229-41 (1938).—*C.A.* 33, 1847^3.

For detg. small quantities of heavy metals in water, the sample was filtd. at the source through a Permutit tube. The adsorbed heavy metals were washed out with NaCl soln. in the lab. Instead of Permutit, a resinous filtering material was obtainable on the market. Excellent recovery of added ion was accomplished in many cases.

7039. BIRD, P.G. **Removal of dissolved salts from water by exchange filters.** *Proc. Am. Soc. Testing Materials*, Preprint No. 101, 6 pp. (1938).—*C.A.* 32, 6370^1.

Org. exchangers should meet the requirements met by zeolites, e.g., 1/2 lb. of salt per 100 grains of hardness removed. Good anion exchangers had a capacity for HCl and H_2SO_4 of 6000 and 15,000 grains/ft^3. Operation of the cation and anion exchanger beds in series effected practically complete removal of dissolved solids, except silica. The removal of carbonate ions by aeration of effluent H_2O left it substantially neutral if effective to 15 p.p.m. Sol. org. matter and tastes and odors may be imparted to the H_2O.

7040. RILEY, RAY. **Latest development in water softening—carbonaceous zeolite.** *Paper Mill and Wood Pulp News* 61, 20-6, Sept. 24, 1938.

The carbonaceous zeolite, Zeo-Karb was used to exchange H^+ for the metal ions Ca^{++}, Mg^{++}, Na^+. The removal of Ca, Mg, and Na bicarbonates in boiler feed water treatment and methods of controlling the alkalinity of Zeo-Karb effluents were discussed.

7041. VAITSEZ, D.V. **Present method for the removal of salt from water.** *Vodosnabzhenie i Sanit, Tekh.*, XIV, No. 11, p. 12, 23-7. (1938).

Three new methods used in Russia for the removal of salt from water were described. One was a distillation method, a second was a freezing method, and a third was an ion exchange method.

7042. WELCH, W.A. **Practical considerations in the evaluation and use of activated carbon for water purification.** *Taste and Odor Control J.* 5, No. 2 October, (1938).

The phenol test and the threshold odor test were discussed as a means for evaluating the activated carbons for taste and odor removal. Individual water plants have particular problems which prevent any generalization to be made. One variable was the effect of acidity on the dispersion of the carbon.

7043. GRIESSBACH. **New ideas in the field of water treatment.** *Melliand-Textilber.* 20, 577-9(1939).—*C.A.* 33, 8417^3.

Certain resins contg. acidic groups, e.g., CO_2H, SO_3H, CH_2SO_3H, phenolic OH, can be used to replace cations, e.g., Ca ions, by Na or H ions, while resins contg. NH_2 or NH groups are capable of replacing anions, e.g., the Cl or SO_4 ions, with the OH ion. A combination treatment makes possible removal of 97% of the salt ions from water of ordinary hardness. The acidic resins are made from polyhydric phenols, natural tannins, etc., reacted with CH_2O and the basic resins from aldehydes condensed with amino bases, especially those of the aromatic series. The pH intervals, within which ion exchange occurs, are given for a no. of resins.

7044. RICHTER, A. **Treating water for use in dyeing with ion exchangers.** *Melliand-Textilber.* 20, 579-82 (1939).—*C.A.* 33, 8417^5.

Resinous ion exchangers were more economical than old-type Permutit exchangers because of greater through-put capacity and smaller pressure drop. A detailed description was given of com.-scale app. using resin ion exchangers for softening water and for removing both anions and cations for special purposes.

7045. RICHTER, A. **The application of ion exchangers having an artificial resin basis to the desalting of waters.** *Angew. Chem.* 52, 679-81 (1939).—*C.A.* 34, 1447^3.

Examples of partial and complete desalting by the use of Wofatit H and (OH) exchangers were discussed. Exptl. data showed successful operation, e.g., reduction of total solids from 1400 mg/liter to 45 and 13 mg/liter for single and double desalting, resp.

7046. BETZ, L.D.; NOLL, C.A., AND MAGUIRE, J.J. **Removal of silica from water by cold process.** *Ind. Eng. Chem.* 32, 1320-3 (1940); *Trans. A.S.M.E.* 63, 713-20 (November) (1941).—*C.A.* 34, 8122^3.

Freshly pptd. Al hydroxide was shown to remove sol. silica from water. The manner of prepg. the Al hydroxide eliminated the introduction of Na salts into the treated water. The removal of silica was most effective in the pH range 8.3 to 9.1. It was estd. that a pH range of 7.6 to 8.0 would probably provide the most effective range for practical use to avoid introduction of Al ion in soln. The efficiency of silica removal was greatest at low temps.

7047. Betz, L.D.; Noll, C.A., and Maguire, J.J. **Removal of silica from water by hot process.** *Ind. Eng. Chem.* 32, 1323-9 (1940).—*C.A.* 34, 8122[5].

Mg oxide reduced the sol. silica to practically zero when added to water. Various types of the oxide behaved differently and it was found that the most effective forms were the U.S.P. light oxide and a specially prepd. tech. grade obtained from the California Chem. Co. Greater silica removal and a lowering of hardness occurred at 95°C with a retention period of 15 min.

7048. Davis, Daniel E. **Observations on water softening.** *J. Am. Water Works Assoc.* 32[1], 85-92(1940).

The first large municipal zeolite softening plant in this country was built in 1926 in Pittsburgh. The Ca and Mg were exchanged with Na, regeneration of the glauconite being effected with NaCl. The performance of the zeolite cycle in this and other large installations was discussed.

7049. Kelley, W.P.; Brown, S.M., and Liebig, G.F., Jr. **Chemical effects of saline irrigation water on soils.** *Soil Sci.* 49, 95-107 (1940).—*C.A.* 34, 4201[8].

Irrigation waters contained varying quantities of Na which reacted with soil by base exchange. The absorption of Na by soil increased with increasing ratio of Na to Ca in the saline solns. The kind of base held by a soil in replaceable form influenced the absorption of Na. If Mg constituted a relatively high percentage of the total replaceable bases of the soil, relatively much Na would be absorbed. The ratio of Na to Ca + Mg should not exceed about 1:1 except where the sol. salts of the irrigation water were very low.

7050. Knodel, H. **Resin exchanger or carbon exchanger? Remarks on the work of E. Seyb.** *Chem. Fabrik* 13, 363-4 (1940).—*C.A.* 37, 6065[8].

The superiority of the resin to the carbon-exchange material as regards greater exchange capacity and greater resistance to hot and alk. water was disputed. Although the salt consumption was greater and not comparable to that under usual conditions, the resin-exchange material was shown to be superior under the special conditions of treating a water of high salt content and previously softened with NaOH.

7051. Mott, Kennon. **The water quality requirements of the soft drink industry.** *J. Am. Water Works Assoc.* 32, 1512-16 (1940).

Water at all times should meet the bacteriological standard established for I.C.C. It should have low turbidity and favorably compare to distd. water on visual observation. Lack of odor in a water means absence of all observable odor when submitted to both cold and hot test. Total hardness of 200 p.p.m. or less was considered unobjectionable, and over that figure objectionable. Total alkalinity of less than 50 p.p.m. was unobjectionable. Fe content of less than 0.1 p.p.m. was unobjectionable.

7052. Seyb, E. **The development of the exchange softening (of water) on the basis of ten years' operating experience in Leuna.** *Chem. Fabrik* 1940, 30-4.—*C.A.* 34, 2503[7].

Saale river H_2O, high in salts and hardness, was reduced in hardness to use in boilers at 45 atms. pressure. Experiences with silicate, carbon and synthetic resin softeners were reviewed in respect to efficiency, filter capacity, and effect of temp., pH and mech. abrasion on the material. The synthetic material gave the best results.

7053. Burtsev, D. **Operational results of chemical water purification by the base-exchange process.** *Teplosilóvoe Khoz.* 1941, No. 3, 33-45.—*C.A.* 37, 6776[9].

Because coagulation with Fe SO_4 was initially omitted and as a result of the preheating of the raw water with boiler water, the glauconite filters became strongly contaminated. At 35-40°C decompn. of the glauconite occurred. However, reducing the temp. of the raw water made preliminary purification more difficult (the reaction was slowed down, liming was incomplete and the carbonate hardness was increased). Reducing the alky. from 0.3-0.8° to 0.2° reduced the exchange capacity of the glauconite by 300-350°. Detn. of the alky. was carried out by adding to the water sample 5% of its vol. of a 10% $BaCl_2$ soln., which pptd. all the carbonate, and then titrating the hydroxide against phenolphthalein.

7054. Goodwin, R.C. and Litton, James B. **Removal of fluorides from public water supplies.** *Ind. Eng. Chem.* 33, 1046-8 (1941).—*C.A.* 35, 6031[9].

A pilot plant charged with 1.3 ft^3 of a mixt. of $Ca_3P_2O_8$ and $3Ca_3P_2O_8.Ca(OH)_2$ gave an av. of 346 grains F removed at a flow rate of 1.5 gal/min. The original H_2O contained 5.2 p.p.m. F. The av. F content of the effluent was 0.42 p.p.m. The phosphate was regenerated with 1.4 lb of NaOH when the F content reached 1 p.p.m.

7055. Guasch, J. Rovirosa. **The purification of water in industry.** *Afinidad* 18, 158-63 (1941).—*C.A.* 37, 3209[7].

The zeolite method of water softening was reviewed, including standards and analytical methods. The organic ion-exchange preparations and their use in industry for softening water was included.

7056. Hausen, J. **Treatment of water with artificial resins, increased possibilities, and improved processes with new exchange materials.** *Deut. Wasserw.* 1941, No. 2, 88; *Dept. Sci. Ind. Research (Brit.), Water Pollution Research Summary Current Lit.* 15, 108(1942).—*C.A.* 39, 2602[6].

The range of ion-exchange processes for use in treatment of water was increased by the discovery of the exchange properties of artificial resins. These could be prepd. in a variety of forms and could be used for the absorption of anions as well as cations, so that a water free from dissolved salts could be obtained.

7057. HOFER, K. **Tests of modern base-exchange materials in practice.** *Progressus* (Berlin) 6, 424 (1941); *Arch. Wärmewirt* **21**, 185 (1940); *Dept. Sci. Ind. Research (Brit.), Water Pollution Research, Summary Current Lit.* **14**, 264 (1941).—*C.A.* **38**, 5343[4].

Fused zeolites have been used, but these were attacked by waters containing aggressive CO_2. Nonsiliceous exchange materials were resistant to acids and also to waters contg. considerable alky. (up to a pH value of 9.5). They could be used to treat waters at temps. up to 95°C and could be regenerated with acids, or with an acid soln. of NaCl contg. acid and salt. Comparative tests on the use of Invertit, a mineral base-exchange material, and Wofatit, a synthetic resin, were made at a large plant. In the tests on Invertit and Wofatit filters a soln. of NaCl with a sp. gr. of 1.2 was used for regeneration. Regeneration of the Invertit filter took 40 min. and of the Wofatit 2 hrs.

7058. HULBERT, ROBERTS AND FEBEN, DOUGLAS. **Studies on the accuracy of threshold odor values.** *J. Am. Water Works Assoc.* **33**, 1945-64(1941).—*C.A.* **36**, 1123[7].

Four test carbons were sent 3 times under different codings to 4 labs. for grading. Results were uncertain - a stock odor sample was then sent to 5 labs. The results were equally uncertain. The method and the so-called "twilight zone" were discussed.

7059. LAUGHLIN, HENRY F. **Developments in taste and odor control.** *J. Am. Water Works Assoc.* **32**, 1191-4(1941).—*C.A.* **34**, 6741[3].

In two cases activated carbon was used. Prechlorination impaired the efficiency of carbon in one case. The use of any treatment should be preceded by lab. investigation.

7060. NAGAI, SHOICHIRO AND MURAKAMI, KEIICHI. **Water-softening materials of zeolite type. III.** *J. Soc. Chem. Ind. Japan* **44**, 709-12 (1941).—*C.A.* **42**, 2372*d*.

The water-softening power and the regenerative power were tested of various com. synthetic and water softeners. Gel-type water softeners prepd. from Na silicate, AcOH, and $Al_2(SO_4)_3$ solns. were good and had approx. equal water-softening and recovering powers.

7061. OLSON, H. M. **Census of U.S. Municipal water softening plants.** *J. Am. Water Works Assoc.* **33**[2], 2153-91 (1941).

The results of a questionnaire covering various aspects of water softening plants were presented in tabular form. There were 199 zeolite plants and 377 chemical pptn. plants. The questions covered included: supply, type plant, hardness of water, tap water pH, capacity, population served, etc.

7062. WEISER, HARRY B.; MILLIGAN, W.O., AND PURCELL, W.R. **Alumina floc. Composition of floc formed at pH values below 5.5.** *Ind. Eng. Chem.* **33**, 669-72 (1941).—*C.A.* **35**, 3874[7].

The alumina floc in water-purification practice was γ $Al_2O_3.H_2O$ free of basic Al sulfate. The x-ray diffraction pattern of fresh gels thrown down below pH = 5.5 consisted of broad bands that did not correspond to the lines in the γ-$Al_2O_3.H_2O$ pattern. Aging this gel in the mother liquor increased the primary crystal size until it gave a relatively sharp x-ray diffraction pattern.

7063. ADAMS, R.B. **Taste and odor control with activated carbon on waters of low odor concentrations.** *J. Penna. Water Works Operators' Assoc.* **14**, 59-64 (1942).—*C.A.* **37**, 1214[7].

Reductions of 70-75% in threshold odor were accomplished by filtration and sedimentation and by application of activated carbon on top of filters. A threshold odor of less than 2 was maintained in the tap water at Wilkinsburg, Pa.

7064. BAĬCHIKOV, A.G. AND SELIMOV, J. **Adsorption of iodine from oil-well waters by means of activated charcoal.** *J. Applied Chem.* (U.S.S.R.) **15**, 228-36 (1942).—*C.A.* **37**, 2548[9].

Extn. of I_2 from oil-well waters in southern U.S.S.R. by means of activated charcoal was found to be feasible even in waters contg. naphthenic acids. It was possible to recover up to 66% of the I_2. The charcoal used (No. 12) could be used in acid waters. Treatment of the charcoal with alkali lead to almost complete desorption of I_2; but the product was contaminated with naphthenic acids, which required an addnl. sepn. that was rather difficult.

7065. GOEHRING, E.C. **Taste and odor control for phenols with activated carbon.** *J. Penna. Water Works Operators' Assoc.* **14**, 65-73 (1942).—*C.A.* **37**, 1214[8].

Dosages as high as 948 pounds of carbon per million gallons of water were required to control phenol tastes. Other processes for the removal of tastes and odors were not as effective as activated carbon. Increase in the carbon dosage always caused an increase in the alum required for coagulation. Phenol tastes were highest when the raw water was 40°F or less.

7066. JOHNSON, B.F. **Taste and odor control with ammonia-chlorine and activated carbon.** *J. Penna. Water Works Operators' Assoc.* **14**, 74-6 (1942).—*C.A.* **37**, 1214[9].

Filtered water at New Castle, Penna., was treated with NH_3- Cl_2at all times, the raw water was treated when required. Musty, septic, sulfuretted and decomposition odors were satisfactorily removed by pretreatment with NH_3-Cl_2. The dose varied from 1/4 to 1/8 ratio of NH_3/Cl_2, with an average dose of 0.25/1.25 p.p.m. Activated carbon was applied as needed to control chem., hydrocarbon, and medicinal odors in doses ranging from 0.1 to 1.0 grains per gallon.

7067. LINDSAY, F.K. **Some applications of the organic ion exchangers.** *Proc. Ann. Water Conf., Eng. Soc. Western Penna.* **3**, 103-12(1942).—*C.A.* **38**, 6443[9].

The production of water comparable to distd. water was described for boiler make-up, for pharmaceutical manufg., and the removal of Zn ions from water soln.

7068. PARKER, A. **Potable water from sea water.** *Nature* **149**, 184-6 (1942).—*C.A.* **36**, 2653[4].

A discussion of possible methods.

7069. POLYAKOV, A.G.; ZHDANOVA, O.G., AND ASMOLOVA, M.F. **Deodorizing water in army camps at the front.** *Sovet, Zdravookhranenie Turkmenii* 1942, No. 2, 22-5.—*C.A.* 38, 1057[7].

Odors due to putrefaction of plant material in water was partially removed: (a) adding 3-5 drops of 1:1000 $KMnO_4$ soln. per 100 cc. of water, letting stand 1 hr, and treating with NaOH soln., then with $Ca(OH)_2$ soln. to alk. reaction; (b) boiling the water with permanganate for 15 min. and on cooling adding $Ca(OH)_2$ to ppt. MnO_2. Odor from putrefaction of animal waste matter was not removed by permanganate. Powd. charcoal (1 g per liter of water) completely removed odors of plant origin in 15-20 min.

7070. TIGER, H.L. **Silica removal by an improved magnesia process.** *Trans. Am. Soc. Mech Engrs.* 64, 49-63 (1942).—*C.A.* 36, 2063[3].

In the cold-process treatment, silica removal was applied first and post treatment by carbonaceous zeolites to remove any residual hardness. Carbonaceous hydrogen zeolite might also be included. These carbonaceous zeolites might be used without danger of silica pickup from them.

7071. AKEROYD, E.I. **Recent developments in water treatment.** *J. Inst. Brewing* 40, 238-44 (1943).—*C.A.* 38, 1824[8].

A general discussion of lime or lime-soda and base-exchange processes.

7072. AMERICAN WATER WORKS ASSOCN. **Tentative manual of zeolite test procedures.** *J. Am. Water Works Assoc.* 35, 721-50 (1943).

Test procedures were proposed for cation exchangers operating on the Na-cycle. Details in the construction of the testing tubes were given and the sequence of packings in the tube described. The proposed tests were: density of dry zeolite, density of saturated zeolite, sieve analysis, attrition losses, resistance to attack, exchange values, color leaching, porosity, and chemical compn.

7073. APPLEBAUM, SAMUEL B. **The demineralizing process of water softening. Latest development in the use of zeolites.** *Water and Sewage* 81, No. 10, 13-16, 42-4 (1943).—*C.A.* 38, 1825[9].

Even distd. water may contain some mineral salts owing to the mech. carry-over in evaporators and condenser leakage. It was more expensive to remove sulfates or chlorides than bicarbonates. The two-step demineralizing process involving cation- and anion-exchangers was described.

7074. BOCHER, G. **Manufacture of distilled water and the chemical purification of water.** *Ann. pharm. franc.* 1, 56-8, 126-7, 155-6(1943); 2, 33-5, 82-4(1944).—*C.A.* 40, 4825[5].

A review of methods of purifying water (by chem. treatment and by ionic exchange by means of zeolites), and of problems involved in the construction of distg. app.

7075. BUSWELL, A. M.; GORE, R. C.; HUDSON, H. E. JR.; WIESE, A. C., AND LARSON, T. E. **War problems in analysis and treatment.** *J. Am. Water Works Assoc.* 35, 1303-11 (1943).—*C.A.* 38, 439[1].

The treatment of water contaminated with war gases was considered. The studies considered were Cl_2 demand of mustard and lewisite, a titration for quant. est. of either or both. Threshold odor value of mustard and lewisite and amt. of activated charcoal required to remove mustard odors were discussed.

7076. DAVIS, D. E. **Softening and manganese removal by zeolites.** *Water Works Eng.* 96, 1012-17 (1943).—*C.A.* 38, 1826[1].

The plant described (capacity 1.5 m.g.d.) treated well water having a hardness varying between 150 and 230 p.p.m. The carbonate and noncarbonate hardness were about equal, and the Mn content varied between 1.5 and 2.9 p.p.m. Both hardness and Mn were removed by filtration through beds of greensand over gravel.

7077. DE REUTER, HERBERT. **Water softening increases consumption at Oak Lawn, Illinois.** *Public Works* 74, No. 5, 26 (1943).—*C.A.* 37, 3864[2].

A zeolite plant served 900 users.

7078. DONNELLY, R. P. **"Organolites" for water treatment. III. Some special application of the new synthetic resin products by which an extension of normal base-exchange water treatment is possible.** *Power & Works Engr.* 33, 136-7(1943).—*C.A.* 37, 5812[8].

7079. DUDOMAINE, JOHN; SWAIN, R. L., AND HOUGEN, O. A. **Cation-exchange water-softening rates.** *Ind. Eng. Chem.* 35, 546-53 (1943).—*C.A.* 37, 4837[9].

Expts. were conducted on the softening of water by a cation-exchanger ($Na_2O.Al_2O_3$-$5SiO_2$) and the regeneration of the exchanger by a salt soln. A bed (0.5 in.) was used which permitted the data to be used in detg. the differential rate equations. Equations and charts were given for the performance of com. beds of zeolite under conditions of variable thickness, rate of water flow, initial hardness of the water, and initial base-exchange capacity, particle size and activity of exchanger.

7080. FETTE, ANTHONY A. **Pure water without heat.** *Power Plant Eng.* 47, No. 5, 118, 138, 140, 144 (1943).—*C.A.* 37, 4507[3].

Distd. water from condensing steam was compared to water obtained from synthetic ion-exchange filters. The theory of the process was discussed, also operating details as applied to this particular case.

7081. GADDIS, SHIRLEY AND KUBINA, CONRAD. **Distilled water supply for small schools.** *J. Chem. Education* 20, 381, 400(1943).—*C.A.* 38, 2859[8].

Org. anion and cation exchangers were employed.

7082. HARRISSON, J. W. E.; MYERS, R. J., AND HERR, D. S. **Purified mineral-free water for pharmaceutical purposes.** *J. Am. Pharm. Assoc.* 32, 121-8(1943).—*C.A.* 37, 3564[1].

The production of resin exchange adsorbents have made possible mineral-free water equal in quality to that required for distd. water of the U.S.P. Ease of manipulation, low initial cost, and freedom from costly maintenance recommend this method of prepg. mineral-free water for many pharm. uses.

7083. HIRSCH, A. A. **Silica sol as auxiliary coagulant with copperas; graphical determination of optimum proportions of dual coagulants in water treatment.** *Ind. Eng. Chem.* 35, 811-14 (1943).—*C.A.* 37 6383^5.

A graphical method was given for the optimum coagulant adjustment of activated silica sol and copperas in treatment of the Lower Mississippi River water. Results showed advantages in the use of these dual coagulants in the treatment of the raw water and of the lime-softened water.

7084. KAHN, J. M. **Color removal with the Accelator.** *J. Am. Water Works Assoc.* 35, 597-600 (1943).—*C.A.* 37, 4168^2.

The Accelator for softening was considered a satisfactory device for clarification and color removal. Several cases were cited where, with proper selection of chemicals, very good results were obtained.

7085. KEMMER, FRANK N. AND THOMPSON, JOSEPH. **Some characteristics of acid-regenerated carbonaceous zeolite.** *Proc. Ann. Water Conf., Engrs. Soc. Western Penna.* 4, 109-19(1943).—*C.A.* 39, 1950^1.

7086. KVIRIKASHVILA, V. L. **Use of Askangel-bentonite clay as coagulant for water clarification and as antiscale.** *Bull. Acad. Sci. Georgian S.S.S.R.* 4, 977-86 (1943) (in Georgian and Russian).—*C.A.* 41, 3237*d*.

The fine-disperse, high-swelling, thixotropic clay, added in amts. of 20 mg/liter, clarified water by coagulation, particularly in mixt. with lime, as effectively as $Al_2(SO_4)_3$. Moreover, it lowered the permanent hardness. The action consisted in ion exchange against the Na and K ions of the clay. The action depended entirely on the high dispersity of the clay; coarser fractions were ineffective.

7087. LIEBIG, GEORGE F. JR.; VANSELOW, ALBERT P., AND CHAPMAN, H. D. **The suitability of water purified by synthetic ion-exchange resins for the growing of plants in controlled nutrient cultures.** *Soil Sci.* 55, 371-6(1943).—*C.A.* 37, 6711^1.

Passage of distilled water through an H- satd. cation-exchange resin removed objectionable traces of Cu and other heavy metals. Lab. distd. water contg. Cu 0.2000, Pb 0.0550 and Zn 0.02 p.p.m. contained Cu 0.0035, Pb 0.0015 and Zn 0.00 p.p.m. after one passage through the cation-exchange resin. After 5 passages, it contained Cu 0.0000, Pb 0.0010 and Zn 0.00 p.p.m. Redistd. water from an all-Pyrex-glass still contained Cu 0.0016, Pb 0.0025 and Zn 0.00 p.p.m.

7088. LINDSAY, F. K. **Removal of iron from water—use of carbonaceous ion exchangers.** *Ind. Eng. Chem.* 35, 378-80 (1943).—*C.A.* 37, 2853^6.

Tests were made confirming the removal of Fe as well as Ca and Mg by a carbonaceous exchanger. Data were given on the removal of Fe, Ca and Mg by the NaCl-regenerated carbonaceous exchanger. Also, comparative data were given with regeneration by NaCl, $MgCl_2$, or $CaCl_2$. Fe^{++} can displace the Ca and Mg ions, and Fe removal may continue after the hardness-removal capacity of the NaCl-regenerated exchanger has become exhausted.

7089. MILLER, DURANDO. **Latest developments in removal of cations and anions from water by demineralizing.** *Proc. Ann. Water Conf., Eng. Soc. Western Penna.* 4, 121-31(1943).—*C.A.* 39, 2167^8.

Large installations were made with wood to save steel and rubber previously used for acid resistance. Plants having capacities of 1000 gal per min. have been constructed. CO_2 was removed by use of a vacuum cold water deaerator to prevent satn. of the H_2O with O_2.

7090. NORDELL, ESKEL. **Demineralizing industrial water and process liquors.** *Chem. & Met. Eng.* 50, No. 10, 112-15 (1943).—*C.A.* 38, 821^4.

For the waters listed, ion-exchange operating costs ranged from $0.03 to $0.16 per 1000 gal. Comparable figures for distn. costs were $2.00 to $8.00 when single- and double-effect evaporators and $0.60 to somewhat over $1.00 for a quadruple-effect installation. Fixed charges were not included.

7091. SIGWORTH, E. A. **The extent of use of activated carbon.** *J. Am. Water Works Assoc.* 35, 1587-92(1943).—*C.A.* 38, 1308^9.

From data tabulated the av. carbon dosage was a little over 10 lb per million gal. Rivers required less than lakes, reservoirs, etc., and the av. doses decreased as the size of the plant increased.

7092. SMITH, O. K. **Water purification by the new ion-exchange method.** *Am. Gas Assoc. Proc.* 25, 308-14; *Petroleum Eng.* 14, No. 13, 57-60 (1943).—*C.A.* 38, 4355^5.

A discussion of ion-exchange water-purification materials. Complete demineralization can be accomplished without a remaining neutral salt.

7093. STICH, CONRAD. **Adsorption of microörganisms by charcoal and other adsorbents.** *Chem.-Ztg.* 67, 349(1943).—*C.A.* 39, 2833^7.

Microörganisms were almost completely removed from two potable waters by 0.2 g/100 cc., and from 0.5% yeast suspension by 1 g/100 cc. of charcoal. Talc was much less effective.

7094. TIGER, HOWARD L. AND SUSSMAN, SIDNEY. **Demineralizing solutions by a two-step ion-exchange process.** *Ind. Eng. Chem.* 35, 186-92 (1943).—*C.A.* 37, 2109^3.

A two-step ion-exchange process was outlined in which both cations and anions were removed, giving a final effluent that approached distd. water in quality. First step: acid-regenerated org. cation exchangers replaced the metallic cations in the water with H ions converting the salts present into the corresponding acids, i.e., HCl, H_2SO_4 and H_2CO_3. Second step: removal of the strong acids (HCl and H_2SO_4) formed by the anion exchangers by absorption and removal of the CO_2 in the H_2CO_3 by degasification. When necessary, silica removal must precede the demineralizing treatment.

7095. Turner, H. G. **Pennsylvania anthracite as a filter medium.** *Ind. Eng. Chem.* 35, 145-7 (1943).—*C.A.* 37, 1539^5.

Anthracite was more nearly chemically inert than other substances such as sand which, though insol. in acids, reacted readily with alkalies. Filter anthracite was prepd. from coal which would yield a particle free from fracture cracks. Its low sp. gr. and angular particle shape made possible longer filter runs and more effective filter bed washing at lower back wash rates.

7096. Akeroyd, E.I. **"Deminrolit" process of water treatment.** *Water & Water Eng.* 47, 8-12 (1944).—*C.A.* 38, 1825^6.

The Zeo-Karb H-Ion Deminrolit process was described and analyses reported on 5 waters before and after treatment. The water passed first through a base-exchange and then through an acid-exchange unit. The content of $NaHCO_3$ in the effluent was of the order of 5-10 p.p.m. as Na_2CO_3 and the content of NaCl of the order of 2 p.p.m.

7097. Bachmann, Frank. **The economics of deionized water supplies.** *J. Am. Water Works Assoc.* 36, 876-85 (1944).—*C.A.* 38, 6018^8.

Ion-exchange materials, their character and their reactions were discussed, with special reference to their interest to municipalities. Two plants were discussed, one with high $NaHCO_3$, the other with high NaCl content. In both cases part of the water was treated and later mixed with the raw water. The results were calcd. and the operating costs detd.

7098. Berry, A.E. **Activated carbon in Canadian water-treatment practice. Comparison with United States usage.** *Water and Sewage*, 82, No. 4, 24-5, 58, 60 (1944); *Water & Water Eng.* 47, 511-13 (1944).—*C.A.* 38, 6443^7; 39, 5007^5.

7099. Black, Hayse H. and Spaulding, Charles H. **Diatomite water filtration developed for field troops.** *J. Am. Water Works Assoc.* 36, 1208-21 (1944).—*C.A.* 39, 369^8.

Diatomite filtration had advantages in the quality of water produced and the capacity of the filter per unit of weight and per unit of vol. Sand filters failed to remove *Endameba histolytica* at the rates employed in the field. Diatomite or diatomaceous earth effects virtually complete removal under most severe tests. Filter elements in the form of porous cylindrical shells were given a precoat of diatomite in the form of a slurry.

7100. Breitenstein, G. von and Berger, H. **Deoiling of boiler feed water by base exchange material.** *Glückauf* 80, 261-262 (1944); *Brit. Coal Utilisation Research Assoc. Monthly Bull.* 9, 349 (1945).—*C.A.* 42, 4295*a*.

Beds of 5 tons of coarse "Invertitmasse" were used for reducing the oil content of 25 m^3 of dirty condensate per hr from 6 to 1.3 mg/liter. The filter was flushed with cold H_2O every 48 hrs and regenerated with aq. NaCl; the amt of oil removed at each flushing was 90 mg/liter. The process was officially tested for its effect in the boiler and for its cost, which compared favorably with that of alternative methods.

7101. Consolazio, W.V. and Pace, N. **Drinking water from sea water.** *U.S. Naval Inst. Proc.* 70, 971-8 (1944).—*C.A.* 38, 6441^1.

Apparatus and available methods were described. Under practical tests the most satisfactory process was a modified Permutit method.

7102. Gilwood, M.E. and Calise, V.J. **Recent experiences in demineralizing water.** *Proc. Ann. Water Conf., Eng. Soc. Western Penna.* 5, 11-26 (1944).—*C.A.* 39,5373^1.

Demineralizing units designed for flow rates of 4, 55, and 1000 gallons per min. of treated water were described. The operating cost of demineralization ranged from \$0.01 to \$0.20 per 1000 gal depending on the type of H_2O treated, compared to \$0.80 to \$8.00 per 1000 gal for com. distd. H_2O.

7103. Hassler, J.W. and Faye, Martin. **Influence of various chemicals on palatability of drinking water.** *J. Am. Water Works Assoc.* 36, 1185-91 (1944).—*C.A.* 39, 368^6.

The effect of odor from chem. elements normally employed in water purification was studied. Most chemicals used in coagulation and softening have no appreciable effect on odor intensity. Cl_2 frequently increased the odor which could be reduced by active charcoal or NH_3 in certain cases. A combination of charcoal and NH_3-Cl_2 was much more effective than charcoal alone.

7104. Hudson, F.A. **Activated charcoal in the preparation of intravenous solutions.** *Pharm.* 98, 131-2 (1944).

The successful removal of pyrogens was obtained with 0.1% of activated charcoal. Two factors of importance in considering its use in the prepn. of intravenous solns. was the surface area and diffusability of the charcoal, and the filtration of the soln. so that no particles were present in the final product.

7105. Kenworthy, Alvin L. and Howard, John Nelson. **Purification of water by use of synthetic ion-exchange resins with pH as a control.** *Soil Sci.* 57, 293-7(1944).—*C.A.* 38, 4355^6.

Water passed through "Amberlite" was comparable to distd. H_2O. The break-through or satn. point for towers filled with such a synthetic resin could be detd. by the use of an ordinary lab. model pH meter. Germination of *sporangia* of *Phytophthora infestans Thax.* (Guss.) indicated that there was a continued adsorption of Cu after the cation exchanger was satd. The Cu content of the H_2O was lower than that of distd. H_2O, but not so low as that of redistd. H_2O.

7106. Love, S.K. **Cation exchange in groundwater contaminated with sea water near Miami, Florida.** *Trans. Am. Geophys. Union* 25, Pt. 6, 951-5 (1944) (Pub. 1945).—*C.A.* 39, 4176^7.

Contaminated ground water was richer in Ca, and poorer in Mg and Na than would be expected on the basis of simple mixing. This might be due to cation exchange between clay or org. colloids and the water mixts.

7107. MANRING, W.E. **The demineralization of water by ion exchange.** *Paper Trade J.* **119**, No. 12, 33-6(1944).—*C.A.* 38, 6444[1].

Ionac C-284 and Ionac A-293, cation and anion ion-exchange resins, resp., were described. Particular attention was directed to their performance in a 4-bed system consisting of alternate beds of the cation and anion resins, as applied to (1) the treatment of brackish water, (2) a portable disposable cartridge unit, and (3) a self-contained lab. unit of 30 gal per hr capacity.

7108. PAPP, SZILÁRD. **A new filtering material for removing manganese and iron from industrial and drinking waters.** *Magyar Mérnök Építészegylet Közlönye* 78, 345-55 (1944).—*C.A.* 41, 7590*i*.

A special material called "fermago" (oxides of Fe and Mg treated by heat and mixed with disintegrated quartz), oxidized dissolved Fe or Mn, pptd. colloidal hydroxides, and removed them by filtration. This material was produced in grain sizes 0.5-1.5, 1.5-3.0, and 3.0-5.0 mm or larger. In water high in CO_2, material of smaller grain sizes (thus contg. larger surface) must be used.

7109. SOLLNER, KARL AND ANDERMAN, JOAN. **The structure of the collodion membrane and its electrical behavior. VIII. Quantitative studies concerning the acidic properties of collodion and their correlation with membrane structure and activity.** *J. Gen. Physiol.* 27, 433-49 (1944).—*C.A.* 38, 3889[9].

The activity of collodion membranes depends on dissociable acidic groups in the interstices, and can be measured by base exchange. The base-exchange capacity (after 48 hrs in 0.01 N NaOH) for the same prepns. varied within a range of 1:200. Inactive prepns. had only 1 in 770 acid groups available for exchange, whereas in the most active collodion 1 in 13 groups was available.

7110. SPEALMAN, CLAIR R. **Chemical removal of salts from sea water to produce a potable water.** *Science* 99, 184-5 (1944).—*C.A.* 38, 3061[7].

Ag_2O and uric acid were used to ppt. most of the salts. The product contained 0.58% sol. material of which 0.13% were urates.

7111. STACH, H. **Base exchange on lignite glance coals.** *Glückauf* 80, 79-80(1944).—*C.A.* 39, 4176[6].

The properties and manner of origin of this black, humified, sub-bituminous coal and its use for the removal of hardness, acids, and salts from water were discussed. The recovery of valuable metals from dil. solns. by metal ion exchange on this coal was mentioned.

7112. TURNER, H.G. **Anthrafilt and its significance.** *J. Am. Water Works Assoc.* 36, 431-8 (1944).—*C.A.* 38, 2775[2].

Because of its chem. inertness anthrafilt had many advantages as a filter material. Filter capacities were greatly increased through its use.

7113. AKEROYD, E.I.; HOLMES, E.L., AND KLEIN, A. **Drinking water from sea water by a chemical method.** *Water and Water Eng.* 48, 556-60(1945); *J. Soc. Chem. Ind.* 65, No. 1, 28-32(1946).—*C.A.* 40, 2559[9].

The ion exchanger was a Ba-Ag zeolite contg. Ag_2O. The latter compd. was used to remove the Mg ions. The mixed zeolite was compressed into briquets together with activated fuller's earth, which acted as a disruptive agent when the briquet was immersed in sea water. The sea water was treated with the briquet in a rubberized bag which was provided with a filter for the treated water.

7114. ATTEBERRY, ROBERT W. AND HERR, DONALD S. **Useful life of a molecularly dehydrated phosphate in sulfuric acid.** *Ind. Eng. Chem.* 37, 100 (1945).—*C.A.* 39, 857[9].

The use of H_2SO_4 contg. relatively small amts. of Calgon was found more beneficial for the regeneration of a cation-exchange material than H_2SO_4 alone. The effect of the metaphosphate, even in the presence of acid, was to prevent the deposition of $CaSO_4$, etc., upon the exchanger bed, improve the efficiency of regeneration, and decrease the subsequent rinse-water requirements.

7115. BAUMAN, W.C. **Synthetic ion-exchange resins.** *J. Am. Water Works Assoc.* 37, 1211-15 (1945).—*C.A.* 40, 971[9].

After brief reference to ion exchange in water treatment, the synthetic-resin exchange was described in more detail. The application of this process to silica removal was outlined.

7116. BURWELL, A.L.; CASE, L.C., AND GOODNIGHT, C.H. **Fluoride removal from drinking water. Small installations using virgin bone char.** *Okla. Geol. Survey, Circ. No.* 25, 1-41(1945).—*C.A.* 39, 3863[7].

The presence of fluoride in excess of 1.0 p.p.m. makes the water unsafe and is ground for rejection of the water supply. Waters contg. fluorides in amts. above the safe limit can be made safe by using virgin bone char, which was found to be superior to Ca phosphate in efficiency and ease of regeneration. It also removes odor and taste.

7117. CAROLLO, JOHN A. **The removal of DDT from water supplies.** *J. Am. Water Works Assoc.* 37, 1310-17 (1945).—*C.A.* 40, 969[9].

DDT in any water gradually became ineffective. Turbidity did not reduce DDT efficiency but removed some DDT by settling. Coagulation, sedimentation, filtration, and the presence of activated carbon will remove DDT from a water supply.

7118. CONSOLAZIO, W.V.; PACE, N., AND IVY, A.C. **Drinking water from sea water.** *Smithsonian Repts.*, Pub. No. **3820**, 153-63 (1945).—*C.A.* 41 2823*i*.

Silver zeolite was added to sea water and the pptd. AgCl and $Mg(OH)_2$ filtered off. Expts. were conducted to det. the optimal compn. of drinking water under field conditions, and the new method was adjusted accordingly. The zeolite was compressed to the smallest vol. possible, but because high pressure made briquets indispersible, an inert chemical which swelled to 6 to 12 times its original vol. was added to the briquets.

7119. COUVREUR, M. **Decarbonization by crystallization, base exchangers, demineralization, degassing, and the conditioning of boiler feed water.** *Soc. roy. belge ing. ind., Mém., Sér. B. No.* 2, 450-61(1945).—*C.A.* 40, 4453[9].

A procedure was described for decarbonization of H_2O in a decanter by means of milk of lime. The action took place in 2-3 hrs. Base exchangers were divided into inorg. and org. exchangers. Two methods were given for demineralization. The first consisted in electroösmosis and made use of the principle of a combination of electrodes and semipermeable membranes. In the second method the resistance employed was between 50 and 70 ohms while in the first method the resistance was generally not above 100,000 ohms. Degassing was accomplished by taking advantage of cooling the feed water and atomizing under pressure.

7120. Delaroziere, F. **Complete demineralization of water by ion removers.** *Chimie & industrie* 53, 329(1945).—*C.A.* 40, 3209[7].

Ion removers were generally humic acids obtained by oxidative treatment of certain types of lignites or coals in presence of H_2SO_4, condensation products of polyphenols (tannins) or aromatic polyamides with CH_2O.

7121. Farrow, J. Carlisle. **Your industrial water is no better than your operator.** *Southern Power and Ind.* 63, No. 10, 58-60, 67(1945). —*C.A.* 39, 5374[8].

The operation and control of a water-filtration plant for meeting textile-plant requirements was discussed. In addn. to soda ash and alum, Cl_2 and active carbon were added, the former to retard the formation of algae and scum in the settling basins and filters, and the latter whenever there was an objectionable taste or odor.

7122. Gault, Henri and Hiong, K.W. **Purification of hard waters by means of technical lignin, by-product of wood saccharification.** *Compt. rend.* **220**, 608-9(1945).—*C.A.* 40, 2248[8].

Technical lignin, retaining about 42% cellulose (100 g), was gradually triturated with 1 kg H_2SO_4 until the temp. reached 60°C. The mixt., after standing for 1 hr at room temp., was poured into 3 liters H_2O, and the residue filtered and washed with H_2O, $NaHCO_3$ (until neutral), and H_2O, and then dried at 110-20°C. The black granular mass could be used directly or after mech. disintegration for all purposes requiring cationic exchange, and was found to be especially effective in softening hard water.

7123. Gilwood, M.E. and Calise, V.J. **Mineral-free water without distillation.** *Power* 89, No. 6, 101, 144, 146, 148 (1945).—*C.A.* 39, 3099[3].

The use of sodium and carbonaceous zeolites for purifying water was described. It was possible to get almost completely mineral-free water by proper treatment. Several installations were described.

7124. Grindley, J. **Treatment and disposal of waste waters containing chromate.** *J. Soc. Chem. Ind.* 64, 339-44 (1945).—*C.A.* 40, 2563[2].

Ion-exchange with Zeo-Karb and Deminrolit B yielded demineralized H_2O, substantially nontoxic to minnows, but the activity of the exchange materials was not regenerated by simple treatment.

7125. Ingleson, H. **Preparation of drinking water from sea water.** *J. Soc. Chem. Ind.* 64, 305-9 (1945).—*C.A.* 40, 4825[7].

When sea water was passed first through a base-exchange material and then through an acid-exchange material (Zeo-Karb and Deminrolit B or Amberlite IR-1 and Amberlite IR-4), the vol. of water which could be treated was only about 1.5 times the vol. of the reagents. A Ag zeolite was prepd. by treating Doucil (an artificial Al silicate of high base-exchange capacity) with a soln. of $AgNO_3$. When sea water was passed over such a zeolite, Na was removed from the water and the Ag so displaced pptd. the Cl^- from the water. Various mixts. contg. this zeolite were compressed into briquets at a pressure of about 13.6 tons/in.[2] The most satisfactory mixt. contained: Ag zeolite 79.1, $Ba(OH)_2.8H_2O$ 9.5, Ag_2O 0.5, fuller's earth (to facilitate disintegration of the briquets in water) 9.0, and graphite 1.9%.

7126. Joos, C.E. **Removal of ammonia from boiler feedwater?** *Power Plant Eng.* 49, No. 1, 122, 124 (1945).—*C.A.* 39, 1003[2].

Troubles due to NH_3 in the steam were outlined. Three methods for its removal were given, by mech. means, ion exchange, and the use of Cl_2.

7127. Lourier, Ya. Ya. and Klyachko, V.A. **Removal of silica from boiler feed water.** *Compt. rend. acad. sci. U.R.S.S.* 49, 40-2 (1945).—*C.A.* 40, 4455[8].

Si compds. were converted into H_2SiF_6 by adding HF or a sol. fluoride and HCl, followed by air agitation, according to the following equation: $H_4SiO_4 + 6F^- + 4H^+ = SiF_6^- + 4\,H_2O$. SiF_6 ions were then removed by filtration through a special exchange resin. This was obtained by condensation of *m*-phenylenediamine with formalin in the presence of HCl followed by methylation with dimethyl sulfate for an hr on a water bath. After use, this resin was regenerated by treatment with a 5% soln. of NaOH or Na_2CO_3, with the substantially quant. removal of the SiF_6 ions.

7128. Mann, E.H. and Ruchhoft, C.C. **A study of the suitability of Chemical Warfare Service activated carbons for use in treatment of public water supplies.** *J. Am. Water Works Assoc.* 37, 238-44(1945).—*C.A.* 39, 1709[2].

Added materials for gas adsorbtion were Cu and/or Ag. Comparative tests showed that neither of these elements would be objectionable. For odor removal the carbons were not nearly so effective as activated carbons of water-purification grade and much more of the Chem. Warfare Service carbons would have to be used to produce the same results.

7129. Manring, W.E. **Demineralization of water by ion exchange.** *Proc. Ann. Water Conf., Engrs. Soc. West. Penna.* 6, 121-6 (1945).

Four alternate beds of Ionac cation and anion exchange resins were used in the demineralization of water. Regeneration of the four beds in parallel was carried out at a flow rate of approx. 5 bed-vol./hr. The first and third beds of cation resin were regenerated with dil. H_2SO_4. Where high Ca/Na prevailed in the influent water, acid regeneration of the first bed was preceded by a NaCl regeneration in order to prevent the deposition of insol. $CaSO_4$ in the bed during the subsequent passage of H_2SO_4. The sec. bed was regenerated with caustic soda and the fourth bed with sodium bicarbonate and caustic soda or sodium carbonate, their proportions depending on the alkalinity of the raw water. The purpose of this type of fourth bed activation was to buffer it by partial exhaustion with carbonic acid.

7130. MORRISON, W.S. **De-ionized water for war plants and the ceramic finishing field.** *Paper Trade J.* **120**, No. 1, 31-2(1945); *Tech. Assoc. Papers* 27, 222-3 (1944); *Finish.* **1**, No. 2-3, 14-17, 44, 50 (1944).—*C.A.* 39, 1001^5, 2167^9.

The chem. reactions involved were discussed including the Na and H exchanges and the acid adsorption. A typical water-treating unit with plastic-lined cationic and anionic reactor tanks was shown. Several com. installations were presented to illustrate the possibilities of water-treatment systems by the pulp and paper industry.

7131. NOREUS, R.E. **Use of activated silica in the coagulation of highly colored water.** *Paper Trade J.* **120**, No. 11, 45-7 (1945).—*C.A.* 39, 2361^2.

The use of activated silica in the treatment of highly colored soft water resulted in lower settled effluent turbidities, lower filtered water colors, and increased filter runs. These improvements were attributed to the much lower effluent turbidities resulting from the heavier, faster-settling coagulation.

7132. OLIN, H.L. AND MYERS, E.M. **Water purification with bentonite.** *Paper Trade J.* **120**, No. 10, 46-9(1945).—*C.A.* 39, 2166^5.

A "split treatment", in which bentonite fortified with a small amt. of alum when needed, was utilized. It is believed that bentonite water clarification has passed the primary research stage and that it has demonstrated its applicability and value in the treatment of numerous types of water showing promise of lowering the cost of chem. dosage.

7133. STOCKWELL, H. P. JR. **Treating a colored water supply at Ottawa, Ontario.** *Water and Sewage* **83**, No. 4, 52-8, 88, 90 (1945).—*C.A.* 39, 3863^9.

Water of highest bacteriol. quality and phys. cleanliness was obtained by use of Cl_2, $Al_2(SO_4)_3$, activated carbon and lime.

7134. STRAUB, F.G. AND GRABOWSKI, H.A. **Silica deposition in steam turbines.** *Combustion* **16**, No. 7, 41-3 (1945); *Trans. Am. Soc. Mech. Engrs.* 67, 309-16 (1945).—*C.A.* 39, 1486^7.

Lab. and power-plant tests indicated that the SiO_2 left the boiler as vaporized silicic acid, which later crystallized on the blades in the lower-pressure stages of the turbine. When the SiO_2 in the steam was below 0.1 p.p.m., no appreciable deposits were found in the turbines. Deposits could be prevented by maintaining the SiO_2 in the boiler water below 5 p.p.m. or removing the SiO_2 from the steam by scrubbing with a pure water.

7135. SUSSMAN, SIDNEY AND MINDLER, ALBERT B. **Ion exchange. Old process finds new uses.** *Chem.Industries* **56**, 789-95 (1945).—*C.A.* 39, 2833^4.

7136. THOMPSON, R.B. **Some fundamental factors and the design and operation of ion exchange installations.** *Proc. Ann. Water Conf., Engrs. Soc. West. Penna.* 6, 135-41 (1945).

The raw water analysis controlled the type and quantity of regenerants to be employed and represented the greatest single item of operating cost in water de-ionization. The cation exchangers tested all exhibited leakage of cations. Under identical regeneration conditions, the cation leakage was directly proportional to strength of exhausting soln. for the same proportion of alkalinity in the raw water. The proportion of alkalinity in the untreated water detd. the capacities and regenerant quantities. Flow rate was important in affecting cation leakage, the rate per ft^3 of exchanger being of greater significance than the rate per ft^2. Anion exchangers would accomplish essentially 100% removal of mineral acids under the concns. usually encountered in water treatment and their capacity depended on the strength of the exhausting soln. as well as on the acid being removed.

7137. WEBB, W.L. **Experience with potassium treatment at Windsor station.** *Trans. Am. Soc. Mech. Engrs.* 67, 325-8 (1945).—*C.A.* 39, 4415^1.

With hardness, Al_2O_3, and SiO_2 in quantity entering the cycle through condenser leakage, wall-tube losses in two 1350-lb/in^2 boilers were extensive under conventional Na treatment. When both boilers were operated under K treatment, with e.p.m. ratios of $K/Na = 2$ and $SiO_2/OH = 0.5$, the treatment did not prevent the failure of wall tubes on which analcite had already formed. The two boilers were then chemically cleaned and one was put on K treatment and the other on Na treatment. Both boilers received the same feedwater.

7138. APPLEBAUM, S.B. **Filtration of water through diatomaceous earth.** *Water & Sewage Works* 93, 308-10 (1946).—*C.A.* **41**, 546^i.

Pretreatment with coagulant hypochlorite was needed for all but clear surface waters. The initial precoating of diatomite on the filter membrane was patterned after industrial practice; "body-feeding" of more diatomite during progress of the filter run was required to prevent surface sealing of the media. During body-feeding the diatomite slurry was agitated by a water motor, and dild. by filtrate so as to become progressively weaker in step with decreasing rate of filtration. Backwashing required 1 min., and consumed about 2% of the output.

7139. ASTAF'EV, V.P. AND ASTAF'EVA, M.F. **Experiments on water softening with humus coals.** *Za Ekonomiyu Topliva* 3, No. 1, 32-4 (1946).—*C.A.* **40**, 4455^2.

The exchange capacity of humus coals in the Moscow region of grain size 0.3-3 mm was 400-800 and the size 0.3-1 mm was 600-1200 tons/degree/m^3. The exchange capacity of humus coals in the

Bogoslov deposit was 1200-200 tons/degree/m^3, and those found in Bashkiria were similar to those in the Moscow region. Expts. were reported on their repeated use for softening feed water.

7140. BILLINGS, L.C. **Experience with anthracite coal filter.** *Southwest Water Works J.* 28, No. 3, 18-20 (1946).—*C.A.* 40, 7456^2.

Coal permitted more desirable wash-water expansion; the bed was kept cleaner; when properly sized it was equal to sand in removing turbidity and bacteria. Filter runs were lengthened from 75 to 130%, the capacity being the same. Coal will cost 140% more than sand.

7141. BONGIOVANNI, J.P. AND NAVARRO, J.R. HURTADO **Zeolite plants for municipal water supplies.** *Rév. sanidad y asistencia social (Caracas, Venezuela)* 11, 173-8 (1946).—*C.A.* 41, 3236*i*.

7142. BRINDLE, HARRY AND RIGBY, GERALD. **Preparation of nonpyrogenic water and infusion fluids using activated charcoal.** *Pharm. J.* 157, 85 (1946); *Quart. J. Pharm. and Pharmacol.* 19, 302-9 (1946).—*C.A.* 40, 7518^2.

Dist. H_2O was rendered pyrogen-free when shaken at intervals for 15 min. with 1 g of charcoal per liter. Adsorption losses in the case of NaCl and dextrose were negligible; with procaine-HCl the loss was 27-35% on the wt of charcoal.

7143. BUNKER, GEO. C. **The control of odor and taste and the elimination of dissolved gases in water supplies.** *Rév. sanidad y asistencia social (Caracas, Venezuela)* 11, 145-72 (1946). —*C.A.* 41, 3237*i*.

7144. CHEKURDA, A.F. **Technical conditions and rate of charging filtering fields.** *Sakharnaya Prom.* 19, No. 9, 24-35 (1946).—*C.A.* 41, 4666*f*.

Sugar refineries have large quantities of waste water which require biol. purification and disposal. This was accomplished by discharging the waste water into filtering fields. The effectiveness of the disposal depended on the nature of the soil (structure, mech. analysis, etc.) and the rate of charging the filtering field. Formulas were given for calg. the filtering capacity of various types of soils.

7145. DONNELLY, R.P. **The selection and installation of a water-treatment plant.** *Power and Works Engr.* 41, 5-8, 24 (1946).—*C.A.* 40, 4453^6.

Processes in the order of their merit were: (1) full deionization to produce water free from saline constituents, (2) lime-base exchange treatment, (3) hot lime-soda process, (4) cold lime-soda process, and (5) simple base exchange.

7146. ENGLE, JAMES W. **Application of diatomaceous earth filters to swimming pool recirculation systems.** *Proc. Ann. Conf. Maryland-Delaware Water Sewerage Assoc.* 19, 36-46 (1946).—*C.A.* 45, 8173*d*.

In military use, diatomite filtration of water pretreated with a coagulant removed all amebic cysts and cercariae of schistosomes, produced water of less than 0.1 p.p.m. turbidity, and removed 90% of all bacteria. Design criteria were presented. The cost was less than sand filtration, and a smaller space required. Chlorination was still necessary.

7147. EVANS, U.R. **A simple device for preventing the formation of hard deposits in laboratory stills fed with water partially softened by base-exchange treatment.** *Chemistry & Industry* 1946, 434-5.—*C.A.* 41, 1780*f*.

A self-contained electrochem. device consisting of Zn and Cu plates supported on a glass frame was described. Use of the device in a still resulted in the formation of an easily removable sludge rather than a hard-clinging scale formed in the absence of the device.

7148. GRANATA, M. **Bacterial purification of water by means of silvered activated charcoal filters.** *Ann. igiene* 56, 284-8(1946); *Chimie & industrie* 58, 148(1947).—*C.A.* 42, 3880*b*.

Activated charcoal was silvered by the Uglow method with silvered quartz sand. Each filter element contained 85 g charcoal with 5, 10, or 20% silvered activated charcoal. Tap water or water artificially polluted with *Escherichia coli* was passed through at the rate of 1000 cc. per hr. Expts. showed the greater efficiency of the silvered charcoal.

7149. GURNEY, W.B. **Anthrafilt as a filter medium.** *Proc. 9th Ann. Short Course Water Sewerage Plant Supts. and Operators,* 1946, *Louisiana State Univ. Eng. Expt. Sta. Bull. Ser.* No. 10, 71-8 (1947).—*C.A.* 43, 2717^g.

Water for boiler feed, filtered through Anthrafilt, showed a decrease in SiO_2 owing to the removal of undissolved SiO_2 without contact action, whereas sand filter effluents showed increase in SiO_2, especially when the inital concn. was low. Vol. of water filtered during the run increased with the rate of filtration by using Anthrafilt, but decreased with sand. Cementation between the top of the gravel and sand and disturbances in the gravel were costly. With precipitators ahead of filters, no cementation occurred in Anthrafilt beds, the gravel remained level, and no topping was needed.

7150. GURVICH, S.M. **Use of anthractie as filtering material.** *Elektricheskie Stantsii* 17, No. 8, 27-30 (1946).—*C.A.* 41, 2186^d.

The use of anthracite for filtering feed water and for communal water supply was discussed. U.S.A. practices and exptl. work carried out in U.S.S.R. were compared.

7151. HARDENBERGH, W.A. **Army water supply in World War II.** *J. Am. Water Works Assoc.* 38, 952-8 (1946).—*C.A.* 40, 6718^3.

7152. HAY, HAROLD R. **Improving water-plant operation with activated silica. I. Conventional flocculation and sedimentation plants.** *Water & Sewage Works* 93, 353-8 (1946). —*C.A.* 41, 545*i*.

A summary was presented of recommended practices and advantages in the application of activated silica to aid coagulation and filtration. For waters low in turbidity, activated silica should precede alum; for other cases the silica should be added after formation of pinpoint floc with alum. Silica usually precedes lime for calcium carbonate pptn., but follows lime by several min. for Mg removal.

7153. HAY, HAROLD R. **Improving water-plant operation with activated silica. II. Upflow units. III. Low-temperature coagulation.** *Water & Sewage Works* 93, 389-92, 479-82 (1946). —*C.A.* 41, 546*e*, 5239*b*.

Activated silica improved the majority of installations by rapidly forming large, tough, heavy floc which settled well despite turbulence caused by high rates or agitation effects within the sludge zone. For color removal it was essential that silica be added with rapid mixing after alum had already formed a partial floc. In upflow softening of waters contg. org. matter and low in Mg, or in cases where only Ca was removed, the usual fine granular ppt. was transformed by activated silica to large, leathery floc. $Mg(OH)_2$ ppts. also were increased in density. Several cases were cited to show the improved flocculation and settling resulting from the use of activated silica treatment with alum. A higher ratio of silica to alum seemed advisable in cold water.

7154. HISSCHEMÖLLER, F.W. **Preparation of distilled water from tapwater containing ammonia.** *Chem. Weekblad* 42, 72-3(1946).—*C.A.* 40, 3952^4.

The tapwater at Gouda contained 2 Mg of NH_3/ liter. NH_3-free distd. water was obtained by neutralizing the feed water of the still with H_2SO_4 or H_3PO_4 or by filtering it through active carbon (Norit).

7155. HOPKINS, S.J. **Synthetic resins and water softening.** *Mfg. Chemist* 17, 285-8(1946).—*C.A.* 42, 6027*f*.

The use of these materials for producing H_2O of high purity was described.

7156. HOWARD, F. AND SPOONER, E.C.R. **Removal of taints from water.** *Chemistry & Industry* 1946, 186-8.—*C.A.* 40, 5175^5.

Sources of tastes and odors were discussed, with emphasis on American and British practice in the use of activated carbon in removing tastes and odors from potable waters. During the war activated carbon was used to remove pyrogens from distd. H_2O and medicaments.

7157. HOWARD, NORMAN J. **Progress in the treatment of water for taste and odor correction.** *Water and Sewage* 84, No. 11, 14-15, 54 (1946). —*C.A.* 41, 2512*h*.

Chlorine dioxide was used successfully in several Canadian municipalities. It was not as effective a bactericide as Cl_2 if org. matter was present. Use of activated carbon continued to grow yearly. Chloramine treatment employed where algae were present was uncertain.

7158. JOHNS, T.M. **Maintenance of base-exchange softeners.** *Southern Power and Ind.* 64, No. 2, 85, 90 (1946).—*C.A.* 40, 1956^9.

Badly-polluted zeolite was detected by washing a sample from the top of the bed in an Erlenmeyer flask; the zeolite settled out and suspended matter was visible above the zeolite. A procedure for killing and removing algae was given, which included removing and discarding the top two inches of the zeolite, washing, chlorination and rewashing, after which new material was added to restore the original depth.

7159. JONES, MYRNA F. AND BRADY, FREDERICK J. **Romoval of the cercariae of Schistosoma mansoni from water by filtration through diatomaceous silica in a small model filter.** *U.S. Pub. Health Repts.* 61, 1538-43 (1946).—*C.A.* 41, 240*b*.

Tests were made to det. the efficiency of a small model diatomaceous silica filter in the removal of the *cercariae* of *Schistosoma mansoni* from raw water. *Cercariae* added to the percolating soln. were found to be present in the water passing the filter for as long as 12 min. after the beginning of recirculation even though the filtered water appeared to be visibly free from turbidity within 1 min. after the beginning of recirculation.

7160. KIMSEY, E.G. **The softening of municipal water supplies.** *J. Junior Inst. Engrs. (London)*, 56, 270-86 (1946).—*C.A.* 41, 2825*a*.

A discussion of water hardness, old-type Clark process, development of the Clark process, excess-lime process, Accelator process, lime and lime-proportioning app., alumina-proportioning app., sludge, stabilizing treatment, base-exchange process, zeolite, and base-exchange plant.

7161. KLINGER, L.L. **Improvements in the coagulation of surface waters with activated silica.** *Paper Trade J.* 122, No. 15, 44-50(1946).—*C.A.* 40, 3843^5.

Colloidal silica was used successfully as a coagulant aid for both colored and soft lowland waters and turbid and hard lowland waters. The principle of continuous feed was applied successfully in the prepn. of the hydrosol. The resultant filtered water was less turbid, of somewhat lower color and SiO_2 content, of somewhat higher pH, sparkling and clear. The activated SiO_2 remedied many of the difficulties attendant upon the production of a suitable filtered water, such as needed in the paper industry.

7162. KOSTRIKIN, YU, M. AND YANKOVSKIĬ, K.A. **Determination of sulfates in natural, boiler, and feed waters by means of sulfocoal.** *Zavodskaya Lab.* 12, 623-4 (1946).—*C.A.* 41, 2512*i*.

Place approx. 20 g of moistened sulfonated coal in a 50-ml buret, slowly pour 50 ml of 5% HCl to replace all cations by H^+. If hydroxides, carbonates, or bicarbonates are present in the water, a part of the H^+ is used up for their neutralization. The residual acidity of natural waters is equiv. to their contents of Cl^- and SO_4^{--}, that of boiler water to contents of Cl^-, SO_4^{--}, PO_4^{---}, and very seldom NO_3^-. Det. Cl^- by the Mohr and Vollhardt method, NO_3^- and PO_4^{---} colorimetrically, and SO_4^{--} by difference.

7163. KRUSHEL, G.E. **Preventing precipitation of carbonates on glauconite grains.** *Elektricheskie Stantsii* 17, No. 9, 24-8(1946).—*C.A.* 41, 2186*f*.

Glauconite lost its effectiveness owing to pptn. of $CaCO_3$ and $Mg(OH)_2$ on it. The mech. causes could be removed by better design of filters, settling tanks, and clarifiers for the lime-treated water. The main chem. cause was supersatn. of the clarified water with $CaCO_3$ and $Mg(OH)_2$. This could be remedied in one of 4 ways: addn. of H_2SO_4 to transform the carbonates into sulfates and bicarbonates, passing in CO_2 to transform carbonates into bicarbonates, addn. of hexametaphosphate, and diln. with already softened water.

7164. Lendall, H.N. **A comprehensive survey of the taste and odor problem.** *J. Penna. Water Works Operators' Assoc.* **18**, 74-83 (1946).—*C.A.* **41**, 1780^b.
$CuSO_4$, Cl_2, and activated charcoal have been successfully used as algicides; this prevented undesirable taste and odor formation. Tastes and odors already present could be removed by: aeration, superchlorination, activated charcoal, breakpoint chlorination, and ClO_2. Other methods of limited use were ozonation, $KMnO_4$, and clays.

7165. MacGonagle, F. Robert. **Activated silica sol in water treatment.** *Paper Ind. Paper World* **28**, 533-4, 538 (1946).—*C.A.* **40**, 5917^6.
A general discussion, with special reference to its application to the pulp and paper industry.

7166. Nagai, Toyotaro; Morise, Taro; Yamamoto, Mitsugu, and Iwata, Kiyoko. **Extraction of salt from sea water.** *Research Rept. Osaka Munic. Inst. Domestic Sci.* **17**, 483-526 (1946).—*C.A.* **42**, 4695*b*.
Tests were made to find a simple method of extg. salt from sea water by using the ion substitution-water softener method. With 60 g of pos-ion substitutable resins per liter of sea water, only 6% of the salt was extd. By using Ag_2CO_3 and Ca Parmuchito the salt content was brought to 2000-3000 p.p.m. from 1 liter of sea water; 150 g of the Ag_2CO_3 and Ca Parmuchito was used over and over again.

7167. Nolte, Ernst. **Three decades of experience with waste waters from sugar refineries.** *Beitr. Wasser-, Abwasser- u. Fischereichem. Madgeburg* **1946**, 24-33.—*C.A.* **42**, 9213*d*.
Waste waters must be sufficiently dild. before discharge into streams. Disposal plants for the treatment of such wastes would have to be too large and too expensive, since they would be operated only 1/4 of the year (during the campaign.)

7168. Ôshima, Yoshio. **Filter-paper test of hot-spring water.** *Igaku to Seibutsugaku* (Med. and Biol.) **9**, 309-10(1946).—*C.A.* **47**, 1311*i*.
Capillary diffusion of a dye on filter paper was examd. as a measure of the effect of hot-spring water on the elec. charge of colloids. Congo red was used as a dye which showed a neg. charge in aq. soln. Filter paper, 1 × 9 cm, was immersed in a mixt. of 0.5 cc. of 0.5% aq. Congo red soln. and 2.0 cc. of hot-spring water for 2 min., and the distance of the diffusion of the dye was measured.

7169. Royal Naval Scientific Service. **Production of potable water from sea water.** *Chimie & industrie* **56**, 14-17(1946).—*C.A.* **40**, 7458^7.
A method suitable for emergency use at sea was outlined. The method consisted essentially in treatment with a mixt. of Ba and Ag zeolites, Ag_2O, a disintegrating agent, and activated charcoal.

7170. Simonsson, Lennart. **Investigation of stability of zeolites.** *Ing. Vetenskaps Akad., Handl. No.* **186**, 75 pp. (1946).—*C.A.* **41**, 2513*c*.
Neopermutit, SN-Permutit, greensand products, Doucil, Invertit F, Refinite, Natrolit 1933, B-Natrolit, B-Natrolit HK, and Basolit were tested for stability with distd. water at 0-60°C, with solns. contg. 0.0001-1.0 *N* NaCl and 0-60 mg/liter SiO_2, and over a range of 4-10 in pH. Sludge formation increased linearly with time and accelerated at higher temps. but did not correlate with liberation of silica or Al.

7171. Streatfield, E.L. **Recent developments in water treatment.** *Trans. Liverpool Eng. Soc.* **67**, 80 (1946); *J. Am. Water Works Assoc.* **40**, 989-90 (1948)—*C.A.* **43**, 6765*b*.
Use of silicates as aid to coagulation showed promising results. Bentonite, another aid to coagulation, was also developed in America. Coagulation by an elec. process was used for removing emulsified oil from condensate. Oil-contaminated condensate passed between electrodes, across which passed small direct current, during which time emulsified particles coagulated. Water then passed to a rapid filter contg. sand, anthracite, or activated carbon. A small quantity of water contg. sol. solids had to be added to the condensate to produce elec. cond. The conventional rectangular sedimentation tank with over- and under-baffles was unsatisfactory. An interesting development in filtration was the use of anthracite as a filter medium.

7172. Tach, M. **Chemical purification of water by mineral and organic exchange media.** *Chaleur et ind.* **27**, 169-76 (1946).—*C.A.* **41**, 545^h.
The theory and practice of the use of zeolite and org. anionic and cationic exchangers were reviewed.

7173. Teis, R.V. **Isotope composition of mineral waters.** *Compt rend. acad. sci. U.R.S.S.* **53**, 135-7(1946)(in English).—*C.A.* **41**, 4345*b*.
Previous d. detns. of 35 natural waters showed the least mineralized to have the lowest d., which resulted from soil layers adsorbing D during percolation. Isotopic exchange was also considered responsible for d. decrease, by substitution of light H for D or O exchange.

7174. Warth, A.H. **Purifying water by ion exchange.** *The Crown* **36**, No. 1, 13(1946).—*C.A.* **41**, 2512^f.
Description of the chemistry of the ion-exchange process and the use of Amberlites in water purification.

7175. Akeroyd, E. I. **Water treatment.** *Proc. Tech. Sect., Paper Makers' Assoc. Gt. Brit. & Ireland* **27**, 203-14(1947).—*C.A.* **41**, 7018*f*.
Clarification, pptn. softening, ion-exchange softening, and ion-exchange processes for removing dissolved salts were discussed. Analytical data were given to show the effect of the various treatments on a raw water.

7176. APPLEBAUM, S. B. **Iron and manganese removal.** *Proc. Ann. Water Conf., Engrs. Soc. West. Penna.* 7, 123-30 (1947).

There was no single method that was satisfactory for the removal of Fe and Mn in all cases. Individual study was required in each case to decide the most economical design of plant to accomplish the desired result. Mn-zeolite was very valuable as a finishing or polishing process because it reduced the Fe and Mn to under 0.1 p.p.m. It was particularly efficient in Mn removal.

7177. BAILEY, HOWARD E. AND STEADLEY, JAMES. **Activated-carbon treatment of an open reservoir.** *Water & Sewage Works*, 94, 219-22 (1947). —*C.A.* 42, 8377*a*.

A pond (108 acres) used as a municipal H_2O supply was cleared of tastes and odors by application from a boat of 0.6 p.p.m. of $CuSO_4$ and 1.25 p.p.m. of activated carbon. Tastes and odors from algae could be successfully removed upon 72 hrs notice.

7178. BAUMAN, W. C.; EICHHORN, J., AND WIRTH, L. F. **Symposium on silica removal by ion exchange.** *Proc. Ann. Water Conf., Engrs. Soc. West. Penna.* 7, 98-103 (1947).

It was of prime importance to remove the last traces of silica in the demineralized boiler feed water. A typical demineralizing unit was described, consisting of cation and anion exchangers placed in series. The exhausted anion exchanger was treated with 5% HCl before regeneration. Silica removal from the anion bed was 98% complete. Anion resin (T-A) was used in a one-inch diameter Saran tower. The cation exchanger used in all the silica tests was Dowex-30.

7179. BAUMAN, W. C.; EICHHORN, J., AND WIRTH, L. F. **Silica-free boiler feed water by ion exchange.** *Ind. Eng. Chem.* 39, 1453-7(1947).—*C.A.* 42, 701*i*.

The complete removal of silica from water was attained with ion-exchange resins. Silica was converted to fluosilicic acid and removed as such by an anion resin. Six different resins were used in this study, and the effect of various methods of adding the fluoride ion. Alkali regeneration of exhausted anion beds must be preceded by acid or salt treatment to avoid pptn. of silica in the anion exchangers.

7180. BLIGHT, F. C. **Base-exchange of lime-soda water softening?** *Mech. World*, 122, 179-82 (1947); *Dept. Sci. Ind. Research (Brit.) Fuel Abstracts* 2, No. 5, 136(1947).—*C.A.* 42, 5589*c*.

The factors influencing the choice of method of softening feed water for boilers working at less than 200 p.s.i. and 2,000 gals/hr were considered under three headings, mech., chem., and economic. The mech. aspect was shown to be wholly in favor of the base-exchange process. The chem. aspect was discussed at some length with reference to different types of boilers and of hardnesses and the results were summarized.

7181. CAMPBELL, JOHN T. **New West Penn Water Co. supply.** *J. Am. Water Works Assoc.* 39, 770-2 (1947).—*C.A.* 41, 7021*b*.

The old supply, a surface water, became contaminated with mine wastes. The new supply, also surface, was located where mine wastes were not apt to be present. Treatment includes prefiltration, settling, helped by a precipitator. The filter media of the sand filters were graded gravel and anthrafilt.

7182. CERNA, W. W. **Survey of German feed-water practice.** *Power* 91, No. 9, 72-6(1947).—*C.A.* 41, 7022*c*.

Physically hard exchange resins were used as high as 210-12°F with water deaerated and having a max. pH value of 8.5. Silica removal was based largely on the use of Mg. The use of NH_3 was successfully developed.

7183. ELLIOT, O. M. **Brackish feed water treatment.** *Proc., 8th Annual Water Conf. Engrs's Soc. of West. Penna.* 1947.

Processes in economic competition for treatment of brackish waters were: distillation, deionization, softening by ion exchange, and softening by precipitation. A discussion of the applicability of each process and a description of a precipitation plant were given.

7184. FRANCIS-BOEUF, CLAUDE. **The amount of oxygen dissolved in the interior medium of fluviomarine slimes.** *Compt. rend.* 225, 392-4 (1947).—*C.A.* 42, 3025*f*.

The interior medium of estuary slimes contained no dissolved O_2. The surrounding pellicle of these slimes, on the other hand, was the seat of photosynthesis which offset in part the high reducing power of these org. sediments and the O_2 consumption by bacteria.

7185. FULMER, J. O. JR. **Production and maintenance of water quality at Easton.** *J. Penna. Water Works Operators' Assoc.* 19, 72-5 (1947). —*C.A.* 42, 2697*f*.

Chloramine was replaced by activated carbon, added at the mixing chamber and at the filters, and postchlorination, with dosages from 6.8 to 7.3 p.p.m. Cl, to provide H_2O with free available Cl of 2.5-3.5 p.p.m.

7186. GILWOOD, M. E. **Symposium on silica removal by ion exchange.** *Proc. Ann. Water Conf., Engrs. Soc. West. Penna.* 7, 94-98 (1947).

Silica may be removed from waters contg. low dissolved solids cheaply, if demineralizing treatment was not desired. Demineralized silica-free water was available by commercial processes. It was now possible to supply boiler-makeup water having virtually the same quality as distilled water. However, before deciding which treatment should be recommended for a given boiler plant, it was necessary in each case to make a complete engineering-economic study to det. which process resulted in the most economical over-all boiler and water plant operation.

7187. GILWOOD, M. E. **Five ways to remove dissolved silica from boiler feed water.** *Power* 91, No. 8, 86-9 (1947).—*C.A.* 41, 7022*e*.

The ways outlined were with ferric sulfate, with Mg salts, by fluosilicate anion-exchange reactions, by direct absorption in exchange reactions, and by combination treatment.

7188. HALVORSEN, GORDON G. **Diatomaceous filter aids for paper-mill waters and effluents.** *Paper Trade J.* 125, No. 18, 37-41 (1947).—*C.A.* 42, 367*e*.

Filtration cycles of 3-8 hrs at 30 gal/ft^2/hr with 4-16 lb filter-aid/1000 gal and filtration pressures up to 16 p.s.i. could be obtained on av. mill white waters. Lower quantities of the filter aid and longer cycles were obtained on white waters contg. stock from the manuf. of higher-quality boards and paper. Filtration of well or river water were accomplished by using extremely small quantities of diatomaceous earth; this assured pos. clarified waters which will give satisfactory operation on low-vol. type showers.

7189. HANEY, PAUL D. **Disposal of water-purification and -softening plant wastes. Brine disposal from sodium zeolite softeners.** *J. Am. Water Works Assoc.* 39, 1215-19 (1947).—*C.A.* 42, 2041*a*.

Evapn., brine-disposal wells, and uncontrolled and controlled diln. were the methods under consideration; controlled diln. seemed to offer the generally best means at present.

7190. HAUCK, CHAS. F. **Current trends in the re-use of water.** *Proc. Ann. Water Conf., Engrs. Soc. West. Penna.* 7, 155-60 (1947).

Re-use practices were divided on the basis of first use: (1) re-use of process waters; (2) water from cooling and heating circuits; (3) re-use of sewage plant effluent.

7191. HEERTJES, P. M. AND HEKMAN, E. E. **Purification of the waste water from plants manufacturing potato starch, by treatment with a cation-exchanger.** *Chem. Weekblad* 43, 789-96 (1947).—*C.A.* 42, 5699*b*.

The potatoes were grated, and the juice obtained therefrom was analyzed for total nitrogen and albumin contents. The sap was then treated with the exchanger. Two methods of procedure were utilized—treatment of small samples and treatment of a continuously flowing column. If the cation-exchanger method can be adapted to practical large-scale operations, the purification problem will be solved.

7192. HOOT, R. A. **Mathematical calculation of phenol value of an activated carbon.** *Water & Sewage Works* 94, 402-4(1947).—*C.A.* 42, 8445*d*.

The phenol value for an activated carbon can be calculated instead of detd. graphically, by applying the method of least squares to Freundlich's equation. Use of an elec. calculator reduced the time required in the method presented.

7193. JUKKOLA, W. W. AND THOMPSON, R. B. **Symposium on silica removal by ion exchange.** *Proc. Ann. Water Conf., Engrs. Soc. West. Penna.* 7, 89-94 (1947).

Silica was removed by ion exchange with the available exchange resins. For small plants with moderate amts. of SiO_2, addn. of fluorides to the raw water appeared to be an economical soln. When either high silica waters were encountered or high vols. involved, the cost of silica removal may be materially lowered by employing a cyclic process which involved the recovery and re-use of the fluorides.

7194. LEAF, WALTER. **Silica removal.** *Mech. Eng.* 69, No. 2, 156-7 (1947).—*C.A.* 41, 2186*i*.

Hydrated Fe_2O_3 was found to be effective for removal of SiO_2 from H_2O. In one treatment plant it was found impossible to secure continuous rusting of steel shavings, probably because the high SiO_2 content of the water formed a protective film. Better results were secured with cast Fe chips, which rusted readily, but cemented together to form a solid mass that had to be broken up with a fork.

7195. LUR'E, YU YU AND STEFANOVICH, S. N. **Use of organolites in the analysis of water.** *Zavodskaya Lab.* 13, 660-3(1947).—*C.A.* 42, 7464*f*.

Cation organolites were used to eliminate Ca and Mg in natural and sewer water. Extd. Ca and Mg were recovered by adding HCl (1:9) and (1:4), resp. Loss in extn. was approx. 2%. Sulfate was detd. by titrating the filtrate with 0.1 *N* NaOH (methyl orange indicator).

7196. MAIER, F. J. **Methods of removing fluorides from water.** *Am. J. Pub. Health* 37, 1559-66(1947).—*C.A.* 42, 2371*i*.

7197. McDILL, BRUCE M. **Industrial wastes. Beet-sugar industry.** *Ind. Eng. Chem.* 39, 657-69 (1947).—*C.A.* 41, 4259*f*.

The wastes were of large vol., high in solids and org. matter, and produced during a short period of late autumn and early winter. Changes in process to effect economics in waste disposal appeared logical.

7198. MERRILL, REYNOLD AND BOLTON, HARRY L. **Activated silica, a new chemical-engineering tool.** *Chem. Eng. Progress* 1, No. 1, 27-32 (1947).—*C.A.* 41, 2213*a*.

Activated silica sols were effective in improving coagulation. They were used for treating raw H_2O, white H_2O from paper mills, sewage, and oil-refinery waste. The method used had some bearing on the properties of the finished product. The silica sols would be a valuable tool in any application where a highly charged, readily adsorbed, neg. lyophilic colloid was needed.

7199. MIEDENDORP, HENRY. **Quality textile products demand pure, clean and soft water.** *Rayon Textile Monthly* 28, 80 (1947).

The selection of the zeolite depended upon many factors: (a) durability of zeolite as to pH rating silica, iron, suspended matter, and temperature, (b) ratio of capacity, price, and bulk of zeolite, (c) type and amount of regenerate used, (d) auxiliary treatment.

7200. MILLER, LEWIS B. **Process water treatment for rayon manufacture.** *Rayon Textile Monthly* 28, 133 (1947).

Several types of water treatment used extensively by rayon plants for the treatment of raw waters were discussed: water clarification for turbidity removal; softening of water; iron and manganese removal; color removal.

7201. MINDLER, A. B. AND GILWOOD, M. E. **Ion exchange in the treatment of wastes.** *Proc. Ann. Water Conf., Engrs. Soc. West. Penna.* 7, 181-2 (1947).

Harmful electrolytes present in extremely low concns. were removed by ion exchange, subsequently recovering the electrolytes in relatively high concns. from the exchange material. The recovery of metals or org. acids were examples. A valuable product arising from the removal of harmful electrolytes from a waste soln. may be concd. for sale. The demineralization of pineapple mill juice for the production of a sugar syrup was the example.

7202. MORRISON, W. S. **Symposium on silica removal by ion exchange.** *Proc. Ann. Water Conf., Engrs. Soc. West. Penna.* 7, 103-108 (1947).

Waters contg. 8 to 10 p.p.m. of silica could be successfully treated to remove all but a trace of this troublesome substance from hard water supplies. Silica and silicic acid were converted to the highly ionizable fluosilicic acid H_2SiF_6 and was adsorbed on the anion resin. The possibility of slurrying the hydrogen exchange resin with CaF_2 for silica removal was studied. The cation resin so treated not only removed metal ions, but tended in its acid state to react with CaF_2 to form hydrofluoride for silica removal.

7203. NESSLER, R. L. **Soft water for silk hosiery mill with zeolite water conditioning.** *Rayon Textile Monthly* 28, 286 (1947).

After several years of continuous service at full boiler capacities, recent internal inspection of the boilers revealed no evidence of corrosion. Thus was indicated the effectiveness of the deaerating heater in removing the dissolved oxygen and the large amount of carbon dioxide from the feedwater.

7204. OWENS, F. R. **Silica deposits in steam turbines from softening of makeup through natural zeolite.** *Combustion* 19, 37-9(1947).—*C.A.* 41, 7022*g*.

In steam turbines operating at pressures of 600 p.s.i. or less, when greensand was used as water softener, SiO_2 deposits were found; samples from 3 plants contained, resp., SiO_2 93.89, 88.10, and 88.01; Fe_2O_3 2.56, 6.00, and 4.20; SO_4^{-} 1.40, 0.42, and 3.46; Cl 0.37, 1.27, and 0.96; OH none, none, none; CO_3^{--} none, 0.42, and none; P_2O_5 none, 0.49, and 0.94; CaO 0.29, none, and 0.12; MgO 0.96, none, none; Na_2O 1.01, 1.65, and 1.42. The loss of SiO_2 from greensand increased with OH concn. and with total ion concn. in a water supply.

7205. PEACEMAN, DONALD. **Demineralization of water.** *City Coll. Vector (N.Y.)* 10, 38-9, 53 (1947).—*C.A.* 41, 7020*g*.

A review of processes for removing minerals from water.

7206. RUCHHOFT, C. C. AND ETTINGER, M. B. **Tastes and odors in water resulting from industrial wastes.** *Proc. 3rd Ind. Waste Conf., Purdue Univ. Eng. Bull., Extension Ser. No.* 64, 321-50(1947).—*C.A.* 43, 4794*c*.

Satisfactory phenolic-waste treatment depends upon plant-recovery practices, although phenols in dild. wastes were handled by trickling filters, since biochem. oxidation with proper seeding was the major dissipating agent. Tastes and odors from phenolic compds. in chlorinated H_2O can be removed by activated carbon, chloramine treatment, ClO_2, and breakpoint chlorination.

7207. SALAC, VÂCLAV. **Correction of water with Wofatite.** *Congr. intern. inds. fermentations Confs. et communs.* 1947, 514-25.—*C.A.* 42, 8378*i*.

Since 1943, Wofatite resins have been employed for softening water in a brewery. Wofatite K(H exchanger), a phenol-HCHO resin and Wofatite M(OH exchanger), a polyamine-type resin, were used. Compared to beer made from boiled water, that from resin-purified water showed notable improvement in taste. Harder water could be used; e.g., a water of 42.1° total hardness and 22.3° temporary hardness was reduced, resp., to 21.3 and 5.7°.

7208. SIGWORTH, E. A. **Taste and odor control with activated carbon.** *Water & Sewage Works, Reference & Data sect. Pt. 1*, 94, No. 7, R-135-6 (1947).—*C.A.* 42, 8377*b*.

7209. STORRIE, WILLIAM. **Toronto water-works extensions—a general description of the system with details of some outstanding features.** *J. New Engl. Water Works Assoc.* 61, 1-33 (1947).—*C.A.* 41, 3889*h*.

The supply (Lake Ontario) was chlorinated and sometimes superchlorinated. Dechlorination with SO_2 for taste removal will be practiced when necessary. A water-purification plant was planned which will include mixing, coagulation, addition of activated carbon, and use of both Cl_2 and SO_2.

7210. STREATFIELD, E. L. **Anthracite as a water filter medium.** *Paper-Maker* (London) 113, TS5-6 (1947)—*C.A.* 43, 5139*e*.

Comparative data for anthracite and sand-filters used for a river H_2O treated with $Al_2(SO_4)_3$ showed that the filter areas of 336 ft^2, bed depths 2 ft, filtration rates 120-128 and 128 $gal/ft^2/hr$, and effective particle sizes 0.6 and 0.5 mm, resp., the av. lengths of the runs obtainable were 5 and 1 hr, resp. A 5-min. air scour of 2.7 $ft^3/min./ft^2$ of filter area with back-washing (3000 gal/min.) for 4 min. cleaned the anthracite filter but after similar air scour and back-washing for 6-7 min. the sand filter was still unworkable.

7211. STREICHER, L.; PEARSON, H. E., AND BOWERS, A. E. **Operating characteristics of synthetic siliceous zeolite.** *J. Am. Water Works Assoc.* 39, 1133-51 (1947).—*C.A.* 42, 1679*f*.

The principal causes of zeolite aging were mech. attrition and loss of silica by soln. in the softened water. The effects of pH and the influence of fluorides, as well as other salts in the water on soln., were discussed. Operation control was important, especially control of brine concn. and contact time of brine with zeolite during regeneration.

7212. TAYLOR, ELBERT J. **Water-works improvements for Philadelphia.** *J. Am. Water Works Assoc.* 39, 123-7 (1947).—*C.A.* 41, 2512*e*.

A high bacterial load, tastes, odors, and corrosion made the present supply, largely from the Schuylkill River, objectionable and difficult to treat. The new recommended supply will be the Delaware River taken above the Delaware Water Gap. Treatment will include activated carbon, preozonation, and free residual chlorination.

7213. THOMPSON, J. AND MCGARVEY, F. X. **Some practical aspects of deionization.** *Proc., 8th Annual Water Conf. Engrs's Soc. of West. Penna.* 1947.

Operational procedures and problems arising in the operation of ion exchange beds were discussed. Data were presented to show head losses, leakage, backwash effects, and regeneration treatments with various materials.

7214. THOMPSON, RUDOLPH E. **Diatomite filtration.** *Water and Sewage* 85, No. 9, 31, 57-8, 60 (1947). —*C.A.* 41, 7591*b*.

Diatomite filters and their use in the American Army were described. Similar units are now employed for swimming pools.

7215. VOSLOO, P. B. B. **Rapid sand filtration of sewage works effluents without coagulants.** *Inst. Sewage Purif., J. and Proc.* 1947, Pt. I, 204-9.—*C.A.* 44, 250*i*.

For slow sand filters treating humus tank effluent, the av. rate of filtration was 3 gals/ft^2/hr, and the filters were out of service 2/3rds of the time for cleaning. Expts. on pressure filtration with 20-30 mesh sand as the top layer showed that practically all the suspended matter was removed at rates of filtration at least up to 200 gals/ft^2/hr. The amt. of effluent filtered between backwashes was not dependent on the rate of filtration, provided the conditions of head and rate at the end of the run were fixed.

7216. WAMSLEY, ROBERT AND JONES, W. E. **Fluoride removal.** *Water & Sewage Works* 94, 272-6(1947). —*C.A.* 42, 8377*c*.

Underground H_2O, contg. 80-250 p.p.m. total hardness, variable turbidity, high SO_4^{--} content, and 14 p.p.m.F, was treated at a rate of 300,000 gals/day, screening, softening with lime, soda ash, and $NaAlO_2$; rapid sand filtration; and recarbonation; followed by $Ca_3(PO_4)_2$ filters for F removal. The phosphate filter was regenerated with 1% NaOH and CO_2 obtained from dry ice. F was reduced to 0.5 to 0.7 p.p.m., and total hardness to 75 to 96 p.p.m.

7217. WEDGWOOD, PHILIP. **Practical progress in water treatment.** *Gas World* 126, 688-91(1947); *Gas J.* 250, 453, 455, 457-8.—*C.A.* 41, 5238*h*.

The water to the plant boilers was treated in lime-soda softening unit, and then by-passed through a synthetic zeolite. The av. hardness of the raw water was 18.2 grains per gal temporary, and 0.7 grain permanent (expressed as $CaCO_3$). The treated water over a 6 months' period had an av. hardness of 0.59 grains per gal, and an alky. to phenolphthalein of 0.47 and to methyl orange of 4.3.

7218. WICKERT, K. **Conditioning and checking of boiler feedwater.** *Arch. Metalkunde* 1, 499-521(1947).—*C.A.* 42, 8379*f*.

After removal of coarse contaminants feedwater was usually passed through a gravel filter. Depending upon types of contamination, different purification filters may follow: e.g. activated carbon for oil and aeration for Fe (in form of bicarbonate or sulfate). Some purification operations were necessary for the protection of the water-softening app. Various softening methods were described, including the alkali exchange, chem., and thermal methods.

7219. WILEY, JOHN T.; DELONEY, JOE E., AND DENTON, S. WALTER. **Accurate particle-size determination of fluid catalyst by coordination of Roller analysis and microscopic examination.** *Proc. Am. Petroleum Inst.* 27, Sect. III 23-8(1947).—*C.A.* 42, 5723*h*.

A novel filter trap and adapter were used with a Roller Analyzer which measured with a precision of ±1.3%. Necessary precautions and factors affecting the results were listed.

7220. WILLIAMS, W. L. **Microbial fouling of zeolite water softeners.** *J. Am. Water Works Assoc.* 39, 779-82 (1947).—*C.A.* 41, 7022*b*.

A plant was described, using pre-softening ahead of Zeo-Karb softeners. When well water became short, Ohio River water was used. This was highly polluted and the zeolite was soon contaminated with org. growths. High-Cl_2 residuals, removal of filter material, and cleaning were necessary before the trouble was overcome.

7221. WINDEN, F. J. V. D. **Use of an ion-exchange softener for softening of scrubbing water in a Berkhuysen ammonia washer.** *Het Gas* 67, 31-5 (1947).—*C.A.* 41 7704*g*.

The hardness of the water should be below 2° to prevent plugging of sprays. An installation was described for treatment of some 300 liters water/hr used to remove NH_3 practically completely from 3000m^3/hr of gas, the effluent NH_3 liquor being up to 8° Bé. An open aerator-gravel filter treatment was used for Fe removal followed by a set of carbonaceous zeolite washers (375 kg Thymharsite each).

7222. BAUMAN, W. C.; SKIDMORE, J. R., AND OSMUM, R. H. **Dowex 50.** *Ind. Eng. Chem.* 40, 1350-5 (1948).—*C.A.* 42, 8379*i*.

Dowex 50 exhibited properties of high capacity and chem. stability when applied to the softening and demineralization of H_2O. River H_2O contg. 3 grains/gal hardness and total solids of 350 p.p.m. and receiving sedimentation and adjustment to pH 8.5 with H_2SO_4, was treated to a hardness of less than 1 p.p.m. and a turbidity of 0.5 p.p.m. A resin bed of 300 ft^3 capacity operated successfully through 176 cycles over a period of 22 months, treating 1,250,000 gals/ft^3 or 2,000,000 gal/cycle, with a cycle time of 33 hrs. The regeneration was accomplished by 16 lb NaCl/kilograin $CaCO_3$.

7223. Bliss, Harding. **Developing a waste-disposal process. Examples from the copper and brass industry.** *Chem. Eng. Progress* 44, 887-94(1948).—*C.A.* 43, 7885*g*.

A discussion of the nature of specific copper and brass industry wastes and flow sheets for treatment thereof involving ion-exchange, electrochem., and electrolytic methods.

7224. Blumer, M. **A field method for water investigation with ion exchangers.** *Experientiz* 4, 351(1948).—*C.A.* 43, 791*f*.

After measurement of the pH and titration for alky., the cations were exchanged for H ions in a resin-exchange column. Titration with NaOH showed the total cation content, with an error not exceeding 1%. Free CO_2, and permanent and temporary hardness could be estd. from the 3 values.

7225. Bogdanchenko, A. G. **Multiple-action sand filter.** *Zavodskaya Lab.* 14, 119-23(1948).—*C.A.* 43, 909*d*.

Details were given for prepg. multiple-action quartz sand filters for solns which were to be used for vol. analysis. Sketches, vols., and wts of sand fractions were given and results from paper and sand filters compared.

7226. Calise, V. J. and Lane, M. **Silica removal by an improved ion-exchange process. A comparison with the fluosilicic acid method.** *Chem. Eng. Progr.* 44, No. 4, *Trans. Am. Inst. Chem. Engrs.* 269-74 (1948).—*C.A.* 42, 3624*e*.

A comparison was made of silica removal by ion-exchange processes with the fluosilicic acid method in reference to operating results, plant design and construction, removal of CO_2, necessary material of construction and treatment costs.

7227. Colebaugh, David C. **Taste and odor control.** *Proc. 11th Ann. Short Course Water and Sewerage Plant Supts. and Operators,* **1948**; *Louisiana State Univ. Eng. Expt. Sta., Bull., Ser. No.* 16, 37-40 (1949).—*C.A.* 43, 6343*c*.

Plant practice, particularly in the application of activated carbon, was reviewed.

7228. Gandenberger, Wilhelm. **Water purification at the Gallenklinge Waterworks, Stuttgart.** *Gas- u Wasserfach* 89, 305-10 (1948).—*C.A.* 43, 1885*g*.

Prior to the settling basin, addns./m^3 included 3 to 5 g of Cl_2; 60 g aluminum sulfate, and up to 60 g of clay (added only when necessary). Before filtration, the following chemicals were added (per m^3) 20-40 g hydrated lime and 4 to 6 g of powd. active carbon; after filtration 1 to 2 g Cl_2/m^3 was added, with final Cl_2 removal by means of active carbon filters, which had a relatively long life. A very satisfactory water, free from chlorophenol taste, was secured.

7229. Grove, C. S. Jr. and Casey, Robert S. **Deionized water for writing-ink manufacture.** *Chem. Eng. Progr.* 44, 733-6(1948).—*C.A.* 43, 336*a*.

A plant for purifying water by deionization, which produced from 3600 to 4800 gal/day, was described and the operating procedure and costs discussed. The raw water had an av. cond. of 300 micromhos (about 10 grains/gal of NaCl equiv.), from which a purified water of less than 3 micromhos cond. was produced.

7230. Hey, Raimund. **"Microspur," a new means of sterilizing drinking water.** *Zentr. Bakt. Parasitenk. I. Abt. Orig.* 152, 327-33(1948).—*C.A.* 43, 790*d*.

"Microspur" is a complex mixt. of Ag salts. Ordinary tap water was sterilized in 6 hrs, but if turbid 24 hrs may be required. If a combination of "microspur" and the activator was used, clear water would be sterilized in 1 hr. Turbid waters should first be pptd. and filtered.

7231. Hock, Heinz. **Determination of the total cation content of water.** *Chimia (Switz)* 2, 227-9 (1948).—*C.A.* 43, 2715*h*.

The metallic ions were detd. with Amberlite IR-100. A glass tube 15 mm in diam. and 350 mm high contained the exchanger to a height of about 270 mm. Three hundred cc. of H_2O was passed through the exchanger bed at the rate of about 20 cc./min. The first 200 cc. was discarded and the final 100 cc. titrated with 0.1 *N* NaOH to the yellow-end-point of methyl orange.

7232. Kominek, E. G. **Evaluation of demineralization methods.** *Chem. Eng. Progr.* 44, No. 9, 697-702 (1948).—*C.A.* 42, 8380*d*.

Demineralization by means of ion-exchangers afforded the most economical means of providing a low-solids water provided that the raw water contained less than about 40 grains/gal of dissolved solids. Distn. was superior to demineralization in ion-exchangers where a pyrogen-free water or where removal of unionized solids was required. Compression distn. merited consideration for removal of solids from a highly mineralized water.

7233. Kortschak, Hugo P. and Payne, John H. **Hydrolysis regeneration of an anion-exchange resin.** *J. Am. Chem. Soc.* 70, 3139-40 (1948).—*C.A.* 43, 2067*a*.

Water, run through Amberlite IR-4B which had been exhausted with HCl, caused appreciable hydrolysis of the resin (200 liter water hydrolyzed the resin to 70% of total capacity). The Freundlich equation was applicable at acid concns. below 0.01 N and the mechanism of acid removal by this resin was one of adsorption, not ion exchange.

7234. Kullgren, Carl. **Testing and purification of distilled water.** *Svensk Kem. Tid.* 60, 169-76(1948).—*C.A.* 43, 790*f*.

A filter made from defibered kraft sulfite cellulose (3 g) was treated with 200 ml 0.3 *N* HCl (5-6 portions) and washed with 400 ml distd. H_2O. In a test, the filter was washed with the water to be tested until 2 successive washings (150 ml each) showed the same acidity. At this point, the developed acidity corresponded to the cation-exchange between the filter and the water to be tested and was, therefore, a measure of the impurities in it.

7235. Leaf, Walter B. **Silica removal with iron shavings.** *J. Am. Water Works Assoc.* 40, 980-9(1948).—*C.A.* 43, 1127*g*.

The high adsorptive capacity of ferrous iron for silica was used after other methods of silica removal had proved unsatisfactory. Cast iron chips were more satisfactory than steel lathe turnings. Silica removal was a function of the amt. of rust formed, and the iron to be effective must be in a colloidal form.

7236. MacDuff, Harry W. **Home zeolite service.** *J. Am. Water Works Assoc.* 40, 309-12 (1948). —*C.A.* 42, 3107*c*.

Two systems of home zeolite service were considered and construction details given. Control and costs of the service were studied. Such home service should be considered as supplementing rather than replacing municipal softening.

7237. Merrill, Reynold C. **Activated silica sols in water treatment.** *Ind. Eng. Chem.* 40, 1355-9 (1948).—*C.A.* 42, 8376*b*.

Activated silica sols were prepd. by the reaction of a com. 41° Bé. sodium silicate soln. with either H_2SO_4, HCl, $Al_2(SO_4)_3$, $FeSO_4$, $(NH_4)_2SO_4$, Cl_2, $NaHCO_3$, CO_2, $Na_2B_4O_7$, $NaAlO_2$, or dil. solns. of metal salts capable of forming insol. silicates, followed by aging to incipient gelation, and either prompt use or diln. for stable storage. The cost of H_2O treatment varied from 35 to 50 cents p.p.m. SiO_2/million gals. Advantages obtained included increased size, toughness, and density of the floc, decreased time required for floc formation, settling time, turbidity, and color, resulting in clearer H_2O and lengthened filter runs. In addn. to H_2O treatment, these sols were used for the treatment of sewage and various industrial wastes.

7238. Miedendorp, Henry. **Water purification and waste disposal.** *Rayon Textile Monthly* 29, 86, (1948).

In the Zeolite process water was filtered through a bed of small, hard particles called "zeolite," which were composed principally of Na and Al silicates. The Na was exchanged for Ca and Mg. The removal of these elements resulted in the water being "soft," and soft water will not form a curd with soap in the dye bath and will not allow scale to form in piping or boilers.

7239. Miklyutin, V. N. **Softening of water with natural coal.** *Energet. Byull.* 1948, No. 5, 10-14.—*C.A.* 43, 5139*h*.

Soft coal contg. 15-19% humic acid had an ion-exchange capacity comparable to that of best grades of glauconite, and was successfully used for softening water. In filtration through 0.3-1.5-mm grain size, increase of the height of the column from 20 to 90 cm doubled the efficiency. The efficiency was proportional to the temp. of the water, and at 93°C was about 3.5-4.0 times that at 12°-15°C.

7240. Morris, J. Carrell and Carritt, Jeanne B. **Contamination of water supplies by radioactive substances.** *J. New Engl. Water Works Assoc.* 62, 1-9 (1948).—*C.A.* 42, 3882*d*.

Water contamination could be due to induced radioactivity, presence of radioactive chem. wastes, at. bomb explosion, or sabotage. Possible methods of removal were suggested, such as ion-exchange treatment with filtration and deaeration. Modifications of coagulation processes were mentioned.

7241. Oda, Ryohei; Shimizu, Hiroshi, and Nakayama, Yoshio. **Ion-exchange synthetic resins. XI. Purification of water by cation-exchange resin from natural rubber. XII. Purification of water by *p*-phenolsulfonic acid-formaldehyde resin.** *Chem. High Polymers* 5, 112-13, 113-15 (1948).—*C.A.* 46, 1185*e*.

In the purification of water by cation-exchange resin (KH-1) prepd. from natural rubber, Na-Ca and H-Ca exchange, regeneration, and flow velocity were studied. The highest cation-exchange capacity was 3.57 milliequiv./g, break-through capacity for Na-Ca exchange was 3.2 milliequiv./g, break-through ratio 0.89, regeneration effect with 0.5 *N* NaCl (500% of the theoretical amt.) was 61%, and regeneration efficiency was 12.2%. For the synthetic resin the cation-exchange capacity was 3.15 milliequiv./g, break-through capacity for Na-Ca exchange 2.8 milliequiv./g, break-through ratio 0.89, regeneration effect with 0.5 *N* NaCl (500% of the theoretical amt.) 61%, and regeneration efficiency 12.2%.

7242. Olson, H. M. **A review of soft water services.** *J. Am. Water Works Assoc.* 40, 301-8 (1948).—*C.A.* 42, 3107*c*.

Several types of residential base-exchange softeners were discussed as to care, operation, and cost.

7243. Pavlish, Louis A. **De-ionized water for porcelain enamel mill rooms.** *Enamelist* 25, 21-6 (1948).

Enamel defects often can be attributed to water hardness. By the use of de-ionizers, hard water can be economically and efficiently treated to reduce rejects, improve quality, and control another variable in the Porcelain enameling plant.

7244. Richheimer, Charles E. **Sea water regeneration of zeolite water-treatment plants.** *Southern Power and Ind.* 66, No. 7, 67-9, 124, 126-8, 130 (1948).—*C.A.* 42, 6477*f*.

About 0.35 to 0.45 lb of NaCl were required per 1000 grains of hardness removed. Filtered and chlorinated sea water could be used for regeneration; the sea water should contain at least 17,000 p.p.m. of NaCl, but short periods of operation at 14,000 p.p.m. were carried out.

7245. Riley, F. R. and Day, H. M. **Ion-exchange demineralizing of solutions.** *Chem. Eng. Progress* 44, No. 5; *Trans. Am. Inst. Chem. Engrs.* 353-8 (1948).—*C.A.* 42, 4004*g*.

Water treatment is still the largest user of ion exchange. Demineralized H_2O which was usually chemically equiv. to distd. H_2O could ordinarily be produced. Improvements in operating technique and new resins have increased the versatility and flexibility of the demineralizing process until it was possible to demineralize H_2O and other aq. solns. on a scale and for purposes recently considered impractical. Demineralizing plants have been installed with capacities ranging from a few gal to millions of gal/day.

7246. Schilling, Karl. **The fine filtration of waters used in textile processing through Magno filters.** *Textil-Praxis* 3, 185-6(1948). —*C.A.* 46, 7334*f*.

The water was filtered through partially burned dolomite. The Magno mass (either the natural Magno-Dol or the synthetic, uniformly grained Magno-Syn) removed acid and Fe without softening the water. When the Mn:Fe ratio was not less than 1:5, Mn was also removed. The increase in pH stopped troublesome algae growth.

7247. Thibon, Honoré. **The nature of alumina hydrate precipitated from solutions sodium aluminate.** *Bull. soc. chim. France* 1948, 870-1.—*C.A.* 43, 55*e*.

Pptn. of Al_2O_3 by carbonation of $NaAlO_2$ soln. with a mol. ratio of $Na_2O:Al_2O_3$ equal to 1.95 was studied for Al_2O_3 concns. of 1-100 g per liter at 25° and 70-75°C. The ppt. was washed, dried at 100°C, and ground to pass a no. 200 sieve. Diffraction patterns indicated that boehmite was the stable phase up to 20 g Al_2O_3 per liter, though samples at 5 g per liter showed a trace of bayerite.

7248. Walker, J. Geoffrey. **The line-zeolite process. A method of water treatment which is finding increasing application.** *Chemistry & Industry* 1948, 695-7.—*C.A.* 43, 1507*b*.

7249. Webb, Thomas L. B. and Yoder, Joseph D. **Hydrogen-zeolite treated water dissolves boiler, super-heater scale.** *Power* 92, No. 1 99-101, 140, 142, 143(1948).—*C.A.* 42, 2372*e*.

Uninhibited 0.01-0.03% acid, such as might be prepd. by passing a normal water through hydrogen-zeolite softeners was used successfully to remove superheater scale. It was also used in boilers and for external cleaning.

7250. Wise, William S. **The industrial waste problem. IV. Brass and copper, electroplating, and textile wastes.** *Sewage Works J.* 20, 96-102 (1948).—*C.A.* 42, 3882*g*.

Brass and copper mill wastes contained H_2SO_4, Cu, Zn, and Cr. Those wastes were treated by equalization, reduction of Cr^{+6} with SO_2, neutralization with high-Mg lime, flocculation, sedimentation, and vacuum filtration of the sludge. Expts. in progress used ion-exchange beds to remove the Cu, Zn, and Cr, and treatment of the regenerating soln. to recover $NaCrO_4$ by roasting and extg., and the Cu and Zn electrolytically. Electroplating wastes, containing Cu, Ni, Cr, Fe, and CN^-, were treated with $FeSO_4$ and CaO followed by sedimentation, lagooning, and Cl_2 to destroy CN^-.

7251. Zufniček, Jiří. **Water softening by means of brown coal.** *Paliva a voda* 28, 230-4 (1948). —*C.A.* 42 8378*c*.

The samples of brown coal of different mines in Czechoslovakia were checked as to their ion-exchange ability. The hardness of the entering unsoftened water was 7.5 German degrees and the hardness of the exiting softened water was 0.15 in the beginning and rose to 3 German degrees by the end of the expt. The ion-exchange ability of coal depended on the humate and similar materials. The price was approx. 10% of that of Permutit.

7252. Aultman, William W. **Fresh water from salt.** *Eng. and Sci. Monthly*, 12, No. 2 (1949).

The more frequently proposed methods of demineralization were reviewed.

7253. Beohner, H. L. and Mindler, A. B. **Ion-exchange in waste treatment.** *Ing. Eng. Chem.* 41, 448-52 (1949).—*C.A.* 43, 3668*c*.

The general principles of ion exchange and their application in waste treatment were discussed. Illustrative examples included the recovery of Cu, Cu and Cr, org. acids and bases, the softening of sulfate waste liquors, the manuf. of high-grade pectin from waste grapefruit peel, and the demineralization of waste-sugar solns.

7254. Bermejo Martínez, F. **Artificial zeolites and permutites. I.** *Anales real soc. españ. fís. y quím.* 45B, 533-60 (1949). —*C.A.* 46, 8291*a*.

A permutite of NH_2-NH_2 reacts with H_2O_2 to give a permutite of H_2O_2 without base-exchange capacity. Treatment of this with liquid SO_2 gives a permutite of SO_2 of similar properties. Originally Na permutites were used in prepn. of Ca permutites, which were used to remove alkalies from molasses; use in water softening came later.

7255. Bermejo Martínez, F. J. **Artificial zeolites and permutites. II.** *Anales real soc. españ. fís. y quím.* 45B, 735-48(1949).—*C.A.* 46, 8291*c*.

"Wet" prepn. methods were used to obtain permutites having good exchange properties and a high SiO_2/Al_2O_3 ratio (SiO_2 was cheaper than Al compds.). The general method employed (3 variations given) was to add a Na aluminate soln. (about 2.5% Al_2O_3 from $AlCl_3$ and NaOH) to a Na silicate soln. (about 5% SiO_2). A voluminous ppt. forms. After 24 hrs the mother liquors were drained; the gel was broken and dried for 24 hrs. Chloride ion was removed by washing.

7256. Besozzi, Leo and Vaughn, J. C. **Experimental studies of odor control at Whiting, Indiana.** *J. Am. Water Works Assoc.* 41, 1035-45 (1949).—*C.A.* 44 1631*f*.

Dry fuller's earth and chlorinated copperas successfully removed the oil film on, and the dissolved oil content of, the water. The combination also assisted in removing the oily taste. ClO_2, O_3, and granular activated carbon were not considered successful. Activated carbon seemed to give the best results, but the handling was difficult.

7257. BOYNTON, PERKINS AND GAY, HENRY. **Maintenance of zeolite filters.** *J. Am. Water Works Assoc.* 41, 187-8(1949).—*C.A.* 43, 3122*a*.
Replacement of greensand and frequent drying resulted in satisfactory operation.

7258. BRADBURY, G. F. **Diatomite filtration as developed by the Canadian Army.** *Water and Sewage* 87, No. 1, 20-1, 42, 44, 46 (1949).—*C.A.* 43, 3545*i*.
Mobile units used during the late war were described with photographs and drawings.

7259. CALISE, V. J. **Operating experience with resin zeolites on the hydrogen cycle.** *Tenth Ann. Water Conf. Engs. Soc. West. Penna.* October 18 (1949).
The performance characteristics of ion exchange resins regenerated with acid were given. The quality of effluent water produced, the amount of acid regenerant required, the capacity of the resin, the long-term life of the exchanger, and the ease and convenience of its operation were discussed.

7260. CALLAHAM, JOHN R. **Synthetic zeolite.** *Chem. Eng.* 56, No. 9, 92-3, 140-3 (1949).—*C.A.* 43, 8577*g*.
The production of synthetic zeolite ($Na_2O.Al_2O_3.6SiO_2.xH_2O$) for use in home H_2O softeners was described.

7261. CLOUGH, J. **Water treatment: operation, maintenance, and costs.** *J. Inst. Water Engrs.* 3, 41-66(1949).—*C.A.* 43, 3545*e*.
The water from the Taff Fawr catchment area was collected in two reservoirs and filtered at pretreatment plants. Alum was used as coagulant and activated carbon, Na aluminate, $Al_2(SO_4)_3$, and lime was applied as needed. Lime was better than Na_2CO_3. The filtered water was again filtered on slow sand filters.

7262. COLAS, R. **Aggressive waters.** *Eau* 36, 105-9, 121-4 (1949).—*C.A.* 43, 8582*f*.
The published studies of $CaCO_3$-H_2CO_3 equil. have produced a practical method of estn. of aggressiveness, but have dealt with details and not with the problem as a whole. The pH as a criterion rests on faulty interpretation; the notion of aggressive CO_2 and the presumed effect of alky. depended on inexact results.

7263. COLEBAUGH, DAVID C. JR. AND HASSLER, JOHN W. **Removal of tastes and odors from water supplies by active carbon.** *Taste Odor Control J.* 15, No. 1, 1-15 (1949).—*C.A.* 43, 4403*i*.
With phenolic contaminants, the addition of 4 p.p.m. active carbon, in one case to the untreated water, pH 7.5-8.0, instead of after lime settling, pH 10.0 and in another case application of active carbon before chlorination produced palatable waters. To remove the musty-moldy odor caused by a predominance of *Anabaena* with some *Melosirae* and *Tabellaria* present, the active carbon dosage was increased from 8 p.p.m. to 20 p.p.m. and added later in the sedimentation basin.

7264. COX, GERALD J. **Optimum fluorine level in drinking water.** *Chem. Eng. News* 27, 2956 (1949).—*C.A.* 44, 249*c*.
About 0.9 p.p.m. of F^- in drinking water may cause mottled enamel under certain conditions, but it also prevented tooth decay. Data were given for the no. of cases of mottled enamel, dental caries, and concn. of F^- in the drinking water of a no. of cities. Climatic conditions could account for certain inconsistencies in the data on F^- concn. and the prevalence of dental fluorosis. The concn. of F^- in city water supplies should be decreased during the summer months.

7265. CROTOGINO, H. **Recent experiences in the waste-water treatment of coal-hydrogenation plants.** *Vom Wasser* 17, 49-61(1949).—*C.A.* 44, 8089*i*.
The final purification of the combined waters after individual pretreatments was particularly difficult because of a relatively high residual phenol content (3000 kg per hr). A modified biol. purification method combined with activated carbon treatment was developed which gave satisfactory results at reasonable operating costs. The biol. treatment was improved by addn. of asbestos which resulted in increased capacity and stabilization of the operating conditions.

7266. EDELSHTEIN, S. A. AND PETATSKII, V. I. **Determination of excess of phosphates in boiler water by using cation-exchange agents.** *Zavodskaya Lab.* 15, 850-1(1949).—*C.A.* 44, 776*c*.
Cation-exchange resins (unstated nature) were used to adsorb Ca and Mg from boiler water in a vertical column (gravity feed) with elution successively by 50 ml 5% HCl and 50 ml H_2O; the eluate was neutralized to phenolphthalein by NaOH and hardness detd. by the eleate method. The phosphate excess was calcd. by (P_2O_5) excess $= (P_2O_5)$ total—10(hardness), where hardness was expressed in degrees.

7267. FRASCHINA, K. **Filter-paper method for suspended solids determination.** *Sewage Works J.* 21, 221-7 (1949).—*C.A.* 43, 8582*d*.
The rate of sorption of moisture in the lab. air by dried filter papers was studied. All filter papers including a blank were wetted, sucked dry, dried at 103°C for 1 hr, and cooled in the lab. air near the balance to absorb moisture. Filter a sample of sewage through one of the papers in a Büchner funnel, and wash the residue and paper. Treat the blank paper in the same way with distd. water. Dry the sample and the blank at 103°C and cool in the lab. air before weighing. The method was more adaptable to wastes which were hard to filter through the small area of a Gooch crucible.

7268. GREGOR, HARRY P. AND SHERMAN, N. N. **Demineralization of photographic wash water by ion exchange.** *J. Soc. Motion Picture Engrs.* 53, 183-92 (1949).—*C.A.* 43, 7359*h*.
An ion-exchange system was developed to purify photographic wash water and allow its re-use.

The effluent from a print-washing machine was cycled through a cation- and then an anion-exchange resin bed, and returned to the machine. The purity of the water obtained approached that of distd. water.

7269. GUSTAFSON, H. B. **Ion exchange in water treatment.** *Ind. Eng. Chem.* **41**, 464-6(1949).—*C.A.* 43, 4404*f*.

Water-treatment processes consumed most of the material manufd. in 1946. Na Al silicate was the largest product, ion-exchange softening the largest application, anion-exchanger production a small fraction of the total ion-exchanger production, about 2% of the phys. and 10% of the dollar vol., the house-hold softener the largest use of ion exchangers, and the Na cycle for softening water the largest use by industry.

7270. HANEY, PAUL D. **Brine disposal from cation-exchange softeners.** *J. Am. Water Works Assoc.* **41**, 829-36 (1949).—*C.A.* 43, 8587*e*.

The disposal of cation-exchange softener brine was difficult. The methods suggested and discussed were: evapn., controlled or uncontrolled diln., and brine-disposal wells.

7271. HEFFELFINGER, DONALD. **Alliance, Ohio, adopts zeolite softening.** *Am. City* **44**, No. 4, 88-9(1949).—*C.A.* 43, 4794*e*.

A municipal H_2O supply, with a total hardness of 200-300 p.p.m., pumping 6 million gal/day was softened with zeolite filters to a total hardness of 90 p.p.m. The filters were regenerated with brine contg. 3.5% NaCl pumped from a 650 ft well. Split treatment was followed, with 75% of the supply treated and mixed with the remaining 25% raw H_2O.

7272. HILFIGER, J. P. **Rapid method for determining total solids in water.** *Chim. anal.* **31**, 226-7(1949).—*C.A.* 44, 775*i*.

Pass the sample through a column of properly treated exchange resin and titrate the acid liberated by the adsorption of the cations. Calc. the equiv. NaCl.

7273. HOFFMAN, ROSS E. **Control of oil pollution.** *Public Works* **80**, No. 9, 26-7 (1949).—*C.A.* 43, 8587*h*.

Layers of oil accumulating on H_2O surfaces were eliminated by applying finely divided sand coated with carbon. The hydrophobic properties of the carbonized sand allow it to float and to form a stable oil-solid suspension which could be submerged and removed from the H_2O surface.

7274. JACKSON, LEON W. **Varied chemical dosage easy in new Phoenix water plant.** *Eng. News-Record* **142**, No. 21, 47-8 (1949).—*C.A.* 43, 7167*c*.

The new 30-million gallon per day filtration and softening plant, treating Verde River water, provided for mech. grit removal, flocculation and sedimentation, recarbonation, rapid sand filtration, and chlorination. The 8 filters contained 27 in. of sand with an effective size of 0.5 mm and uniformity coeff. of 1.68, and the max rate of filtration would be 3 gallons/ft^2/min. The backwash system included rotary surface agitation and was designed to give a vertical rise of 30 in./min. Flexibility was provided in feeding facilities for lime, activated carbon, Cl_2, and, for coagulation, alum or $Fe_2(SO_4)_3$, either dry or in soln.

7275. KIKER, JOHN E. JR. **Diatomite filters for swimming pools.** *J. Am. Water Works Assoc.* **41**, 801-9 (1949).—*C.A.* 43, 8584*e*.

Where the turbidity was low, filters of diatomaceous earth could be used without added coagulants. Reuse without treatment was possible.

7276. LECLERC, EDM. AND BEECKMANS, IVAN. **Residual water at sugar refineries.** *Conf. faite assemblée gén. soc. tech. et chim. sucrerie Belg.* **1949**, 40 pp.—*C.A.* 43, 9307*d*.

7277. LORIO, NEZEM J. **Odor and taste control in a lower Mississippi River supply.** *Proc. 12th Ann. Short Course Water and Sewerage Plant Supts. and Operators*, **1949**; *Louisiana State Univ. Eng. Expt. Sta. Bull. Ser. No.* **18**, 35-6 (1950).—*C.A.* 44, 5041*g*.

Taste and odor problems, nil until 5 yrs ago, have increased. For the past 3 summers and autumns at low river stages, a medicinal taste, with threshold odor from 10 to 40, was controlled best by activated carbon split before coagulation with alum and lime, and after floc formation. Early in the winter of 1949, with turbidities from 400 to 700 p.p.m., a medicinal taste was corrected by adding all carbon after flocculation to prevent absorption of carbon by turbidity particles.

7278. MIDDLETON, A. B. **Practical applications of activated silica sols as coagulant aids.** *Proc. Ann. Conf. Maryland-Delaware Water Sewerage Assoc.* **22**, 45-9 (1949).—*C.A.* 45, 8173*a*.

7279. ODA, RYOHEI AND SHIMIZU, HIROSHI. **Cation-exchange resin from natural rubber. VIII. Fundamental studies on water purification. XXI. Elimination of fluorine from water by anion-exchange resins.** *Chem. High Polymers* (Japan) **6**, 31-5, 337-46 (1949).—*C.A.* 46, 1184*i*, 1186*e*.

The break-through capacity of H-Ca exchange was 0.799 mol. Ca/kg. Removal of Ca was complete and the break-through point sharp. Elimination of F from water was accomplished with a HCl salt of an anion-exchange resin. The resin was reactivated by either dil. NaCl soln. or sea water.

7280. RAGOZINA, T. A. **Hydrolysis and hydration of calcium β-orthosilicate in solutions of salts.** *Zhur. Priklad. Khim. (J. Applied Chem.)* **22**, 545-52(1949).—*C.A.* 45, 4017*c*.

In hydrolysis and hydration tests, 2-g ground samples were shaken for 6 hrs to 6 months with 200 ml of water and various salt solns. in the absence of CO_2 and in the presence of the normal amt. of CO_2 in air and in solns. The soly. and hydration are increased by Na_2SO_4 and $CaCl_2$. $CaSO_4$ and NaCl have no significant influence on soly. and process of hydration. $MgSO_4$ and $MgCl_2$ favor hydrolysis.

7281. SHERRATT, J. GRAHAM. **Experience in silica-assisted coagulation of polluted surface water.** *J. Soc. Chem. Ind. (London)* 68, 158-62 (1949). —*C.A.* 43, 7169*e*.

In the treatment of rivers Mersey and Irwell water, 6 and 3 million gal/day, resp., for industrial purposes, the Baylis method which used activated silica with $Al_2(SO_4)_3$ in the ratio 0.25-0.30 to 1 improved coagulation, org. purification, and color removal. A lower dose of $Al_2(SO_4)_3$ was required, time for clarification shortened, after-pptn. of alum in filtered H_2O prevented, the pH range for clarification extended, and the retardation of coagulation at low temp. counteracted.

7282. SIGWORTH, E. A. **Taste and odor control.** *J. New Engl. Water Works Assoc.* 63, 238-49 (1949).—*C.A.* 43, 9304*i*.

The conditions producing tastes and odors were discussed. Five cases were studied in which a final addn. of activated carbon was necessary to produce a satisfactory supply. The proper time and point of application were important.

7283. STASSART, M. **The elimination of silica from water by means of strongly basic anion-exchange resins.** *Bull. centre belge étude et document. eaux* (Liége) No. 6, 371-6, (1949) No. 7, 393-5 (1950).—*C.A.* 46, 3687*c*.

Strongly basic ion-exchange resins had made the direct elimination of ionized SiO_2 possible. Owing to the fact that strongly basic resins eliminated both strong and weak acids, resulting in the formation of anionic layers in the resin which were proportionate to the strength and concn. of the acids, the demineralization in most cases was carried out in several stages. Exptl. data were presented showing the effect of various factors on the efficiency of the SiO_2 removal, e.g. initial SiO_2 concn. and contact time as a function of particle diam., flow rate, and thickness of the resin bed. An appraisal was made of the cost of SiO_2 removal from water.

7284. THOMPSON, JOSEPH AND MCGARVEY, FRANCIS X. **Backwashing of ion exchangers.** *Water & Sewage Works* 96, 182-3(1949).—*C.A.* 43, 5139*g*.

Ion-exchanger units should be backwashed to produce a bed expansion of 50%. Efficiency of backwashing was increased by maintenance of proper ratio of temp. to flow rate, by "bumping" in combating progressive capacity reduction, and by applying surface wash units. Deposition of bacterial growths was eliminated by applying 5 p.p.m. Cl_2 to the wash H_2O.

7285. VERÉBESTEL, J. **Removal of iron, lead, and manganese from water.** *Bull. centre belge étude et document. eaux* **1949**, 307-10.—*C.A.* 44, 9090*d*.

Mn and Fe in water (0.1 to 0.3 mg/liter) were removed by oxidation and alkalizing. When Mn exceeded 0.2 to 0.3 mg/liter, two separate operations became necessary. Filtering may be interfered with by org. matter, in which case the unit must be dried out. Oxidation was effected by aeration or O_3 combined with Cl_2, $KMnO_4$, NaOCl treatment. For alkalizing, $Ca(OH)_2$, NaOH, $NaAlO_2$, Na_2SiO_3, $CaMg(CO_3)_2$ were used. Bakelite filters, activated carbon, or Magno was preferred. Permutit was difficult to regenerate.

7286. WILLIAMS, D. B. **A new method of odor control.** *J. Am. Water Works Assoc.* 41, 441-9 (1949).—*C.A.* 43, 5522*b*.

NCl_3 was described, as were the conditions under which it would form, methods for its identification, and methods for its removal. The use of activated carbon or aeration to bring about removal was discussed.

7287. YODER, J. D. **Removal of silica from boiler feedwater by the sludge blanket hot-process softener and exchange methods.** *Blast Furnace Steel Plant*, 37, 1228-30, 1258 (1949). —*C.A.* 44, 250*a*.

$Fe(OH)_3$ served as a coagulant and color remover. Its disadvantage was that it increased the total solids and did not reduce the SiO_2 to as low a figure as otherwise obtainable. $Mg(OH)_2$ was more effective at high temp. By hot-process treatment SiO_2 could be reduced to a lower figure than by $Fe(OH)_3$, but not so low as by demineralization.

7288. YORSTON, F. H. **Studies on sulfite waste liquor. I. The action of anion exchangers.** *Pulp Paper Mag. Can.* 50, No. 12, 108-11, 111-13 (Nov. 1949).—*C.A.* 44, 4247*g*.

Sulfite waste liquor was deashed with cation-exchange resin Amberlite IR120. The deashed liquor was passed through columns contg. Amberlite IR4B and IRA400. Both weak-base and strong-base exchangers adsorbed sulfuric, sulfurous, and acetic acids and other acidic substances of low mol. wt, leaving sulfonic acids to be separated from one another by other physical and chem. means. Seventy percent of the copper-reducing substances in sulfite waste liquors may be adsorbed consistently on the strongly basic resin and eluted by means of dilute weak acid.

7289. ANDERSON, J. W. **Conditioning boiler feed waters by the ion-exchange process.** *Modern Power and Eng.* 44, No. 9, 83-7, 152 (1950).—*C.A.* 44, 10972*d*.

The various types of ion exchangers were discussed and their applications pointed out, as well as complete demineralizers and silica-removal plants.

7290. ANON. **Tentative standard specifications for bauxite. First printing.** *J. Am. Water Works Assoc.* 42, 707-14(1950).—*C.A.* 44, 9595*b*.

Methods of sampling and testing were carefully covered, as well as the calcn. of the results obtained.

7291. ARGANT, HENRI. **Demineralization of water by cation-anion exchange at the central power station at Villers-Saint-Paul.** *Chimie & industrie* 64, 57-8(1950).—*C.A.* 45, 792*h*.

Ninety tons per hr of water from the Oise was treated.

7292. AULTMAN, WM. W. **Desalting sea water for domestic use.** *J. Am. Water Works Assoc.* 42, 786-96(1950).—*C.A.* 44, 9595*e*.

Mech. processes, which include various types of distn. including vapor-compression distn., chem. processes, in org. anion and cation exchangers were used, and electrolytic demineralization were considered as to efficiency and cost. These methods were not considered desirable or economical. The seriousness of the scale and corrosion problems confronted in the thermo (vapor) compression distn. method were described.

7293. BARTLETT, LUIS H. **Principles of ion exchange in water treatment.** *Proc. 13th Ann. Short Course Water and Sewerage Plant Supts. and Operators*, **1950**, *Louisiana State Univ., Eng. Expt. Sta. Bull. Ser.* No. **21**, 31-5.—*C.A.* 45, 4380*f*.
A review.

7294. BLASZKOWSKA, Z. AND TATUR, H. **Laboratory plant for demineralization of water.** *Przemysl Chem.* 6, 423-30 (1950).—*C.A.* 46, 8297*e*.
App. based on the action of ion exchangers lowered the inorg. solute content of tap water from 161 to 0.8 p.p.m.

7295. BLOODGOOD, DON E. AND STRICKLAND, AUBREY. **Chromium removal by ion exchange.** *Water & Sewage Works* 96, 28-32(1950).—*C.A.* 44, 2678*f*.
In studying the elimination of toxic Cr from plating wastes, a K_2CrO_4 soln., contg. 100 p.p.m. CrO^{2-}, was passed through anion- and cation-exchange beds and removed 99% of the chromates. Only partial regeneration of exchanger beds was accomplished by direct replacement reactions.

7296. BÖRNER, H. **Akdolit, a modern filter material of dolomitic origin.** *Vom Wasser* **18**, 340-5(1950-51).—*C.A.* 46, 7260*h*.
A filter material was prepd. from dolomite in a rotating kiln. This material, Akdolit, was characterized by a MgO content of 26-28%, and an alky. no. of about 95. Electron-microscope examn. showed the presence of MgO cubes; chem. analysis showed that $MgCO_3$ was not present. $CaCO_3$ was dispersed very finely in the Akdolit and provided the mass with the proper specific surface for filtration and phys.-chem. adsorption.

7297. BROWN, HORACE A. **Bold triple chlorination now standard practice at Ottumwa.** *Water and Sewage Works* 97, 267-9(1950).—*C.A.* 44, 8573*a*.
Incoming H_2O from a surface supply is chlorinated to a residual of 10 to 25 p.p.m.; settled for 1.5 hrs; dosed with $FeSO_4$, Na_2CO_3, and $Ca(OH)_2$; flocculated for 45 min.; settled for 6 hrs; dosed with CO_2 and activated carbon; settled for 4 hrs; recarbonated; filtered; and collected in a clear well. SO_2 was applied to remove all residual Cl_2; the H_2O was filtered through a carbon filter; and dosed with Na_2CO_3, NH_3, and Cl_2 to produce a Cl_2 residual of 1 p.p.m.

7298. BRYSON, J. L.; EDWARDS, G., AND TAYLOR, A. W. **Silica-assisted coagulation.** *Chemistry & Industry* 1950, 626.—*C.A.* 47, 6583*c*.
In the purification of H_2O with Na_2SiO_3 partially neutralized with H_2SO_4, the percent neutralization of the Na_2O was more important than the residual alky. in prepg. a stable sol. Thus, 85% of the alky. of com. Na_2SiO_3, having a SiO_2/Na_2O ratio of 3.22, was neutralized. The sol. had a residual alky. of 1100-1350 p.p.m. and was stable for some hrs.

7299. CALISE, V. J. **Hot zeolite softening.** *Power Eng.* 54, No. 9, 54-9(1950).—*C.A.* 44, 10221*e*.
The advantages of using styrenebase resin softeners as second-stage treatment following first-stage hot-process pptn. softeners was discussed. Hot phosphate, in particular, for second-stage treatment was considered.

7300. COOPER, J. E. **How to dispose of acid wastes.** *Chem. Inds.* 66, 684-5 (1950).—*C.A.* 46, 9754*a*.
Spent pickling liquors were best disposed of by diln. and discharge to a stream or municipal sewage system. For neutralization in limestone beds, the acid strength must be $< 0.5\%$ H_2SO_4 to maintain the $CaSO_4$ in soln. and prevent coating of the bed, and flow rates should be 0.5-1.0 gal (down-flow beds) or 40-50 gal (up-flow beds) /ft^2 of bed area/min. High-Ca limestones ($CaCO_3$ 95%) gave higher reaction rates than did dolomites.

7301. DUPONT, A. **Use of activated silica in coagulation and vacuum filtration of sewage sludge.** *Chem. Weekblad* 46, 545-50 (1950).—*C.A.* 45, 3536*d*.
If a 2% silica sol. was added (15 cc./200 cc. sludge) prior to $Al_2(SO_4)_3$ addn. (15 cc. of 5.58% soln.) the rate of filtration was up to 2.5 times better than with $Al_2(SO_4)_3$ addn. alone. Nylon filter cloth was recommended over woolen cloth. All expts. were performed with a Buchner filter, 55-cm Hg vacuum with 200 cc. sludge, a mixt. of fresh and active sludge in equal quantities after finished fermentation.

7302. ECKSTEIN, HORST. **Decarbolith, a new water purifier from West German dolomite.** *Bergbau u. Energiewirt.* 3, 326-7(1950).—*C.A.* 45, 4856*g*.
Prepn. of a new water purifier from dolomite ore was described.

7303. EHEMMAN, GEORGE C.; BURNETT, L. K., AND WADDELL, JOHN C. **Application of the OCO water system to paper-mill white-water recovery.** *Pulp & Paper Mag. Can.* **51**, No. 7, 107-11 (1950).—*C.A.* 44, 8655*c*.
The OCO water system utilized a plate and frame filter press with diatomaceous earth filter aid to filter low-solids H_2O from the board machine. The filtered water was used in low-vol., high-pressure showers. The filter cake was used in filler stock prepn., as was all high-solids white water from the machine.

7304. ENDLER, A. S. AND GRUENWALD, F. **Cationic softeners (chemical types and recent improvements).** *Rayon and Synthetic Textiles* 31, No. 8, 73-5(1950).—*C.A.* 46, 8297*f*.
The constitution of several cationic softeners was discussed and the development of a simple test to rate the oxidation-resistance of softeners was described.

7305. GROMBACH, H. **Rapid filters.** *Schweiz. Ver. Gas- u. Wasserfach. Monats-Bull.* **30**, 297-301 (1950).—*C.A.* **45**, 9780*a*.

Water samples were taken at depths of 15, 40, 65, 90, 115, and 140 cm below the surface of a rapid sand filter installation at the Mannedorf waterworks, the filtration rate of which was 5 m per hr. The tests extended over a 19-hr uninterrupted filtration period. The general conclusion is that the surface filtration effect is negligible. *Oscillatoria* appear after a throughput of 100 m^3/m^2 surface.

7306. IWANOWSKI. **Equipment and methods for treatment of river water.** *Vom Wasser* **18**, 220-5 (1950-51).—*C.A.* **46**, 8296*i*.

Rhine river water was treated with Cl_2, $FeCl_3$, lime, and activated carbon to give high-quality drinking water for the city of Weisbaden.

7307. KAKIHANA, HIDETAKE. **A new method for the analysis of aqueous solutions or natural waters with ion-exchange resins.** *J. Chem. Soc. Japan,* Pure Chem. Sect., 71, 481(1950).—*C.A.* **45**, 6125*c*.

The sample was passed through the cation exchanger and all the cations adsorbed; the effluent contained H^+ and all anions. By titrating the effluent the acid concn. and Cl^- were detd. The resin was washed with 0.1 *N* HCl and all the univalent cations were washed out. This soln. was evapd. to dryness and the wts of alkali chlorides were detd. Finally the resin was washed with *N* HCl and all the multivalent cations eluted.

7308. KEEFER, C. E. **Oil waste exclusion from sewers.** *Water & Sewage Works* 97, R123 (1950). —*C.A.* **46**, 7262*h*.

In Baltimore, waste oil and grease were collected and treated in bulk. Oil was pumped to a dehydrating tank with steam coils. After evapn. for 5-8 hrs the wastes were further dehydrated with H_2SO_4. Clay was added and the oil cooked with steam at 600°F for 8-10 hrs. Kerosine, naphthalene, and alcs. were distd. off and used as fuel in the steam-generating plant.

7309. KEMMER, F. N. **Conditioning makeup by high-temperature, sodium-ion exchange, excess-calcium, hot lime-zeolite process.** *Combustion* **21**, No. 10, 59-62(1950).—*C.A.* **44**, 10221*f*.

The development of the sulfonated-styrene resin exchangers able to resist attack at high temps. in a caustic environment made available a new process for treatment of boiler makeup as well as a supplementary second-stage treatment after the hot lime softener. Further advantages included a greater decrease in silica, an effluent having a turbidity below 10 p.p.m. without a coagulant, a saving in salt because of lower hardness from the lime treatment, and the lack of need for acid or hexametaphosphate for zeolite protection against after-reactions as with the cold process.

7310. KNIGHT, A. G.; AITKEN, R. W., AND MERCER, D. **The measurement of turbidity in water.** *J. Inst. Water Engr.* 4, 449-56 (1950); **5**, 328-30, 633-4 (1951).—*C.A.* **46**, 666*i*.

The basic measure of turbidity should be a suspension such that a depth of 150 mm would absorb 10% of the light falling on it and that this suspension should be given the value of 10. Light extinction was measured without the use of an arbitrary instrument such as the Jackson Turbidimeter or the necessity of weighing the material in suspension. A method of calibration was proposed. Calcns. gave results not far from the actual suspension values obtained.

7311. LATTRE, ANDRÉ DE. **Lead removal by means of a resin.** *Bull. centre belge étude et document. eaux* (Liége) No. 7, 415-20 (1950/I).—*C.A.* **46**, 1679*f*.

Pb removal by ion-exchange methods was studied with a view toward purification of industrial waste prior to disposal in rivers or toward reduction of excessive Pb from drinking water. A rapid microanalytical method for Pb was adopted, consisting in concn. of the Pb in a small vol. by extn. with dithizone, and polarographic detn. of the Pb after extn. with aq. AcOH. Better than 50% of the Pb could be removed from a hard water contg. approx. 100 g/liter of Pb in spite of the concurrent elution effect of the Ca. The fixation capacity of the resin for Pb was found to be enormous.

7312. LECLERC, EDM. AND BEAUJEAN, P. **Filtration study.** *Centre belge étude et document. eaux, J. mens.* No. 9, 131-3(1950).—*C.A.* **45**, 10445*d*.

The comparative efficacy and clarification obtained with sintered glass, charcoal, asbestos, cellulose, and filter paper was studied on river and sewage water and industrial effluents.

7313. LEICK, J. **Regeneration of base-exchange materials with sodium chloride.** *Vom Wasser* **18**, 346-59(1950-51).—*C.A.* **46**, 7260*e*.

The min. requirement for brine concn. is 20-40 g NaCl/liter. Concns. can be used up to 100 g/liter. The min. requirement will be adequate to regenerate a resin that will remove 7 g CaO/liter from the raw water. The salt and the brine soln. should be free of insol. impurities; a high content of alkali earths in the brine reduces the exchange capacity, and compensation must be made by increasing the salt and the brine concn.

7314. LEICK, J. **Processes in hydrogen-exchange filters and research on hydrogen-exchange filters in the laboratory.** *Vom Wasser* **18**, 380-407(1950-51).—*C.A.* **46**, 7260*a*.

Three methods were described for ion exchange on the H-cycle: (1) Begin the operation of deionizing with the filtrate having a residual hardness less than that of the combined mineral acid content of the raw H_2O and ending with an increase of alky. in the filtrate. (2) Begin the deionization with the filtrate having a residual hardness under 0.1°d. (1°d. = 1 part CaO per 100,000 parts of H_2O) and ending with a residual hardness over 0.1°d. (3) Begin the operation with an acid value of the filtrate equal to the mineral acid content of the raw H_2O and ending with an acid-value smaller than the mineral acid content. Data were given for the regeneration of Group A resins, sulfonate-type resins, and Group B resins, carboxylic-type resins, with strong acids.

7315. LEX, WALTER. **Technology of graphite as a boiler scale preventive.** *Bergbau u. Energiewirt.* 3, 191-2(1950).—*C.A.* 45, 327*b*.

Colloidal graphite used for boiler scale prevention had a very large surface and a high adsorptive power, and was effective in both boiler scale prevention and removal. A proprietary form of colloidal graphite was also claimed to inhibit corrosion owing to CO_2, O_2, and chlorides. A coating of graphite on boiler tubes was suggested as a means of preventing scale formation; however, such coatings would reduce heat transfer to the same extent as a very much thicker layer of scale.

7316. LINDSAY, F. K. **High-capacity cation exchangers.** *J. Am. Water Works Assoc.* 42, 75-80 (1950).—*C.A.* 44, 2150*c*.

Among the many types of materials used in cation-exchange, the nonphenolic (styrene base) resins had capacities far greater than any of the others. These resins were also capable of removing sol. Fe and Mn during the softening cycle. Sea water and natural brines had been successfully used for regeneration.

7317. LÜNEBURG, H. **Boiler-water treatment for fisheries.** *Vom Wasser* 18, 416-19(1950-51).—*C.A.* 46, 8297*h*.

Graphite added to boiler water formed a heat-conducting layer in the boiler and prevented the formation of scale.

7318. MAIER, F. J. **Fluoridation of public water supplies.** *J. Am. Water Works Assoc.* 42, 1120-32(1950).—*C.A.* 45, 2121*f*.

The use of fluorides in water supplies was discussed. The dosage, ranging between 0.5 and 1.5 p.p.m. fluoride, should be the result of careful study. Feeding and point of application were important, as well as sampling and control.

7319. MANSFIELD, MYRON G. **Philadelphia improvement program.** *J. Am. Water Works Assoc.* 42, 645-53(1950).—*C.A.* 44, 9593*g*.

The program, planned and started in 1940, provided for complete rehabilitation of various existing plants, control of tastes, odors, and color, also purification, etc.

7320. MCGARVEY, JOSEPH AND MCGARVEY, FRANCIS X. **Silica removal by ion exchange.** *Power* 94, No. 2, 93-5, 170 (1950).—*C.A.* 44, 2149*e*.

A strongly basic anion-exchange resin was found that was satisfactory. As all waters were not alike, several combinations were listed to fit the various kinds of supply.

7321. MONET, G. P. **Cost of ion exchange.** *Chem. Eng.* 57, No. 3, 106-7(1950).—*C.A.* 44, 6057*a*.

Ion-exchange equipment, for demineralizing raw water or process water, was discussed.

7322. NEIHOF, REX AND SOLLNER, KARL. **A quantitative electrochemical theory of the electrolyte permeability of mosaic membranes composed of selectively anion-permeable and selectively cation-permeable parts and its experimental verification. I. An outline of the theory and its quantitative test in model systems with auxiliary electrodes.** *J. Phys. & Colloid Chem.* 54, 157-76(1950).—*C.A.* 44, 4802*g*.

In an "all-electrolyte elec. circuit" or ring system, |dil. soln. | anion-selective membrane| concd. soln. | cation-selective membrane|, cations moved from concd. to dil. solns. across the cation-selective membrane and an equiv. no. of anions through the anion-permeable membrane. Intensity of current depended on the e.m.f. of the system, the sum of the membrane potentials, and its resistance. Since movement of ions and flow of current were different aspects of the same process, the no. of equivs. of electrolyte penetrating the membranes were equal to the no. of faradays which flowed during a given period.

7323. PAGE, C. H. AND WANTZ, JOHN F. **Ion-exchange resin takes residual hardness from hot lime-soda effluent.** *Power* 94, No. 3, 104-6 (1950).—*C.A.* 44, 4170*i*.

The best hot lime-soda softening rarely removed all residual hardness. A polystyrene resin was described which was not affected by heat and wide variations in pH.

7324. PEGG, EDWIN S. **Diatomite filters turn out safe, clean water.** *Eng. News-Record* 144, No. 20, 35-7 (1950).—*C.A.* 44, 9091*g*.

Raw water, drawn from an impounding reservoir, was treated with 0.5 p.p.m. Cl_2 before passing to the 2 filter units. The latter consisted of plastic-lined steel shells 3 ft in diam. and 8 ft high, each contg. 45 Al_2O_3 tube elements providing 94 ft^2 of filtering area. Diatomaceous earth slurry was used to precoat the elements and also fed continuously to the applied water. The effluent pressure decreased from 34 to 5 p.s.i. in 2-5 days. The raw water contained up to 60 p.p.m. turbidity. The filtered water turbidity was practically 0, the bacterial count consistently low and coliforms were absent.

7325. RUBINOV, YU. S. **Modification of filters for chemical purification of water.** *Sakharnaya Prom.* 24, No. 5, 24-7 (1950).—*C.A.* 45, 2609*i*.

Sulfonated carbon in cation filters was recommended since it had large absorptive capacity and required less frequent regeneration. Quartz sand was replaced by anthracite, which required less washing and had a porosity which was higher than that of quartz sand by 13-15% and increased the cycle of filter by 25-40%.

7326. SABATIER, G. **Chemical purification of water by filtration. Artificial zeolites and permutites.** *Rev. gén. sci.* 57, 54-63(1950).—*C.A.* 44, 7467*h*.

The mechanism of softening water by using permutites was explained.

7327. SCHOONENBEEK, P. W. **Water softening by Dusarit.** *Chem. & Pharm. Tech. (Dordrecht)* 5, 165-9(1950).—*C.A.* 44, 6058*d*.

Ion-exchange process was described for demineralization of water by using synthetic resins in a "Dusarit" unit and an "Asmit" unit. The former converted salts into the corresponding acids; in the latter the acids were fixed, CO_2 being expelled by mineral acid and removed by intense aeration. "Asmit" was reactivated by NaOH, Na_2CO_3, or NH_3.

7328. SHIMIZU, HIROSHI. **Ion-exchange synthetic resins. XXIV. Determination of fluorine in water.** *Chem. High Polymers* (Japan) 7, 108-14 (1950).—*C.A.* 45, 7725*g*.
Fe and Ca ions in water were first removed by a cation exchanger and then F was detd. colorimetrically with Al and hematoxylin.

7329. SPIEGLER, K. S. AND HELLINGER, ESTHER. **Effect of partial demineralization of water on bacteria.** *J. Am. Water Works Assoc.* 42, 409-12 (1950).—*C.A.* 44, 5503*d*.
Initial examn. showed cation exchangers removed bacteria, and anion exchangers did not. Tests were described to det. the effect of exchange softening on a contaminated, brackish water. At the beginning of a run complete destruction of bacteria took place, and as the unit neared exhaustion contamination occurred.

7330. SPLITTGERBER, A. **Technology of graphite as a boiler scale preventive.** *Bergbau u. Energiewirt.* 3, 192-3(1950).—*C.A.* 45, 327*c*.
Coatings on boiler tubes were not very permanent and were useful mainly in shut-down boilers. Many of the boiler scale preventives contained tannic acid in addn. to the colloidal graphite, with or without org. or inorg. protective colloids.

7331. STREICHER, LEE AND BOWERS, A. E. **Cation exchanges for municipal water softening.** *J. Am. Water Works Assoc.* 42, 81-92 (1950).—*C.A.* 44, 2150*a*.
The exchangers tested included synthetic siliceous zeolites, carbonaceous exchangers, and phenolic and polystyrene resins. Siliceous zeolites lost material because of Si soln. and attrition; carbonaceous exchangers were lost largely because of particle size; phenolic resins were oxidized by Cl_2 in the influent water. Polystyrene resins, on the other hand, seemed stable and did not tend to lose capacity.

7332. THOMPSON, J. AND MCGARVEY, F. X. **Silica removal by ion exchange.** *Power* 94, No. 2, 93-95, 170 (1950).
Until recently, anion exchange resins were not basic enough to remove silica directly. Now, however, by the use of a strongly basic resin, the weak silicic acid may be removed directly through any one of four methods used in conjunction with deionization procedures.

7333. TOMPKINS, P. C.; BIZZELL, O. M., AND WATSON, C. D. **Practical aspects of surface decontamination.** *Nucleonics* 7, No. 2, 42-54, 87(1950).—*C.A.* 45, 3722*i*.
Methods of removing radioactive residues from various types of lab. surfaces and protective coatings were reported. The test contaminants were solns. of $H_3P^{32}O_4$, $Ba^{140}Cl_2$, and NaI^{131}. Decontaminable surfaces must be nonporous, chemically resistant, and H_2O-repellent.

7334. ULLRICH, A. H. **Water-treating experiences. IV. Handling soft lake-water at Fort Smith, Arkansas.** *Water & Sewage Works* 97, 323-5 (1950).—*C.A.* 46, 9751*a*.
Experiences were reported in the treatment of this water with coagulants, chloramine, $(NaPO_3)_6$, and activated carbon. The water was very soft; low in alky., dissolved solids, and pH; and had practically no buffering capacity.

7335. WADE, I. L. **Demineralizer produces plant savings.** *Power* 94, No. 10, 88-91 (1950).
Two identical sets of cation-, anion-, and silica-removing elements—with one aerating tower for the removal of carbon dioxide—make up the deionizing system. Made possible by the advent of strong-base anion exchange resins, the first complete plant to deionize boiler makeup water in the central station was installed recently in Waukegan, Ill.

7336. WHEATON, H. J. AND WALKER, J. GEOFFREY. **Activated silica as an aid to coagulation in water-treatment processes. I.** *Chemistry & Industry* 1950, 710-16.—*C.A.* 45, 2122*e*.
The application and directions for operation of the method were reviewed.

7337. WHEATON, H. J. AND WALKER, J. GEOFFREY. **Activated silica as an aid to coagulation in water treatment processes. II.** *Chemistry & Industry* 1950, 802-5.—*C.A.* 45, 4380*e*.
The effect of activated silica on coagulation with reagents other than alum, the removal of color, and factors in process selection were discussed. Other uses of activated silica such as coagulation of sewage, white H_2O coagulation, and petroleum coagulation were described.

7338. WINKLER, WILLIBALD. **Purification of water in the Austrian pharmacy.** *Österr. Apoth.-Ztg.* 4, 585-6(1950).—*C.A.* 45, 1296*i*.
The acceptance of aqua depurata (prepd. by deionization) and aqua pro injectione (prepd. by distn.) was proposed.

7339. AKEROYD, E. I. **Production of distilled water by deionization.** *Chemistry & Industry* 1951, 1187-8.—*C.A.* 47, 3497*e*.
The mixed-bed deionization process produced H_2O with less than 1 p.p.m. dissolved solids, less than 0.2 p.p.m. SiO_2, and cond. of less than 1 micromho/cc. The economics of the following processes were compared: (1) 2-stage deionization; (2) direct deionization by mixed bed; (3) bicarbonate removal, mixed-bed deionization; and (4) 2-stage deionization, CO_2 removal with mixed bed to remove the last traces of dissolved solids.

7340. ALDRICH, E. H. **A new water supply for the Alexandria water company.** *J. Am. Water Works Assoc.* 43, 332-48 (1951).—*C.A.* 45, 6323*g*.
Surface (Occoquan Creek) water was treated with alum, lime, carbon, and Cl_2 as required. The treating plant, control house, and purification units were described.

7341. APPLEBAUM, S. B. **New hot lime-zeolite process.** *Power* 95, No. 2, 114-17 (1951).—*C.A.* 45, 2121*i*.
Hot lime-sodium zeolite softening was compared with other methods for prepg. water for use in high-pressure boilers. Properly adjusted hot lime-zeolite softening will remove silica, eliminate hardness, and keep soda solids low.

7342. ASHIZAWA, TAKASHI. **Flocculation value of mineral waters.** *Repts. Balneol. Lab. Okayama Univ.* **1951**, No. 5, 82-3(English summary).—*C.A.* **46**, 8295*e*.

The flocculation values of 24 Japanese mineral waters were measured by use of a positively charged colloidal soln. of iron hydroxide prepd. by adding 3 g of $FeCl_3$ to 500 ml of boiling H_2O. One ml of this soln. contained 1.2 mg Fe. Two ml of this soln. was dild. to 10 ml with distd. water, and the mineral water added until the flocculation occurred. There exists a neg. correlation between the log of sulfate ion concn. of the mineral waters and the flocculation value.

7343. AYRES, JOHN A. **Treatment of radioactive waste by ion exchange.** *Ind. Eng. Chem.* **43**, 1526-31(1951).—*C.A.* **45**, 9205*c*.

Three ion-exchange procedures were evaluated for treatment of liquid lab. wastes contg. radioactive contaminants. A 2-bed system consisting of columns of cation-and anion-exchange resins in series gave a decontamination factor of approx. 10^5 corresponding to an effluent with undetectable radioactivity for most wastes. An addnl. concn. by a factor of approx. 16 can be obtained by ashing the org. exchangers. Evaluations were made of the effectiveness of various cation exchangers for removal of Na, Ba, and La ions from synthetic wastes, the behavior of anions, particularly of Te, Mo, and Ru on anion exchangers, of radio colloids and of the effects of pptg. or complexing agents.

7344. BATTAREL. **Experimental study of the properties of permutite exchangers of hydrogen ions.** *Rev. ind. minérale* **32**, 76-81(1951).—*C.A.* **45**, 10446*a*.

The method of treating water from a coal mine, and contg. much H_2SO_4, was described. After passing through the H-ion exchangers the water contained a considerable amt. of H_2SO_4, which could not be eliminated by degassing as was the case with H_2CO_3. The neutralization must be accomplished by the water from the Na-ion exchanger; the amt. of the residual acid must therefore be known exactly. This was measured with an app. contg. 400 g of permutite, through which the water flowed.

7345. BAYLIS, JOHN R. **Chicago controls the taste with carbon slurries.** *Am. City* **66**, No. 12, 108-9 (1951).—*C.A.* **46**, 3186*h*.

The application of activated carbon in the form of a slurry (produced by mixing powdered carbon in tanks fitted with paddle mixers and at dosage rates up to 70 lbs activated carbon/million gal H_2O) removed tastes from H_2O received from a lake supply.

7346. BRAUS, HARRY; MIDDLETON, F. M., AND WALTON, GRAHAM. **Organic chemical compounds in raw and filtered surface waters.** *Anal. Chem.* 23, 1160-4 (1951).—*C.A.* **45**, 10445*h*.

A metered vol. of water was passed through a small portable filter contg. activated carbon. The carbon was removed, air-dried, and extd. in a Soxhlet app. with ether. The ether was evapd., and the residue dried in a vacuum over $CaCl_2$ and weighed. The org. residue was sepd. into 5 groups and a modification of the Shriner and Fuson method was used.

7347. BRINDISI, PAUL. **Water-softening methods. I. Zeolites.** *Power* **95**, No. 11, 84-5, 210, 12, 14 (1951).—*C.A.* **46**, 1192*g*.

A general study of the materials available was presented. Discussed in some detail were: (1) Na-cycle operation, (2) H-cycle operation, and (3) demineralization.

7348. CHRISTENSON, C. W.; ETTINGER, M. B.; ROBECK, GORDON G.; HERMANN, E. R.; KOHR, K. C., AND NEWELL, J. F. **Removal of plutonium from laboratory wastes.** *Ind. Eng. Chem.* **43**, 1509-16 (1951).—*C.A.* **45**, 8685*e*.

Several methods were studied for removing Pu from liquid lab. wastes which varied from 200-25,000 counts/min. liter in concn. and from 2 to 13 in pH and contained as much as 100 p.p.m. of F and widely divergent amts. of mineral and org. matter. Although effective, inorg. adsorbents, such as celite, kaolin, pumice and volcanic tuff, would require serial treatment and result in large quantities of radioactive sludges. The rate of adsorption on activated carbon was low and conditions including pH and presence of complexing agents such as citrates were critical. Coagulation with iron and lime was the preferred method.

7349. CLARKE, FRANK E. **The distinguishing characteristics of water-formed deposits.** *J. Am. Soc. Naval Engrs.* **63**, 153-60(1951).—*C.A.* **45**, 3535*h*.

A discussion of scale, sludge, corrosion products, high temp. oxides, and biol. deposits.

7350. COLEBAUGH, D.; FILICKY, J., AND HYNDSHAW, A. **Factors influencing the efficiency of activated carbon.** *J. Am. Water Works Assoc.* **43**, 322-6(1951).—*C.A.* **45**, 5848*a*.

The factors considered include pH, contact time, Cl_2, ClO_2, chloramines, coagulation, filtration, and the handling of the carbon itself.

7351. CONLON, R. B. **How to protect stand-by boilers.** *Paper Ind.* **33**, 799-800(1951).—*C.A.* **46**, 1193*c*.

"Dry storage" of idle boilers may involve the introduction of CaO, silica gel, and Al_2O_3. "In wet storage," mixts. of Na_2SO_3 and aq. NaOH, or aq. solns. of $Na_2Cr_2O_7$ (at pH 7.5-9.5) can be used.

7352. DAVIDSON, J. H. **Color removal of process waters.** *Tappi* **34**, 407-9(1951).—*C.A.* **46**, 1193*e*.

By using 2 precipitators and 5 gravity filters, the color of 15,000,000 gal/day of water was reduced from 40-80 to 2-4 p.p.m. The use of 2.25 g/gal of alum and 1.5 g/gal lime plus, when required, 1 to 2 g/gal of clay was required.

7353. ECKSTEIN, HORST. **A year's operating experience with Decarbolith.** *Bergbau u. Energiewirt.* **4**, 175-7(1951).—*C.A.* **45**, 9777*c*.

This new water-purification reagent, prepd. by controlled calcining of West German dolomite, was effective for deacidification of water, and Fe and Mn removal. The calcination of the dolomite should be controlled so that the product has a loss on ignition of at least 30% and not over 32%. Before use, the product should be hydrated under water for some time, to insure complete removal of Fe and Mn. The filter should be washed only with purified water, or if necessary, only with raw water with low Fe and CO_2 content.

7354. GOETZ, ALEXANDER AND TSUNEISHI, NOEL. **Application of molecular filter membranes to the bacteriological analysis of water.** *J. Am. Water Works Assoc.* 43, 943-69, discussion, 969-84(1951).—*C.A.* 46, 3188*a*.

Cellulose nitrate and cellulose acetate membranes were used. The filter was highly efficient in retaining bacteria. Several nutrients were discussed, also possible variations in procedure. Several colonies, under differing conditions, were grown on the same filter. A lucite plate and "selector disk" for comparative work were described.

7355. GUTZEIT, G. AND ENYART, GLENN. **Tank-car wastes treated by chemiadsorption.** *Wastes Eng.* 23, 18-22(1951).—*C.A.* 46, 2724*g*.

The treatment was based on adsorption at the surface of hydrophobic solids of toxic materials, such as phenols, cresols, and naphthalenes, and of emulsified oils. The size of the absorption medium (coal) and temp. were varied with the type of material to be removed from wastes. Phenol (208-406 p.p.m.) in raw wastes was reduced 64-74% by chem. treatment and to 99.7-99.8% on trickling filter, leaving 0.2 p.p.m. in the effluent.

7356. HAMMAN, CECIL A. **Illinois water-flood plant uses closed water system.** *Oil and Gas J.* 50, No. 19, 114, 116 (1951).—*C.A.* 45, 10549*c*.

Water was treated (500 barrels per day from a Pennsylvania sand 800 ft deep) with Calgon to prevent the pptn. of Fe or a carbonate and a bactericide to inhibit anaerobic bacteria. The treated water was filtered through diatomaceous-earth filters and injected into the water zone of an oil-bearing formation.

7357. HARLOW, J.; CALISE, V. J., AND LANE, M. **Boiler feedwater treatment for a high-pressure, high-makeup, power and steam producing plant.** *Proc. Midwest Power Conf.*, XIII, 290-303(1951).

The factors which entered into the selection of a silica-removing deionizing system were evaluated. Careful consideration was given to cost of various methods of water conditioning. The major units in the installation were: four hydrogen cation exchange units, height 14 ft, diam. 11 ft; four strongly basic anion exchange units, height 12 ft, diam. 11 ft; and two 10 foot diameter by 16 foot height degasifying towers.

7358. HARTUNG, H. O.; BEHRMAN, A. S.; HAYWOOD, R. W. JR.; KNOX, W. H.; KRAMER, W. A., AND SPAULDING, C. H. **Capacity and loadings of suspended solids contact units.** *J. Am. Water Works Assoc.* 43, 263-91 (1951).—*C.A.* 45, 5849*b*.

Eight available "suspended solids contact softeners" were carefully described. The general theories behind their operation were discussed.

7359. HYNDSHAW, A.; FILICKY, J., AND COLEBAUGH, D. **Factors influencing the efficiency of activated carbon.** *Munic. Utilities* 89, No. 8, 32, 38, 40, 42-3 (1951).—*C.A.* 45, 10544*i*.

7360. KNIGHT, A. G. **The photometric estimation of color in turbid waters.** *J. Inst. Water Engrs.* 5, 623-33(1951).—*C.A.* 46, 667*b*.

Color in a turbid water can be estd. photometrically without the disturbing facts of filtration or other clarifications by using the differential absorption of the water in this spectral region. The instrument must be calibrated at the pH value to be used.

7361. KNOP, E. **The sedimentation process in filter beds.** *Gesundh.-Ing.* 72, 144-9(1951).—*C.A.* 45, 8173*c*.

The settling of industrial and domestic waste waters in filter-beds, especially carbon was investigated. For the deposition of large particles the surface load (quantity of water per hr, divided by the surface of the filter-bed) was the important quantity. As the settling of the fine dust was the longest operation, this process, as well as the compn. and origin of the waste water, were the detg. factors in the planning of a filter-bed.

7362. KRAPF, G. H. **Conversion of filters to zeolite softeners.** *Iron Steel Engr.* 28, No. 11, 98-102(1951).—*C.A.* 46, 669*g*.

7363. LAMOUREUX, V. C. **Biological warfare and water supplies.** *Southwest Waterworks J.* 33, No. 9, 4-5(1951).—*C.A.* 46, 6296*g*.

Suitable agents can be selected because of infectivity, casualty effectiveness, availability, resistance, mode of transmission, epidemicity, specific immunization, therapy, detection, and retroactivity. Agents offering most chance of success are botulinus toxin, leptospirosis, and bacillary dysentery (amoebic). Brucellosis and tularemia may be water-borne. Sedimentation, coagulation, filtration, and disinfection will reduce chances of effective infection to practically nothing.

7364. LAUDERDALE, R. A. AND EMMONS, A. H. **A method for decontaminating small volumes of radioactive water.** *J. Am. Water Works Assoc.* 43, 327-31(1951).—*C.A.* 45, 6329*c*.

Extremely radioactive water was improved to about one-hundredth of the max. concn. considered acceptable for emergency use. The materials used, arranged in series, were steel wool, burnt clay, activated carbon, and a mixture of ion-exchange resins (strong base and strong acid). Each material listed had some particular property in the removal of the different objectionable elements.

7365. LEETS, C.A.; BATCHMAN, R.F., AND JARRETT, H.W. **Procedure for washing and testing steam generators on locomotives other than steam.** *Proc. Master Boiler Makers' Assoc.* 1951, 186-201.—*C.A.* 46, 5751*h*.

Acid washing with suitable inhibitor followed by alkali rinse should be done as required to maintain clean surfaces. Demineralizing water treatment with Na zeolite was recommended as next preferable.

7366. Lindsay, F.K.; Wirth, L.F. Jr., and Durinski, A.M. **Ion exchange in high-temperature applications.** *Ind. Eng. Chem.* 43, 1062-5 (1951).—*C.A.* 45, 7730*i*.

Nalcite HCR was examd. under operating conditions at 110°C. Back-wash rates must be in the magnitude of 12 gal/ft^2 of bed and must be started at a low rate of flow and increased to the high rate in order to remove the light, readily removable turbidity. The capacity at high temp. remained high with frequent backwashing. There was no evidence that thermal shock had any effect on the resin. Slightly higher operating rates may be employed, and regenerating was most effective at 8% NaCl soln. for 30 min.

7367. Martin, Edward M. **Portable diatomite filters for emergency use.** *Water and Sewage Works* 98, 485-7(1951).—*C.A.* 46, 3188*d*.

Filter units ranging from 0.5 to 150 ft.^{2} of filter area, utilizing a deposition of diatomaceous earth from slurry on porous septums, and providing a rate of flow from 1 to 300 gal/min. can be mounted on trucks to provide emergency H_2O filtration.

7368. McGarvey, Francis X. and Thompson, Joseph. **Carboxylic cation exchange resin in water conditioning. Hydrogen cycle.** *Ind. Eng. Chem.* 43, 741-6(1951).—*C.A.* 45, 4380*g*.

IRC-50, the carboxylic exchanger, was found to possess a greater degree of selectivity for bivalent ions over univalent ions than sulfonic acid resins. Studies with solns. of $Ca(HCO_3)_2$, Na_2CO_3-$NaHCO_3$, and with mixed influents show that this exchanger was excellent for removing large amts. Ca and Mg in HCO_3. The carboxylic resin was more economical than a sulfonic-type exchanger for this application.

7369. Moiseev, S.V. **Experimental studies on removal of fluorine from water.** *Gigiena i Sanit.* **1951**, No. 1,49-51.—*C.A.* 45, 5848*e*.

Removal of F from drinking water was satisfactory if the dosage of the coagulant was carefully selected and if the pH range was held closely (8.4 for river and artesian water). Below 15°C the dosage of Al coagulant was 40 or 50 mg/liter at higher temp. The removal was effective if F concn. was below 5 mg/liter.

7370. Moore, Edward W. **Desalting of saline waters; a review of the present status.** *J. New Engl. Water Works Assoc.* 65, 319-37(1951).—*C.A.* 46, 3185*h*.

The objectionable characteristics of saline water were stated. For desalting, evapn. and ion exchange were the only methods economically feasible. Above 2,500 p.p.m. total salts, evapn. processes become apparently more effective and economical.

7371. Muto, Satoru. **Application of cation-exchange resin for the separation of boric acid from some cations.** *J. Chem. Soc. Japan,* Pure Chem. Sect. 72, 976-9(1951).—*C.A.* 46, 6996*a*.

In detg. H_3BO_3 contained in natural waters, its sepn. from Fe^{+++}, Al^{+++}, Zn^{++}, and NH_4^+ by a cation exchanger was studied with good results. H_3BO_3 was not adsorbed by H- or Na-resin and could be titrated with NaOH in the presence of mannitol.

7372. Newell, John F. and Christenson, C.W. **Radioactive waste disposal.** *Sewage and Ind. Wastes* 23, 861-7(1951).—*C.A.* 46, 1679*d*.

Radio-active material discharged to streams, rivers, and lakes will tend to concentrate in aquatic life which apparently was not harmed by the radioactivity normally present in wastes. Natural ground and surface waters have been found to contain some Ra.

7373. Newell, John F. and Christenson, C.W. **What treatment for radioactive wastes?** *Eng. News-Record* 147, No. 19, 37-8(1951).—*C.A.* 46, 2211*i*.

The Pu content of composite daily samples of Los Alamos wastes varied from 200 to 25,000 counts per min. per liter (C/M/L), the pH varied from 2 to 13 and total solids from 230 to over 15,000 p.p.m. Of the adsorptive agents tried, celite, kaolin, pumice, tuff, and activated carbon, the latter was most effective, 500 p.p.m. removing 99% of the activity from artificially polluted tap water. Activated sludge removed 90-95% of the Pu. Of chem. coagulants, $FeCl_3$ and lime gave best results. Substitution of NaOH for lime for neutralization reduced the vol. of sludge somewhat. About 20 p.p.m. Fe was added as $FeCl_3$ and sufficient lime to maintain the pH at or near 8.

7374. Osmun, Roy and Wirth, Louis Jr. **Silica removal with highly basic anion-exchange resins.** *Ind. Eng. Chem.* 43, 1076-9 (1951).—*C.A.* 45, 7731*a*.

SiO_2 in the effluent was less than 0.05 p.p.m. and the total solids was less than 0.5 p.p.m. Regeneration of the anion exchanger was most efficient at 35°C with 2.5 lb of caustic/ft^3 for a contact period of 1 hr. Rinsing with 50 gallons of H_2O at a rate of 5 gallons/ft^2/min. at a temp. of 5°C gave the best results. The position of the ions in an exhausted bed of Dowex 2 showed that the SiO_2 was concd. near the bottom of the bed.

7375. Reents, A.C. and Kahler, F.H. **Mixed-bed deionization.** *Ind. Eng. Chem.* 43, 730-4(1951).—*C.A.* 45, 4380*h*.

The availability of low d. anion-exchange resins and higher d. cation-exchange resins made possible operation of mixed-bed deionizing units in which the resins could be regenerated in the same unit. Comparison of the mixed-bed technique with the conventional two-bed deionization showed that the mixed-bed technique was superior with respect to saving in H_2O consumption, time of regeneration, economy of space required, efficiency of operation with respect to length of time of operation after standing, and resistivity of the effluent of the unit.

7376. Rose, H.E. **The analysis of water by the assessment of turbidity.** *J. Inst. Water Engrs.* 5, 521-45(1951).—*C.A.* 45, 10443*d*.

A photo-extinction app. was devised which gave abs. results. Calibration was not required.

7377. Rösl, Robert. **Water in industry. II.** *Seifen-Öle-Fette-Wachse* 77, 539-41, 563-6, 587-9(1951).—*C.A.* 46, 11519*b*.

Processes were described for removing impurities in dispersion and in soln. (carbonate and noncarbonate hardness, $CaSO_4$, $MgSO_4$, Na_2SO_4, free CO_2, Fe, Mn, SiO_2, dissolved O_2 and CO_2). Ion exchange and phosphate treatment were included.

7378. Sanchis, Joseph M. and Merrell, John C. Jr. **Studies on diatomaceous earth filtration.** *J. Am. Water Works Assoc.* 43, 475-93, discussion, 494-5(1951).—*C.A.* 45, 9203*i*.

The control of plankton growths, and the taste and odor problems they create, was responsible for the work done on diatomaceous earth filtration. Horizontal filtration with diatomaceous silica as a "filter aid" was possible and saved much space. Coarser products gave the longest runs. Water quality was satisfactory. Addn. of activated carbon did not interfere.

7379. Showell, E.B. **Ion exchange for water treatment.** *J. Am. Water Works Assoc.* 43, 522-38 (1951).—*C.A.* 45, 9203*d*.

Many details of ion-exchange were discussed. Typical analyses from many points were included, also relative costs.

7380. Shvidenko, A.A. **Coagulation of water by bentonite.** *Gigiena i Sanit*, 1951, No. 7, 19. —*C.A.* 46, 667*d*.

Treatment of water with Askan bentonite required a dosage of 60-100 mg/liter to give a water with transparency of 3-11 cm; it was best done at 16°C with pH not below 7.5 and moderate noncarbonate hardness. Addn. of 30-100 mg/liter of lime to the bentonite improved the effectiveness of the coagulation.

7381. Šmíd, Jaromír. **Review of methods for purifying phenolic wastes.** *Paliva* 31, 35-6(1951). —*C.A.* 45, 9782*d*.

The main extn. solvents were BuOAc, tritolyl phosphate, and C_6H_6 and similar hydrocarbons. Phenolic matter could be destroyed or removed by biol., phys.-chem., oxidative, or chem. methods. The biol. method depended on bacterial oxidation in an aerated system, promoted by the addn. of ammonium phosphate or nitrogenous wastes. Asbestos or paper pulp could be used as bacterial carrier. The phys.-chem. method depended upon adsorption on solid agents such as activated charcoal. Oil and tar prevent regeneration of the charcoal with C_6H_6 and must be absent.

7382. Smith, R.I. and Denton, J.R. **Preparing water for evaporator feed.** *Power* 95, No. 8, 80-3 (1951).—*C.A.* 45, 9203*g*.

A satisfactory evaporator feedwater was obtained by treating raw water in a cation-exchange system, operating on the H-cycle with upflow regeneration and pH control by the addition of caustic soda. An evaporator vapor of high quality could be produced from this water. The nonscaling character of the treated water resulted in low evaporator maintenance.

7383. Spaulding, Charles H.; Lowe, Harry N. Jr., and Schmitt, Richard P. **Improved coagulation by the use of pulverized limestone.** *J. Am. Water Works Assoc.* 43, 793-802(1951).—*C.A.* 46, 1191*e*.

Solid $CaCO_3$ was found to possess unique properties in promoting isoelec. conditions. The equipment for conducting the investigation was described. Limestone was pulverized so that over 90% would pass a 100-mesh sieve. In the field, the suspended solids contact-procedure was applied and described.

7384. Stomquist, D.M. and Reents, A.C. **Removal of cations from chromic acid solutions.** *Proc. 6th Ind. Waste Conf., Purdue Univ. Eng. Bull., Extension Ser.*, No. 76, 181-9(1951).—*C.A.* 46, 10974*d*.

Chromium plating or anodizing solns. contaminated with metallic ions and unsuitable for plating operations was processed for reuse in a system including a diln. tank for reduction of CrO_3 to 125 g/liter, an ion-exchange bed of the styrene type, and an evaporator to concentrate the exchanger effluent to plating-bath strength.

7385. Straub, Conrad P. **Removal of radioactive materials from waste solutions.** *Sewage and Ind. Wastes* 23, 188-93 (1951).—*C.A.* 46, 355*c*.

Evapn. would remove all activity from the liquid portion and conc. it in the sludge or slurry. Coagulation with alum removed 10% I^{131}, 98% P^{32}, 10 of Sr^{89}, 45-98 of Y^{91}, 98 of Ce^{144}, 98 of Y^{90}, and 10 of Sr^{90}. Phosphate coagulation gave results as follows : Zn^{65}, 99; Sr^{89}, 98; Y^{91}, 99; Sb^{124}, 67; Ce^{144}, 99; W^{185}, 10. Sand filtration removed 85-98% P^{32} and only 1-25% I^{131}. Ion-exchange materials were effective; activated sludge removed 96% Pu and about the same amt. I^{131}.

7386. Straub, Conrad P.; Morton, Roy J., and Placak, Oliver R. **Oak Ridge reports results on water decontamination study.** *Eng. News-Record* 147, No. 7, 38-41 (1951).—*C.A.* 45, 10448*i*.

Removal of radioactive contaminants was studied in a 250-gallon-per-day exptl. rapid sand filtration plant and by means of jar tests. Tap water contg. about 100 p.p.m. turbidity, added as clay slurry, was used as raw water, and to this was added radioactive material. Addn. of 4 p.p.m. activated carbon increased the removal to 26%. Using a synthetic fission product mixt. simulating the elements and products remaining 1 month after a bomb blast, coagulation and sedimentation removed 46% and filtration 44-50% of the remainder, the overall removal being 70-3%. Removal of specific radioisotopes varied considerably. Addn. of clay influenced removal by coagulation. A combination of steel wool, burnt clay, activated carbon and synthetic anion and cation exchange materials reduced radioactivity from 2.5 to $< 10^{-4}$ microcuries per cc., i.e., >99.996%.

7387. Straub, Conrad P.; Morton, Roy J., and Placak, Oliver R. **Studies on the removal of radioactive contaminants from water.** *J. Am. Water Works Assoc.* 43, 773-92 (1951).—*C.A.* 46, 1191*i*.

Conventional methods of water treatment were used, including phosphate coagulation and clay adsorption, in lab. and pilot plant procedures. The isotopes treated were P^{32} as phosphate, Ce^{144}, Y^{91}, Sr^{89}, and Ru^{106}, as chlorides, I^{131}, as iodide, and Zr^{95}, and Nb^{95}, as oxalates. The use of NaOH and Na_2CO_3, especially Na_2CO_3, with alum or Fe improved results. Results with $FeCl_3$ were slightly better than with alum. Approx. 70% of the radioactive material can be removed by coagulation, sedimentation, and filtration.

7388. Thornton, H.A. and Moore, J.R. **Adsorbents in waste water treatment-dye adsorption and recovery studies.** *Sewage and Ind. Wastes* **23**, 497-504(1951). —*C.A.* 46, 670*g*.

The capacity of fuller's earth and activated bauxite for removal of dyes from waste waters was investigated. Economical use of these materials would require regeneration and re-use. Regeneration of the absorbent and recovery of the dye by means of solvents were feasible for some dyes.

7389. Troitskiĭ, Yu. A. and Protserov, B.M. **Characteristics of drinking water containing iron.** *Gigiena i Sanit.* 1951, No. 7, 19.—*C.A.* 46, 666 *g*.

Water of the Khabarovsk area may contain as much as 36 mg/liter Fe, especially in very deep wells. Aeration served to remove 50-60% of the Fe content. Coagulation effectively removed the ferric form, while overchlorination removed all forms quite satisfactorily. Pptd. Fe and its compds. were removable by filter beds (charcoal or sand).

7390. Tyler, Richard G.; Maske, William, and Westin, Milton J. **Treatment of chromium waste by ion exchange.** *Sewage and Ind. Wastes* **23**, 1032-5 (1951); *Proc. 6th Ind. Waste Conf., Purdue Univ. Eng. Bull., Extension Ser.*, No. 76, 135-40 (1951).—*C.A.* 46, 2724*e*; 10974*i*.

Removal of Cr by Zeo-Karb indicated that the material acted as an adsorbent rather than as an ion-exchange medium. Regeneration with alkali resulted in recovery of sexivalent Cr. Acid regeneration produced the less toxic trivalent Cr and would therefore be more satisfactory for discharge into a stream. However, the large quantities of acid required for regeneration would in themselves produce a pollution problem unless neutralized.

7391. Ullrich, A.H. and Smith, Mansel W. **The biosorption process of sewage and waste treatment.** *Sewage and Ind. Wastes* **23**, 1248-53(1951). —*C.A.* 46, 3189*g*.

The process was an accelerated high-rate treatment process in which activated sludge was mixed intimately for a brief period with raw sewage adsorbing a high percentage of suspended and dissolved material. The mixed liquor was settled in a clarifier and sludge pumped to an aeration compartment where it was aerobically digested.

7392. Venkataramanan, K.; Krishnaswamy, N. and Ramakrishnan, T. **Removal of fluorides from water. I. The use of ion-exchange resins. II. Use of Alum-treated ion-exchange resin.** *Indian J. Med. Research* **39**, 211-17, 218-22 (1951).—*C.A.* 46, 3686*g*.

A cation-exchange resin was prepd. by refluxing a sulfited ext. of Avaram bark with CH_2O, promoting gel formation by adding a small quantity of acid, air-drying the gel, powdering, boiling with acid, washing thoroughly, and drying. A two-bed system with "Amberlite IR-4" as the anion exchanger was efficient in removing F from H_2O contg. up to 5 p.p.m. Treating the cation-exchanger with alum made it an effective material for removing F from H_2O, with the advantages of an one-bed system easily regenerated with alum.

7393. Veselov, M.P. and Iovlev, V.M. **Multiple-passage tap for sodium-cationite filters.** *Za Ekon. Topliva* **8**, No. 3, 33-4(1951).—*C.A.* 46, 1305*e*.

The design of the tap was such that according to the setting it (1) fed the water downward through the cationite and conveyed the treated water to storage, (2) pushed the water upward through the cationite to loosen it, and (3) fed a NaCl soln. through the filter to regenerate the latter.

7394. Villar, G.E. **Contamination of surface waters by refinery wastes.** *Rev. ing.* (Montevideo) No. 515, 13 pp. (1951).—*C.A.* **46**, 3739*h*.

Petroleum refinery contamination of surface waters was reviewed under the following headings: general characteristics of refinery wastes, harmful effects of contamination by these wastes, general requirements for treating liquid refinery wastes, legal considerations in prevention of contamination, and conclusions.

7395. Weiss, Charles M. **Adsorption of** *Escherichia coli* **in river and estuarine silts.** *Sewage and Ind. Wastes* **23**, 227-37 (1951). —*C.A.* 46, 667*i*.

In the range of turbidities usually encountered in natural water *E. coli* was adsorbed to the particulate matter and the degree of adsorption was characteristic of the origin and particle size. Adsorption to silt particles increased the rate of sedimentation of bacterial cells. Dild. sea water increased the rate of flocculation of silts.

7396. Willard, B.J. and McCaleb, T.L. **Water treatment in natural-gasoline plants.** *Oil Gas J.* **49**, 78-84 (1951).—*C.A.* 45, 5916*e*.

The treatment of waters for heating, power, and cooling was discussed. The control of scale, algae, slime, and corrosion as well as reduction of foaming and carryover, was discussed. Methods of water conditioning by ion exchange were given.

7397. Wirth, Louis Jr. **Hot lime-zeoline—A versatile water treatment process.** *Southern Pulp Paper Mfr.* **14**, 14-18 (1951).

The new method, involving a primary hot lime process followed by secondary hot zeolite softening, accomplished the following: (1) Hardness reduction to "zero", (2) alkalinity reduction to as low as 15 p.p.m. without the use of acids, (3) silica reduction to tolerable limits, (4) dissolved solids reduction equal to the total alkalinity minus about 30 p.p.m. and (5) clarification to "zero" turbidity. Successful operation at 275°-285°F was claimed.

7398. Wirth, L.F. Jr. and Butler, W.S. **Hot lime zeolite proves practical.** *Power* **95**, No. 3, 110-13, 174, 176 (1951).—*C.A.* **45**, 3535*h*.

The advantages were simplified control, improved Si removal, lower softener turbidities, hardness reduction, and reduction of CO_2 in the steam. A hot-lime-aluminate-styrene-type exchange softener was used. Total hardness of raw water was reduced from 167 p.p.m. to 0.5 p.p.m. Silica concentration dropped from 3 p.p.m. in the primary softener influent to 0.5 p.p.m. in the secondary effluent. Turbidity at the effluent of the primary softener averaged 0.7 p.p.m. Carbon dioxide ran 1.0 p.p.m. in this period.

7399. Yokovleva, M.N. **Use of bentonite and other clay coagulants as substitutes for aluminum sulfate in water purification.** *Gigiena i Sanit.* **1951**, No. 7, 20-1.—*C.A.* 46, 667*h*.

Some 20 specimens of bentonites, subbentonites, and active clays showed effective action only if total water hardness was above 7°. Cloudiness was decreased and color reduced only by the removal of suspended matter; the ppt. formed with bentonites amounted to 1-5% by vol.

7400. Baylis, John R. **Slurry feeding of activated carbon.** *J. Am. Water Works Assoc.* 44, 1161-8(1952).—*C.A.* 47, 1314*f*.

Unloading carbon directly into water and then, when wet, making a slurry, was considered satisfactory. One to 1.25 pounds/gal is the proper concn. Several days were frequently required. Steel tanks holding the slurry must have a protective coating.

7401. Brindisi, Paul. **Water-softening methods. 3: Combined treatments.** *Power* 96, No. 2, 86-7, 216, 218 (1952).—*C.A.* 46, 3688*a*.

In combining lime soda with zeolite, selection of coagulants, and advantages of phosphate addn. were studied. It was felt that combined treatment gave the best results.

7402. Brines, M.E. **Demineralization builds up an excellent operating record.** *Power Eng.* 56, No. 6, 82, 114-7 (1952); *Power* 96, No. 6, 94-7, 206-8 (1952).—*C.A.* 46, 7260*d*.

Diagrams and cuts helped explain the operating procedure in Dow's Midland, Mich. plant where combined cation and anion exchangers were in use. Both cation and anion exchangers were described. This treatment, however, did not always remove insol. colloidal silica, although analysis of the finished water did not show its presence.

7403. Brooke, Maxey and Holbrook, Marvin. **Determination of hardness of waters containing polyphosphates.** *Chemist Analyst* 41, 80-1 (1952).—*C.A.* 47, 2405*g*.

An ion-exchange method was found successful in detg. hardness in waters contg. polyphosphates. Amberlite IR-4B served as an exchanger. The water to be tested was passed through the exchange column at the rate of 5-10 ml per min.

7404. Butler, William S. **Dow's hot-lime-zeolite system after 18 months.** *Power Eng.* 56, No. 1, 80-2 (1952).—*C.A.* 46, 3186*i*.

The quality of water, before and after treatment, operating details, and costs were tabulated. Lime and sodium aluminate were fed to the primary softener and a pH of approx. 10 maintained.

7405. Cillie, G.G. **Defluoridation of water supplies using an activated superphosphate.** *Chemistry & Industry* **1952**, 856-7.—*C.A.* 47, 1876*c*.

Com. lime superphosphate (1 g) was stirred 24 hrs with 6 ml of 5% NaOH, the liquid decanted, and the solid washed. H_2O contg. 10 p.p.m. of F^- at pH 6-7 (maintained by the addn. of CO_2 to the feed) was passed at 30 ml/min. through a filter of 30 g, giving an effluent contg. 1-2 p.p.m. of F^-. The capacity was 2.4 mg of F^-/g/cycle over 10 cycles.

7406. Dutton, L.F. **Few customers, large pumpage at Groton water works.** *Public Works* 83, No. 9, 53-5(1952).—*C.A.* 46, 10498*a*.

A H_2O supply was obtained from a reservoir fed in part from ground-H_2O storage and treated in a plant providing dosage with $Al_2(SO_4)_3$, CaO, and activated carbon; coagulation; sedimentation; filtration; chlorination; and corrosion control with $Ca(OH)_2$.

7407. Emmerson, George S. **Filters will deoil your boiler feedwater.** *Power Eng.* 56, No. 4, 67-70; No. 7, 66-8 (1952).—*C.A.* 46, 5750*i*, 10503*e*.

Filter design and materials of construction used in oil filtration were considered. Diatomaceous earth was considered the most successful filter aid. Methods of operation for the best results were discussed.

7408. Emmons, A.H. and Lauderdale, R.A. **Low levels of radioactive contaminants in water.** *Nucleonics* 10, No. 6, 22-3(1952).—*C.A.* 46, 9434*h*.

A 20-cm silvered-glass-cathode Geiger-Müller tube was embedded vertically in a cation-exchange resin column and fission products from water or liquid wastes passed through it. The resin was easily regenerated. A continuous system was obtained by alternating between 2 identical columns.

7409. Erdei, Joseph F.; Lee, George S.; Louis, Leo, and Sampson, James A. **Taste and odor problems during spring runoff.** *J. Am. Water Works Assoc.* 44, 112-43, (1952).—*C.A.* 47, 1314*h*.

Four sources of tastes and odors were listed. An effort to det. color from the tannin content was not satisfactory. Activated carbon, prechlorination, and ClO_2 all have been used with varying success.

7410. Finney, J. Wiley Jr. **Turbidity and odor problems overcome in filter-plant design.** *Public Works* 83, No. 11, 60-1(1952).—*C.A.* 47, 2406*g*.

H_2O from a surface supply was treated to produce a satisfactory effluent in a plant including aeration, coagulation with alum and lime, flocculation, sedimentation, treatment with activated carbon, filtration, and chlorination.

7411. Gemmell, Lee. **Efficiency of filter beds for treating radioactive waste.** *Nucleonics* 10, No. 10, 40-2(1952).—*C.A.* 47, 2046*f*.

Combined sanitary sewage, ordinary lab. wastes, and low-level radioactive wastes flowed through a settling tank and 1 of 6 intermittent sand and gravel filters of about 1 acre area each. The 12-month av. flow was 223,000 gal/day. Some filter performance tests with sep. solns. of 6-month-old mixed fission products, radio-P as H_3PO_4, radioiodide, and radio-Sr chloride showed 88-99% removal of the activities, while pile canal water, whose main radioactive component was anionic, showed 47% removal.

7412. Gilwood, M.E.; Calmon, Calvin, and Greer, A.H. **Silica-removal characteristics of highly basic anion exchangers.** *J. Am. Water Works Assoc.* 44, 1057-64(1952).—*C.A.* 47, 1314*e*.

Two types of quaternary ammonium, highly basic, anion-exchange resins, one of which was not as stable as the other, were described. In the two-step demineralization, and also in the mixed-bed process, they reduced SiO_2 to substantially the same low levels of 0.01-0.05 p.p.m.

7413. Hamlin, G.H. **The taste had to be better.** *Am. City* 67, No. 7, 104-5 (1952).—*C.A.* 46, 10501*d*.

Water from a reservoir with algae-induced taste and odor problems was treated in a plant consisting of a mixing chamber, a flocculation chamber, a clarifier, and sand filters, with $Al_2(SO_4)_3$, CaO, and activated carbon used in treatment. Wash H_2O for filter backwashing was recovered, stored in a reservoir, and refiltered to save H_2O and to conform to a restriction against draining wash water into adjacent streams.

7414. Hanya, Takahisa. **Suspending matters in natural waters. II. Change of turbidity.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 73, 288-90(1952).—*C.A.* 47, 2913*g*.

The turbidity of natural waters changed its value within ±50% after 5 days' standing. The turbidity of sea water contg. large amts. of org. substances was apt to increase, while that of fresh water contg. much inorg. matter showed the tendency to decrease. Stability of turbidity was defined as the ratio of turbidity after standing to that at the time of sampling.

7415. Harlow, J.H. **Two-bed demineralizer installed at Schuylkill electric generating station for the supply of steam to the district-heating system.** *Bull. Natl. District Heating Assoc.* 38, No. 1, 11-13, 20-2(1952).—*C.A.* 47, 1315*d*.

The use of a two-bed ion-exchange unit to demineralize boiler feed water was described.

7416. Heide, F. **The geochemistry of fresh waters.** *Chem. Erde* 16, 1-21(1952).—*C.A.* 47, 2913*b*.

A discussion of the major factors in the geochem. cycle, including problems of sampling, inhomogeneity of stream compn., secular variation, changes in compn. on standing, and problems of the content of elements present largely as adsorbed particles on suspended matter in streams.

7417. Heinecke, Georg. **Processes for removal of iron from water for drinking and for other purposes.** *Bau u. Betrieb* (Suppl. to Gas- u. Wasserfach) 4, No. 2, 1-2(1952).—*C.A.* 46, 4152*g*.

Open and closed filters for removal of Fe were described and illustrated. These were filled with coke, quartz sand, etc. Two-stage closed filters were used where filtration was difficult, the first filter used comparatively coarse material, and the second sand.

7418. Henry, Clarence R. **Stability and activity of activated silica sols.** *J. Am. Water Works Assoc.* 44, 49-57(1952).—*C.A.* 46, 3687*b*.

The experimental work described involved the preparation and storage of sols used in water treatment. The measurement and improvement of activity, stability, and turbidity was part of the study.

7419. Hiester, Nevin K. and Vermeulen, Theodore. **Saturation performance of ion-exchange and adsorption columns.** *Chem. Eng. Progress* 48, 505-16(1952).—*C.A.* 46, 10701*c*.

Regenerative operations in fixed beds were inherently more difficult to explain and calc. than the common steady-state counterflow operations. The use of suitable dimensionless parameters made it possible to represent the complete family of concn.-history curves, at any one value of an equil. parameter, as a contour plot in terms of a column-capacity parameter and a soln.-capacity parameter. Numerical solutions can be used by methods outlined to predict column behavior over substantial ranges of operating conditions.

7420. Howe, Everett D. **Sea water as a source of fresh water.** *J. Am. Water Works Assoc.* 44, 690-700 (1952).—*C.A.* 46, 10495*f*.

The Diesel-waste heat method, the temp.-difference method, and the solar-distn. method were discussed. Figures showed recommended plant design. The solar-distn. method seemed most promising.

7421. Hyndshaw, A.Y. **Removal of chlorine from water by active carbon.** *Munic. Utilities* 90, No. 5, 27, 48, 50, 52, 54 (1952).—*C.A.* 46, 11519*e*.

Active carbon was found to be an effective dechlorinating agent. It also removed remaining tastes and odors.

7422. Hyndshaw, A.Y.; Laughlin, H.F.; Colebaugh, D.C. Jr., and Filicky, J.G. **Factors influencing the efficiency of activated carbon.** *J. New Engl. Water Works Assoc.* 66, 36-42 (1952).—*C.A.* 46, 5232*c*.

Activated carbon was most efficient at pH 8.5 or lower. Increasing the time, with low dosages, improved results. The carbon should be added prior to chlorination. Monochloramine was least adsorbed by carbon. Heavy floc formation reduced carbon efficiency. ClO_2 was more efficient in removal of medicinal tastes and odors while carbon was most effective with algae.

7423. Janssen, C. and Mijnken, J.W. **Composition of water for high-pressure boilers.** *Ingenieur* 64, CH67-9(1952).—*C.A.* 47, 6075*h*.

For boilers with pressures of 70 atm. or more the pH had to be 10.4-11.0 and SiO_2 less than 5 mg/liter. Some phosphate must be present to ppt. Ca (as hydroxyapatite). The pH could be reached with phosphates or lye. Phosphates may cause a Mg ppt. on the boiler wall.

7424. Krick, Irving P. **Increasing water resources through weather modification.** *J. Am. Water Works Assoc.* 44, 996-1020(1952).—*C.A.* 47, 1460*e*.

The principles involved in nucleation and drop formation where outlined. The action of AgI was studied as well as the methods necessary to get it into its most efficient form for use. The ultimate effect on weather was discussed.

7425. KRUSE, HEINRICH. **Membrane filter.** *Gas- u Wasserfach* 93, 712-15(1952).—*C.A.* 47, 4017*b*.
Membrane filters were prepd. by evapg. a definite quantity of a soln. of nitrocellulose on a horizontal plate; the filter porosity varied with the state of polymerization of the nitrocellulose as well as with humidity and temp. at which it was used. The pore size of these filters was estd. by the air pressure required to bubble air through a layer of water over the horizontal filter. They could be sterilized with flowing steam in a layer of alternate membrane filters and filter papers, weighted down. A membrane of this type will retain bacteria of a much smaller size than the pore size and could be used for the quant. removal of bacteria from relatively large amts. of water or dil. sewage (up to 1 liter or more).

7426. LACY, W.J. **Removal of radioactive material from water by slurrying with powdered metal.** *J. Am. Water Works Assoc.* 44, 824-8 (1952).—*C.A.* 46, 10501*h*.
Tap water was artificially contaminated with radioactive materials and then mixed with powd. metal, as Fe, Cu, Al, and Zn. Adsorption was rapid. Conventional coagulation and filtration resulted in removal of contaminants to a safe tolerance level for emergency drinking purposes.

7427. LALLI, G. AND ORLANDI, A. **Biological depuration of waters subjected to demineralization by ion-exchange resins.** *Riv. med. aeronaut.* 15, 231-60(1952).—*C.A.* 47, 4016*d*.
Weak cation-exchange resins, as Amberlite IRC-50, were practically inactive; Amberlite IR-120 was inactive on *E. coli* in H_2O but strongly active against acid-sensible germs contained in water with a considerable salt content; weak anion-exchange resins, as Amberlite IR-4B, were scarcely active; Amberlite IRA-400, was intensely active against all germs contained in natural waters.

7428. LANGELIER, WILFRED F. **The electrochemical desalting of sea water with permselective membranes; a hypothetical process.** *J. Am. Water Works Assoc.* 44, 845-8(1952).—*C.A.* 46, 11519*f*.
A demineralizing unit was presented involving elementary electro-chem. theory. Only the basic principles involved were shown.

7429. LARSON, T.E. **Hardness reduction vs. removal—a critical evaluation.** *Water and Sewage Works* 99, 226-9(1952).—*C.A.* 46, 10502*f*.
Municipal hardness reduction, home service and home-owned hardness removal, and detergents were vital factors in water-treatment practices, with municipal softening to a hardness of 5 grains/gal providing more hardness reduction per unit cost to the user. Individual softening units could be adapted for final treatment at relatively low cost.

7430. LEE, JAMES A. **Cheap way to remove fluorides from water.** *Chem. Eng.* 59, No. 7, 211, 400-1(1952).—*C.A.* 46, 9237*i*.
Raw water was treated with activated Al_2O_3, which adsorbs or absorbs the fluorides; the Al_2O_3 was then regenerated by washing successively with dil. NaOH and dil. H_2SO_4.

7431. MARTIN, OWEN. **Water demineralization by mixed-bed ion exchange.** *Ind. Chemist*, 28, 448-50(1952).—*C.A.* 47, 4016*f*.

7432. McCOY, JAMES W. **Some applications of ion exchange to water analysis.** *Anal. Chim. Acta* 6, 259-66(1952)(in English).—*C.A.* 46, 7685*f*.
A system for the sepn. of the various ions found in cooling waters was described based on the use of ion-exchange resins. These sepns. made possible the use of rapid colorimetric methods and saved considerable time in the routine analysis of industrial waters.

7433. McGARVEY, F.X.; TENHOOR, R.E., AND NEVERS, R.P. **Cation exchangers for metals concentrations from pickle rinse waters.** *Ind. Eng. Chem.* 44, 534-41 (1952).
The recovery and disposal of Cu and brass alloy metals from wash waters might be accomplished with strongly acidic cation exchange resins of high capacity. H-cycle operation was more economical than Na-cycle. Major factors influencing capacity for Cu and Zn were the relative amounts of Ca and Mg hardness in the raw water, particularly where Cu concentration was low in the rinse water. Advantages of Na-cycle operation were: greater capacity, less sensitivity to total hardness in rinse water, greater concentration of toxic metals in regenerant, more complete removal of trivalent chromium, and reduced acidity.

7434. MEYER-EPPLER, WERNER AND WESSEL, BERT. **A process for fine screening of ceramic masses by using vibrations of sound frequency.** *Sprechsaal* 85, 557-9 (1952).—*C.A.* 47, 2446*d*.
Screening was expedited with a min. of water by using screens that were vibrated at sound frequency, and rubber rakes vibrating at low frequency.

7435. MIDDLETON, F.M.; BRAUS, HARRY, AND RUCHHOFT, C.C. **Fundamental studies of taste and odor in water supplies.** *J. Am. Water Works Assoc.* 44, 538-46(1952).—*C.A.* 46, 10498*h*.
Carbon filter technique developed for the concn. and estn. of the small quantities of org. chemicals responsible for tastes and odors in water was discussed. Two types of activated carbon were used, i.e. Cliffchar and Nuchar. Diagrams of sand and carbon and activated carbon filter assemblies are included. In several cases activated carbon was especially successful.

7436. MORENO, J.R. AND BURLAGE, HENRY M. **Ion exchange in water conditioning.** *Am. Profess. Pharmacist* 18, 783-9, 823-6(1952).—*C.A.* 47, 802*g*.
Various methods of water conditioning were described with special emphasis on the use of ion-exchange resins.

7437. MÜLLER, JOSEF. **Contamination of ground water supplies by gasoline.** *Gas- u. Wasserfach* 93, 205-9 (1952).—*C.A.* 46, 6295*h*.

With a lowering of ground-water level, the lighter gasoline was absorbed by the soil in one instance, to be evident again during high water. Gasoline in the soil appeared to be oxidized first by atm. O_2 and then by means of nitrate with the aid of a catalytic or biol. process. CO_2 and N were formed, the former reacting with Ca compds. to increase alky. and hardness of the water. When only slight traces of gasoline remained in the water, active carbon filters were successfully used to purify the water for domestic purposes.

7438. PAPP, SZ. **Removal of iron from industrial and potable waters.** *Acta Tech. Acad. Sci. Hung.* 5, 437-61(1952)(in German).—*C.A.* 47, 5589*e*.

Fermago, a filter material prepd. from sintered MgO contg. Fe_2O_3 and quartz fines, removed Fe and Mn and increased alky. Iron pipes in chilled wells were given a protective coating by treating with a mixt. of Na_2CO_3, CaO, and $Ca(OCl)_2$. The Fe content of the water was greatly reduced, and the life of the pipes increased.

7439. PAULSON, C.F. **Wastes recovery by ion exchange.** *Wastes Eng.* 23, 208-9 (1952).—*C.A.* 46, 4927*h*.

Cr from baths employed for anodizing Al, Cr plating, and Cu stripping could be recovered by ion-exchange resins at a cost less than that of disposal; cation-exchange app. was incorporated in plating lines.

7440. PIS'MEROVA, O.V. AND KALMYKOVA, A.I. **Use of cation accumulation in the analysis of steam and condensate under industrial conditions.** *Izvest. Vsesoyuz. Teplotekh. Inst. im. Feliksa Dzherzhinskogo* 21, No. 2, 23-5 (1952).—*C.A.* 46, 6297*b*.

The use of ion exchange in a power-generating station was described.

7441. POLUKAROVA, E.I. **Increasing the efficiency of cationic filters.** *Izvest. Vsesoyuz. Teplotekh. Inst. im. Feliksa Dzhershinskogo* 21, No. 1, 22(1952).—*C.A.* 46, 6298*a*.

Design and mech. improvements of water-softening filters were described. By virtue of these improvements the exchange capacity of the cationite rose from 500°-600° to 800°-900°C/m^3.

7442. QUENTIN, K.E. **Paper chromatographic isolation and colorimetric determination of boron in mineral waters.** *Z. Lebensm.-Untersuch. u. - Forsch.* 95, 305-13 (1952).—*C.A.* 47, 2082*f*.

The color obtained with turmeric soln. was made semiquant. by standardizing technique and comparing the color developed with that from standards with 0.1, 1, 5, and 10γB. In the quant. method 5 chromatographs were developed with samples contg. about 5γB. The B portions of 3 of the papers contg. B were cut up so that the B test spot was in the upper 1/3of the paper. The 3 samples were cut and washed 4 hrs. in a dish contg. water.

7443. RAMAKRISHNAN, T. AND VENKATRAMANAN, K. **Fluorine removal by tricalcium phosphate.** *J. Indian Inst. Sci.* 34, 119-22(1952).—*C.A.* 47, 441*i*.

The removal of NaF from aq. soln. (2-8 p.p.m.) by treatment with varying quantities of $Ca_3(PO_4)_2$ was studied. The reaction was complex, involving anion exchange of F^- for $PO_4{}^{3-}$, total mol. absorption of NaF, and possibly the partial replacement of Ca by Na in the phosphate.

7444. RENNER, G. LYALL. **Lime treatment and the Halifax water supply.** *Eng. Contract Record* 65. No. 5, 112, 114, 116, 118, 120, 122, 124, 126, 128, 130, 132(1952).—*C.A.* 46, 9237*h*.

The supply contained about 30 p.p.m. total solids and 5 p.p.m. hardness, a pH value of 4.5-6.5, and was very corrosive. After pilot plant tests on treatment with lime, Na silicate, and Na hexametaphosphate and lime, and large-scale tests with the first two, lime treatment was adopted. About 5-6 p.p.m. was required to increase the pH to 7 or slightly higher. The av. Pb content of the delivered water was reduced from 1.18 to 0.14 p.p.m. About 19% more Cl_2, which was applied following the lime, was required to maintain a residual of 0.2 p.p.m.

7445. RENSHAW, ARNOLD. **Emergency method of water sterilization.** *Farm. Chilena* 26, 351-3 (1952).—*C.A.* 47, 4528*d*.

I_2 added at a diln. of 1:20,000 destroyed most pathogenic germs in 10 min. An excess of I_2 could be removed by filtration through active charcoal.

7446. ROBINSON, M.P. **Water treatment by zeolites. A general view.** *Water and Sewage Works* 99, 152-6(1952).—*C.A.* 46, 10502*d*.

7447. SHOGENJI, TADASHI; TAKAHASHI, HIDEO, AND AKASHI, KANEMICHI. **The cold alkaline purification of sulfite pulp. Use of ion-exchange resin for the analysis of waste liquor and some information on alkali consumption.** *J. Japan. Tech. Assoc. Pulp Paper Ind.* 6, 201-11(1952) (English summary).—*C.A.* 46, 9304*b*.

The waste liquors were analyzed for total alkali by conductometric titration and for combined alkali by potentiometric and conductometric titration after treating with Amberlite IR-120 to remove the greater part of free alkali which interfered with the titration end point.

7448. SIMPSON, A.D. **Hot lime zeolite, a 287°F installation.** *Combustion* 23, No. 12, 49-51 (1952).—*C.A.* 46, 9308*h*.

A hot lime zeolite installation economically extended the capacity of existing conventional H_2O-treatment facilities in a paper mill by 35%. Hardness as $CaCO_3$ was reduced from 10 to 1.2 p.p.m. To avoid costly modifications and eliminate the secondary softener (Na_2HPO_4 treatment) with its undesired Mg and $PO_4{}^{3-}$ combination, styrene cation-resin ion-exchange units supplement the primary softener. Stability of the resin at 140°C appeared satisfactory after 60 days.

7449. SIMPSON, D. AND WHELAN, P.F. **Anthracite filter media.** *Chem. Trade J.* **130**, 1461-3(1952). —*C.A.* 46, 7827*d*.

The testing machine consisted of a cylindrical steel tank 10 in. high by 6 in. in diam. equipped with a 3-bladed propeller, 3 in. in diam. Above the propeller was supported a short standpipe which caused the circulating pulp to pass down the standpipe and up the outer space to overflow again inwards. The following test conditions were used: the charge was 1 kg of anthracite and 2.5 liter of H_2O, sample size was 1-2 mm, speed was 1000 r.p.m., and time of test was 4 hrs.

7450. SIMPSON, R.W.; DUKE, E.T., AND THOMPSON, K. **Asbestos paper wastes treatment.** *Water and Sewage Works* **99**, 286-91(1952).—*C.A.* 46, 9754*b*.

Wastes from asbestos-paper manuf. contg. asbestos fibers, unbleached sulfite screenings, bleached sulfite, pulverized limestone, starch, mixed paper, Na silicate, $Ca(OH_2)$, cattle hair, and NaOH neither vacuum nor pressure filtration provided satisfactory treatment, but flocculation and sedimentation was applicable. A plant of the high-rate clarification type, with $Al_2(SO_4)_3$ and activated silica for flocculation, provided removal of 95.8% suspended solids, 74.5% total solids, 89.9% turbidity, and 47.5% B.O.D.

7451. SPIEGLER, K.S.; JUDA, WALTER, AND CARRON, MORRIS. **Counterflow regeneration of cation exchanger in partial demineralization of brackish waters.** *J. Am. Water Works Assoc.* **44**, 80-8 (1952).—*C.A.* 46, 3687*g*.

The work, based on pilot-plant operation, was done to reduce the cost of purified water lost in regeneration and washing. Following a base-exchange softener were two pairs of demineralizers, a strongly acid cation, and a weakly basic anion, exchanger. H_2SO_4, as regenerant, was passed down through the cation exchangers and subsequently passed the exchanger in the opposite direction. Results are considered highly successful and economical. Dissolved salts were reduced from 2000 to 500 p.p.m. Na_2SO_4 was recovered.

7452. SUSSMAN, SIDNEY AND PORTNOY, IRVING L. **Determination of heavy metals and silica in chromate-treated cooling waters.** *Anal. Chem.* **24**, 1644-6(1952).—*C.A.* 47, 802*f*.

By means of the cation-exchange resin Dowex-50 (and probably any other sulfonated, polystyrene-type exchange resin) it was possible to remove Cu^{2+} and Fe^{3+} from cooling waters contg. chromate, although erratic results were obtained when the Fe content exceeded 12 p.p.m. To det. Si, an anion-exchange resin was used to prevent interference of CrO_4^{2-}. The cation-exchange resin could be easily regenerated by treatment with 5% HCl, but it was often more convenient in the SiO_2 detn. to use less resin and discard it after using.

7453. THOMPSON, J. **Ion exchange resins.--A new approach to water conditioning.** *Laundry Age* **1952**, 59-63(Sept.), 62-65(Oct.)

The water softening process and the advantages of ion exchange treatment of wash and boiler feed water were considered.

7454. VALIN, A.T. **The measurement of the color of water and the decolorization of water supplies.** *Water and Water Eng.* 56, 267-9(1952). —*C.A.* 46, 10498*h*.

The various methods for the detn. of color in water supplies as well as color removal by coagulation, chlorination, and ozonization were discussed.

7455. WAL, S.S. VAN DER. **Removal of iron from ground water by adsorption.** *Water* (Neth.) 36, (Jan. 31, 1952).—*C.A.* 46, 5229*e*.

It was difficult to remove Fe and Mn without floc formation and use of filter material only. If removal was insufficient, about 0.5 p.p.m. of Cu could be added. The activating action of the Cu was two-fold: Cu acted catalytically by the oxidation of Fe; Cu aided adsorption on the filter material.

7456. WHEELER, R.T. **Water-treating plants for secondary recovery and waste disposal (California) I. Methods of design. II.** *Oil Gas J.* **51**, No. 7, 95-6, No. 8, 66, 69. (1952). —*C.A.* 46, 8358*b*.

The advantages of a closed water-treating system, sand and diatomaceous earth filters, capacity of filtered-water storage, injection pumps, chem. treatment, and scale control were discussed. Considerable down time and expensive maintenance could be avoided by proper engineering and design of the water plant.

7457. WHEELER, R.T. **The design and maintenance of water-treating plants for secondary recovery and waste disposal in California.** *Calif. Oil World* **45**, No. 13, 4, 6, 8, 10, 12(1952).—*C.A.* **46**, 10598*e*.

A plant provided for the treatment of waste brine from petroleum operations by injecting it into the producing formation to drive the remaining oil to the producing wells. In the closed system corrosion was minimized, airborne bacteria excluded, dissolved Fe kept in soln., and H_2S gas not oxidized. If filtration was needed, diatomaceous earth filters had several definite advantages over sand filters.

7458. WILLIAMS, D.B. **How to solve odor problems in water-chlorination practice.** *Water and Sewage Works* **99**, 358-64(1952).—*C.A.* 46, 10501*e*.

Odors arising from free residual chlorination are chiefly due to NCl_3, which may be controlled by elevation of pH to 8.5 to 9, aeration, addn. of NH_3, addn. of activated carbon, or dechlorination with SO_2.

7459. YODER, J.D. **Demineralization by ion exchange.** *Paper Mill News* 75, 83-84, 86, 130 (Dec. 6, 1952).

The demineralization of feed water for high-pressure boilers was accomplished by means of the new ion-exchange resins. The higher the amount of the mineral solids to be removed, the more expensive the demineralizing equipment will be; however, the quality of the treated water justified the higher cost.

7460. ANON. **Dealkalization—without acid.** *Power Eng.* 57, 68, 117-119 (1953).

Dealkalization by a two step process not requiring acid was discussed. Influent water was first passed through a conventional softener (cation exchanger in the Na form), then through a strongly basic anion exchange resin in the Cl form. Chloride anions from the second exchanger replaced other anions in the sodium salt effluent from the softening step. Treatment for elimination of carbon dioxide was still necessary.

7461. ANON. **Iron removal and iron retention.** *The Betz Indicator* 22, No. 7 pp. 3-8 (1953).

Objectionable amounts of iron in water could be either removed, in the case of drinking water, etc., or treated so that it was not deposited, in the case of cooling water, etc. Iron retention by stabilization of the ions was secured by the use of surface-active agents such as polyphosphates or organic sequestrants.

7462. ANON. **Deionization yields low-silica feed water.** *Power Eng.* 57, No. 2, 60-1, 114, 117, 119(1953).—*C.A.* 47, 4527*h*.

A deionizing system delivered a 500,000-ohm-resistant water with a Si content of 0.05 p.p.m. or less. The plant (4 cation-exchange units) was covered in detail. Operation had been uninterrupted for 2 years.

7463. APPLEBAUM, S.B. **Demineralization passes in review.** *Power* 97, No. 8, 88-91, 196, 198, 202, 204(1953).—*C.A.* 47, 11610*h*.

Silica removal and complete demineralization, which was essential, was described. Advantages and disadvantages of mixed-bed demineralization were listed.

7464. BICKELL, L.K. AND TRETHEWEY, G.D. **A recovery method for sodium-base sulfite liquor.** *Pulp Paper Mag. Can.* 54, No. 13, 110-16 (1953). —*C.A.* 48, 3684*a*.

By a cyclic process, Na-base sulfite waste liquor was used economically to effect chem. and heat recovery, increase yield, and eliminate stream pollution. By means of ion exchangers, e.g. Amberlite IRC-50, Na was recovered from the smelt, and simultaneously sulfide S recovered as H_2S, which was burnt to give SO_2. The ion exchanger in the Na form was stripped with H_2SO_3 to give raw acid ready for cooking.

7465. BURGER, A.A. **At last plenty of water for Cleveland.** *Am. City* 68, No. 2, 83-5(1953).—*C.A.* 47, 4527*d*.

A municipal H_2O supply was increased in capacity by obtaining H_2O from a lake with turbidity of 2 to 200 p.p.m., alky. of 85 to 95, hardness of 115 to 125, and a coliform index in the range of 200 to 10000 per 100 ml. Treatment included the use of activated carbon for taste and odor control, $Ca(OH)_2$ for coagulation and corrosion control, $Al_2(SO_4)_3$ for coagulation, and Cl_2 for disinfection.

7466. FITZPATRICK, L.W. **Water-treatment engineering. Raw water treatment.** *Power Eng.* 57, No. 3, 70-3(1953).—*C.A.* 47, 4527*f*.

The advantages of deionization with ion exchange resins, softening with exchangers, and lime-soda softening were considered; advantages of the first two techniques were enumerated in tabular form. Rapid tests and calculations for correct softener operation, and chemical equations illustrating the reactions occurring with the systems were described.

7467. GILWOOD, M.E. AND CALMON, C. **Mixed-bed vs. two-step demineralizing.** *Power* 97, No. 5, 73-6(1953).—*C.A.* 47, 6582*e*.

Two-step demineralization with a degassifier and mixed-bed treatment with no degassifier were discussed. For waters of low mineral content the mixed-bed had advantages.

7468. LARSON, T.E. **Municipal and home water softening.** *J. Am. Water Works Assoc.* 45, 557-61(1953).—*C.A.* 47, 10780*b*.

The cost of softening hard water to 85 p.p.m. by a municipal softening plant was about 0.1 cent per p.p.m. hardness removed. Home owned softeners average 0.11 cent per p.p.m. and the domestic service type about 0.65 cent per p.p.m. Soap costs average 0.21 cent per p.p.m. All values are cent/p.p.m./1000 gals.

7469. MIDDLETON, A.B. **Activated silica treatment of raw and waste waters.** *Water & Sewage Works* 100, 85-7(1953).—*C.A.* 47, 4529*c*.

Municipal and industrial applications demonstrated the economy of improved flocculation.

7470. RIESS, C. **Water treatment by the threshold method.** *Mitt. chem. Forsch.-Inst. Wirtsch. Österr.* 7, 1-6(1953).—*C.A.* 47, 6584*h*.

Curves were given for the influence of metaphosphate on the pptn. and stabilization of the $CaCO_3$ hardness. Ultramicroscopic studies have shown that the $CaCO_3$ did not pass into the colloidal state. The colloidal state was not stabilized by phosphates. The ppts. contained Ca and P in an almost const. ratio of 300: 1 for an application of more than 0.6 mg metaphosphate/liter.

7471. SAUNDERS, MAX D. **Water for education.** *Water and Sewage Works* 100, 142-5(1953).—*C.A.* 47, 6582*d*.

The H_2O requirements were met by a surface supply treated in a plant consisting of dosage with $Al_2(SO_4)_3$, activated carbon, and CaO; flash mixing; prechlorination; flocculation; sedimentation; postchlorination; filtration; and dosage with $Ca(OH)_2$ for corrosion control.

7472. SMITH, JAMES BOYD. **Water impurities and electroplating.** *Metal Finishing* 51, No. 2, 69-72, 74, No. 3, 65-9(1953).—*C.A.* 47, 4226*a*.

The effect of various impurities, which may be found in water supplies, on various types of plating baths was described.

7473. THOMPSON, JOSEPH AND MCGARVEY, FRANCIS X. **Ion-exchange treatment of water supplies.** *J. Am. Water Works Assoc.* 45, 145-52 (1953).—*C.A.* 47, 4527*e*.

The availability of a variety of new resins, in ion-and cation-exchange, made possible improved softening, fluoride removal, alky. reduction, and H_2S removal.

7474. Valley, E.E. and Hanlon, R.T. **Modification of the feedwater treatment system at Port Arthur Division, Provincial Paper Ltd.** *Pulp & Paper Mag. Can.* 54, No. 3, 190-4, 201 (1953). —*C.A.* 47, 9616^d.

The acid-cycle cation exchange system, followed by a lignin deriv., NaOH, and an amine, was found to be most suitable for softening and decarbonating the Lake Superior water used in the mill.

7475. Yoder, J.D. **Demineralization—makeup water for steam power plants.** *Southern Power and Ind.* 71, No. 5, 74-8, 114, 116(1953).—*C.A.* 47, 6075^c.

The water was treated first in the cation exchanger, Permutit Q (a sulfonated styrenetype resin), or Zeo-Karb (a sulfonated, granulated, and suitably prepd. bituminous coal). Both materials were usually regenerated with H_2SO_4. With carbonate-contg. waters the effluent from this exchanger contained CO_2, which was more economically removed by means of an aerator or vacuum deaerator than by anion exchange. The demineralized water is somewhat corrosive to steel; if it is to be handled in steel the pH should be increased to 9.2 by the addn. of NaOH soln.; this is especially important with mixed-bed demineralization.

V-5. Refining of Petroleum Products

7476. Burrell, G.A.; Oberfell, G.G., and Voress, C.L. **Gasoline by the charcoal absorption process.** *Chem. & Met. Eng.* 24, 156-60(1921).

The properties of activated charcoal suitable for use in the recovery of gasoline were described. The heat effects in the absorption process, subsequent distillation with superheated steams, and condensation of the gasoline vapors were discussed. The gasoline recovered by the charcoal process was compared to that recovered by oil absorption.

7477. Fitzsimons, Ogden. **Fuller's earth and bauxite type adsorbents compared.** *Natl. Petroleum News* **29**, No. 24, 60-3, 67 (1937).

A comparison of costs showed the advantages of Fuller's earth over bauxite type adsorbents. Comparing filter houses of equal volume capacity (for example, 500 tons capacity of Fuller's earth and 850 tons of bauxite since bauxite was 1.7 to 1.9 times heavier), an annual cost of $60,900 was computed for Fuller's earth as compared with $85,980 for activated bauxite. Bauxite had a little higher loss rate but no discard.

7478. Trauffer, W.E. **Bentonite for oil refineries.** *Pit & Quarry* 29, (June) 60-2, 66(1937)

The equipment and processing methods of the Filtral plant at Jackson, Mississippi, was described. Placed in operation in 1936, the plant had a capacity of 75 tons of acid-treated bentonite bleaching agent (Super Filtrol) for cottonseed, linseed, and petroleum oils. A wet slurry was treated with H_2SO_4 and brought to the b.p. by steam. Details of the washing, drying, milling, and packing processes were given.

7479. Anon. **Filtering with bauxite produces economies in the lube processing.** *Natl. Petroleum News* 30, (April 20) R195-96 (1938)

The bauxite called "X-YTE" was compared with standard Fuller's earth. The bauxite was a high Al_2O_3 earth produced by calcining, activating, and sizing a selected bauxite. A decolorizing efficiency of 80 to 90% of the original material could be retained in regeneration. The average dustloss per burn was between 1% and 2%.

7480. Hubbell, R.H. Jr. and Ferguson, R.P. **Revivification characteristics of bauxite used in filtration.** *Oil Gas J.* 37, 135-39(Nov. 18, 1938).

The average adsorption efficiency of bauxite (compared with new material or with Fuller's earth) varied with the source, type of stock to be filtered, and the method of filtration. While fresh bauxite exerted a pronounced "solvent" action, this effect diminished with continued revivification. Improved gravity and carbon were obtainable with only the low-numbered bauxites, and only then at the sacrifice of viscosity. The selection of absorbent for a given service remained an individual problem.

7481. Egloff, Gustav; Morrell, J.C.; Thomas, Charles L., and Bloch, Herman S. **Catalytic cracking of aliphatic hydrocarbons.** *J. Am. Chem. Soc.* 61, 3571-80(1939).—*C.A.* 34, 1467^8.

A no. of hydrocarbons were cracked at atm. pressure in the presence of an activated SiO_2-Al_2O_3 catalyst. A mixt. of butenes underwent extensive catalytic isomerization to isobutene in the range 385-600°C, accompanied by polymerization and cracking; between 450 and 600°C the isobutene content of the C_4 product was 24.1 ± 1.5%. Pentenes showed reactions similar to those of the butenes, yielding 50% of isopentenes at 400°. A mixt. of octenes underwent both catalytic isomerization to isoöctenes and catalytic cracking to gaseous products consisting principally of equal amts. of butene and isobutene. The results were consistent with the theory that isomerization preceded cracking.

7482. Williams, Neil. **Atlantic Refinery on Gulf Coast.** *Oil Gas J.* 37, 70-1, 75, 78, 82 (February 23, 1939).

Two dehydrator towers containing activated alumina were described as part of the auxiliary equipment in the cracking and polymerization plant at Atrew, Texas.

7483. Harteck, P. **Purification and separation of hydrocarbons with the aid of desorption.** *Reichsamt Wirtschaftsaubau, Prüf-Nr.* 43, (PB 52003), 121-8 (1940).—*C.A.* 41, 6492*c*.

Selective adsorption of hydrocarbons on silica gel was described. In the sepn. studies approx. 1 g silica gel adsorbed 0.1 g hydrocarbon. In the sepn., the hydrocarbon gases were adsorbed on the silica gel, and the mass cooled to liquid-air temps. and the system evacuated. The stepwise desorption of the hydrocarbons was carefully followed. Graphs were shown for the sepn. of

C_2H_6-C_3H_8, C_2H_6-C_2H_4, and C_3H_8-C_3H_6 mixts with activated charcoal and silica gel.

7484. Roper, William N. **Natural gas progress.** *Natl. Petroleum News* 32, R398-9 (October 30, 1940).

Improvements in the design and operation of gasoline plants refrigeration units for the recovery of natural gasoline was made practical by the use of suitable de-hydration units. Freezing and the formation of petroleum hydrates was prevented.

7485. Tiddy, W. and Miller, M.J. **Light oil recovery from coke oven gas.** *Am. Gas Journal* 153, (Sept.) 7-10, 46 (1940).

The adsorption plant at Beckton, England, was described, including operation and plant results. Several objections were given to the adsorption system applied to American practice: (1) deterioration and replacement of charcoal; (2) corrosion of adsorbers; (3) intermittent operation; (4) higher sulfur content of the recovered crude benzol as compared with oil washing process.

7486. Hamai, Senzo **The velocity of sedimentation of the catalyst in the process of washing from it adsorbed ions.** *Science (Japan)* **11**, 518-19(1941).—*C.A.* 44, 10962*d*.

The catalyst of the Co group contg. Fuller's earth and some accelerators (for manuf. of synthetic petroleum) must be washed free of adsorbed ions. The sedimentation velocity of the catalyst in decantation was markedly affected by the temp.; washing with hot water (77-81°C) was advisable. The adsorbed ion studied was nitrate.

7487. Randolph, J.R. **Gas-gathering and discharge systems.** *Oil Gas J.* **40**, 46, 49, 51 (September 25, 1941).

Adsorption-type dehydrator units, filled with 3 tons of activated alumina as the adsorbing agent, were described, These were used at the Taylor Gasoline Plant and the Dove pressure-maintenance plant of the Carter Oil Co.

7488. Schulze, W.A.; Morris, L.C., and Alden, R.C. **Reducing internal corrosion of gasoline pipe lines.** *Oil Gas J.* **40**, 172-75 (Nov. 6, 1941).

The rate of internal corrosion of gasoline pipe lines was reduced: (1) removal of O_2 from the gasoline by injection of an aq. soln. of sodium sulfite into the line; (2) removal of entrained and some dissolved H_2O from the oil by passage over dehydrated beds of commercial bauxite; (3) use of mercaptobenzothiazole as a corrosion inhibitor.

7489. Ferns, J.L. **Deacidification of transformer oil.** *Elec. Times* **102**, 824-6 (1942).—*C.A.* 37, 5851^9.

A cylinder contg. 6 lb of activated Al_2O_3 was connected to a 500 kv.-amp. transformer contg. 170 gal of oil. After 4 months, during which 4 charges of Al_2O_3 were used, the acid value was lowered from 0.9 to 0.4.

7490. Hesse, Gerhard and Tschachotin, B. **Adsorption analysis of gases and vapors.** *Naturwissenschaften* 30, 387-92 (1942).—*C.A.* 37, 6211^4.

The mixt. was vaporized, and passed with a carrier gas into a heated adsorption tube contg. silica gel. The vapor passing through was condensed and analyzed. The method was applied to the sepn. of C_6H_6 and cyclohexane. The sepn. of a C_6H_6-cyclohexene mixt. was difficult, but with a greater quantity of adsorbent, 25% of C_6H_6-cyclohexene was obtained optically pure. C_6H_6 and CCl_4 were easily sepd.; iso-PrOH and *tert*-BuOH could not be sepd.; *cis*- and *trans*-$C_2H_4Cl_2$ were partly sepd. Silica gel was a better adsorbent than activated charcoal.

7491. Rossini, Frederick D.; Mair, Beveridge J.; Forziati, Alphonse F.; Glasgow, Augustus R. Jr., and Willingham, Charles B. **Method for analyzing the gasoline fraction of petroleum, with preliminary results on East Texas and Oklahoma crudes.** *Petroleum Refiner* **21**, 377-82 (1942); *Proc. Am. Petroleum Inst.* **23**, III, 7-14 (1942).—*C.A.* 37, 1249^6.

The fractionating processes of adsorption and distillation was applied to the naphtha fraction. Preliminary results on the naphtha fractions from East Texas and Oklahoma crude oils were presented with results of a test experiment on a mixture of 17 known hydrocarbons b. 60-174°C.

7492. Simpson, T.P.; Evans, L.P.; Hornberg, C.V., and Payne, J.W. **The Thermofor catalytic cracking process.** *Natl. Petroleum News* 34, No. 47, R427-31 (1942); *Petroleum Refiner* **21**, 401-5 (1942); *Oil Gas J.* **41**, No. 27, 96, 99, 100, 102, 104 (1942); *Proc. Am. Petroleum Inst.*, Sect. III, **24**, 83-8 (1943).—*C.A.* 37, 1250^5, 6862^3; 38, 1625^5.

The methods in the principal catalytic cracking processes for handling catalyst, bringing oil and catalyst into contact, and regenerating were discussed in general and in detail for the Thermofor process.

7493. Stanisavlievici, Louis. **Removal of organic sulfur compounds from city gas by wood charcoal.** *Gas u. Wasserfach* **85**, 353-9(1942).—*C.A.* 37, 3908^9.

A simple procedure employing passage of the gas over charcoal was described suitable for the removal of org. S compds. from S-rich distn. gases and other fuel gases. The following factors were critically studied as regards the efficiency of S removal by the charcoal: (1) particle size of the charcoal, (2) concn. of CS_2 in the gas, (3) rate of gas flow through the adsorber, (4) moisture of the charcoal, (5) steaming out as in regeneration, (6) residual loading, (7) decrease in thermal value of the gas due to adsorption, (8) temp. and (9) make of charcoal.

7494. Stourdze, Yvonne E. **Bleaching earths and their activation; technology, analysis and applications.** *Rév. brasil. quim (Sao Paulo)* 13, 290-2 (1942).—*C.A.* 37, 503^9.

The use of earths and clays in refining oils was discussed.

7495. Amero, R.C. and Capell, R.G. **Effect of high-pressure extrusion on the adsorption capacity of floridin.** *Petroleum Refiner* **22**, 22-6 (1943).—*C.A.* 37, 1250^8.

Floridin (Fuller's earth), the most widely used oil decolorizing medium in the U.S., was improved about 30% in 10 years, largely through the addition of an extrusion step in processing. Extrusion brought about profound changes in the microscopic and possibly the submicroscopic character of the clay.

7496. BYRNS, A. C.; BRADLEY, W.E., AND LEE, M.W. **Catalytic desulfurization of gasolines by cobalt molybdate process.** *Ind. Eng. Chem.* 35, 1160-7 (1943).—*C.A.* 37, 6862[9].

Thiophenes, thiophanes, thioethers and mercaptans were decompd. to H_2S and hydrocarbons by passing straight-run or cracked stocks with H_2over a Co molybdate at 750°F and a pressure of 100-250 lb per in^2. The S content was reduced from 3.0% to less than 0.01% in favorable cases.

7497. FERNS, J.L. **Deacidification of transformer oil by activated alumina.** *Petroleum (London)* 6, 34-6 (1943).—*C.A.* 37, 6867[9].

Alumina was recommended for reclaiming transformer, turbine, circuit breaker and other oils, which were subject to relatively rapid breakdown and oxidation.

7498. HARTECK, P. AND SUHR, KL. A. **Separation of hydrocarbons by means of fractional desorption. III.** *Die Chemie* 56, 120-3 (1943).—*C.A.* 37, 5227[9].

Exptl. data were presented for the sepn. of hydrocarbons b. between 60° and 145°C. The exptl. app. was shown, and conditions given for a no. of expts., together with variations in the sepn. factor with progressive desorption. For the analysis of gasolines prefractionation into 10° cuts was recommended.

7499. KOMAREWSKY, V.I. AND RIESZ, C.H. **Catalytic reforming of straight-run gasoline increases aromatic content.** *Oil Gas J.* 42, No. 7, 90-3, 119 (1943).—*C.A.* 37, 6862[3].

Cuts from Pennsylvania straight-run gasoline were used as charging stock for catalytic aromatization. The methods studied were (a) two-stage, two-catalyst procedure with Ni alumina or Pt-alumina followed by chromia (Cr_2O_3) alumina at 310° and 450°C resp.; (b) two-stage single catalyst of Ni, chromia and alumina with temp. of 300°-450°C; and (c) a single-stage Ni, chromia, alumina catalyst at high temp.

7500. MURPHREE, E.V.; BROWN, C.L.; FISCHER, H.G.M.; GOHR, E.J., AND SWEENEY, W.J. **Fluid catalyst process. Catalytic cracking of petroleum.** *Ind. Eng. Chem.* 35, 768-73 (1943). —*C.A.* 37, 5227[4].

The fluid catalyst cracking process was described, and information was given on the production of the motor gasoline from 4 charge stocks.

7501. PEMSEL, H. **Estimation of the value of bleaching earths.** *Chem.-Ztg.* 67, 305-6 (1943). —*C.A.* 38, 1852[7].

These estns. were correctly made only by including the colorimetric value of the unbleached oil and the amts. of oil lost with the bleaching earth. A graphic method for comparing oils was given.

7502. PRICKETT, T.B. AND NEWTON, R.H. **Recent developments in Houdry fixed-bed catalytic processes.** *Petroleum Refiner* 22, 377-8 (1943); *Natl. Petroleum News* 35, R568 (1943); *Proc. Am. Petroleum Inst.*, Sect. III, 24, 89-90 (1943). —*C.A.* 38, 637[1], 1625[9].

A résumé of how the original fixed-bed Houdry process was adapted to the production of base stock for aviation gasoline.

7503. TURNER, NELSON C. **The analysis of hydrocarbon gases by adsorption fractionation.** *Natl. Petroleum News* 35, No. 18, R234-7(1943); *Petroleum Refiner* 22, 140-4(1943); *Oil Gas J.* 41, No. 51, 48, 51, 52, 69 (1943).—*C.A.* 37, 3914[4], 6860[6].

Adsorption fractionation for the analysis of light hydrocarbons was described. The analysis was made by taking advantage of the difference in compn. of the adsorbed and unadsorbed phases existing in equil. in a system with activated charcoal as the adsorbing agent.

7504. WHEELDON, HARRY. **Recycling-plant design and operation.** *Gas* 19, No. 3, 31-3 (1943).—*C.A.* 37, 2549[2].

Wet gas was first passed through a separator and then to a high-pressure oil absorber, before returning to the formation. The procedure used in determining the possible yield from wells involved the use of an experimental separator, with a meter and charcoal tube on the residue-gas side.

7505. WHITLATCH, GEO. I. **Probable new bentonitic clay horizon in Eocene of West Tennessee.** *J. Tenn. Acad. Sci.* 18, 280-4 (1943).—*C.A.* 38, 41[5].

A 22 ft vein of bentonitic clay on sample tests indicated favorable results for use in oil bleaching.

7506. BLOCH, HERMAN S. AND THOMAS, CHARLES L. **Hydrocarbon reactions in the presence of cracking catalysts. III. Cyclohexene, decalin and tetralin.** *J. Am. Chem. Soc.* 66, 1589-94 (1944).—*C.A.* 38, 6529[6].

A study was made of the reactions, at atm. pres., of cyclohexene in the presence of a synthetic SiO_2- Al_2O_3-ThO_2 catalyst at 250-400°C; of tetralin with a SiO_2-Al_2O_3-ZrO_2 catalyst at 400-500°C; and of decalin with the latter catalyst in both the fresh and partially spent state at 400-500°C.

7507. CAPELL, R.G.; HAMMERSCHMIDT, E.G., AND DESCHNER, W.W. **Dehydration of commercial gases by solid adsorbents.** *Ind. Eng. Chem.* 36, 779-84(1944).—*C.A.* 38, 5659[9].

Operating and lab. data were presented on the solid adsorption dehydration of natural gases. The adsorptive capacities of the 4 solid adsorbents tested declined with continued use and reactivation, and the loss in adsorptive capacity of the adsorbents was given as a function of the no. of reactivations. Dehydration of some gases was made difficult by H_2S or compds. forming polymers of high mol. wt. Lab. data on accelerated fouling of adsorbents showed the effect of reactivation atms. on the decline in adsorptive capacity. Florite desiccant was used continuously for 2 years in a com. plant for dehydrating natural gas under reasonably favorable operating conditions, and has dehydrated 2 million ft^3 of gas per lb of adsorbent.

7508. KLISHINA, V.E. **Experimental treatment of tar oils with alkali and decolorizing clays.** *Lesnaya Prom.* 1944, No. 6, 22-3.—*C.A.* 39, 4214^4.

Tar oils treated with alkali (NaOH or $Ca(OH)_2$) or with various decolorizing clays showed increased acidity and ash. It was recommended that the automotive-lubricant fraction of the tar be topped under reduced pressure, and that chem. treatments be avoided.

7509. MAIR, BEVERIDGE J. AND FORZIATI, ALPHONSE F. **Analytical determination of aromatic hydrocarbons by adsorption.** *J. Research Natl. Bur. Standards* 32, 151-64 (1944) (Research Paper No. 1582).—*C.A.* 38, 3569^9.

Filtration through a column of silica gel gave a filtrate free of aromatic hydrocarbons. The concn. of aromatic hydrocarbon in an unknown soln. (gasoline) was detd. by means of a calibration curve which showed the amt. of filtrate produced by the standard adsorbent from solns. of various concns. of the aromatic hydrocarbon. Results of expts. were given for several concns. of 8 binary solns. of an aromatic hydrocarbon with a paraffin or a naphthene hydrocarbon and for 3 concns. of a soln. consisting of an aromatic hydrocarbon with a paraffin and an olefin.

7510. MAIR, BEVERIDGE J. AND FORZIATI, ALPHONSE F. **Separation and recovery of aromatic hydrocarbons from paraffins and naphthenes by adsorption.** *J. Research Natl. Bur Standards* 32, 165-83 (1944) *(Research Paper No. 1583)*.—*C.A.* 38, 3570^2.

The mixt. was introduced into the top of a column contg. an excess of adsorbent [silica gel, charcoal, MgO, Al_2O_3, filtrol and Florisil]. A low-boiling paraffin hydrocarbon, such as pentane, butane or propane, was added in sufficient quantity to remove the paraffin and naphthene hydrocarbons from the column but not the aromatic hydrocarbons. These were removed by adding an appropriate desorbing liquid, such as MeOH. The paraffins, naphthenes and pentane were thus obtained as a mixt. from which the pentane was easily removed by distn. The aromatic hydrocarbons were obtained as a mixt. with pentane and MeOH. The MeOH was removed by extn. with H_2O and the pentane by distn.

7511. THOMAS, CHARLES L. **Hydrocarbon reactions in the presence of cracking catalysts. II. Hydrogen transfer.** *J. Am. Chem. Soc.* 66, 1586-9 (1944); *Natl. Petroleum News* 36, R320-2 (1944).—*C.A.* 38, 6529^3.

Some of the H needed to convert the olefins to paraffins was made available by the formation of a H-deficient catalyst deposit. Octenes were subjected to the action of a cracking catalyst under conditions which gave chiefly paraffinic products. The catalyst caused H-transfer in the absence of added cycloparaffins. This H-transfer resulted in the formation of paraffin and aromatic hydrocarbons and a carbonaceous catalyst deposit poor in H. At least 50% of the H needed to account for the paraffins found came from the catalyst deposit.

7512. BAI, ARMANDO VERGARA. **Dehydration of petroleum by means of activated clays (bentonite).** *Bol. informaciones petroleras (Buenos Aires)* 22, No. 254, 239-48(1945).—*C.A.* 40, 2609^7.

Lab. and large scale tests established that ground, calcined bentonite was an effective deemulsifier for the dehydration of petroleum. Bentonite ground to 200-325 mesh and calcined at 350-400°C, in concn. 1-3 parts per thousand, agitated for 5 min., at 60-70°C, gave best results.

7513. BARRER, R.M. AND BELCHETZ, L. **Separation of mixtures using zeolites as molecular sieves. II. The use of zeolite to resolve hydrocarbon mixtures.** *J. Soc. Chem. Ind.* 64, 131-3(1945).—*C.A.* 39, 4790^1.

Chabazite was used to sep. gaseous and liquid hydrocarbon mixts. Hydrocarbons with 1 or 2 C atoms can be sepd. from higher paraffin and cyclic hydrocarbons at room temp. or below, and at higher temps. quant. sepns. of normal paraffins from admixt. with isoparaffins and aromatic hydrocarbons were effected.

7514. BARRER, R.M. **Separation of mixtures using zeolites as molecular sieves. III. The use of zeolites to separate polar molecules from mixtures containing them.** *J. Soc. Chem. Ind.* 64, 133-5(1945).—*C.A.* 39, 4790^2.

Specific sepns. were effected, quantitatively or semiquantitatively, of polar mols. with the zeolites. Mixts. whose components had nearly the same b.p., and others that were azeotropic were sepd. The scope and possible uses of the method were discussed.

7515. HARWOOD, J. AND DAVIES, W. CULE. **Activated alumina.** *Power & Works Engr.* 40, 59-62(1945).—*C.A.* 39, 5415^8.

Applications in drying gases, liquids, and solids in the oil industry were discussed.

7516. MYERS, H.C. AND OWEN, R.M. **Economic survey of Thermofor installations in Socony-Vacuum lubricating oil refineries.** *Oil Gas J.* 44, No. 13, 93-7(1945).—*C.A.* 39, 4745^4.

An economic comparison of Thermofor kiln and other methods of adsorbent regeneration, including labor, repairs, maintenance, and utility costs for kilns of varying capacities. The installation of Thermofor kilns resulted in substantial reductions in filter-plant-operating expenses primarily as a result of reduced adsorbent purchases.

7517. REID, LAURANCE S. **Dehydration of supply gas is successful in preventing freeze-ups of pilot regulators on natural gas pipe lines.** *Petroleum Engr.* 16, No. 4, 194-7(1945).—*C.A.* 40, 3868^8.

Small-scale equipment for dehydrating natural gas with activated alumina was described.

7518. SUEN, TSENG-JOU AND YAO, FENG-HSIEN. **Some Chinese clays as adsorbing agents for treatment of gasoline and lubricating oil.** *J. Inst. Petroleum* 31, 179-87 (1945); *J. Chem. Eng. China* 12, 1-10 (1945).—*C.A.* 39, 5073^9; 40, 2964^9.

Two clays of Nanchuan, one of them classified as *collyrite*, the other as *cimolite*, and a *Tsunyi halloysite* sample were tested as to their ability to reduce the gum content of gasoline made by cracking tung oil. The *collyrite* was treated with H_2SO_4 and with HCl, and the addn. of Fe, Al, and Mg salts was also tried as a means of increasing the adsorptive power. Gasolines, rapeseed oils, and lubricating oils required different temps. for the best results in decolorization.

7519. WILLIAMS, K.A. **Peroxide values and the chromatographic separation of oxidation products as a guide to the aging of a turbine oil.** *Analyst* 70, 409-11(1945).—*C.A.* 40, 1012^2.

Turbine oils had low peroxide values during their long period of usefulness. By peroxide detns. and chromatogenic sepn. of the oxidized products, the course of the deterioration of oil in use was shown to be similar to that of the atm. oxidation of fatty oils.

7520. ALDEN, R.C. **Conversion of natural gas to liquid fuels.** *Oil Gas J.* 45, No. 27, 79-82, 97-8 (1946).—*C.A.* 41, 264*b*.

The German development of the Fischer-Tropsch process and the American refinements to use natural gas as raw material were reviewed. Natural gas was cheaper raw material, simpler to handle, and desulfurization was easier than with coal.

7521. ARTEMENKO, A.V. **Regeneration of lubricating oils with adsorbents activated by ammonia.** *Elektricheskie Stantsii* 17, No. 7, 26-8 (1946). —*C.A.* 41, 2563*f*.

The adsorptive capacity of silica gel for products of oil aging were increased by treating the gel with NH_3 vapor. Thus-treated silica gel was more effective in regenerating lubricating oils than gel not treated.

7522. EVANS, L.P. **Comparison of bead and clay catalysts.** *Oil Gas J.* 44, No. 47, 167-83 (1946).—*C.A.* 40, 4503^1.

Data were presented showing 4-8% more 10# RVP motor gasoline was obtained under the same general operating conditions of a Thermofor cracking unit by using bead catalysts as compared with clay catalyst. Clay catalyst tended to be poisoned by S and N_2 compds. in charge stocks, sometimes to a prohibitive rate of decrease in gasoline yield and increase in gas and coke formation, whereas bead catalyst was not affected in efficiency by such stocks.

7523. GRIFFITHS, J.C. **Clay research and oil-development problems.** *J. Inst. Petroleum* 32, 18-31 (1946).—*C.A.* 40, 4499^9.

Montmorillonite was the largest absorber of water. Na clays took up most water, Ca and Mg clays next, and H clays least. Montmorillonite was the most active of the clays in base exchange, in which the above-named and similar bases replaced each other, ion for ion, without destroying the lattice structure. Hence, it was possible, as an aid in oil production, to replace an unfavorable ion by a more favorable one by means of a simple soln. Substitution of Ca for Na in a clay usually means an increase of permeability.

7524. HANSON, E.A.; RADFORD, D., AND SEED, R. **The revivification of purifying material.** *Natl. Gas Bull. Australia* 10, July-Aug., 25-8 (1946).—*C.A.* 41, 2227*b*.

Analyses were made on oxide samples taken from various parts of a purifier box immediately after opening the box and for several days thereafter. The rate of revivification of dropped oxide proceeded at about one pound of S per week. Considerable revivification was effected during operation by the oxygen contained in the gas being purified. The exptl. evidence gathered indicated that a box of fouled oxide could be revivified in place by opening it to the air for a three-day period.

7525. KEITH, P.C. **Gasoline from natural gas. The development of the Hydrocol plant to convert natural gas to gasoline and the effect of new processes on the national fuel economy.** *Am. Gas J.* 164, No. 6, 11-15 (1946); *Gas* 22, No. 6, 21-6 (1946).—*C.A.* 40, 4873^6.

The Hydrocol process consisted in the conversion of natural gas to a mixt. of CO and H, followed by their catalytic reaction to produce liquid hydrocarbons boiling sustantially within the range of gasoline. Diesel oil and oxygenated compds., such as alcs., were by-products.

7526. LANE, JOHN C. AND WEIL, B.H. **Synthine (Fischer-Tropsch) process. I. Introduction, synthesis gas production and purification.** *Petroleum Refiner* 25, No. 8, 87-98 (1946).—*C.A.* 42, 9118*f*.

The ratio of H_2 to CO ranged from 2 to 1 to less than 1 to 1. Underground gasification of coal by (1) the chamber, (2) the stream, and (3) the percolation methods was discussed in some detail. Synthesis gas could also be obtained by means of the reaction: $CH_4 + H_2O \rightarrow 3H_2 + CO$ or $CH_4 + CO_2 \rightarrow 2CO + 2H_2$. Yields, catalysts, and manufg. procedures were given for these two reactions. Controlled oxidation of methane to give H_2 and CO was also economical and catalysts and reaction conditions were discussed. Regardless of its source, synthesis gas must be purified of S and its compds.

7527. LOVE, FRANK H. **Solid-adsorbent-type dehydration plant placed in operation in Carthage Field [Texas].** *Petroleum Engr.* 17, No. 5, 151-6(1946).—*C.A.* 40, 5545^9.

An activated bauxite contg. 60-70% Al_2O_3 was used to adsorb water from natural gas. The dew point of the gas was reduced from 32° to -1°C. The desiccant was regenerated by passing a flow of inlet gas through the bauxite bed that has been heated to 163°C.

7528. MAPSTONE, GEORGE E. **Some notes on the desulfurization of gasoline by adsorption.** *Australian Chem. Inst. J. & Proc.* 14, 61-7 (1946).—*C.A.* 41, 4913*b*.

The total S content of gasoline passed through a bed of adsorbent silica gel was first reduced and then increased; this subsequent desorption of some of the S compds. appears to have been overlooked by previous workers. Mercaptans were completely removed at first, the removal subsequently giving an adsorption isotherm; they did not appear to be desorbed again as were some of the less polar S compds.

7529. Papok, K.K. and Saranchuk, L.I. **Effect of refining on the thermal stability of Emba aviation oils.** *Neftyanoe Koz.* **24**, No. 9/10, 51-8 (1946).—*C.A.* **41**, 3948*g*.

Clay treatment of the oil after refining with H_2SO_4 sharply decreased its thermal stability regardless of the type of treatment preceding the acid treatment (alkali treatment, oxidation, or extn. with nitrobenzene). With increase in percentage of the clay used, the stability decreased to a min. at 20-25% of clay and remained unchanged thereafter. Clay treatment had no adverse effect on stability if it followed directly after extn. with nitrobenzene. The best results with respect to stability were always obtained when the acid treatment was last and followed by neutralization with alkali.

7530. Ramsey, L.L. and Patterson, W.I. **Separation and purification of some constituents of commercial hexachlorocyclohexane.** *J. Assoc. Official Agr. Chem.* **29**, 337-46(1946).—*C.A.* **41**, 831*b*.

By means of partition chromatography, using silicic acid as the column medium, nitromethane as the immobile solvent, and n-hexane as the mobile solvent, tech. hexachlorocyclohexane (benzene hexachloride or "666") was sepd. into its known isomers, alpha, beta, gamma, delta; in addn. 2 other cryst. compds. were isolated, one having the empirical formula of heptachlorocyclohexane and the other with the compn. of octachlorocyclohexane. This general technique shows some promise for the sepn. and purification of the minor and more sol. constituents of complex chem. mixts.

7531. Rytslin, A.M. **Use of silica gel for regeneration of transformer oil.** *Elektricheskie Stantsii* **17**, No. 8, 56 (1946).—*C.A.* **41**, 2563*g*.

Silica gel prepd. at the power-generating station from equal vols. of a 1.3 sp. gr. Na silicate soln. and 50% HCl was fully satisfactory for continuous regeneration (thermosiphon method) of transformer oil.

7532. Terwilliger, P.L. and Yuster, S.T. **Chemical agents in water flooding.** *Tenth Tech. Conf. in Petroleum Production in Penna. State Coll. Mineral Inds. Expt. Sta., Bull.* No. **45**, 41-51 (1946) (Pub. 1947); *Oil Weekly* **126**, No. 1, 54-6 (1947).—*C.A.* **41**, 7081*i*, 5287*e*.

At present H_2O flooding is an inefficient process because 25% of the oil is left in the sand after the flood. Expts. showed that there would be a slight increase in recovery if SO_2 were forced into a sand before a H_2O-flood was begun and a small decrease if NH_3 were used. There was no appreciable difference in recovery when H_2O-sol. surface-inactive compds. such as borax, Na_2CO_3, NaOH, and Na_2SO_3 were used as compared to the results with distd. H_2O. The oil-sol. wetting agents did not increase recovery and were adsorbed by the sand surface; this would make their use impractical.

7533. Ventura, Manuel Mateus. **Adsorbent earths from the Northeast of Brazil.** *Rév. soc. brasil quím.* **15**, 11-29(1946).—*C.A.* **41**, 6739*d*.

Four different earths were compared in adsorbing power to frankonite; 2 of them were found to have good qualities as adsorbing agents of pigments extd. during the bleaching process of oils.

7534. Amero, R.C. and Wood, W.H. **Catalytic desulfurization of cracked and straight-run gasolines.** *Oil Gas J.* **46**, No. 3, 82-5, 99(1947).—*C.A.* **41**, 4913*d*.

Lab. investigations were reported which showed that the relative efficiencies of fuller's earth and bauxite as desulfurizing catalysts depended upon the characteristics of the stock being treated. Where the 2 had equal abilities, Fuller's earth had an economic advantage.

7535. Augustin, Stéphane. **Decolorizing earths.** *Tech et appl. pétrole* **2**, 297-8 (1947).—*C.A.* **41**, 6030*a*.

7536. Berg, Clyde. **Hypersorption; a process for separation of light gases.** *Gas* **23**, No. 1, 32-7 (1947).—*C.A.* **41**, 1412*g*.

A moving bed of activated charcoal adsorbed hydrocarbons from lean gas streams: C_2H_4 from gases produced in cracking, C_3H_8 from heavier components of natural gas, sepn. of CH_4 from H_2, and similar applications. Activated charcoal descended through a cooler section, in which H_2O was removed by a gas current, then through the adsorption section, countercurrent to the gas to be stripped, then through the rectifying section, where it was contacted with a reflux of heavy constituents liberated by the stripper at the bottom of the unit. Steam introduced below the stripper passed countercurrent to the charcoal in the vertical stripper tubes, through the steaming section, and was discharged with the bottom-product gas. A small parallel stream of charcoal was activated by a high-temp, steam stripping operation to remove heavy residual hydrocarbons.

7537. Bogulovskaya, M.A. and Velikovskii, A.S. **The adsorption method of producing oils and determining their composition.** *Neftyanoe Khoz.* **25**, No. 3, 52-60(1947).—*C.A.* **41**, 7083*a*.

The group compn. of a fraction from naphthene-base crude oil was detd. by passing a sample dild. with a low-boiling paraffin hydrocarbon into a tall column of silica gel until completely adsorbed, then adding more of the low-boiling paraffin and collecting successive portions of the ext. soln. This yielded a series of naphthenic and aromatic fractions, in which the aromatic content was detd. by sulfonation and by measuring the sp dispersion. The resins were extd. from the silica gel with Me Et ketone and finally in a Soxhlet app. with acetone, but not investigated.

7538. Corigan, Brian. **Oil purification, filtration reclamation.** *Iron Age* **159**, No. 14, 56-62 (1947).—*C.A.* **41**, 3606*b*.

Lubricating oil could be purified by 3 basic methods: gravity purification methods; filtering, and reclaiming methods. Oil was reclaimed by chem. treatment in connection with clay treatment by either of the following methods: treatment with alk. or caustic solns.; acid treatment followed by caustic or clay neutralization. Details of these treatments were given.

7539. DEED, DONALD W.; SCHUTZ, P.W., AND DREW, THOMAS. **Comparison of rectification and desorption in packed columns.** *Ind. Eng. Chem.* 39, 766-74 (1947).—*C.A.* 41, 4970*d*.

Rectification and desorption expts. were performed in the same packed tower in order to det. whether the height of a transfer unit was the same for both processes. On the basis of these expts. and those of other authors, no clear evidence of any difference was found, but the results were not sufficiently accurate to be conclusive.

7540. DINNEEN, G.U.; BAILEY, C.W.; SMITH, J.R., AND BALL, JOHN S. **Shale-oil naphthas. Analysis of small samples by the silica gel adsorption method.** *Anal. Chem.* 19, 992-8(1947).—*C.A.* 42, 3941*g*.

The sample free of tar was passed through 50 g of silica gel (passed No. 150 U.S. standard sieve) in a column consisting of two sections, 1.3 cm inside diam. by 40 cm and 0.6 cm inside diam. by 85 cm. The components of the sample were arranged along the silica in order of decreasing adsorbability. With samples boiling below 200°C, 2-propanol was used as the desorbing solvent. N_2 pressure was used to force the sample and solvent through. If a paraffin and naphthene were present in equal concns., the compd. having the greater no. of C atoms emerged first. Aliphatic olefins emerged in order of decreasing mol. wt, followed by cyclic olefins. Difficulties arose when the aromatic compds. had a lower viscosity than the two other groups.

7541. DONALDSON, JOHN A.; LOOMIS, RAY J., AND KRCHMA, L.C. **The measurement of aggregate absorption.** *Proc. Assoc. Asphalt Paving Technol.* **16**, 353-72 (1947).—*C.A.* 43, 7207*e*.

An adapted Centrifuge Kerosene Equivalent test was used as a quant. measure of absorption. The procedure measured the kerosene absorbed and retained on the surface of the known nonabsorptive aggregate (Platte River gravel) of the same gradation.

7542. GANDYRUINA, A.I. **Study of the filtration process in purification of lubricating oils with clays.** *Azerbaidzhanskoe Neftyanoe Khoz.* 26, No. 5, 21-3 (1947).—*C.A.* 43, 3182*i*.

For the purpose of studying their effect on filtration, oil was freed of all surface-active components, such as naphthenic acids and tars. Then these substances were added in controlled quantities, the oil was stirred with clay, and the time of filtration noted. The surface-active compds. added to the oil impeded filtration and the time of filtration was prolonged 4-5 fold. Sulfonic acids and tars were most active in this respect.

7543. GOL'DBERG, D.O. **Improving oil purification with activated gumbrin.** *Azerbaĭdzhanskoe Neftyanoe Khoz.* 26, No. 11, 24-6(1947).—*C.A.* 43, 3996*i*.

The effect of acid concn. on the activation of gumbrin clay (a floridin type of bleaching clay) was studied. Up to 20% strength, the quantity of acid was immaterial, above 20% excess quantity lowered the effectiveness of the clay. The recommended procedure was to use 10% strong H_2SO_4 taking 25%, calcd. as monohydrate, of the quantity of clay.

7544. HALL, C.C. **The production of oil from coal by the Fischer-Tropsch process.** *J. Junior Inst. Engrs. (London)* 57, 309-34 (1947).—*C.A.* 42, 2743*d*.

A discussion of the history, the main steps of the process, the reaction products, and costs.

7545. HIRSCHLER, ALFRED E. AND AMON, SENTA. **Adsorption - a tool in the preparation of high-purity saturated hydrocarbons.** *Ind. Eng. Chem.* 39, 1585-96 (1947).—*C.A.* 42, 1102*i*.

Sepn. by adsorption of isomeric hydrocarbons was accomplished, including geometric isomers, and many binary mixts. of the paraffin-paraffin, paraffin-naphthene, and naphthene-naphthene types. Unsatd. and high-mol.-wt hydrocarbons were also examd. The adsorbents studied were silica gel, activated carbon, and activated alumina, the latter giving very little sepn. Most of the systems had S-type isotherms on silica gel whereas on activated carbon the majority had U-type isotherms. Adsorbability in the liquid phase on silica and carbon was in part a function of mol. wt, and in a homologous series appeared to decrease with increased mol. wt for silica gel, whereas carbon exhibited the reverse effect.

7546. HORNBERG, C.V.; KEIPER, E.D., AND CHESNEY, R.M. **Use of bead catalyst in commercial Houdry units.** *Oil Gas J.* 46, No. 12, 214-16, 242-3(1947).—*C.A.* 41, 6697*c*.

The performance record of bead catalyst in the first year of service in the Socony-Vacuum Houdry unit at Paulsboro was excellent. Outstanding from the operators' viewpoint were the relative freedom from orifice plugging and the smooth regeneration characteristics.

7547. KING, J.G. **The control of chemical reactions on a large scale.** *Gas Times* **51**, 369-72 (1947); *Inst. Gas Engrs., Commun.* No. 315, *Gas World* **126**, 779-86, 808; **127**, 93-8 (1947).—*C.A.* 41, 7015*e*.

Fluid catalyst process of oil refining, downflow system, control of flow of solids, applications of the "fluidized" technique, catalytic reactions, and gas-solid reaction technique were discussed.

7548. LANE, JOHN C. AND WEIL, B.H. Synthine **(Fischer-Tropsch) process. II. The catalytic synthesis, including catalysts and reaction mechanisms. III. Products, by-products, and**

special topics. IV. Basic economics and the current situation. *Petroleum Refiner* **28**, No. 9, 423-34; No. 10, 493-504; No. 11, 587-98 (1947).—*C.A.* **42**, 9118*i*.

Two main reactions took place: (1) $n\mathrm{CO} + (2n+1)\mathrm{H_2} \rightarrow \mathrm{C}_n\mathrm{H}_{2n\pm2} + n\mathrm{H_2O}$; (2) $n\mathrm{CO} + 2n\mathrm{H_2} \rightarrow \mathrm{C}_n\mathrm{H}_{2n} + n\mathrm{H_2O}$. Since the reaction was exothermic and involved a reduction in vol., relatively low temps. and elevated pressures favored the reaction. Temps. ranged from 375°C with Ni or Co catalysts to 465°C with Fe catalysts, and pressures varied from atm. pressure to 150 $\mathrm{lb/in^2}$. The synthesis gas was passed through reaction chambers in one or more stages, with or without recycle of the unconverted portion. The heavier products were condensed from the residual gas and the lighter products were adsorbed on charcoal or in oil.

7549. LEE, JAMES A. **Esso's fluid catalyst modifies Fischer-Tropsch.** *Chem. Eng.* **54**, No. 10, 105-7(1947).—*C.A.* **44**, 5075*h*.

By use of a fluid catalyst contg. Fe as against the original solid Co type, the efficiency of the Fischer-Tropsch process in pilot and full-scale production was much increased. Natural gas was used as the raw material and the gasoline produced had a relatively high octane no.

7550. MAMEDLI, M. G. **Catalytic purification of gasolines.** *Doklady Akad. Nauk Azerbaĭdzhan. S.S.R.* 3, No. 1, 8-9 (1947).—*C.A.* **46**, 1743*g*.

Desulfurization of Karachukhursk gasoline by means of clays at 400°C to the extent of 69-70% was reported, the starting material having 0.041% S. Four specimens of local clay, gumbrin, and Tula bauxite proved to be identical in effectiveness.

7551. MURPHREE, E.V.; GOHR, E.J., AND KAULAKIS, A.F. **The fluid-solids technique; applications in the petroleum industry.** *J. Inst. Petroleum* 33, 608-20 (1947).—*C.A.* 42, 3162*i*.

This technique has proven to be so successful in catalytic cracking to produce gasoline of high antiknock rating that the work capacity of cracking by the method was 1,000,000 bbl./day, or 60% of the total catalytic cracking capacity. Flow of catalyst was continuous through both the reactor and the regenerator. The oil products passed out of the reactor at the top, the spent catalyst was drawn out from the bottom and forced by a stream of air into the regenerator. The regenerated catalyst and the fresh oil to be charged entered the reactor near the bottom with the aid of steam.

7552. NELSON, J.A. **The filtration of Diesel lubricating oils.** *Power Plant Eng.* **51**, No. 4, 122-6 (1947).—*C.A.* **41**, 3606*f*.

The cleaning of the oil should include removal of solids, such as dirt, fuel soot, and metal particles, as well as water. The use of adsorbent earths was not recommended, partly because such use frequently removed "additives" which were especially valuable in heavy-duty oils.

7553. PRETTRE, M. **Methane as a reactant in hydrocarbon syntheses.** *Conf. réunion soc. belge étude pétrole, dérivés et succédanes (Brussels)* **1947**, 16 pp.; *Rév. inst. franc. pétrole et Ann. combustibles liquides* **2**, 131-40, 195-200 (1947).—*C.A.* **42**, 6084*c*.

Hydrogenating and cracking reaction mixts. contg. $\mathrm{CH_4}$ yielded considerable amts. of $\mathrm{CH_4}$ after completion of the process. The used contact catalyst contained considerable amts. of adsorbed $\mathrm{CH_4}$. Only a small portion of the Me radicals in the adsorbed phase on the catalyst was found as $\mathrm{CH_4}$ in the reaction products; by far the greater part of the radicals reacted with adsorbed hydrocarbons or their radicals to form either straight-chain or branch homologs.

7554. ROBERTS, GEORGE JR. AND PHINNEY, J.A. **Manufacture of synthetic gasoline nearing commercial application in U.S.** *Oil Gas J.* **45**, No. 45, 72-3, 139-41(1947).—*C.A.* **41**, 4286*h*.

The engineering aspects of the com. synthetic gasoline plants in Germany and of the proposed plants in the U.S. were outlined. An Fe catalyst replaced the German Co catalyst. Another improvement was the fluidized catalyst technique.

7555. SALDAÑA, LUIS ALVA. **The activation of bentonite from Paracas for decolorizing of oils.** *Bol. soc. quím. Peru* **12**, 197-210(1947).—*C.A.* **42**, 1031*c*.

The bentonite was treated with $\mathrm{H_2SO_4}$ under various conditions and the ability of the product to decolorize a neutral crude oil was studied. The best results were obtained with bentonite from which 25% of the basic constituents was removed. The activated bentonite was obtained by treatment with 98% $\mathrm{H_2SO_4}$ (1 hr, 200°C), or with dil. acid over longer periods of time.

7556. SNUGGS, JOHN F. **Regeneration of spent catalyst in fluid catalytic cracking.** *Petroleum Engr.* **18**, No. 6, 230-6 (1947); *Oil Gas J.* 45, 88-91 (1947).—*C.A.* **41**, 3283*b*, 4296*f*.

The regeneration of spent cracking catalyst was accomplished by burning 1-2 wt % of carbonaceous material from the catalyst under closely controlled operating conditions. The large amt. of heat produced by this combustion was used to support the reaction in the catalytic conversion zone and to produce steam. A description of the facilities used for regeneration and the integration of these facilities with the rest of the catalytic plant was presented.

7557. SULLIVAN, FREDERICK W. JR. **Fuel synthesis by-products as a source of chemicals.** *Chem. Eng. Prog.* 43, No. 12, 13-17 (1947).

The Hydrocol process for the production of liquid fuels from natural gas was described. The various chemicals which would be available in large quantities were outlined.

7558. VAN DORNICK, E. **Modern fluid catalytic cracking.** *Petroleum Engr.* **18**, No. 7, 149-54 (1947).—*C.A* **41**, 3945*i*.

The operation and advantages of fluid catalytic cracking were described and economic considerations discussed.

7559. VELIKOVSKII, A.S.; PAVLOVA, S.N. GOFMAN, P.S., AND DRIATSKAYA, Z.V. **Use of the adsorption method in determining the chemical composition of straight-run gasoline and kerosene.** *Neftyanoe Khoz.* 25, No. 9, 30-9(1947).—*C.A.* 42, 3941*b*.

The sepn. of artificial binary and ternary mixts. of hydrocarbons and of straight-run gasolines and kerosenes into aromatic and non-aromatic hydrocarbons by passage through a column packed with silica gel gave results comparable to those obtained by treatment with H_2SO_4. With an aromatic content as high as 20%, only 25-28 g of silica gel was needed to obtain 3.2-3.5 ml of filtrate free from aromatic hydrocarbons. After these preliminary expts. columns contg. 1000 g and 150 g silica gel were set up for handling a charge of 300 and 50 ml, resp. The procedure used in packing them, feeding the charge and the desorbent liquid (alc. or H_2O), collecting the fractions, and regeneration of the silica gel was described in detail.

7560. BARROW, D.N. **Natural-gas dehydration.** *Petroleum Refiner* 27, No. 12, 645-8(1948).—*C.A.* 43, 3171*i*.

The most satisfactory method of removing moisture was by the use of liquid or solid desiccants. Flow diagrams were given for processes in which diethylene glycol and activated Al_2O_3 were used. Both methods gave a wide range of throughput capacity. A graph of moisture content of satd. gas vs. temp. and pressure was also included.

7561. CARNEY, W. M.; NOLL, HENRY D., AND HOGE, A. WESLEY. **Thermofor catalytic cracking unit catalytically processes sour gas oil.** *Petroleum Engr.* 20, No. 2, 246-50; *Petroleum Times* 52, 974-6(1948).—*C.A.* 43, 840*i*.

A charging stock contg. 1.7% S was successfully processed. Less than 5% of the total S present in the reactor charge appeared in the gasoline produced.

7562. CONRAD, ANNE L. **Determination of aromatic compounds in petroleum products. Chromato-graphic method.** *Anal. Chem.* 20, 725-6 (1948).—*C.A.* 43, 3179*c*.

A rapid (45-min.) method was described which employed columns of silica gel. A hydrocarbonsol fluorescent material was added to the sample (2- to 5-ml) which was developed on a 9-mm internal-diam. column with 2 vol. of EtOH or iso-PrOH. Ultraviolet illumination permitted accurate measurement of the fluorescent (aromatic) band. A precision with ± 2% was claimed.

7563. FOSTER, ARCH. L. **Hypersorption - this process provides precise concentration-separation of gases.** *Oil Gas J.* 47, No. 15, 90-100 (1948).—*C.A.* 42, 8448*f*.

The process employed the principle of selective adsorption of hydrocarbons by a moving bed of activated charcoal, with the subsequent removal of the adsorbed hydrocarbons by heat and steam. It was applied to the recovery of C_2H_4 found in relatively low concns. in natural gas, where high recoveries and high concns. of the product were desired. The details of a com. operation were discussed.

7564. GARD, C.D. **The extraction of carbon dioxide gas from natural gas and the manufacture of Dry Ice.** *Calif. Oil World* 41, No. 24, 3-15 (1948).—*C.A.* 43, 1882*d*.

Natural gas from the petroleum field was purged of CO_2 with a 20% soln. of monoethanolamine and H_2O. It was purified by extg. the H_2S with Fe_2O_3-soda ash soln. The gas was dried with activated alumina.

7565. HELMERS, C.J. AND BROONER, G.M. **Catalytic desulfurization and reforming of naphthas over bauxite.** *Petroleum Processing* 3, 133-8(1948). —*C.A.* 42, 9142*c*.

Catalytic desulfurization of both straight-run and cracked naphthas offered a means of improving the clear and leaded octane rating. Even though S-content of a cracked gasoline was relatively low, it was treated over bauxite at normal desulfurizing conditions since a part of the octane-improvement of cracked stocks was due to olefin isomerization. Catalytic reforming of naphtha over bauxite differed from catalytic desulfurization in that a higher temp. level was required, some gaseous products produced, and the unleaded octane rating improved from 5 to 15 octane nos.

7566. HOLM, ULLA AND WODE, GUNNAR. **A spectrophotometric study of oils.** *Arkiv. Kemi, Mineral. Geol* 26A, No. 29 10 pp. (in English) (1948).—*C.A.* 43, 4873*i*.

Crude, oxidized, and refined oils were chromatographically fractionated into 2 adsorbed fractions and a percolate, and studied spectrophoto-metrically. Peroxides were concentrated by adsorption on Al_2O_3 to make possible more accurate detn. of the peroxide value of fat with low peroxide content than did the direct method. The results on crude cottonseed oil showed a low content of conjugated trienes and no max. at 2300 A. (i.e. no dienes). Chromatographically adsorbed portions of the oil had a high percentage of dienes. Bleaching decreased dienes and increased trienes. Deodorization decreased both, owing probably to polymerization.

7567. HUBBARD, RETHEL L. AND STANFIELD, K.E. **Determination of asphaltenes, oils, and resins in asphalt.** *Anal. Chem.* 20, 460-5(1948). —*C.A.* 42, 6098*i*.

About 1.5 g of asphalt was dispersed in pentane and allowed to stand overnight, pptg. the insol. asphaltene fraction. The concd. pentane ext. was adsorbed on anhyd. Al_2O_3 and extd. first with pentane to give an oil fraction and then with a 10:90 vol. mixt. of MeOH and C_6H_6 to obtain the resin fraction.

7568. JOHNSTON, R.W.B.; APPLEBY, W.G., AND BAKER M.O. **Determination of olefins in gasoline. Application of infrared spectroscopy.** *Anal. Chem.* 20, 805-12(1948).—*C.A.* 43, 383*a*.

Synthetic blends of pure olefins in n-C_7H_{16} were used to prep. calibration curves for the semiquant detn. of α olefin types and other olefin types in gasolines. The method was best applied to an olefin concentrate prepd. by adsorption of the sample on silica gel, the olefin fraction being desorbed between the satd. and aromatic compds. The method was applied to catalytically cracked, thermally cracked, and reformed gasolines.

7569. KEHDE, HOWARD; FAIRFIELD, R.G.; FRANK, JOSEPH C., AND ZAHNSTECHER, L.W. **Ethylene recovery. Commercial hypersorption operation.** *Chem. Eng. Progress* 44, No. 8, 575-82 (1948).—*C.A.* 42, 8149*g*.

The first plant was built in 1947 for the Dow Chemical Co. to recover small concns. of C_2H_4 from a H_2- CH_4 stream at 75 p.s.i. From a feed gas contg. 4.5-6.0 vol. % C_2H_2, an ethylene product was obtained of 92-93% purity and 0.1% max. CH_4 contamination. The H_2-CH_4 overhead stream contained less than 0.1% C_2H_4. During its operation the unit ability to absorb increased in C_2H_4 content of the feed as high as 400% of the design compn. for several hrs before appreciable quantities of C_2H_4 were lost overhead in the discharge gas.

7570. KIPP, E.M. **Filtration of insulating oils through adsorbent materials.** *Lubrication Eng.* 4, 122-4(1948).—*C.A.* 44, 6110*c*.

By means of a modified ASTM turbine oil oxidation cell from which the oil was by-passed through an adsorbent, it was shown that sludging was inhibited and, as a result, the life of the oil was greatly prolonged. Application to elec. power systems was discussed.

7571. LATTA, JAMES E. AND WALKER, SCOTT W. **Commercial application of hydrocarbon synthesis in the United States.** *Chem. Eng. Prog.* 44, No. 2, 173-6 (1948).

Two commercial plants to synthesize hydrocarbons and oxygenated derivatives of hydrocarbons were mentioned. The synthesis feed gas was prepd. by the partial combustion of natural gas with O_2 at 20 atm. The synthesis reaction was conducted over a cheap Fe catalyst in a fluid bed yielding hydrocarbons as the principal products, with smaller amounts of oxygenated derivatives as byproducts. Operability of the fluid iron catalyst process was confirmed in pilot plants, but much research work was required to det. the many effects of changes in the reaction variables.

7572. LECUTIER, EDMOND; LE BARBIER; DUBREUIL, RENÉ, AND DUBOIS. **Conditions of temperature and humidity in chemical gas purification with iron oxide.** *Compt. rend. congr. ind. gaz Paris* (Assoc. tech. ind. gaz France) 65, 333-81 (1948).—*C.A.* 46, 10585*a*.

An elaborate study of temp. and humidity conditions in purification boxes with many examples, heat balances, etc.

7573. MAIR, BEVERIDGE J. **Fractionation and analysis of hydrocarbons by adsorption.** *Ann. N. Y. Acad. Sci.* 49, 218-19(1948).—*C.A.* 42, 5378*e*.

7574. MALQUORI, ALBERTO. **The surface activity of argillaceous materials. I. Colloidal phenomena due to the adsorption of sulfur on various types of clays. II. Reactivity of sulfur adsorbed on various types of clay and the factors that affect it.** *Ann. chim. applicata* 38, 137-45, 146-51(1948).—*C.A.* 45, 6898*g*.

The *thixotropic index* (TI) of a clay was defined as the vol. of H_2O per g of clay just sufficient to prevent flow if the sample tube is inverted after resting 1 min. vertically. Less adsorbed S dissolved in lime water when the sample was aged in a humid atm. than when the sample was freshly prepd.

7575. O'CONNOR, BUELL. **Silica gel percolation. Application to synthol.** *Ind. Eng. Chem.* 40, 2102-3(1948).—*C.A.* 43, 1169*e*.

The classes of compds. were detd. by n_D^{20} measurement after sepn. by passage through silica gel columns (75% of particles restrained by 325 mesh) in heptane with MeOH as the eluting agent and a pressure of 35 p.s.i. In the presence of oxygenated materials the addn. of a red azo dye permitted detn. of hydrocarbon and oxygenated fractions in synthol, since the dye would not pass through until the hydrocarbon fraction was through.

7576. ROSS, DONALD W. **A method of evaluating bleaching clays.** *U.S. Bur. Mines, Repts. Invest. No.* 4295, 26 pp. (1948).—*C.A.* 42, 6522*c*.

Petroleum oils were decolorized or clarified by activated clays. Decolorizing capacities were detd. by modified percolation and contact methods at room and elevated temps. on air-dry clay, clay, clay dried at various temps., and on both activated and unactivated materials. The decolorizing capacity of any given clay increased as its absorbed H_2O content decreased. No decolorizing capacity figure had a definite meaning unless the remaining absorbed moisture was also indicated. The activation treatment consisted of actively boiling for 1 hr 50 g of dry clay plus 30 ml of 95%, 1.84-gravity H_2SO_4, plus enough distd. H_2O to make a total vol. of 300 ml in a 600-ml beaker.

7577. SMIT, W. M. **Application of adsorptive percolation to the analysis of hydrocarbon mixtures.** *Anal. Chim. Acta* 2, 671-80 (1948) (in English).—*C.A.* 43, 7868*d*.

An empirical factor, called the "transport factor," was defined as the ratio of the wt of the adsorbent in a column to the volume of developer necessary to transport the front of the adsorption band of a certain substance from the top of the column to the bottom. Transport factors of 5 hydrocarbons, on SiO_2 gel in a combination with several developers, were detd. and a sepn. of the mixt. carried out with three developers.

7578. VERGARA, A. A. **Dehydration of petroleum with activated clays.** *Experimenta* (Mendoza) 1, 48-61(1948).—*C.A.* 45, 8236*h*.

Calcined and finely ground bentonite was used as absorbent or adsorbent under varying conditions. The optimum concn. of bentonite was 1-3 g per liter of petroleum; fineness grade 200-325-mesh (U.S. standard); calcination temp. 350-400°C; and optimum temp. of petroleum from 55 to 60°C. Bentonite proved more effective than did chem. agents hitherto used. Tests on an industrial scale were described.

7579. BACKHOUSE, T. AND HAM, A. J. **A study of the relationship between composition and ignition quality of nonolefinic gas oils.** *Fuel* 28, 246-52 (1949).—*C.A.* 44, 827*e*.

An adsorption technique was developed to sep. a nonolefinic gas oil into two distinct fractions, one aromatic and the other entirely satd. Percolation of a gas oil through silica gel removed the S compds. along with the aromatic components. In each series of blends of a particular gas oil and its sep. fractions there was a linear relationship between the cetane no. and the percentage of satd. compds. present.

7580. BERG, CLYDE; FAIRFIELD, R. G.; IMHOFF, D. H., AND MULTER, H. J. **The hypersorption process for separation of gases and vapors.** *Petroleum Refiner* 28, No. 11, 113-20(1949).—*C.A.* 44, 3746*d*.

The present status and possible applications of the process were reviewed.

7581. BROOKS, BENJAMIN T. **Active-surface catalysts in formation of petroleum. II.** *Bull. Am. Assoc. Petrol. Geol.* 33, 1600-12 (1949).—*C.A.* 44, 6107*a*.

The tendency of oils with more light constituents and less heavy residue to correspond with greater age and depth was not as regular as previously thought.

7582. BROWN, BAHNGRELL W. **The effect of sodium carboxymethylcellulose on bentonite.** *World Oil* 129, No. 6, 122, 124 (1949).—*C.A.* 43, 8652*g*.

Na carboxymethylcellulose had considerable viscosity in aq. soln. and imparted viscosity and gel strength to certain clays far out of proportion to its phys. properties. The response of a given clay was in the largest part a function of the clay itself.

7583. CLARK, ALFRED; ANDREWS, ANTHONY, AND FLEMING, HAROLD W. **Composition of a synthetic gasoline.** *Ind. Eng. Chem.* 41, 1527-32 (1949).—*C.A.* 43, 7211*h*.

A synthetic gasoline prepd. by reaction of CO and H_2 with a fluidized Fe catalyst of the synthetic-NH_3 type was debutanized and sepd. by distn. into 8 fractions—C_5 to C_{12} inclusive. Br_2 no., hydroxyl no., carbonyl no., and acid no. were detd. on each fraction, and each was sepd. into paraffins, olefins, aromatic, and oxygenated compds. by percolation at 0°C through silica gel, with abs. EtOH as the desorbing liquid.

7584. DOBRYANSKIĬ, A. F.; BOGOMOLOV, A. I., AND SHKLYAR, I. V. **Catalytic effect of geological formations on the composition of petroleum.** *Zhur. Priklad. Khim.* (J. Applied Chem.) 22, 1124-32(1949).—*C.A.* 45, 3583*b*.

Heating of wide fractions of cylinder oil with bentonite-glass ring packing in a Cu vessel at 250°C, 70 hrs resulted in significant decyclization. The reactions which involve H-transfer can be correlated with similar effects in nature.

7585. EAGLE, S. AND SCOTT, J. W. **Refining by adsorption. New cyclic adsorption process separates high-purity aromatics and olefins from petroleum.** *Petroleum Processing* 4, 881-4 (1949).—*C.A.* 44, 1680*h*.

A novel cyclic procedure utilized a plurality of adsorption columns, each contg. fine particle size adsorbent. Cyclic operation was secured by automatically shifting the adsorption columns countercurrent to the feed injection point and product-withdrawal points. Premium kerosene, Diesel fuels, spray oils and lubricating oils as well as high-purity aromatics and olefins were readily prepd.

7586. FUNAKUBO, EIICHI AND KAWASAKI, GENICHI. **Fractionation of coal-tar components by chromatography. I. II.** *Coal Tar* (J. Japan Tar Ind. Assoc.) 1, 193-5, 319-24 (1949).—*C.A.* 46, 7740*c*.

Two samples of anthracene, purified by fusion and H_2SO_4 treatment were analyzed by chromatography. The former contained anthracene 85.3, anthraquinone 8-12, and unknown substances 2% or more. The latter contained anthracene 85.46, anthraquinone 1.2-4.85, carbazole 2.60-5.48, and unknown substances 3.7% or more. No measurable amount of anthraquinone was formed during the chromatography.

7587. GODLEWICZ, M. **A new method for the separation of hydrocarbons by selective adsorption.** *Nature* 164, 1132-3(1949).—*C.A.* 44, 3396*f*.

The method was based on the use of indicators such as trinitrobenzene, deposited on silica gel. These produced a color which was dependent mainly on the structure of the hydrocarbon.

7588. HARESNAPE, DOROTHY; FIDLER, F. A., AND LOWRY, R. A. **Separation of sulfur compounds by adsorption on silica gel.** *Ind. Eng. Chem.* 41, 2691-7 (1949).—*C.A.* 44, 2214*c*.

S compds. were sepd. from each other and from aromatic hydrocarbons by adsorption on silica gel. Abs. EtOH was used as the eluent in most cases. Toluene was separable in all cases, but sepn. from BuSH and $(EtS)_2$ was best done at 0°C and was not sharp. The relative adsorbabilities were given in increasing order: aromatic hydrocarbons, thiophenes, alkanethiols, alkane disulfides, aromatic and cycloalkanethiols, alkane sulfides, and cyclic sulfides.

7589. HENNIKER, J. C. AND McBAIN, J. W. **Flow in a thin glass capillary as affected by wetting the exterior of the capillary.** *Science* 109, 286 (1949).

The particularly marked retardation in the flow of crude petroleum might occur if the apparatus or the oil was exposed to radiant energy during a measurement, or if the room temperature rose just before a measurement. Either of these variations would have warmed the dry capillary or reservoir of oil more rapidly than the capillary surrounded by a relatively large mass of water, and would then have led to a faster flow in the dry tube than in the wet.

7590. HIBBARD, R. R. **Silica gel fractionation of 300-viscosity lubricating oil.** *Ind. Eng. Chem.* 41, 197-200 (1949).—*C.A.* 43, 6400*h*.

A chromatographic fractionation was run to resolve a 300-viscosity red oil into its hydrocarbon types. A large no. of fractions were taken and phys. and chem. properties detd. on many of them. Blends contg. 10% of the various aromatic fractions were run in the Sohio oxidation test and the tendencies of these fractions to form sludge, pentane insolubles, and acids have been related to hydrocarbon type.

7591. HOGE, A. W. AND TERNAN, WM. **Ashland modernizes wartime Thermofor catalytic cracking unit.** *Petroleum Engr.* 21C, No. 4, 7-10(1949). —*C.A.* 43, 4839*b*.

Conversion of the reactor from countercurrent to concurrent flow and modification of catalyst-handling facilities increased the gasoline yield and furnace oil yield of a cracking unit by 50 and 20%, resp.

7592. HRÁDEK, VÁCLAV. **Conversion of light hydrocarbons into carbon monoxide and hydrogen.** *Paliva a voda* 29, 100-2, 122-6 (1949); 31, 266-77, 303-18, 371-5 (1951).—*C.A.* 46, 5290*g*.

CH_4 and other light hydrocarbons could be converted into gases rich in H_2 by heating (1) with H_2O (endothermic) to give CO or CO_2 and H_2, depending on the ratio of CH_4 to H_2O, or (2) with a limited supply of air (exothermic) to give CO or CO_2 and H_2. Reaction (2) can supply the heat required for (1). Ni and Co oxides, activated with alk.-earth metal oxides on Al_2O_3-SiO_2 carriers were used as catalysts.

7593. KAMIEŃSKI, B. **Potentiometric chromatography. II. A microelement for the detection of weak acids and bases in gasoline solutions.** *Bull. intern. acad. polon. sci., Classe sci. math. nat.* 1949A, 75-80.—*C.A.* 44, 8098*e*.

A micro cell consisted of 2 concentric tubes: the center one contained a Pt wire sealed in a glass tube and tipped with a thin adsorption layer of silica gel contg. quinhydrone, and the outer tube was a micro calomel electrode tipped with a sintered glass filter satd. with KCl soln. The output, as measured on a Lindeman quadrant electrometer, when the cell was immersed successively in gasoline-cinchonidine and gasoline-caproic acid concn. of about 0.05%, 40 mv. at 0.005%, and 22 mv. at 0.0005%.

7594. LAWRENCE, A. S. C. AND BARBY, D. **Chromatographic fractionation of black oils.** *Discussions Faraday Soc.* 1949, No. 7, 255-8.—*C.A.* 45, 1755*b*.

A fuel oil from Venezuela was sepd. by vacuum distn. into 4 volatile fractions and a residuum. Each fraction and the original oil were chromatographed and compared. Al_2O_3 was used as the adsorbent. Samples were placed on the column as a 2% soln. in hexane (optimum). This was followed by cyclohexane, toluene, and $CHCl_3$. The sepn. of the black oils into hydrocarbon types was feasible.

7595. MAIR, BEVERIDGE J.; SWEETMAN, ALBERT J., AND ROSSINI, FREDERICK D. **Separation of gas-oil and wax fractions of petroleum by adsorption.** *Ind. Eng. Chem.* 41, 2224-30 (1949).—*C.A.* 44, 825*e*.

In a single pass through silica gel, the gas-oil fraction of petroleum could be sepd. into 3 portions: (1) a mixt. of paraffins and naphthenes, (2) largely mononuclear aromatic compds., and (3) largely polynuclear aromatic compds. A simple analogy between fractionation by adsorption and fractionation by distn. was drawn.

7596. MOOS, JOSEF. **The determination of asphalt in crude oil and crude oil products.** *Erdöl u. Kohle* 2, 345-57 (1949).—*C.A.* 43, 9421*i*.

Results of the adsorption analysis showed that Fuller's earth was unsuitable for a quant. analysis, silica gel unsatisfactory, Al oxide satisfactory. It was necessary to shield the adsorption column against light to prevent photochem. action. For eluting, CCl_4 was unsatisfactory; petr. ether (30/50) was better than benzene, methylcyclohexane or cyclohexane. Small amts. of water or the use of N_2 did not affect the results.

7597. NEDERBRAGT, G. W. **Separation of long-chain and compact molecules by adsorption on attapulgite-containing clays.** *Clay Minerals Bull.* 3, 72-5(1949).—*C.A.* 47, 6215*d*.

Binary mixts. of hexadecane, tetracosane, octadecylcyclohexane, and di-sec-butyldechydronaphthalene dissolved in a little pentane were passed through a column of Floridin earth. Large quantities of pentane were added. Elongated and compact mols. were well sepd. The results were discussed with reference to the structure of attapulgite which contained channels of cross-section approx. 4 × 6.5 A.

7598. OHTSUKA, HIROSHI. **Solid phosphoric acid as polymerization catalyst for olefin gases. III.** *Mem. Faculty Eng., Hokkaido Univ.* 8, 38-66(1949).—*C.A.* 44, 7466*d*.

Kieselguhr from Okayama Pref. was the best carrier available for its large surface area, strong adsorption, and inactivity with H_3PO_4. The best catalyst was made from 90% H_3PO_4 400, kieselguhr 100, and graphite powder 30 parts by drying at 200°C, molding into pills, and heating at 300-50°C for a few hrs.

7599. OHTSUKA, HIROSHI. **Solid phosphoric acid as polymerization catalyst for olefin gases. IV.** *Mem. Faculty Eng., Hokkaido Univ.* 8, 67-122(1949).—*C.A.* 44, 7466*e*.

For the activation of the catalyst heating at 200°C combined with steaming at 300°-50°C were found most effective (for stripping H_2O mols. adhering on the surface, converting H_3PO_4 into active $H_4P_2O_7$ but not allowing much dehydration of $H_4P_2O_7$ to inactive HPO_3). Reactivation of the catalyst from 50 to 90% was possible by heating at 350°C with an inert gas contg. 2% O_2 for a few hrs, but this was not industrially feasible.

7600. PEAVY, C. C.; WEINRICH, W.; HORNADAY, G. F., AND NOLL, H. D. **Various refinery applications of Houdriflow catalytic cracking.** *Petroleum Refiner* 28, No. 6, 117-23(1949).—*C.A.* 43, 8656*g*.

The economics of catalytic cracking was discussed as applied to (1) thermal cracking and (2) catalytic cracking combined with vacuum distn., visbreaking, and delayed coking of the reduced crude oil. Calcns. were based on processing 10,000 barrels per day of East Texas crude oil.

7601. PICHLER, HELMUT. **Development of gasoline synthesis in the United States. The Hydrocol process.** *Brennstoff-Chem.* 30, 105-9 (1949).—*C.A.* 43, 7664*b*.

Stress was laid on the use of a fluidized catalyst (alkalized Fe) and the use of a highly efficient external heat exchanger to remove the heat of reaction; this avoided the use of numerous small internally cooled catalyst chambers as in Germany. The catalyst was poisoned by S, but was not affected by the formation of small amts. of C, although excessive amts. of C reduced its efficiency.

7602. Rampton, H. C. **The hydrocarbon-type composition of cracked gasolines.** *J. Inst. Petroleum* 35, 42-60 (1949).—*C.A.* 43, 3998*e*.
The procedures included the sepn. of naphthenes and paraffins from olefins and aromatics by selective adsorption followed by naphthene and paraffin detn. on fractions of selected boiling range and removal of aromatics in hydrogenated cracked gasoline by selective adsorption followed by paraffin and naphthene detn. on fractions of selected boiling range.

7603. Reeves, E. J. and Turkleson, R. E. **Cycle washing of percolation filters.** *Petroleum Refiner* 28, No. 3, 135-7(1949).—*C.A.* 43, 7218*b*.
If filters contg. adsorbent used for decolorizing lubricating oil were washed with a portion of the oil-naphtha mixt. from a previous filter, the vol. of fresh naphtha required was 75% below that required when fresh naphtha was used exclusively. The vol. of oil removed per vol. of wash naphtha was independent of the initial oil content of the recycle naphtha within the range of 0 to 40% oil.

7604. Reis, T. **The theoretical and experimental study of fluidized catalyst systems.** *Bull. assoc. franc. tech. pétrole No.* 76, 3-44 (1949). —*C.A.* 43, 8830*g*.
The behavior of finely divided solid catalyst in disperse suspension in a gas was investigated by the use of an optical system wherein a beam of light of controlled intensity passed laterally through the glass reaction tube and was reflected onto a photoelec. cell connected with an oscillograph circuit. The difference in intensities on the oscillograph curve was proportional to the concn. of solid particles in suspension.

7605. Richardson, R. W.; Johnson, F. B., and Robbins, L. V. Jr. **Fluid catalyst cracking with silica-magnesia.** *Ind. Eng. Chem.* 41, 1729-33 (1949).—*C.A.* 43, 8656*c*.
The over-all results obtained with silica-magnesia in lab. and in large-scale fluid catalyst pilot plants indicated that with respect to gasoline yield this catalyst was superior to silica-alumina and natural clay catalysts. The gasoline octane nos. were lower than those obtained with silica-alumina catalyst but approached those obtained with natural clay catalyst; C formation was equiv. to that with silica-alumina, but dry gas and butane-butene yields were lower; silica-magnesia was superior to silica-alumina from the standpoint of activity maintenance.

7606. Schneider, K. W. **Investigation of northwest German crude oils by means of chromatographic analysis.** *Erdöl u. Kohle* 2, 87-94 (1949).—*C.A.* 43, 5175*c*.
In the chromatographic analysis the light fraction b. 150°C (15 mm) was discarded. Two ml of the remaining oil was dild. with 20 ml of petr. ether and after 24 hrs the pptd. asphalt was filtered off. The filtrate was analyzed in a 400 cm column filled with 120 g of "standardized" Al_2O_3. It was found that the oil closest to the surface had a greater amt. of oxygenated compds. (resins) as well as high mol. wt and polar compds. than the lower layers.

7607. Smit, W. M. **The conservation equation of chromatography.** *Discussions Faraday Soc.* 1949 No. 7, 38-45.—*C.A.* 44, 9772*a*.
The conservation equation was derived for a single solute. A correction was introduced for the vol. of the adsorbed phase, and applied to the derivation of a fundamental equation of chromatography. A mixt. of cetane and cetene could be partly separated by silica gel previously wetted with benzene, using benzene as developing liquid. The total vol. of "developer" necessary to collect all the solutes at the bottom of the column was smaller than the interstitial vol. of the column.

7608. Smit, W. M. **Chromatography of petroleum hydrocarbons.** *Discussions Faraday Soc.* 1949, No. 7, 248-55.—*C.A.* 45, 1753*i*.
Displacement development was favored for nonquant. sepn., frontal analysis for the detn. of not too complex mixts., and elution development for complex hydrocarbon mixts. or where the aim was complete sepn. Silica gel was quite effective as an adsorbent for the sepn. of aromatic from aliphatic compds. and certain mixts. of satd. hydrocarbons. Activated earths may give better sepn. between paraffins and naphthenes. Alumina could be used for the sepn. of individual aromatic compds. Prewetting with the first developing soln. diminished irreversible adsorption.

7609. Suehiro, Yoshiyuki. **Preparation of activated clay and the properties of tabular catalyst for catalytic cracking.** *J. Chem. Soc. Japan, Ind. Chem. Sect.* 52, 16-17(1949).—*C.A.* 45, 1756*b*.
The effect was shown of the rate of catalytic decompn. of light oil, of independent variables such as size of tabular catalyst, concn. of activating H_2SO_4, remaining amt. of SO_4^{--}, intensity of catalyst, temp. of ignition of catalyst after acid treatment, and duration of catalytic action of catalyst.

7610. Thomas, Charles L. **Chemistry of cracking catalysts.** *Ind. Eng. Chem.* 41, 2564-73 (1949). —*C.A.* 44, 2218*i*.
Catalytic activity was attributable to H ions which served to balance the valence and coordination no. within an at. network contg. 2 different metals and O. The catalytic activity and ability to neutralize KOH was detd. for a series of $SiO_2Al_2O_3$ gel prepd. by hydrolyzing graded solns. of Al isopropoxide in ethyl orthosilicate. The catalytic activity reached a max. at an Al/Si at. ratio of 1 to 2 and the ability to neutralize KOH reached a max. at Al/Si = 1. SiO_2-MgO, SiO_2-ZrO_2, Al_2O_3-boria, and titania-boria catalysts were briefly discussed and a carbonium ion mechanism for catalytic cracking presented.

7611. Bellet, Edgard and Levert, Pierre. **Curious example of adsorption and purification in the solid phase.** *Compt. rend.* 231, 1484-5 (1950). —*C.A.* 45, 5393*i*.

Clay materials were employed in the decolorization, clarification, and purification of solid hydrocarbons produced from industrial gases. An intimate mixt. was made at ordinary temps. of a stream of naphthalene with approx. 10% of a decolorizing clay such as Clarsil. The mass took on a rose color which developed on the surface. When the clay was filtered it was found that the clay alone was colored and that the napthalene was purified to the extent that the m.p. became 79.6°C.

7612. Clerc, R. J.; Kincannon, C. B., and Wier, T. P. Jr. **Chromatographic analysis of gas oils for hydrocarbon types—examination of techniques.** *Anal. Chem.* 22, 864-7(1950).—*C.A.* 44, 9663*g*.

Gas-oil samples were suitably fractionated in a column of silica gel by the technique of elution development. An excess of a weak developer, methylcyclohexane, displaced the saturate band and eluted several aromatic bands; subsequent developers (toluene in methylcyclohexane, toluene, and acetone) sepd. the monocyclic, bicyclic, and tricyclic aromatic hydrocarbons.

7613. Conn, A. L.; Meehan, W. F., and Shankland, R. V. **Silica-magnesia cracking catalyst. Commercial performance.** *Chem. Eng. Progress* 46, No. 4, 176-86 (1950).—*C.A.* 44, 5085*c*.

The first significant com. operation of the fluid-catalyst cracking process employing silica-magnesia catalyst was carried out for a 315-day period in a 25,000 bbl./day unit by the Standard Oil Co. (Ind.) With this catalyst, higher gasoline yields, lower butane and gas yields, and lower octane nos. were obtained compared with silica-alumina. An unfavorable trend toward decreased regeneration efficiency was observed which ultimately resulted in the termination of the operation.

7614. Cox, Ben B. **Influence of clay in oil production.** *World Oil* 131, No. 7, 174, 176, 180-2(1950).—*C.A.* 45, 1330*c*.

Depending on the kind of clay in the reservoir strata and the cations brought into contact with it, clay may be a binder of unconsolidated sediments, a disrupting material, or a plugging material in a sand.

7615. Dinneen, G. U.; Thompson, C. J.; Smith, J. R., and Ball, John S. **Adsorption analysis by displacement techniques—applied to shale-oil distillates.** *Anal. Chem.* 22, 871-6(1950). —*C.A.* 44, 10305*f*.

Special app. and methods were described which enabled quant. analyses of small samples containing satd. compds., olefins, and aromatics of the 200° to 325°C boiling range. Criteria were given for the choice of suitable adsorbents. A diln. procedure was described that aided in the analysis of samples for which the adsorptogram showed poor sepn. between adjacent groups of compds., e.g. paraffin-cycloparaffin and satd.-compd.-olefin mixts.

7616. Eagle, Sam and Rudy, Charles E. Jr. **Separation and desulfurization of cracked naphtha. Application of cyclic adsorption process.** *Ind. Eng. Chem.* 42, 1294-9(1950).—*C.A.* 44, 9140*i*.

Preliminary sepn. of cracked naphtha into paraffin-naphthene-olefin raffinate and a high-S aromatic ext. was accomplished by use of a cyclic 8-column pilot unit packed with 28-200 or 48-80 mesh silica gel and operated during adsorption at 70°F. Each packed column was shifted in counter-direction to liquid flow on regular cycle through the successive zones of raffinate refining, ext. enriching, hot stripping, and cooling. Stripping was accomplished with pentane at 200-250°F. Operating at 0.08 gal. of feed per lb. of silica gel regenerated, 0.7 vol. recycle, and 2.0 vols. of strippant per column vol. reduced the S content of cracked naphtha from 1.22% to less than 0.05%, with 75-80% raffinate yield, and an adsorbant life exceeding 6 months.

7617. Eagle, Sam and Scott, John W. **Liquid-phase adsorption equilibrium and kinetics.** *Ind. Eng. Chem.* 42, 1287-94 (1950).—*C.A.* 44, 8732*g*.

The binary liquid system toluene-isoöctane was recommended for evaluation of suitable adsorbents for petroleum refining. Isotherms, *x-y* diagrams, selective adsorption capacities, diffusion coeffs., and fracture resistance of adsorbents, such as silica gel, silica-alumina, silica-MgO, alumina, and charcoal were reported. Measurements of butane surface area, sp pore vol., bulk d., and av. pore diam. for most of the adsorbents were detd.

7618. Ebrey, G. O. **Re-refining of used mineral oils by treatment with activated clay and heat.** *Lubrication Eng.* 6, 267-71(1950).—*C.A.* 45, 1758*d*.

7619. Endell, Joachim. **Clays in petroleum industry.** *Erdöl u. Kohle* 3, 105-9(1950).—*C.A.* 46, 7745*h*.

Electron micrographs of kaolinite with adsorbed particles of colloidal Au, of bentonite, of Fuller's earth, and of micaceous clay were shown. The swelling and thixotropy of bentonite in H_2O were due to the large no. of exchangeable cations held between the silicate layers. Activation of bentonite with acid replaced the basic ions by H ions which by reacting with coloring matters assist the bleaching of oils.

7620. Fink, D. F.; Lewis, R. W., and Weiss, F. T. **Separation of cracked gasolines by chromatographic adsorption-adsorbent characteristics and regeneration techniques.** *Anal. Chem.* 22, 850-7 (1950).—*C.A.* 44, 9662*i*.

The adsorptive capacities at 25°C of various silica gels, activated alumina, bauxite, bentonite, and Fuller's earth for toluene from a 20% soln. in isoöctane were detd. Toluene, *o*-xylene, *m*-xylene, *p*-xylene, propylbenzene, cumene, *tert*-butylbenzene, p-cymene and phenylcyclohexane are adsorbed to the same extent by silica gel. The capacity of the gel for toluene from 0 to 60% solns. decreased with the type of solvent in the order isoöctane, *trans*-3-heptene, diisobutylene, cyclohexene. The capacity at 2°C of silica gel for toluene from 20% solns. in pentane, heptane, nonane, and 2,3,4-trimethylbutane is 18.3 ml/100 g; from soln. in methylcyclohexane it was 15.5.

7621. FINK, D. F.; LEWIS, R. W., AND WEISS, F. T. **Separation of cracked gasolines by chromatographic adsorption-factors affecting efficiency of separation.** *Anal. Chem.* 22, 858-63(1950). —*C.A.* 44, 9663*d*.

Silica gel of 28- to 200-mesh gave a 74% recovery of pure toluene and gel of 100- to 325-mesh an 89% recovery when 50% by vol. solns. of toluene in isoöctane were percolated through identical columns of the gel. The efficiency of sepn. of the components in solns. of cyclohexene in isoöctane and of toluene and cyclohexene in isoöctane was directly proportional to the length (L) and inversely to the square of the diam. (D^2) of the column. Columns having an L/D^2 (cm/cm^2) of 80, if "through 200-mesh" gel was used, or of 230, if 100- to 200-mesh was used, were necessary for suitable sepn. of catalytically cracked gasolines into saturates, olefins, and aromatic hydrocarbons.

7622. FURBY, NEAL W. **Evaluating petroleum residua and lubricating-oil distillates; adsorption method.** *Anal. Chem.* 22, 876-81(1950). —*C.A.* 44, 10306*h*.

A fractionation method was described which employed: . (1) pptn. of asphatenes, (2) adsorption of resins on Fuller's earth, (3) dewaxing of the oil, and (4) fractionation of dewaxed oil by chromatographic adsorption on silica gel or Thermofor cracking catalyst. By blending the fractions; oils were obtained for entire range of compn. from very low to very high viscosity index.

7623. HIBSHMAN, HENRY J. **Separation of iso- and normal paraffins by adsorption.** *Ind. Eng. Chem.* 42, 1310-14(1950).—*C.A.* 44, 9143*b*.

Activated charcoal selectively adsorbed n-C_5, -C_6, and -C_7 paraffins from iso-octane at room temp. Based on exptl. data a flow plan for a continuous sepn. of iso-octane and heptane was presented by using fluidized solids technique. Charcoal introduced at the top of a column fell countercurrently to the feed and liquid reflux streams introduced at the center and bottom, resp. The charcoal withdrawn at the bottom contained heptane in high purity which was removed by washing with pentane, the pentane and heptane being sepd. by distn.

7624. JEFFRIES, ROBERT S. **Dehydration system is designed to end storage field withdrawal freeze-ups.** *Am. Gas J.* 173, No. 5, 10-12 (1950).—*C.A.* 45, 1324*b*.

The natural gas from the storage field was dehydrated by passing through beds of Florite. A wet bed was regenerated by passing gas which had been preheated to approx. 190°C through the bed. Regeneration was stopped when the gas leaving the bed reached approx. 149°C.

7625. JEWELL, J. W. JR. AND CONNOR, J. P. **Economics of petroleum coking for "cat cracking" feed preparation.** *Petroleum Processing* 5, 1199-1202(1950).—*C.A.* 45, 2189*i*.

The relative economic advantages of delayed coking, vacuum flashing, visbreaking, and propane decarbonizing in prepg. catalytic cracking feed stocks from reduced crude oil were discussed. The delayed coking process was shown to have superior earning power in a market in which the supply of fuel oil exceeded the demand, and also in a good and stable coke market.

7626. KRÁLIK, ZSÓFIA AND VAJTA, LÁSZLÓ. **Selective adsorption investigation of lubricating oils.** *Magyar Kém. Folyóirat* 56, 38-41(1950). —*C.A.* 45, 3587*f*.

A cotton disk 2 cm thick and 350 g Fuller's earth (dried previously at 105°C) were located on a porcelain filter disk in a glass tube of 5 cm diam., 60 cm length. 1600 ml of 60/90 gasoline served as the solvent and eluent. The color of eluates varied from colorless to light yellow and red (with a greenish fluorescence). A linear correlation was observed between index of refraction and sp. gr.; this can be utilized for the detn. of the sp. gr. of very minute amts. of eluates.

7627. MAIR, BEVERIDGE J. **Petroleum hydrocarbons. Separation and analysis by adsorption.** *Ind. Eng. Chem.* 42, 1355-60 (1950).—*C.A.* 44, 8097*e*.

Adsorption on silica gel (60% between 200 and 325 mesh) was used for the sepn. of aromatics from paraffins and cycloparaffins, mononuclear from polynuclear aromatics, and olefins, from paraffins and cycloparaffins. The method was also used for the sepn. of hydrocarbons from compds. contg. O, S, and N. The method has been applied to hydrocarbons of gasoline to lubricating-oil boiling range. The equipment varied from small glass columns, 1.25 m length, 2 cm diam., to steel columns, 16 m length, 2 cm diam.

7628. MAIR, BEVERIDGE J.; WESTHAVER, JAMES W., AND ROSSINI, FREDERICK D. **Theoretical analysis of fractionating process of adsorption.** *Ind. Eng. Chem.* 42, 1279-86 (1950).—*C.A.* 44, 8733*f*.

Fundamental equations were obtained for the treatment of adsorption fractionation in a manner analogous to distn. fractionation. The column height equiv. to a unit theoretical stage of sepn. was evaluated. Exptl. results were given for the sepn. factor a (on silica-gel columns) as a function of concn.

7629. MCKEAN, R. A. AND GRANDEY, L. F. **Conversion in Thermofor catalytic cracking.** *Chem. Eng. Progress* 46, No. 5, 245-8(1950).—*C.A.* 44, 6107*g*.

In the past few years catalytic cracking has assumed an increasingly important role in petroleum refining. An improved correlation of feed-stock conversion with space velocity and catalyst-to-oil ratio was presented, based on an empirical formula tested with pilot-plant and com. data.

7630. PRONINA, M. V. **Separation of neutral oxygen compounds from fractions of low-temperature tars and other complex mixtures.** *Doklady Akad. Nauk S.S.S.R.* 74, 115-17 (1950).—*C.A.* 45, 4023*a*.
The tar fractions were dild. with double their vol. of petr. ether and percolated through columns of silica gel (65-115 mesh) until all O and N compds. were removed. S compds. were incompletely removed. This purification reduced gum formation on storage. Part of the adsorbed compds. were eluted from the silica gel with benzene and the rest with acetone.

7631. RILEY, MAX L. **Operating and design features of adsorption-type dehydrators.** *World Oil* **130**, No. 1, 184-6 (1950).—*C.A.* 44, 1288*e*.
Design and selection of dehydrators for specific applications in the dehydration of gas.

7632. SCHLEGEL, C. A. **The cyclic catalytic reforming process for reforming natural gas.** *Gas* **26**, No. 2, 26-9 (1950).—*C.A.* 44, 2731*d*.
This process used preferably a two-shell set, one shell provided with a combustion chamber to burn natural gas for heating the catalyst layer in the second shell; a com. Ni catalyst was used which showed practically no deterioration in 4.5 months' operation. The H-content of the gas varied up to a max. of about 55% and the heating value of the reformed gas over wide limits.

7633. SHERWOOD, PETER W. **High-pressure hydrogenation of carbonaceous matter. V. The liquid phase in industry.** *Petroleum Refiner* **29**, No. 5, 123-7(1950).—*C.A.* 44, 7509*e*.
Various methods of processing the residue obtained from high-pressure hydrogenation of carbonaceous materials were discussed. Standard procedure consisted of centrifuging followed by low-temp. carbonization. The residue could also be processed by filtration; this led to various specialty products.

7634. SITTIG, MARSHALL. **Catalytic cracking. III.** *Petroleum Refiner* **29**, No. 10, 130-6 (1950).—*C.A.* 45, 1331*h*.
The history and development of the fluid catalytic cracking process to its present status were reviewed.

7635. SMITH, J. R.; SMITH, C. R. JR., AND DINEEN, G. U. **Separation of nitrogen compounds by adsorption from shale oil.** *Anal. Chem.* 22, 867-70(1950).—*C.A.* 44, 10304*h*.
A complete description was given of the adsorption app. and procedure for the sepn. of shale-oil distillates. Florisil, a synthetic Mg silicate, was an efficient adsorbent for this sepn.; its capacity for N compds. decreased when it was activated above 1200°F. Pentane eluted the hydrocarbon fraction; abs. MeOH eluted the predominantly non-hydrocarbon fraction which contains 95% of the N.

7636. SPENGLER, GUNTER AND KRENKLER, KARL. **Selective adsorption of hydrocarbons. II.** *Erdöl u. Kohle* 3, 317-21 (1950).—*C.A.* 44, 9768*f*.
Adsorption curves were given for benzene, cyclohexene, and benzene-cyclohexene mixts. in hexane as a solvent on silica gel; for mixts. of cetane and α-methylnaphthalene on active charcoal and silica gel; and for 12 gasolines dild. with hexane in the ratio of 1:3 on active charcoal and silica gel. The adsorption column was 1.5 cm in diam. and 30 cm long. Both adsorbents were specially treated. The aromatic and olefin content could be detd. and a qual. statement made as to whether the remainder consisted principally of n-paraffins, isoparaffins, or naphthenes.

7637. THORNTON, D. P. JR. **New Houdriflow cracking unit has high catalyst-oil ratio, low preheat requirements.** *Petroleum Processing* **5**, 601-5(1950).—*C.A.* 45, 339*a*.
The 4500 barrel per stream day unit at Drumright, Okla. had a max. catalyst-to-oil ratio of 8 to 1. The catalyst circulation capacity was 250 tons, and the system capacity 280 tons.

7638. UHL, WM. C. **T.C.C. (Thermofor catalytic cracking) unit gives high liquid recovery by operating on vapor-liquid feeds.** *Petroleum Processing* **5**, 950-2(1950).—*C.A.* 45, 338*i*.
A modified unit handled a mixed-phase feed stock consisting of total gas oil from crude stills, ranging from heating fuel to asphalt. Vapor feed was fed into the reactor in the usual manner from the furnace plus all possible vapor and liquid from the tar separator. The latter feed entered the reactor through a special distributing nozzle which sprayed it downward into the catalyst bed.

7639. WEBER, GEO. **Double-duty catalyst.** *Oil Gas J.* **49**, No. 24, 78-9, 118-20(1950).—*C.A.* **45**, 1756*c*.
Clay used by Sinclair Refining Co. for treatment of lubricating oil was used as a fluid cracking catalyst.

7640. WILSON, JOHN F. **Analysis of a high-sulfur cracked distillate.** *Proc. Mid-Year Meeting, Am. Petroleum Inst.* **30M** (III), 16-23 (1950). —*C.A.* 45, 3151*g*.
The gasoline fraction from a high-S cracked distillate from coking of Santa Maria Valley crude oil was analyzed by means of fractional distn. followed by silica-gel adsorption. Refractive dispersions were used to interpret the adsorption analyses.

7641. ZEN, C. W.; CHAO, C. S., AND LIU, C. H. **Decolorizing power of clay found in Taiwan.** *Chinese Chem. Ind. Eng.* **1**, No. 1/2, 5-12 (1950)(English summary).—*C.A.* 47, 1370*h*.
The decolorizing power of clay found in different parts of Taiwan was compared according to the efficiency of removing color from kerosine soln. colored with asphalt. One after treatment with 20% H_2SO_4 for 5 hrs, gave the best results.

7642. ZHIGACH, K. F.; KISTER, E. G., AND ZLOTNIK, D. E. **Clay preparations for drilling.** *Doklady Akad. Nauk S.S.S.R.* 72, 1103-6(1950). —*C.A.* 45, 9839*h*.
Air-dried briquets were made from mixts. of subbentonite clay, caustic soda, and alk. peat humates. The briquets were used alone or as admixts. to increase colloidal characteristics of local clays. Use of briquets reduced clay con-

sumption to 30-35 tons per well and increased speed of drilling.

7643. AMES, C. B. **Natural-gas dehydration is robotized in 15 solid desiccant-type plants. Skid-mounted solid desiccant dehydrators built for Transco.** *Am. Gas J.* 174, No. 2, 11-13 (1951); *Gas* 27, No. 4, 102, 104 (1951). —*C.A.* 45, 3579*b*, 4428*c*.

The plants employed florite, and were designed to dehydrate the gas to a dew point of 25°F. The cyclic operations were automatically controlled.

7644. ANDERSON, T. H. JR. AND COLBURN, W. E. **Liquid recovery from hydrocarbon gases.** *Calif. Oil World* 44, No. 23, 3, 5, 6, 8(1951). —*C.A.* 46, 4206d.

The recovery of liquids from wet gas by adsorption, condensation, gas fractionation, and absorption was discussed. Adsorption was undesirable except in the case of ethane or ethylene recovery where the Hypersorption process may prove desirable.

7645. ARDERN, D. B.; DART, J. C., AND LASSIAT, R. C. **Process in petroleum technology.** *Advances Chem. Ser. No.* 5, 13-29 (1951).—*C.A.* 45, 10557*b*.

The development of the fixed-bed process and of the Houdriflow and Thermofor processes was described; it included improvements in reactor and kiln design, use of gas lift for the catalyst, effect of operating conditions upon yield and quality of the products, and characteristics of the catalysts used. Prospects for improvements in the moving-bed catalytic cracking process appear to be in the direction of improved catalysts.

7646. ARNOLD, G. B.; FRASCATI, E. P., AND CARTER, N. D. **High-pressure fixed-bed catalytic unit.** *Ind. Eng. Chem.* 43, 1013-18(1951). —*C.A.* 45, 6372*i*.

A versatile fixed-bed catalytic pilot plant capable of operating at pressures up to 5000 lb/in^2 at 538°C was described. Catalyst capacity of the reactor was 320 ml.

7647. BLAIR, CHARLES M. JR. **Some applications of organic corrosion inhibitors in the petroleum industry.** *Corrosion* 7, 189-95(1951).—*C.A.* 45, 6147*b*.

Properly selected and applied semipolar org. inhibitors were capable of greatly reducing corrosion in oil wells, gas wells, and many other installations handling petroleum and natural brines. The action of such inhibitors appeared to result from surface adsorption which inactivated a portion of the metal and imposed a barrier to migration of the corrosion medium to the metal surface.

7648. BOBROVNIK, D. P. **Bleaching clay from Molodyatyno.** *Doklády Akad. Nauk S.S.S.R.* 80, 933-6(1951).—*C.A.* 47, 6577*e*.

The clay behaved like a mixt. of 62% montmorillonite with 38% amorphous SiO_2 (sol. in 10% Na_2CO_3 soln.) of the empirical formula $0.2\ Na_2O.0.3\ MgO.(Al,\ Fe^{III})_2O_3.4SiO_2$; the ratio $SiO_2:Al_2O_3$ was 5.7, as in many Fuller's earths. The Molodyatyno earth was suitable for bleaching paraffin, added in amts. of 4%.

7649. BRANSON, UZZELL S. JR. **Measurement and use of relative permeability data.** *World Oil* 133, No. 1, 184, 188-9, 190, 193(1951).—*C.A.* 45, 8747*d*.

Relative permeabilities to oil, gas, and water of small core samples were detd. in the lab. by a test in which the sample was cleaned and then treated with the saturating fluid under standardized conditions.

7650. BROOK, J. H. T. AND MATTHEWS, J. B. **Iron and copper as catalysts in oxidation of hydrocarbon lubricating oils.** *Discussions Faraday Soc.* **1951**, No. 10, 298-307.—*C.A.* 46, 3381*a*.

With the rate of absorption of O_2 as a measure of reaction velocity, the kinetics of the oxidation of lubricating oil in the liquid phase was studied. The catalytic activity of Fe, Cu, and "crankcase catalyst" was due to dissolved compds. of Fe and Cu formed by corrosion. The Fe compds. were chain-branching and the Cu compds. chain-initiation catalysts.

7651. COLTEN, O. A. AND JONNARD, A. **Aliphatic chemicals.** *Advances Chem. Ser. No.* 5, 287-98 (1951).—*C.A.* 45, 10560*b*.

Among the newer developments were the direct oxidation of hydrocarbons to produce aldehydes, acids, and alcs.; the partial combustion of CH_4 for a C_2H_2 manuf.; and the Fischer-Tropsch and oxo syntheses to yield oxygenated chemicals. Complicated interprocess and interproduct competition characterized this field, and the concns. of their end use in the more rapidly expanding chem. product segments was pointed out as one of the causes for the rapid growth of aliphatic chemicals.

7652. CRIDDLE, DEAN W. AND LETOURNEAU, ROBERT L. **Fluorescent-indicator absorption method for hydrocarbon-type analysis.** *Anal. Chem.* 23, 1620-4(1951).—*C.A.* 46, 5827*c*.

A simplified procedure based on fluorescent dyes which made the principal hydrocarbon-type boundaries clearly visible was given for chromatographic sepn. of hydrocarbons by silica gel. These new dyes completely resolved the olefin fraction in cracked petroleum stocks by the direct displacement procedure. The adsorption column had an upper adsorption section for receiving the sample and performing the initial sepn. The silica gel found to give best results was of uniform mesh size (100-200 mesh). The silica gel was able to adsorb selectively some of the color bodies in petroleum fractions.

7653. DEIBNER, LÉONCE. **Laboratory techniques utilized in the study of the chemical activation, acid or alkaline, of clay. Essential properties of the final activated products.** *Chim. anal.* 33, 18-23, 51-8, 95-100, 138-42 (1951).—*C.A.* 45, 3531*b*, 5487*b*.

7654. EDEL'MAN, L. I. AND REBINDER, P. A. **Structure formation and elastic-plastic properties of structures in oil and aqueous suspensions of aluminum oxide.** *Kolloid. Zhur.* 13, 64-77(1951).—*C.A.* 45, 3685*d*.

Suspensions of Al_2O_3 in paraffin oil were elastic-brittle bodies and showed elastic after-effect. Their modulus of elasticity E_1, modulus of elastic after-effect E_2, viscosity of the after-effect η_2, and max. shearing stress P did not depend on the measuring app. Aq. suspensions of Al_2O_3 were stable only between 36 and 42 vol. %. Colloidal Al_2O_3 increased the sedimentation vol. of the suspensions.

7655. EFENDIEV, F. M. **Basic principles of a systematic method of luminescence investigation of petroleum and bitumen.** *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* 15, 782-7(1951).—*C.A.* 46, 6816*h*.

Chromatographic luminescence methods allowed better differentiation of bitumens and oil than chem. methods. Quant. methods were developed (1) without standards (*a*) by detn. of the lowest concn. at which luminescence can be observed; (*b*) estn. of luminescence intensity; (2) with standards; (3) by photometry.

7656. FOWLE, M. J.; BENT, R. D.; CIAPETTA, F. G.; PITTS, P. M., AND LEUM, L. N. **Process in petroleum technology. Development of a reforming catalyst.** *Advances Chem. Ser. No.* 5, 76-82 (1951).—*C.A.* 45, 10557*g*.

This development started with a catalyst for the isomerization of paraffin and naphthene hydrocarbons, which consisted of a hydrogenating component, e.g. Ni or Pt, deposited on silica-alumina. By markedly decreasing the surface area of the silica-alumina component, a reforming catalyst was developed that gave the proper balance and direction for the main reactions of reforming: isomerization, dehydrogenation, and hydrocracking.

7657. GEE, W. P. AND GROSS, H. H. **Process in petroleum technology. Dewaxing and deasphalting.** *Advances Chem. Ser. No.* 5, 160-76(1951). —*C.A.* 45, 10558*h*.

Most of the lubricating oil is dewaxed today by the use of a solvent composed of a ketone and an aromatic hydrocarbon or by the use of liquid propane. Solvents were used also for deoiling wax. Adsorption with clay and chem. treatment were also used to some extent.

7658. GLESPEN, G. L. **New synthetic catalyst plant to supply 450,000 barrels per day cracking capacity.** *Petroleum Refiner* 30, No. 12, 134-6(1951).—*C.A.* 46, 2275*c*.

Design and operating details were given for American Cyanamid's new plant at Michigan City. It produced a silica-alumina catalyst of 40 or 60 microns in size.

7659. GRIM, RALPH E. **Clay mineralogy and the petroleum industry.** *World Oil* 132, No. 4, 61-2, 66, 68(1951).—*C.A.* 45, 4431*i*.

Lines of clay-mineral researches that should yield valuable results in relation to the recovery and discovery of petroleum were pointed out.

7660. GUTHRIE, V. B. **Aromatics by adsorption.** *Petroleum Processing* 6, 833-5(1951).—*C.A.* 46, 716*d*.

A stream contg. benzene and toluene produced by catalytic naphthene dehydrogenation was passed through a static bed of silica gel. The aromatics were adsorbed. The charge was immediately followed by a low-boiling paraffin desorbent (butane) which displaced the unadsorbed (satd.) part of the charge from the bed. A second desorbent (xylenes) was next added which displaced from the silica gel the adsorbed aromatics of the charge.

7661. HAENSEL, VLADIMIR AND DONALDSON, GEORGE R. **Platforming of pure hydrocarbons.** *Ind. Eng. Chem.* 43, 2102-4 (1951).—*C.A.* 46, 8837*h*.

The platforming process for the conversion of hydrocarbons was carried out in the presence of recycled H_2 and a catalyst contg. Pt. At 459°C, a pressure of 500 p.s.i. and *n*-heptane as feed stock, the reaction was principally one of isomerization (52 mole % C_7 isomers), although hydrocracking occurred whereby propane and isobutane were formed. The next major reaction was the formation of all the isomeric trimethylbenzenes and ethyltoluenes.

7662. HOPKINS, R. L. **Continuous stripper for adsorption column effluent streams.** *Ind. Eng. Chem.* 43, 1456-8 (1951).—*C.A.* 45, 7388*c*.

Large-scale lab. adsorption operations were reported in which pentane, benzene, and iso-PrOH were used and must subsequently be removed from the solvent. This permitted the collection of oil fractions of any desired size, and provided for the direct observation of the oil-to-solvent ratio at all times.

7663. KATS, M. L. AND SIDOROV, N. K. **Fluorescence spectra of petroleum and its fractions in liquid condition and in a chromatographic column.** *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.*, 15, 777-81(1951).—*C.A.* 46, 6816*f*.

In crude oil and in the distn. residue above 400°C, the fluorescence maxima occurred at 472, 510, 539, and 625 mμ with intensities depending on the type of the oil. In fractions 200-400°C these maxima were absent and 2 maxima for each fraction, 431-445 and 454-458 mμ, appeared, the max. shifted slightly to longer waves with increased distn. temp. In the spectra of crude oil adsorbed on Al_2O_3 in a chromatographic column all lines appeared.

7664. KINNEY, P. T. AND NIELSEN, R. F. **Wettability in oil recovery.** *World Oil* 132, No. 4, 145-6, 148, 150, 154(1951).—*C.A.* 45, 4433*d*.

The relation of wettability to fluid mobility was demonstrated by the flooding behavior of a synthetic and a natural core before and after a treatment that would render the internal surfaces oil wet. The percentage of recoverable oil produced before water break-through was greater in a preferentially water-wet porous medium than in a preferentially oil-wet porous medium. Analogous results were obtained when water was driven by oil.

7665. MCGRATH, HENRY G. **The application of fluid hydroforming.** *Petroleum Refiner* 30, No. 12, 102-8(1951).—*C.A.* 46, 2275*f*.

Catalyst activity was maintained at a const. level indefinitely by periodic addns. of fresh catalyst if activity declined with age. Some of the heat produced in the regeneration can be used to supply endothermic reaction heat, thus reducing preheater duty and thermal cracking in the preheater. Variation in catalyst level in the reactor and the regenerative nature of the process gave addnl. flexibility.

7666. McGrath, Henry G. **Catalytic upgrading by hydroforming.** *Oil and Gas J.* **50**, No. 34, 78-81(1951).—*C.A.* **46**, 2787*a*.
Reactions, effect of catalyst, effect of operating variables, and economics of fluid hydroforming were discussed.

7667. McGrath, Henry G. and Hill, Luther R. **Process in petroleum technology. Intermittent and fluid catalytic reforming of naphthas.** *Advances Chem. Ser. No.* 5, 39-57 (1951).—*C.A.* **45**, 10557*d*.
Typical pilot-plant data on fluid vs. fixed-bed hydroforming of various naphthas were presented. Besides a higher gasoline yield, the fluid process offered savings through elimination of multiple reactors and accessories, simplified regeneration, and longer on stream time.

7668. Mondria, H. **Continuous filtration. Calculation of cake impurity and liquid yield.** *Chem. Eng. Sci.* **1**, 20-35(1951).—*C.A.* **46**, 3332*e*.
Developed relations were applied to the dewaxing of lubricating oils with butanone-benzene mixts. and good agreement with practical results was obtained.

7669. Murphree, E. V. **Process in petroleum technology. Fluid catalytic cracking process.** *Advances Chem. Ser. No.* 5, 30-8 (1951).—*C.A.* **45**, 10557*c*.
The Fluid process represented the first widespread application of a new chem. engineering unit operation—the fluid-solids technique. The development of the process and equipment was described. The possibility existed of integrating fluid catalytic cracking units into refinery operations as a whole.

7670. Murphree, E. V. **Fundamentals of fluid hydroforming.** *Petroleum Refiner* **30**, No. 12, 97-101(1951).—*C.A.* **46**, 2275*d*.
Fluid hydroforming provided an economical means for reforming low-octane-no. naphthas and straight-run gasolines into high-octane-no. gasoline components. Fluid hydroforming with molybdena-alumina gel catalyst was so superior to thermal reforming both from the standpoint of yield and cost that substitution of the former for the latter was attractive.

7671. Nowak, T. J. and Krueger, R. F. **The effect of mud filtrates and mud particles upon the permeabilities of cores.** *World Oil* **133**, No. 1, 125-6, 128, 130; No. 3, 152, 154, 156, 158, 161-2 (1951).—*C.A.* **45**, 8747*b*.
Fresh water and filtrates from fresh water-base muds significantly reduced the effective oil permeabilities of the cores. Oil-base mud filtrate had essentially no effect on the effective oil permeability of the cores. Preliminary tests were run on alundum cores mudded off at high temp. and pressure. Greater improvement of permeability to oil may result from the interaction of fluids with water-sensitive cores than from mud-particle invasion into the interstices of inert cores.

7672. Padovani, C.; Girelli, A., and Sinibamed, C. **A possible catalytic process utilizing bauxite for the improvement of Middle Eastern gasoline.** *Riv. combustibili* **5**, 591-608(1951).—*C.A.* **46**, 10593*g*.
The low octane nos. and Pb susceptibilities of some light distillates from Middle Eastern crude oils were improved by vapor-phase desulfurization over bauxite catalyst. Temps. of 350-550°C and space velocities of 0.24-1.7 were used.

7673. Preston, F. W. and Calhoun, J. C. **Applications of chromatography to petroleum production research.** *15th Tech. Conf. on Petroleum Production, Mineral inds. Expt. Sta., Penna. State Coll., Bull.* No. 59, 36-51 (1951); *Producers Monthly* **16**, No. 5, 22-5 (1952).—*C.A.* **46**, 3247*a*.
Chromatography, or adsorption analysis, was one phase of the general subject of mass transfer within porous materials, and its theory should provide background for study of any reservoir mass-transfer problem.

7674. Resen, F. Lawrence. **Magnolia's Beaument (Thermofor catalytic cracking) units employ catalyst air-lift system developed by Socony-Vacuum Oil Co., Inc.** *Oil Gas J.* **50**, No. 8, 66-7, 91, 93 (1951).—*C.A.* **45**, 9251*e*.
The modified air-lift Thermofor catalytic cracking units incorporated an air-lift for the catalysts. The catalytic section of these latter units could be erected entirely within a 195-ft oil-field-type derrick, which served as a construction rig.

7675. Rodriguez, Ariel F. **The identification of Pennsylvania oils.** *Quimica ind.* (Uruguay) **2**, 112-14(1951).—*C.A.* **46**, 7310*h*.
A chromatographic sepn. of paraffins, olefins, and aromatics was made in a 100-ml buret filled with silica gel. Twenty-five g oil was dild. with 25 ml isopentane and charged to the previously wetted gel and the bands developed with isopentane, benzene, and alc. in that order. Thirteen cuts of 6 ml each were taken; the solvent was evapd. and their *n* measured.

7676. Schuldiner, Jacob A. **Identification of petroleum products by chromatographic fluorescence methods.** *Anal. Chem.* **23**, 1676-80 (1951).—*C.A.* **46**, 7310*i*.
Various crude, semirefined, and refined petroleum products gave characteristic spot chromatograms on white, unbacked blotting paper. A few drops of a sample of an oil slick were placed on the paper and allowed to spread. The relative areas covered by the central spot, the sequence of ring formation, the scalloped effects, and ray formations were characteristic of the sample.

7677. Teutsch, A. **New experiments in gas detoxification with the simultaneous production of liquid fuels.** *Schweiz. Ver. Gas- u. Wassfach., Monats-Bull.* **31**, 345-51 (1951); *Gas- u. Wasserfach* **93**, 374-5 (1952).—*C.A.* **46**, 9284*i*.

The CO content of Bern city gas was reduced by means of a pilot plant operating on a process similar to the Fischer-Tropsch synthesis. An active charcoal adsorber was used to remove light oils and gum-formers from the gas after other liquid products have been removed. The CO content was reduced to 1 to 2%, with a slight decrease in heating value of the treated gas; this could be raised to a higher value than that of the initial gas by scrubbing out CO_2.

7678. Thomas, Charles L. **Petroleum coke and coking.** *Advances Chem. Ser.* No. 5, 278-86 (1951).—*C.A.* **45**, 10560*d*.

The current production of petroleum coke was 3.4 million tons per year, almost all of which was produced in "delayed coker" type drums and removed by various mech. means. Coking may be combined with thermal cracking or Polyforming. Application of the Thermofor cracking and of the fluidized solids principle was tried out, both being in the pilot or semicom. stages. Use of the coke as fuel has declined, but its use as anode material in Al production is growing.

7679. Thornton, D. P. Jr. **Hydrogen fluoride alkylation today.** *Petroleum Processing* **6**, 488-91 (1951).—*C.A.* **45**, 8751*a*.

The reactor effluent hydrocarbon after removal of the acid was deisobutanized and depropanized before destruction of low-mol. org. fluorides; thus, these were recycled to the contactor with the isobutane. Higher-mol. fluorides were destroyed over bauxite ahead of the butane tower. Formation of SiF_4 in treaters was alleviated by the inclusion of $Ca(OH)_2$ in the bauxite. Thorough drying of feed streams was important.

7680. Tománek, Vladimír. **Regeneration of mineral oils with clay from north-western Bohemia.** *Paliva* **31**, 261-2 (1951).—*C.A.* **46**, 1237*a*.

An absorptive clay (SiO_2 46.50, Al_2O_3 31.96, Fe_2O_3 0.95, TiO_2 nil, CaO 0.34, MgO trace) compared favorably with German bleaching earth for the regeneration of lubricating oil. The oil was heated to 90°C and mixed with 15% of the powd. and dried clay, filtered, and analyzed.

7681. Vahrman, M. **Rapid estimation of hydrocarbons in primary tars from coals of low rank.** *Fuel* **30**, 79-82(1951).—*C.A.* **45**, 4428*f*.

A few g of the dewatered tar was adsorbed onto a steam-heated column of silica gel. Chromatography can then be carried out in the normal way, for at temps. above 50°C the tars used form a single liquid phase. The hydrocarbons were completely eluted from the column by means of light petroleum (100-120°C) and were recovered by distg. off the solvent under a water-pump vacuum.

7682. Voreck, W. E. Jr.; Carroll, W. C., and Zurcher, Paul. **Extraction of mercaptans by means of adsorption.** *Petroleum Refiner* **30**, No. 3, 126-9 (1951).—*C.A.* **45**, 5395*d*.

Pilot and semicom. plant tests indicated that sour cracked distillates could be sweetened by percolation through activated charcoal impregnated with NaOH. Primary mercaptans were most readily removed, tertiary mercaptans least. The adsorbent was regenerated with steam or with steam and air. Study of the adsorption isotherms indicated that chem. reaction and adsorption took place simultaneously, and after completion of the chem. reaction, adsorption alone continued.

7683. Wedgwood, Philip and Cooper, R. L. **Detection and determination of small quantities of polynuclear hydrocarbons by a combination of chromatography and absorption spectroscopy.** *Chemistry & Industry* **1951**, 1066-7.—*C.A.* **46**, 3897*b*.

Gas-works and sewage effluents, petroleum, and tar oils were chromatographed (alumina column) and the successive filtrates analyzed by absorption spectroscopy. Hydrocarbons (such as pyrene, fluoranthrene, benzopyrene, perylene, and ananthrene) and chlorophylls were identified.

7684. Weil, Herbert. **Industrial petroleum chromatography. I. Principles and origin. II. History and technology 1914-1934. Analytical and process applications of petroleum chromatography.** *Petroleum* (London) **14**, 5-12, 16, 205-10 (1951); *Brennstoff-Chem.* **32**, 357-66 (1951).—*C.A.* **45**, 2183*f*, 8749*c*; **46**, 2786*c*.

Literature on chromatography was reviewed, with special reference to the sepn. of petroleum components.

7685. Weyl, W. A. and Hauser, E. A. **Formation and structure of silica gel.** *Kolloid-Z.* **124**, 72-6 (1951).—*C.A.* **46**, 2879*d*.

The polymerization of silicic acid and relation of some of the properties of the system, $SiO_2.H_2O$, to its constitution were studied. The formation of silica gel was based on 2 fundamentally different reactions, polymerization and condensation. The former led to the formation of macromols.; condensation led to mech. stresses. Polymerization was based on satisfying the coördinate requirements, and condensation was based on the splitting off of H_2O between 2 closely adjacent OH-ions. Depending on the individual speed of the 2 reactions and on their interaction, silica gels with extraordinarily varying properties could be obtained.

7686. Wilson, Robert E. **Process in petroleum technology. Scope of the symposium.** *Advances Chem. Ser.* No. 5, 1-2(1951).—*C.A.* **45**, 10556*h*.

The two principal developments were: (1) the great increase in tech. knowledge gained by research and (2) the catalytic revolution.

7687. Zahner, R. J. and Swann, W. B. **Chromatographic separation of phenol from cresylic acids.** *Anal. Chem.* **23**, 1093-5(1951).—*C.A.* **45**, 10143*c*.

A silica-gel column with H_2O as the stationary solvent and cyclohexane as a mobile solvent effectively sepd. phenol from its homologs, cresols and cresylic acids. Phenol was the last of these to leave the column. The column was standardized with a mixt. of phenol and *m*-cresol and the specific absorption coeff. of the phenol in cyclohexane detd. experimentally in the region of 270 mμ in a Beckman spectrophotometer.

7688. ANON. **New Autofining process.** *Petroleum Processing* 7, 467-9(1952).—*C.A.* 46, 5827*g*.

Autofining was the name applied to catalytic desulfurization of petroleum-distillate fractions, wherein the H required to remove the S as H_2S was supplied by a minor amount of naphthene dehydrogenation. The process operated at pressures of 50 to 200 p.s.i. and at 700-800°F, with a Co molybdate catalyst. Gasolines and kerosines can be desulfurized to the extent of 98-99%; light gas oils 60-70%.

7689. ARNOLD, ROBERT C.; LAUNER, PHILIP J., AND LIEN, ARTHUR P. **Identification of cyclohexanethiol in virgin naphtha.** *Anal. Chem.* 24, 1741-4(1952).—*C.A.* 47, 5673*a*.

By a combination of techniques involving chem. sepn., distn., chromatography, and infrared spectroscopy the presence of naphthenic thiols was disclosed as a major constituent of petroleum thiols.

7690. BERGMAN, W. E. **Effect of calcium sulfate on properties of a bentonite suspension.** *World Oil* 134, No. 5, 170-2, 174, 177-8, No. 6, 122, 124, 126, 128, 130, 133(1952).—*C.A.* 46, 6367*h*.

The effects of $CaSO_4$ in amts. of 0-5 lb/bbl. upon the phys. properties of an aq. bentonite suspension pretreated with variable amts. of NaOH with 1, 3, and 5 lb quebracho/bbl. were detd. in lab. expts. The effects of time and temp. of aging were correlated with changes that occur in the concns. of Ca^{++} and SO_4^{--} in the filtrate from the mud.

7691. BOEHM, J. C. **Conditioning of natural gas.** *Mech. Eng.* 74, 563-7 (1952).—*C.A.* 46, 7736*h*.

The glycol and adsorbent dehydration processes were described; Transcontinental used the latter, with "fluorite," an activated bauxite, as the adsorbent. The largest unit, handling 30,000,000 ft^3 of gas per day, required 15,100 lb. About 5 lb of water was removed per million ft^3 of gas. The adsorbent was regenerated by passing gas, heated to about 375°F, through the adsorber for 4-5 hrs; cold gas was then passed through the adsorber for the remainder of an 8-hr period.

7692. BOELHOUWER, C.; RIEMSDIJK, A. J. VAN; STEENIS, J. VAN, AND WATERMAN, H. I. **Chromatographic analysis of mineral oils.** *Anal. Chim. Acta* 6, 476-82(1952)(in English).—*C.A.* 46, 8356*e*.

A simple *fraction-collector* for chromatographic work was used in the analysis of a no. of oil fractions, allowing a sepn. into 3 main groups contg., resp., the nonaromatic, monoaromatic, and diaromatic compds. Sepns. between nonaromatics and aromatics were very sharp.

7693. BURTIS, T. A. AND NOLL, H. D. **Houdriforming, its place in the refining of petroleum.** *Petroleum Engr.* 24, No. 6, C39-44(1952).—*C.A.* 46, 7750*b*.

The economics of unit construction and of process operation was shown for several typical combinations of thermal and catalytic cracking, thermal and catalytic reforming, and catalytic polymerization.

7694. CABLE, CHARLES R.; TURCOTTE, P. A., AND DOTTERWEICH, FRANK H. **Properties of natural gas odorants.** *Am. Gas J.* 177, No. 2, 12-13, 34 (1952).—*C.A.* 46, 9827*d*.

The sorptive properties of a no. of soils were detd. by lab. and pilot-plant tests, in which natural gas contg. 0.5 lb concd. odorant/million ft^3 was passed at various rates through standard columns of the soil under test. Adsorption was a major factor in removal of the odorant from the gas by the soil. The odor lost by the natural gas varied directly with the amt. and colloid content of the soil through which it escaped.

7695. CHATENEVER, ALFRED AND CALHOUN, JOHN C. JR. **Visual examinations of fluid behavior in porous media. I.** *Trans. Am. Inst. Mining Met. Engrs.* 195, *Tech. Pub.* No. 3310(in *J. Petroleum Technol.* 4, No. 6, 149-56)(1952).—*C.A.* 46, 9367*e*.

App. and techniques were developed so that microscopic phenomena could be recorded on color movie film as well as be observed visually. The observation flow cells were essentially single-layered matrixes of spheres between plates, sometimes all-glass, sometimes all-Lucite and sometimes a combination of the two. The fluids were limited to H_2O and a filtered crude oil. Channel flow and slug flow were observed.

7696. CULBERTSON, LEROY AND CONNORS, J. S. **How to prevent formation of gas hydrates.** *Oil Gas J.* 51, No. 15, 114, 116 (1952).—*C.A.* 46, 10586*b*.

A comparison was given between the absorption or glycol method of dehydrating natural gas and the adsorption or solid desiccant method. Flow diagrams were given for a typical plant of each type. A disadvantage of solid desiccants was "poisoning" or loss of activity of the desiccant on repeated regeneration.

7697. CULBERTSON, LEROY AND CONNORS, J. S. **How to rid natural gas of undesirable sulfur compounds.** *Oil Gas J.* 51, No. 14, 114-15, 117 (1952).—*C.A.* 46, 10586*c*.

The removal of H_2S and (or) CO_2 was accomplished with NaOH, Fe oxide, Na_2CO_3, 2-stage phenolate, phosphate gas, and aq. amine treatment.

7698. DAVIS, W. H.; HARPER, J. I., AND WEATHERLY, E. R. **The Arosorb Process, a new refining tool.** *Oil Gas J.* 51, No. 2, 112-14, 116, 119-20 (1952).—*C.A.* 46, 7312*b*.

Aromatic hydrocarbons can be sepd. from the accompanying satd. hydrocarbons by selectively adsorbing the aromatics on silica gel and then desorbing them with other aromatic hydrocarbons having a boiling range sufficiently different to permit subsequent sepn. by distn. When relatively low-boiling charge stocks were used, a desorbent having a higher boiling range than the charge stock was used, while desorbents used for removing relatively high-boiling materials from the gel had boiling ranges below these materials.

7699. DODD, CHARLES G.; MOORE, JOHN W., AND DENEKAS, MILTON O. **Metalliferous substances adsorbed at crude petroleum-water interfaces.** *Ind. Eng. Chem.* 44, 2585-90(1952).—*C.A.* 47, 1366*i*.

Zn, Cu, Ni, Ti, Ca, Mg, V, and Fe were found as oil-sol. compds., possibly as porphyrin-metal chelate complexes or complexes with N-contg. compds. Film-forming fractions consisted of proteins, waxes, and resins stabilized by oriented porphyrin rings.

7700. FOWLE, M. J.; BENT, R. D.; MILNER, B. E., AND MASOLOGITES, G. P. **It's the catalyst that counts.** *Petroleum Engr.* **24**, No. 5, C40-4 (1952).—*C.A.* 46, 6369*g*.

The 3 essential properties of a catalyst for reforming straight-run gasoline, selectivity, stability, and stamina were discussed briefly.

7701. GALL, D.; GIBSON, E. J., AND HALL, C. C. **Distribution of alcohols in the products of Fischer-Tropsch synthesis.** *J. Appl. Chem.* (London) 2, 371-80(1952).—*C.A.* 47, 7191*h*.

Evidence was presented that alcs. were precursors of hydrocarbons in the Fischer-Tropsch synthesis. The proportion of MeOH was very low, EtOH was present in the largest proportion, and the proportions of the alcs. higher than PrOH decreased with increasing C no. The proportion of PrOH was less than that of BuOH or AmOH so that the C no. distribution curve for the alcs. showed a marked deflection in the C_3-C_4 region.

7702. GRANQUIST, W. T. AND STREICH, H. J. **Percolation decolorization of a lubricating-oil fraction by Fuller's earth.** *Ind. Eng. Chem.* 44, 2898-2903 (1952).—*C.A.* 47, 2967*d*.

Expts. with percolation of a Pennsylvania steam-refined cylinder stock mixed 40% by vol. with a heavy naphtha, b.p. 300-400°F, through a 10-ft column of Fuller's earth were reported. A general decrease in the amt. and increase in the mol. wt of resin adsorbed was indicated as the activating temp. of the clay was increased from 600° to 1400°F. The decrease in total adsorption was explained on the basis of an assumed irreversible adsorption of an essentially polar compd. A plot of log $V(Do - Dc)/W$ against log D/Do was found to give a linear curve, D = optical d. of effluent, Do = optical d. of feed, Dc = optical d. of the composite, V = the yield, W = weight of clay used.

7703. GUTIERREZ RIOS, ENRIQUE AND LOPEZ-GONZALES, JUAN DE DIOS. **Action of strong acids on the silicates of the isomorphic montmorillonite-beidellite series. III. Industrial applications of acid-treated bentonites.** *Anales edafol. y fisio. vegetal* **11**, 539-51 (1952).—*C.A.* 47, 4254*e*.

Spanish bentonites activated with strong acids were used in the study of mineral lubricating-oil decolorization. Decolorization went up sharply with increase of free SiO_2, indicating fundamental differences in the 2 processes. The amt. of free SiO_2 was not the only factor concerned, however, since 2 samples with equal percentages may have different decolorizing properties.

7704. HACHMUTH, KARL H. **Industrial viewpoints on separation processes. I.** *Chem. Eng. Progress* 48, 523-27(1952).—*C.A.* 46, 10701*e*.

Sepn. processes, such as fractional distn., solvent extn., and others, are basically analogous. Industrial application of new sepn. processes to old sepns. or of familiar sepn. processes to new sepns. became easier to visualize when the inherent similarities were realized.

7705. HARPER, JAMES I.; OLSEN, JOHN LEE, AND SHUMAN, FRANK R. JR. **The Arosorb Process.** *Chem. Eng. Progress* 48, 276-80(1952).—*C.A.* 46, 7311*i*.

Underlying principles of com. hydrocarbon sepn. by silica gel were presented, and the factors involved in setting up a silica-gel case cycle for a typical feed stock were covered. The influence of percolation rate, pressure drop, height, diam., and no. of cases was considered in relation to the shape of silica-gel beds.

7706. HICKERSON, J. F. **Static charge causes flash fire in silica-gel column.** *Chem. Eng. News* 30, 2942-3(1952).—*C.A.* 46, 9845*f*.

Aromatic contaminants were removed from isoöctane by pouring through a glass column contg. silica gel. The gel was charged into the column through a partially enameled funnel. The use of a well grounded all-metal funnel was recommended.

7707. HUBBARD, RETHEL L.; STANFIELD, K. E., AND KOMMES, W. C. **Anhydrous alumina as adsorbent in constituent analysis of asphalt.** *Anal. Chem.* 24, 1490-1 (1952).—*C.A.* 47, 1370*i*.

The adsorption properties of anhyd. cryst. aluminas varied with the source and method of prepn. Samples of the same alumina should be used to compare constituent analyses of a series of different asphalts. The yield of resins increased in proportion to the γ-alumina content of the adsorbent.

7708. KREULEN, D. J. W. **The influence of metal, especially copper, on the oxidation of white oil.** *J. Inst. Petroleum* 38, 449-57 (1952).—*C.A.* 46, 9293*e*.

An adsorption phenomenon was probably involved, with the adsorption of antioxidants on the Cu surface. Sn, with a lower relative adsorption affinity than Cu, was less active in shortening the length of the induction period. When very large quantities of Cu were added, an induction period reappeared. Up to about 500 cm^2 of Cu surface added to 250 ml of oil did not affect the reaction velocity appreciably.

7709. MELPOLDER, F. W.; BROWN, R. A.; YOUNG, W. S., AND HEADINGTON, C. E. **Composition of naphtha from fluid catalytic cracking.** *Ind. Eng. Chem.* 44, 1142-6(1952).—*C.A.* 46, 6370*b*.

Mass, ultraviolet, and infrared spectroscopy and fractional distn., adsorption and hydrogenation were used to det. as many as possible of the chem. components in a naphtha produced by catalytic cracking. Ninety-two individual hydrocarbons, including 21 olefins, were detd.

7710. METCALF, E. L. **Production of aromatic compounds from aliphatic petroleum sources.** *Paint, Oil Chem. Rev.* 115, No. 10, 12-14 (1952).—*C.A.* 46, 6368*c*.

By using a molybdena-on-alumina fixed bed catalyst operating at 900°-1000°F and 200-300 lb/in^2, the Hydroforming Process converted straight-run raw gasoline, paraffinic and naphthenic, to an aromatic naphtha which was fractionated into benzene, toluene, xylene, and heavy aromatic solvents. The Thermofor catalytic reforming process employed a movable bed of copptd. chromia and alumina which was regenerated in sep. kilns. Platforming used a supported Pt catalyst. Houdryforming employed a dual-function catalyst to dehydrogenate and isomerize.

7711. MIDLAN, E. W. AND DORSEY, J. D. **Lube-oil processing and instrumentation.** *Instruments* 25, 1568-70, *et seq.* (1952).—*C.A.* 47, 4590*f*.

The 3 lightest distillates were refined with furfural, dewaxed with methyl ethyl ketone, and treated with clay. Paraffin waxes from 3 lightest distillates were blended, bauxite percolated, slabbed, and packaged. About 800 instruments and 450 diaphragm motor valves were required.

7712. MORGAN, B. E. AND DUMBAULD, G. K. **Use of activated charcoal in cement to combat effects of contamination by drilling muds.** *Trans. Am. Inst. Mining Engrs.* 195, *Tech. Pub.* No. 3396 (in *J. Petroleum Technol.* 4, No. 9, 225-32) (1952).—*C.A.* 46, 10589*i*.

Less than 0.5% charcoal was not satisfactory in accelerating the strength development of exptl. slurry-mud mixts., while increase of charcoal content up to 10% resulted in increase of early strength. It appeared that the optimum charcoal concn. was about 5% by wt of dry cement.

7713. MORGAN, L. O.; PRUSICK, J. H., AND TORREY, PAUL D. **Application of surface chemistry to oil recovery.** *Producers Monthly* 16, No. 9, 18-24(1952).—*C.A.* 46, 9829*h*.

The discussion covered the following topics: (1) nature and classification of clays in reservoir rocks, (2) reservoir-rock texture and pore pattern, (3) nature and utility of org. surface-active agents, (4) principles of surface chemistry, and (5) role of surface-active agents in injection waters.

7714. PALENI, ANDREA. **Decolorization of oils with Fuller's earths.** *Olearia* 6, 19-25(1952). —*C.A.* 47, 888*g*.

7715. PAYNE, J. W.; EVANS, L. P.; BERGSTROM, E. V., AND BOWLES, V. O. **Thermofor catalytic reforming (TCR).** *Petroleum Engr.* 24, No. 6, C10-20(1952).—*C.A.* 46, 7750*c*.

Premium fuels in the F-1 octane no. range of 100 were produced. Almost complete removal of S was effected simultaneously, chiefly as H_2S. Butane yields were low, permitting the use of outside butanes to meet vapor-pressure requirements. The catalyst was chromia-alumina gel in a bead form. The process was a regenerative moving-bed type which employed a single pressure reactor and an atm. Thermofor catalytic cracking-type kiln. Catalyst circulated at a low rate through the system and was regenerated continuously.

7716. POSPELOV, V. **Regeneration of lubricating oils.** *Molochnaya Prom.* 13, No. 10, 28-30 (1952).—*C.A.* 47, 1921*a*.

A description with diagrams was presented for ordinary settling-filtration-type oil-regeneration installation and for an installation in which volatile combustibles were distd. from used oils. Use of such devices as a means for conservation of lubricating oils used in dairy machinery was advised.

7717. PUTSCHER, RICHARD E. **Isolation of olefins from Bradford crude oil.** *Anal. Chem.* 24, 1551-8(1952).—*C.A.* 47, 1366*h*.

Trans-olefins were isolated from the gasoline fraction of a Pennsylvania crude oil. The sepn. was effected by fractional distn. and silica gel adsorption. The fractionation was followed by means of infrared absorption at 10.3 μ and by Br no. The presence of *trans*-heptenes and *trans*-octenes was shown.

7718. REIDEL, JOHN C. **Cities Service puts first Orthoflow cat cracker in United States on stream at Ponca City (Okla.).** *Oil Gas J.* 50, No. 46, 200-3(1952).—*C.A.* 46, 6369*e*.

This unit had a fresh-feed throughput of 8,350 barrels per day. The Orthoflow process operated on the same basic principles as the conventional Fluid catalytic cracking process with somewhat different mech. design intended to reduce the total height of the unit.

7719. SAUER, R. W.; MELPOLDER, F. W., AND BROWN, R. A. **Nitrogen compounds in domestic heating-oil distillates.** *Ind. Eng. Chem.* 44, 2606-9 (1952).—*C.A.* 47, 1368*h*.

Catalytically cracked and virgin Kuwait heating-oil distillates were fractionated by chromatography with activated alumina, and the fractions analyzed with the mass spectrometer to det. nonbasic N. Carbazoles, indoles, pyrroles, pyridines, and quinolines were present in both distillates in amts. of about 0.001-0.1%.

7720. SCHALL, J. W. AND DART, J. C. **Catalytic cracking of high-nitrogen charge stock. I. Presentation of experimental data.** *Petroleum Refiner* 31, No. 3, 101-3(1952).—*C.A.* 46, 5827*b*.

The results were given for a moving-bed catalytic-cracking pilot-plant investigation to det. the cracking characteristics of (1) a charge stock contg. 0.4 wt % N and having an A.P.I. grade of 21.2° and an end point of 910°F, and (2) a 1st-pass catalytic gas oil obtained from moving-bed cracking of the virgin heavy gas oil.

7721. SEEBOLD, JAMES E.; BERTETTI, J. W.; SNUGGS, J. F., AND BOCK, J. A. **Fluid hydroforming; full-scale unit; first to use the fluidized catalyst technique.** *Oil Gas J.* 51, No. 2, 111, 135-6 (1952).—*C.A.* 46, 7311*d*.

Design process conditions were: temp. 930°F; naphtha preheat 940°F; recycle-gas preheat max. temp. 1300°F; pressure 250 lb/in^2; space velocity 0.45 lb of naphtha per hr per lb of catalyst in reactor; catalyst-to-oil ratio 0.35 lb of catalyst circulated per lb of naphtha; recycle-gas rate 6000 standard ft^3 per barrel of naphtha; recycle-gas H content 60 mol. %; regeneration conditions 1100°F temp., and 260 lb/in^2 pressure.

7722. SEMENOV, A. P. **Effect of surface films on the agglomeration of aluminum.** *Doklady Akad. Nauk S.S.S.R.* 86, 357-9 (1952).—*C.A.* 47, 1557*h*.
Adsorbed films preventing agglomeration can be most effectively removed by heating in air 30 min. at 450°C; other methods, such as treatment with solvents, or electrolytic degreasing, failed to give reproducible results. The effectiveness of an oil in preventing agglomeration through stamping and compression can be taken as a direct measure of the lubricating quality of the oil. A no. of oils and liquids were tested from this point of view.

7723. TOMKINS, R. V. **Recent research on Saskatchewan bentonites.** *Trans. Can. Inst. Mining Met.* 55(in *Can. Mining Met. Bull.* No. 478, 110-12)(1952).—*C.A.* 46, 5491*c*.
Properly activated bentonites from 2 deposits produced good oil-decolorizing clays. Modified bentonites from 2 other deposits were suitable for drilling gels.

7724. WEIL, HERBERT. **Fifty years of petroleum chromatography. I. Empirical and scientific eras.** *Petroleum Processing* 7, 812-14(1952).—*C.A.* 46, 8356*e*.

7725. WESTGATE, MARK W. AND CHRISTIAN, MARJORIE R. **Detector for aromatic hydrocarbons.** *Natl. Paint, Varnish Lacquer Assoc., Sci. Sect., Circ.* No. 757, 110-15(1952).—*C.A.* 47, 3049*c*.
The instrument, which depended on development of a brown stain on a gel surface, was capable of detecting separately benzene, toluene, or xylene in air at or below the concns. involved in good industrial hygiene practices. Vapors of nonaromatic solvents did not interfere with the tests.

7726. YOSHIDA, TAKATOSHI; FUJII, KYŪZŌ, AND KITA, YOSHIZO. **Separation of paraffin from gas-generator tar.** *Coal Tar* 4, 188(1952).—*C.A.* 46, 8830*d*.
Gas-generator tar (2500 g), gathered from the surface of washing water, was fractionated and from the fraction, b. 280-360°C, 369 g of paraffin was sepd. by refrigeration. After recrystn. from benzene and treatment with activated acid clay, 126 g (yield, 5.04%), m 56.4°C, was obtained.

7727. BONDI, A. AND PENTHER, C. J. **Electrical properties of colloidal suspensions in oils.** *J. Phys. Chem.* 57, 72-9 (1953).—*C.A.* 47, 4692*i*.
By use of a capacitor with a rotating electrode, studies were made on the degree of flocculation of soap fibers, silica, Fe powder, and carbon black in a nonaq. medium. The decrease in dielec. const. was ascribed to flow orientation of the particles. For all suspensions of nonconducting particles there was an increase in the d. c. cond. and the appearance of an electrokinetic potential during shearing. The deformation of particle aggregates in these systems was attributed to essentially elastic restorable short-range forces.

7728. BUCHWALD, HERBERT AND WOOD, L. G. **Determination of copper in mineral oils using an ion-exchange technique.** *Anal. Chem.* 25, 664-5 (1953).—*C.A.* 47, 6639*g*.
A 10-ml sample of oil was dild. with 10 ml of 2-propanol and percolated through a 30 × 1 cm column of the H form of Zeo-Carb 215, prewashed with 60 ml of 2-propanol. The column was washed with 70 ml of 2-propanol followed by 60 ml of distd. water. The Cu was eluted with 60 ml of 10% H_2SO_4 followed by 20 ml of distd. water and detd. colorimetrically with $Et_2NC(S)SNa$.

7729. DEBRUYNE, H. **Recovery of oils from decolorizing earth.** *Bull. mens. inform. ITERG* 7, 109-11 (1953).—*C.A.* 47, 6155*d*.
One kg of earth contg. 32.5% of oil was boiled with agitation in 5 liters of water contg. 150 g of a mixt. of Na_2CO_3 with sulfonated cetyl and oleyl alc. for 15 min. Up to 93% of the oil from the earth could be skimmed off. The aq. soln. could be employed for subsequent batches.

7730. DIEKMAN, ROBERT AND FORSYTHE, W. L. JR. **Laboratory prediction of flow properties of fluidized solids.** *Ind. Eng. Chem.* 45, 1174-7 (1953).—*C.A.* 47, 9065*h*.
Successful circulation depended on keeping the solids aerated. The method involved measurements of viscosity and deaeration rate of a fluidized bed. Natural clay and used synthetic, SiO_2-Al_2O_3 cracking catalysts were the test solids. Av. particle size was the controlling factor.

7731. EISLER, STANLEY L. **Radiometric study of the adsorption characteristics of stearic acid.** *Corrosion* 9, 91-4(1953).—*C.A.* 47, 3781*h*.
A radiometric test method to measure the amt. of adsorption of polar org. rust inhibitors was developed. Stearic acid (tagged with C^{14}) was chosen because of its known adsorption characteristics. The amt. of stearic acid adsorbed increased with time of immersion, when coupons were agitated as compared with quiescent immersion, and also with increased stearic acid content of the soln. The amt. of stearic acid adsorbed was found to be independent of the drainage time and temp.

7732. GUNNESS, R. C. **Fluidized-solids technique in the petroleum industry.** *Chem. Eng. Progr.* 49, 113-20(1953).—*C.A.* 47, 4591*f*.
In bringing gases into contact with solid reactants or catalysts, use of a fluidized bed of solid particles led to uniform temps. throughout the bed, high reaction rates, and better yields. The solid particles could be easily added to and withdrawn from the reactor; circulation of the solids was effectively used for heat transfer. Other industries beginning to make use of this tool were: the synthesis of phthalic anhydride, the manuf. of activated charcoal, the calcining of limestone, and the roasting of ores.

7733. JOHANSEN, R. T.; LORENZ, P. B.; DODD, C. G.; PIDGEON, FRANCES D., AND DAVIS, J. W. **The permeation of water and isoöctane through plugs of microscopic particles of crushed quartz.** *J. Phys. Chem.* 57, 40-5 (1953).—*C.A.* 47, 5212*g*.
Surface areas by N_2 adsorption and permeation of water and isoöctane through plugs of 4 differ-

ent samples of crushed quartz were measured. Calcn. of the surface area by the Kozeny-Carmen equation from water permeability gave areas from 0.70 to 0.75 that of the B.E.T. area; isoöctane permeation about 0.6.

7734. KOEPKE, BOYD F. AND STOWE, V. M. **With proper care, you can use desiccants years longer.** *Gas* 29, No. 3, 100, 102 (1953).—*C.A.* 47, 4062*d*.

Activated alumina and other desiccants were widely used for drying gases, vapors, and liquids. While activated alumina was resistant to H_2S, traces of O_2 will cause the deposition of S. Any carryover of caustic solns. will seriously impair the capacity of any of the commonly used desiccants; mist extractors should be used here. Activated alumina should be reactivated at the recommended temp. of 350°F and not at lower temps. This reactivation should be carried out promptly after the adsorber is taken out of service.

7735. MARTIN, C. C. AND SANKIN, ALBERT. **Determination of aromatic and naphthene rings in aromatics from petroleum fractions.** *Anal. Chem.* 25, 206-14(1953).—*C.A.* 47, 5672*h*.

The av. no. of aromatic rings and no. of naphthene rings per mol. in aromatic hydrocarbons concd. were detd. by means of silica gel adsorption or solvent extn. from straight-run or cracked petroleum fractions. The required properties were density, specific dispersion, and mol. wt.

7736. MILBERGER, E. C. AND SWATIK, LORRAINE J. **Preparation and properties of silica aerogel-thickened greases.** *Inst. Spokesman* 16, No. 10, 18-29 (1953).—*C.A.* 47, 2967*i*.

Com. silica aerogels consisted of agglomerated particles of 3-5 μ in size which formed from primary particles of β-crystobolite about 8 A. in diam. The worked penetration of lubricating greases prepd. from silica aerogels decreased as the oil viscosity increased and was also affected by processing temps., milling, or homogenization. When suitable additives were incorporated, greases could be made which were highly water-resistant.

7737. OHME, WOLFRAM. **Desulfurization of Diesel fuels.** *Erdöl. u. Kohle* 6, 8-10(1953).—*C.A.* 47, 5103*c*.

Fuller's earth treatment, reduced the initial S content of 1.91% to 0.97% on the av. between 454 and 460°C. Temps. lower than 450-460° gave a residual S content > 1%. Fuller's earth used in other refining operations was as effective as new earth. Fresh earth reduced the S content in the treated Diesel fuel to as low as 0.5%. After reaching the highest permissible S value in the Diesel fuel, the fuller's earth was regenerated by burning in air, but the regenerated earth was not quite as effective as the new.

V-6. Solvent Recovery and Protection From Toxic Gases, Air Conditioning

7738. BOWER, JOHN H. **Comparative efficiencies of various dehydrating agents used for drying gases (Survey of commercial drying agents).** *J. Research Natl. Bur. Standards* 12, 241-8 (1934) Research Paper 649.

The comparative efficiencies were determined by aspirating properly conditioned air through a train of U-tubes containing the drying materials. The amounts of residual water (mg per liter of air dried) in the order of increasing efficiency at 30°C were: $CuSO_4$ (anhydrous) (2.8); $CaCl_2$ (granular) (1.5); $CaCl_2$ ("Technical anhydrous") (1.25); $ZnCl_2$ (sticks) (0.98); $Ba(ClO_4)_2$ (0.82); NaOH (sticks) (0.80); $CaCl_2$ (granular) (dehydrated) (0.36); $Mg(ClO_4)_2 \cdot 3H_2O$ (0.031); silica gel (0.030); KOH (sticks) (0.014); Al_2O_3 (0.005); $CaSO_4$ (anhydrous) (0.005); CaO (0.003); $Mg(ClO_4)_2$ (0.002); BaO (0.00065).

7739. LEDOUX, EDWARD. **Ventilation and drying of underground chambers.** *Le Genie Civil*, 109, 308-10, 334-7 (1936).

Three general methods were discussed: (1) closed recirculation through reconditioning apparatus; (2) partly closed circuit, with intake from outside air; (3) outside air intake and complete discard of foul air. Refrigeration and adsorption on silica gel were discussed as means of lowering the relative humidity.

7740. LEDOUX, EDWARD. **Drying materials by forced air draft at low temperatures.** *Chaleur et ind.* 18, 159-64 (1937).

Methods employed for drying air were discussed, e.g., cooling and treatment with H_2O adsorbents.

7741. ANON. **Air conditioning helps smash the atom.** *Heating & Ventilating* 35, 18-19 (December) 1938.

A dehumidifying unit of the activated alumina type was employed to dry the compressed air in the high voltage chamber at the Atomic Physics Observatory of the Dept. of Terrestrial Magnetism of the Carnegie Institution of Washington. It was important to maintain a relative humidity of 20% or less at all times when the unit was operating.

7742. FONDA, BAYARD P. **Desirability of adsorption dehumidifiers in air conditioning.** *Heating & Ventilating* 35, 37-39 (May, 1938).

Adsorption dehumidifiers were largely confined to those situations where the moisture load was great relative to the total heat to be removed. Adsorbents may be used in a machine for producing dry air and the dry air made available for a great variety of industrial applications.

7743. ANON. **Air conditioning in testing aviation instruments.** *Heating & Ventilating* 37, 36-37 (Nov. 1940).

A silica gel dehumidifier for moisture removal and a refrigeration condensing unit for sensible heat removal was installed in a test room to insure exact humidity control in the testing of aviation instruments.

7744. HOOGEVEEN, A. P. J. **Detection of small quantities of war gases (Dijkstra's method).** *Chemistry & Industry* 1940, 550-6.—*C.A.* 34, 7215^9.

Traces of war gases were volatilized by heating the sample in a slow air current and adsorbed on activated charcoal or on silica gel. The tests could be carried out either directly on the granules or on the gases recovered from the granules by heating them. Test papers were prepd.: (1) from $Cu(OAc)_2$ + benzidine acetate, (2) $CuSO_4$ + NH_4Cl + $NH_2OH.HCl$ + NH_3 + water, (3) dimethylaniline in EtOH, (4) 0.01% fluorescein in 50% EtOH, (5) 0.1% fuchsin in water + 5% $NaHSO_3$, (6) 0.25% $AuCl_3$ soln., (7) 0.5% mercurochrome (chiefly $C_{20}H_{48}O_6Br_2Na_2Hg$), (8) satd. Na_2S soln. and (9) 5 g *p*-dimethylaminobenzaldehyde and 5 g diphenylamine in 96% EtOH.

7745. McNally, Dana R. **Silica-gel air dehumidifiers.** *Heating & Ventilating*, 37, 37-40, (August, 1940).

Ten gas-fired silica gel dehumidifiers removed 2 tons of water from air in the production and storage of candy products. A condition of 65 to 70°F at 40% to 45% relative humidity was maintained. Many production problems which had been attributed to too high temperatures were solved when the proper relative humidity was maintained.

7746. Patterson, James C. **Choice of dehydration methods.** *Chem. & Met. Eng.* 47, 313-15 (1940).

The choice between a solid adsorbent or a liquid absorbent depended: (1) degree of hydration desired; (2) kind of application; (3) temperature and cost of available water; (4) availability and cost of the utility service (gas, steam, etc.) (5) geographic and climatic conditions.

7747. Smith, Adrian C.; Lowe, Charles S., and Fulton, George P. **Development of rancidity in Stoddard dry-cleaning solvent.** *Ind. Eng. Chem.* 32, 454-60 (1940).—*C.A.* 34, 3099^1.

Fatty matter accumulated in dry-cleaning solvent primarily from the soap used and secondarily from soil in the garments which were cleaned. If not removed from the solvent, this became rancid and caused an objectionable odor in the garments that were cleaned later. A series of practical runs were made during which only filtration and adsorption methods of treating the solvent were used.

7748. Anon. **Protection against sulfur dioxide at Utah Smelting Co.** *Heating & Ventilating*, 38, 41 (May), 1941.

Dorex odor adsorber-units employing canisters of activated coconut shell charcoal were installed in crane cabs. The air was constantly recirculated and the unit could be housed within the cab.

7749. Berger, Wilfried. **Obtaining fluid gas and benzene by the activated-carbon process.** *Z. kompr. flüss. Gase* 36, 113-18 (1941).—*C.A.* 37, 3249^5.

A comprehensive report on the scientific and technical state of the process, based upon the literature.

7750. Dubinin, M. M. **Resistance to air flow of layers of granular materials. II.** *J. Applied Chem.* (U.S.S.R.) 14, 906-13 (German summary) (1941).—*C.A.* 39, 3979^3.

The Chilton-Colburn method was used to calc. air-flow resistance in charcoal adsorption installations. Exptl. and theoretical values for spherical particles agreed well, but irregular particles required a nondimensional coeff. for agreement.

7751. Hartman, F. W. **Dehumidifier used for drying blood plasma.** *Heating & Ventilating*, 38, 57, (September, 1941).

Dehumidified air was used to dehydrate blood samples. A Bryant silica gel dehumidifier was adapted to the operation.

7752. Lowe, Charles S. and Smith, Adrian C. **Reclamation of Stoddard dry-cleaning solvent.** *Ind. Eng. Chem.* 33, 762-8(1941).—*C.A.* 35, 4962^2.

Lab. and plant tests were made with activated carbon, magnesium silicate, or fuller's earths. The adsorbents were compared on the basis of peroxide value, acid no., aldehydes, odor, color and Kreis test of the purified solvent. Activated carbon was the most satisfactory with magnesium silicate a good second and the two Fuller's earths a poor third and fourth.

7753. Philippot, E. **Arresting power of active carbon for arsine.** *Rev. Universelle Mines* 17, 212-23 (1941).—*C.A.* 37, 5159^8.

Air contg. AsH_3 (1 g/m^3) was passed at a rate of 1500 liters/hr through boxes contg. active charcoal, and a filter, and the times before break-through of AsH_3 were measured. Ordinary active charcoal was effective for 5-10 min., but anhyd. active charcoal was about 5 times as effective. The provision of a silica gel container for preventing access of H_2O to the active charcoal was recommended in masks worn by workers in atm. likely to contain AsH_3.

7754. Smith, Harry W. Jr. **Dehumidification in candy manufacturing plants.** *Heating & Ventilating*, 38, 24-27 (June) 1941.

Dehumidification equipment employing silica gel and that employing activated alumina were described.

7755. Alekseevskiĭ, E. V. and Kuznetsova-Kharina, O. M. **Sorption of acetylene.** *J. Gen. Chem. (U.S.S.R.)* 12, 296-304 (in English, 304-5) (1942).—*C.A.* 37, 2843^8.

The suitability was investigated of a variety of commercial carbons, charcoals, silica gel and $Fe(OH)_3$ gel and a variety of carbons treated with numerous inorganic salts, as packing for gas-masks or respirators for protection against acetylene; all of these materials were found to be totally unsuitable. Only cellulose and acetylstearoÿlcellulose were found to have appreciably large sorption of C_2H_2.

7756. Anon. **Odor removal at hog station.** *Heating & Ventilating* 39, 58, (May) 1942.

An installation of Dorex odor-eliminator was described employing 144 canisters of charcoal. The treated air was in the neighborhood of 4000 ft^3/min.

7757. ANON. **Air conditioning in handling hygroscopic pharmaceuticals.** *Heating & Ventilating* 39, 78-80 (January) (1942).

The dehumidifying was provided by a Pittsburgh Lectrodryer unit employing activated alumina. Several installations at Sharp & Dohme, Inc. in Philadelphia were described.

7758. AVERY, LESTER T. **Control of humidity in production of safety glass.** *Heating & Ventilating*, 39, 45-7, (January) (1942).

A regenerative dehumidifying unit employing silica gel was used to dry the plastic sheet used in the manufacture of safety glass at the Libbey-Owens-Ford Glass Co. Where low relative and absolute humidities were required, the silica gel machine proved economical.

7759. BRAGGER, H. J. **Dehydration equipment in the manufacture of vitamin capsules.** *Heating & Ventilating*, 39, 86-89, (January) (1942).

A silica gel dehydrator was described at the American Pharmaceutical Co. The air left the dehydrator at 120°F and was cooled by a water cooler. Silica gel or other solid adsorption dehydrators were essentially heat converters changing latent heat into sensible heat which appeared in the dry air at elevated temps. This necessitated the cooling system.

7760. CACHO, J. AND ARIAS, F. **Gas masks and their control in the laboratory.** *Rev. aeronautica* 3, 99-106, 178-82 (1942).—*C.A.* 37, 5511^4.

A description of the gas mask, its various parts and recent development, lab. tests, tests for lens breakage, detn. of field of view, investigation of breather valve, tightness tests, detn. of dead space, chem. permeability tests with benzyl bromide and yperite, cartridge tests with Cl_2, $COCl_2$, chloropicrin and HCN.

7761. FIGEN, MILTON. **Dehumidifiers in permanent wave pad manufacturing.** *Heating & Ventilating*, 39, 35-36, (March) (1942).

The heating pad consisted of a powdered chemical compd. which generated heat on addition of water. Humidities of less than 30% were maintained in the manufacture of the chemical by a silica gel dehumidifying unit. Air from the silica gel averaged between 95° and 100°F and was cooled by water coils cooled with well water.

7762. HARMS, ARTHUR G. **Constant humidity in grinding and packing dehydrated foods.** *Heating & Ventilating*, 39, 76, (January) (1942).

A Bryant silica gel dehumidifier (automatically controlled) was used to maintain 24% relative humidity in grinding and packing operations.

7763. LEDOUX, EDWARD. **Humidity control in underground bombproof spaces.** *Heating, Piping, and Air Conditioning* 14 (No. 1) 6-8 (1942).

Adsorption processes appeared to be the only system which produced a low enough dew point. If the net heat of adsorption was dissipated outside the spaces, dehumidification was ''adiabatic''. The wall evaporation should be used to the full limit of availability.

7764. MEEK, GEORGE W. **Conservation in heating and air conditioning work.** *Heating, Piping and Air Conditioning* 14, 463-66 (August 1942).

The ventilation requirements per person were reviewed. An odor adsorbing unit may be required when the indicated sizable savings were put into practice.

7765. WHITE, D. E. **Chemistry of gas warfare.** *Australian Chem. Inst., J. & Proc.* 9, 143-50 (1942).—*C.A.* 37, 4821^5.

7766. HOWELL, A. K. **Benzole recovery by active carbon.** *Gas J. (London)* 242, 337 (Sept. 15 1943).

The automatic plant at the Manchester Gas Department consisted of four adsorbing vessels. All the benzole and some 60-70% of the S-compds. in the gas were adsorbed. The steam for removing the benzole was introduced countercurrent to the gas flow. The cooling or drying process was accomplished by re-circulating stripped coal gas through an indirect steam heater and then to the adsorbing chamber. The carbon must be dried and cooled before it efficiently adsorbed more benzole.

7767. LEAKE, CHAUNCEY D. AND MARSH, DAVID F. **Action of war gases.** *J. Chem. Education* 20, 339-43, 357 (1943).—*C.A.* 37, 4821^6.

7768. LEDOUX, EDWARD. **Determining the coefficient of evaporation of humidifiers.** *Chem. Met. Eng.* 50 (No. 6) 124-6 (1943).

The general formula was derived for the coefficient of evapn. for broken solids such as a coke-packed tower wetted without excess. The units were in lb/sec and ft^3 of packing per lb absolute humidity difference.

7769. LEDOUX, EDWARD. **Humidity control in underground bombproof spaces.** *Heating, Piping and Air Conditioning* 15, (No. 1) 34-6 (1943); 14 (No. 6) 364-66(1942).

The evapn. of water from walls in underground chambers was discussed. This source of humidity was usually underestimated due to the dry appearance of the walls.

7770. MOFFETT, T. F. J. **Solvent recovery in a rotogravure printing plant.** *Heating & Ventilating* 40, 33-6(April) 1943.

A Columbia activated carbon unit was described which recovered over 300,000 gallons annually of ink-solvent. The solvent was recovered from the exhaust air withdrawn over the presses by adsorption on coconut shell charcoal. The adsorbed solvent was then steamed out of the charcoal. The mechanical problems of the installation were discussed.

7771. SCHRENK, H. H. AND PEARCE, S. J. **Selection, use and maintenance of respiratory protective devices.** *U. S. Bur. Mines, Circ.* 7236, 12pp. (1943).—*C.A.* 37, 4821^7.

7772. SMOCK, R. M. **The influence of stored apples on the ripening of other apples stored with them.** *New York Agr. Expt. Station Cornell Bull.* 799, 1-36, (1943).

A number of absorbents and adsorbents were tested in trying to "air condition" the storage atmosphere to remove the stimulatory emanations. Among the ineffective absorbents and adsorbents were activated lignite charcoal, H_2SO_4, activated H_2SO_4, sodium bisulfite, certain oils, and water. The only really effective adsorbent was Br_2 adsorbed on the surface of activated charcoal.

7773. ZIEL, HERBERT E. AND SLEIK, HENRY. **The economic factors in converting recirculated air for ventilation.** *Heating, Piping and Air Conditioning* 15, 367-72 (1943).

Adsorption on activated charcoal supplemented by adequate filtration of particulate substance and, where warranted, bacteria control, will requalify vitiated room air for re-use as a ventilation medium. The overall average adsorption efficiency of nut charcoal when employed to treat recirculated air was found to be not less than 95% up to the point where the carbon's saturation did not exceed 15% by wt, independent of moisture. Also, with the low concn. encountered, a satn. of 15% represented an exposure of from six months to two years depending upon the nature and condition of service.

7774. CHAPUIS, ALBERT. **Use of adsorption for solvent recovery.** *Chimie & industrie* 52, 52-63 (1944); *Crops gras, savons* 2, 79-80 (1944). —*C.A.* 40, 2701^1, 5548^1.

The properties and the manufacture of activated charcoal were described. The adsorption properties of activated charcoal in the recovery of solvents were reviewed with a few practical examples.

7775. WALKER, C. R.; APPLEBEE, H. C., AND HOWELL, A. K. **Benzene recovery by activated charcoal.** *Gas J.* 243, 310-346, 379 (1944).— *C.A.* 38, 2469^8.

A benzene-recovery plant in Manchester used activated charcoal in 4 adsorbers, each holding approx. 1 ton of 12- to 20- mesh charcoal. Adsorption cycle was about 60 min., steaming, 30 min., and drying, 30 min. The life of the first batch of charcoal was 7 months, it was then sent away for reactivation. The loss during the adsorption period was negligible. The S content of the light oil was between 1.2 and 1.4% by wt, 0.9 to 1% was CS_2, the balance thiophene and other compds. When the charcoal was fresh, the S in the gas was reduced approx. 64%. With increase in age the efficiency of removal dropped to as low as 40%.

7776. ALEKSEEVSKIĬ, E. V. AND VANYUSHINA, Z. S. **Recovery of vapors of volatile solvents on solid sorbents. X. Temperature and kinetic changes in charcoal charge during sorption of water vapor.** *J. Applied Chem. (U.S.S.R.)* 18, 377-80 (1945)(English summary).—*C.A.* 40, 4581^6.

During sorption of water vapor by charcoal AP at 100-3°C a temp. rise of the charcoal mass was observed to 124°C. The amt. of H_2O adsorbed varied from a max. in the leading layer and dropping to a min. in the rear section. The amt. of H_2O adsorbed by the charcoal was less than that obtained under otherwise analogous conditions.

7777. DERINGER, H. **Benzene recovery from city gas. Process Sulzer Brothers, Winterthur. Studies on activated carbon.** *Schweiz. Ver. Gas-Wasserfach Monatsbull.* 25, 261-72 (1945). —*C.A.* 40, 7569^9.

The process was characterized by desorption with cycling inert gas rather than steam, the gas being heated prior to contact with the charcoal, cooled for recovery of benzene. The temp. of the inert gas entering the adsorber was 150°C. The adsorber was preceded in the gas stream with a surface-active filter to remove gum. Advantages of this system over the steam desorption were outlined. Data were given on the life of various types of charcoal.

7778. ZHUKHOVITSKIĬ, A.A.; ZABEZHINSKIĬ, YA. L., AND TIKHONOV, A.N. **Occlusion of gas from an air current by a bed of grains.** *J. Phys. Chem. (U.S.S.R.)* 19, 253-61 (1945); *Acta Physicochim. U.R.S.S.* 21, 345-57 (1946).—*C.A.* 40, 510^9, 1715^5, 6316^3.

The rate of adsorption of a gas much dild. with air was detd. The diffusion within the grains took place in the adsorption layer and was rapid. The rate was proportional to $(c-y)$, c being the av. gas concn. in the given layer of the adsorbent bed and y the concn. in equil. with the amt. adsorbed at a given moment. If the service time was known for definite bed length, grain size, gas concn., and speed of air flow, the equation permitted calcn. of the service time for another set of conditions.

7779. DIJK, J.A. VAN. **Final purification of city gas by benzene recovery.** *Het Gas* 66, 26-32 (1946).—*C.A.* 40, 4868^6.

The economics of benzene recovery from city gas were discussed at some length. Activated charcoal extn. was preferred for auxiliary removal of other gas impurities.

7780. DOWDING, GUY F. AND WARD, STANLEY G. **Modern practice in activated-carbon solvent-recovery plants.** *Eng. J. (Can.)* 29, 719-21 (1946).—*C.A.* 41, 3667^d.

Activated-charcoal plants for recovering solvents were employed in British plants dealing with the manuf. of rubber goods, leather cloth, rubber or balata belting, transparent paper, rayon, films, cables, edible oil, dry cleaning, etc. The C_6H_6-recovery plants in the gas industry were a most valuable source of C_6H_6 and resulted in complete extn. of naphthalene and a considerable reduction of org. S compds. in the treated gas.

7781. DUBININ, M.M. **N. D. Zelinskii, creator of the charcoal gas mask.** *Bull. acad. sci. U.R.S.S., Classe sci. chim.* 1946, 345-50 (in Russian)

Zelinskii's contributions to the production of gas masks in Russia during World War I were reviewed.

7782. KLOTZ, IRVING M. **The adsorption wave.** **Chem. Rev.** 39, 241-68 (1946).—*C.A.* 41, 234^e.

The nature of the steps involved in the removal of a toxic gas from air by a granular adsorbent were stated. Where the rate-controlling process was a single one of these steps, it was possible, within recognized restrictions, to develop a complete analytical expression for the adsorption wave. Where 2 steps contributed to the rate of removal, a complete theory was still lacking.

7783. Sillén, Lars Gunnar. **Filtration through a sorbent layer. I. An attempt at a simple mathematical treatment.** *Arkiv. Kemi, Mineral Geol.* **A22**, No. 15, 22 pp. (1946) (in English).—*C.A.* 41, 4682*c*.

Equations were derived for ion exchange, chromatography, and adsorption processes in which a small amt. of a component *A* was removed from a gaseous or liquid mixt. by passing the mixt. through a granular sorbent. The equation for a gas-mask sorbent was: $t_r=B/c_0v_0(V-V_d)$ in which $V_d=Kv_0\log c_0/c_r$. The time of resistance, t_r, was the time in min. required for the poison *A* in the outflowing gas to reach a certain concn. c_r, when the air contg. *A* in concn. c_0 (mg per liter) was passed through the sorbent at velocity v_0 (liter per min.). V_d was the dead vol., *B* the capacity of the sorbent for *A* in mg/cc.

7784. Sleik, Henry. **Scientific air recovery. Purification by activated carbon recovers costly conditioned air.** *Modern Power and Engineering* **40**, 59-62, 112, 114(1946).—*C.A.* **40**, 5168^9.

Active charcoal air filters in air-conditioning systems permitted the recirculation of a greater fraction of the conditioned air, thus economizing in power or fuel for heating or cooling, as well as removing objectionable odors. The active charcoal can be used in canisters or in panels or frames of conventional air filter size, contg. one or more rows of evenly spaced, perforated, tubes housed in a metal frame.

7785. Tartarini, G. **The recovery of volatile solvents in industry.** *Chimica e industria (Milan)* **28**, 117-22 (1946).—*C.A.* **41**, 1355*g*.

The various types of processes for the recovery of volatile solvents were summarized.

7786. Tikhonov, A.N.; Zhukhovitskii, A.A., and Zabezhinskii, Ya. L. **Adsorption of gas from an air current by a layer of granular material. II.** *J. Phys. Chem. (U.S.S.R.)* **20**, 1113-26 (1946) (in Russian); *Acta Physicochim. U.R.S.S.* **22**, 121-36 (1947) (in English).—*C.A.* **41**, 2958*e*, 6791*c*.

The math. theory was extended to systems in which the adsorption isotherm was concave toward the axis of pressure, such as the Langmuir isotherm.

7787. Yavorovskaya, S.F. **Comparative evaluation of solid and liquid mercury adsorbers (de-mercurizers).** *Gigiena i Sanit.* **11**, No. 6, 27-33 (1946).—*C.A.* **41**, 3233*d*.

Pumice, active carbon, silica gel, active MnO_2 (granules 2-4 mm in diam.) coated with a mixt. of $CuI + I_2$, and active iodized carbon were studied. De-mercurization proceeded according to $Hg + I_2 = HgI_2$ and $CuI + HgI_2 = [CuI\ HgI_2]$. Active MnO_2 was prepd. by pptg. MnO_2 on mixing solns. of $KMnO_4$ and $MnCl_2$, drying and granulating; traces of Cl remain adsorbed. The new sorbents were prepd. by mixing active carbon or silica gel with a satd. soln. of $CuSO_4$, letting stand for several hrs, decanting the soln., adding a satd. soln. of KI, letting stand for 2 hrs, decanting, and drying at 70-80°C.

7788. Amero, R.C.; Moore, J.W. and Capell, R.G. **Design and use of adsorptive drying units.** *Chem. Eng. Progress* 43, No. 7, *Trans. Am. Inst. Chem. Engrs.*, 349-70 (1947).—*C.A.* 41, 4972*i*.

Drying units employing granular desiccants were used on a wide varity of fluids. The effect of fluid temp., pressure, and compn. on desiccant performance was discussed. A discussion of regeneration procedures was included.

7789. Anon. **Solvent recovery with activated carbon.** *Chem. Eng.* 54, No. 1, 136-9(1947).—*C.A.* 41, 2181*d*.

7790. Deringer, H. **A steam-saving process for benzene extraction in gas-works and coke ovens supplying town gas and for solvent recovery by means of activated carbon.** *Trans. Fuel Economy Conf., World Power Conf., Sect.* A4, *Paper No.* 4, 7 pp. (1947).—*C.A.* 42, 739*c*.

The process used an inert gas, free or almost free from air, such as coal gas or internal-combustion engine exhaust gas, for removing the adsorbed vapors. Both the adsorber and the gas were heated by indirect steam during the recovery process. Steam requirements for this process averaged 2.2 kg per kg of light oil, even without recovery of the heat liberated by the light oil during condensation, about half of the steam requirements for the direct steam process.

7791. Gross, C.R.; Hall, G.O., and Smock, R.M. **Odor sources in egg storage and methods of removal.** *Food Inds.* **19**, 919-21, 1028, 1030. —*C.A.* **41**, 7556*d*.

Storage at very high humidity resulted in mold and bacterial growth on eggs which made them unmarketable. Treatment of eggs with mineral oil reduced the storage odor of eggs to some extent, but air purification with activated charcoal was most effective. Ozone did not remove volatile odors evolved by case materials but did control mold growth.

7792. Katz, S.H. **Status of the U.S. Army service gas masks.** *Chem. Corps J.* 2, 32-40(1947). —*C.A.* 42, 299*b*.

The service gas masks of the U.S. Army were briefly described and their characteristics given.

7793. Priestley, J.J. and Morris, H.G. **Organic sulfur compounds in town gas. Experimental plant for their removal.** *Gas World* **126**, 390-2 (1947).—*C.A.* **41**, 3278*a*.

The full-scale exptl. plant, erected at Mirfield, for removal of org. S from manufd. gas by use of a thiomolybdate catalyst was described.

7794. Trägårdh, Uno. **Recovery of solvents by adsorption.** *Tekn. Tids*, 77, 345-56 (1947).—*C.A.* **41**, 4338*b*.

Methods were reviewed.

7795. BENSON, R.E. AND COUROULEAU, P.H. **Activated carbon. Manufacture, capacity of adsorption, and use in solvent recovery. European practice.** *Chem. Eng.* **55**, No. 3, 112-15 (1948); *Chem. Eng. Progress* **44**, 459-68 (1948).—*C.A.* 42, 3932*c*, 5236*i*.

A general description was given. Factors were discussed involved in recovery of solvents in the printing industry, particularly in Europe and South America.

7796. GOSHORN, JOHN C. **Use of adsorbents for protection against ammonia.** *J. Ind. Hyg. Toxicol.* **30**, 201-4 (1948).—*C.A.* 42, 6022*i*.

A special gas mask was required for protection against high concns. of ammonia encountered in the operation of ice plants, in the handling of ammonia cylinders, and in miscellaneous chem. plants. The canister for the ammonia mask was filled with 1100 ml of an ammonia adsorbent. The most efficient adsorbents thus far developed are Kupramite, $CoCl_2.6H_2O$ impregnated pumice, silica gel, and pumice impregnated with 40-50% of acids such as oxalic or phosphoric. Charcoal impregnated with weak acids was the most promising adsorbent.

7797. GUYE, F. **Desirable desiccant properties for refrigerant water removal.** *Refrig. Eng.* **54**, 550-3, 584-5 (1947).—*C.A.* 44, 2805*g*.

The desiccant must be able to remove water from the refrigeration system efficiently, be physically strong, nondeliquescent, and chemically inert. Several materials meeting these requirements in varying degrees were commercially available: silica gels, activated Al_2O_3 and $CaSO_4$.

7798. KATZ, SIDNEY H. AND MACRAE, DUNCAN. **Filtration of aerosols by granular charcoal.** *J. Phys. & Colloid Chem.* **52**, 695-7(1948).—*C.A.* 42, 3876*f*.

The adsorption of vapors by gas-mask charcoal was known to be characterized by a const. that was proportional to the 0.41 power of the product of the particle diam., mass rate of flow, and fluidity of the vapor. Data for the adsorption of a dioctyl phthalate aerosol with particle diam. of 0.3μ gave a similar const. proportional to the 0.41 power of the same product. The agreement indicated that granular charcoal filtered aerosol particles and vapor mols. by much the same mechanism, even though the diffusion const. involved differed by a factor of 100,000.

7799. LEDOUX, EDWARD. **Avoiding destructive velocity through adsorbent beds.** *Chem. Eng.* **55**, No. 3, 118-19 (1948).—*C.A.* 42, 3221*i*.

A dimensionless expression was derived for the max. safe mass velocity of the gas, G, which would not cause motion of the adsorbent bed, with attendant reduction in size due to abrasion. The equation was: $G^2=0.0167\ Dgd_gd_a$, where D was diam. of av. particle, g acceleration of gravity, d_g d. of the gas, and d_a apparent d. of the adsorbent bed. The const., 0.0167, was detd. from industrial experience.

7800. LEDOUX, EDWARD. **Vacuum concentration by adsorption.** *Chem. Eng.* **55**, No. 7, 102-4(1948).—*C.A.* 42, 6587*h*.

Replacing condenser with an adsorber permitted operation of vacuum at lower temp. using the same power.

7801. MUNKELT, F.H. **Air purification and deodorization by use of activated carbon.** *Refrig. Eng.* **56**, 222(1948).—*C.A.* 44, 4609*i*.

7802. OTHMER, DONALD F. AND JOSEFOWITZ, SAMUEL. **Correlating adsorption data.** *Ind. Eng. Chem.* **40**, 723-5 (1948).—*C.A.* 42, 4422*d*.

A method was developed to allow the detn. of adsorption (accurately enough for engineering calcn.) over a full range of temp. and pressures from exptl. data at one temp. and from the vapor pressure of the adsorbate. When ln (P_o/P) was plotted against $1/T$, the slope of the line equaled $\Delta F/R$. The change in free energy was const. for a moderate range below the crit. temp. The use of the equation was tested for the adsorption of acetone on charcoal.

7803. PADOVANI, C.; BUTTAZZONI, A., AND LOTTERI, A. **Extreme desulfurization of illuminating gas.** *Riv. combustibili* **2**, 13-22 (1948).—*C.A.* 43, 3172*i*.

Finely divided Ni, Fe, Cu, Sn, Pb, Bi, Fe, Cu, and especially Ni were very active desulfurizers; the activity reached a max. after an initiation period in which only partial desulfurization was observed. The activity reached finally an equil. value with a residual S of 4-5 g per 100 m^3. The catalysts were regenerated to max. activity by air or steam. Best results were obtained at 450°C and 4.5 sec contact time. Excellent results were obtained with Cu, Ni, or Co oxides. Desulfurization on active carbon was unsatisfactory. On reduction over Ni and adsorption on active carbon the residual S content was 1.1 g per 100 m^3.

7804. SMOCK, R.M. AND SOUTHWICK, F.W. **Air purification in apple storage.** *Agr. Expt. Sta. Bull.* **843**, 3-51(1948).—*C.A.* 43, 3537*d*.

Activated coconut shell charcoal removed scald gases when a single variety was in the room. When several varieties were present, reduction, but not control in all cases, was observed. Air purification gave about the same reduction with mixed varieties as did the use of shredded oiled paper. Air purification added about 3 weeks to the storage life of the apples.

7805. VYLOMOV, V.S. **Carbon monoxide indicator.** *Zavodskaya Lab.* **14**, 1134-5(1948).—*C.A.* 43, 4596*f*.

Pump the sample of air successively through activated charcoal (to take up heavier hydrocarbons, etc.), then silica gel or alumina gel (to take up moisture), into a chamber with hopcalite-silica gel mixt. A thermocouple was introduced for measuring the heat effect. The exit gas was passed through a meter for measurement. The app. was portable and weighed 5 lbs.

7806. WELLS, GEORGE C. **The importance of controlled humidity in long time preservation.** *Corrosion and Material Protec.* **5**, No. 5, 4-9 (1948).—*C.A.* 43, 96*c*.

The dehumidifiers employed solid desiccants and elec. energy used for reactivating the satd.

beds. Appropriate thin-film rust preventative compds. were applied to the interior working surfaces of the machinery. As humidity was increased to approximately 60% relative, there was but small increase in the tendency toward deterioration by corrosion. There was, however, a more definite increase in the tendency of mildew and mold to form on animal and vegetable materials. The general appearance of a ship laid up in accordance with the principles herein presented was impressively excellent.

7807. AMSTUZ, JOHN O. **Solvent-vapor control.** *Mech. Eng.* 71, No. 2, 143-7, 149(1949).—*C.A.* 43, 2342*e*.

A procedure was given for lab. detn. of the rate of solvent evapn. for a given process; data obtained in this way were used to calc. the amt. of solvent evapd. per hr. Sufficient air should be introduced for ventilation so that the solvent concn. never exceeds 40% of the lower explosive limit.

7808. BARTOL, J.H. **Clear the air with activated carbon.** *Safety Eng.* 98, No. 4, 84-6(1949).—*C.A.* 44, 8573*i*.

An air-purification canister contg. activated charcoal was described and a wide range of uses listed. In a Chicago meat-packing plant 450 charcoal-filled canisters filtering 13,000 ft^3 of air/min. removed 150 lb of noxious gases in 18 months.

7809. CROUZET, J. **An evaluation of purifying materials.** *Compt. rend. congr. ind. gaz, Lyon* 66, 508-28(1949).—*C.A.* 46, 6808*h*.

A comparison was made of various Fe oxide mixts., both naturally occurring and prepd. experimentally as to their ability to absorb H_2S from coke gas. The absorption capacity speed of absorption, sensitivity to humidity and temp., ease of regeneration, and loss of charge were investigated. The absorption tests were performed with a column 10 cm high and 29 mm wide through which a pure, deoxygenated coke gas contg. 10 g H_2S/m^3 was charged at 5 mm/sec.

7810. PRING, R.T.; KNUDSEN, J.F., AND DENNIS, RICHARD. **Design of exhaust ventilation for solid materials handling—fundamental considerations.** *Ind. Eng. Chem.* 41, 2442-50(1949). —*C.A.* 44, 1761*i*.

In order to reduce dust abrasion and to avoid loss of and inconvenience to recovering the product removed, the amt. of material carried into the exhaust ducts must be minimized. To permit the settling out of coarser particles, the vol. of effluent air must also be kept at a min. by restricting the ingress of air. Exhaust connections must be so located as to remove the contaminated air near its point of dislodgement from the solids.

7811. BARTOL, J.H. **Planning for deodorizing equipment.** *Eng. News-Record* 144, No. 24, 35-6 (1950).—*C.A.* 44, 8172*b*.

Recirculation of air, conditioned in regard to temp. and humidity, through activated charcoal to remove odors resulted in considerable savings in refrigeration and heating costs. A hypothetical example showed a reduction in capital cost from $950 to $178 and in yearly operating costs from $169 to $33 for a system supplying 1000 ft^3 air per min. When the adsorbed impurities are 20% of the wt of the charcoal the latter was reactivated.

7812. DZHIGIT, O.M.; KISELEV, A.V., AND KRASIL'NIKOV, K.G. **Effect of the structure of the silica gel on the velocity of the sorption of calcium hydroxide from aqueous solutions.** *Doklady Akad. Nauk S.S.S.R.* 71, 77-9(1950).—*C.A.* 44, 5180*i*.

The amts. of $Ca(OH)_2$ sorbed from a clear aq. soln. in a stated time (1 hr to 30 days), were plotted against the concn. after sorption. The isotherms were substantially different for a coarsely-porous silica gel, characterized by marked capillary condensation and considerable hysteresis in the sorption of C_5H_{12} vapor at 20°C, and a finely-porous silica gel showing no capillary condensation under the same conditions. Sorption of $Ca(OH)_2$ was detd. with fractions of the silica gels remaining after sifting with 10,000 mesh/cm^2, and heated 4 hrs at 350°C. The coarse-pore gel permitted ready diffusion of $Ca(OH)_2$, and the Ca silicate formed did not prevent its access to the surface of yet unreacted SiO_2.

7813. FIELDER, H.J. **Benzene recovery by active carbon.** *Gas Times* 62, No. 704, 185-6, 191, 194, 197; *Gas World* 131, 270-1, 276 (1950).—*C.A.* 44, 4654*a*.

The plant consisted of 4 charcoal adsorbers, arranged in two units, each unit with an automatic controller; each unit was operated independently, with a capacity of 3 million ft^3 per day. Two adsorbers adsorbed while one was steamed and the other dried. Each adsorber was a cylindrical vessel, 8 ft 6 in. high and 5 ft diam. The adsorption period varied from 80 min. with new charcoal to 30 min. just before changing. Steaming for recovery was countercurrent to the direction of gas passage for adsorption. The adsorptive capacity of a charcoal was tested with CCl_4, as the break point was easier to det.

7814. KATZ, S.H. **Filtration law for aerosols.** *Armed Forces Chem. J.* 3, No. 7, 14-16(1950). —*C.A.* 44, 3333*d*.

The math. expressions of several investigators were equiv., the simplest form being $Q = q^b$. Data obtained by visually estg. light scattered from smoke-penetrating filters deviated more from the filtration law than data obtained from photoelec. measurements. The better agreement between such measurements and the filtration law was attributed to the greater sensitivity of the photoelec. cell.

7815. SHAW, FRED B. JR. **Packing incendiary bomb clusters. A container problem.** *Armed Forces Chem. J.* 3, No. 8, 20-1, 40(1950).—*C.A.* 44, 5038*h*.

The use of a moisture-proof drum and silica gel dehydrating agent materially reduced the moisture deterioration of Mg and incendiary-oil bombs.

7816. ANON. **Activated carbon in solvent recovery.** *Can. Chem. Process Inds.* 35, 376-7, 411 (1951). —*C.A.* 45, 6321*e*.

A solvent-recovery plant used activated charcoal as adsorbent and resulted in the collection of about 1,000 lb of gasoline per hr from the air, and delivered it ready for use. Ninety-nine % gasoline was recovered.

7817. AUDAS, F.G. **A continuous dry process for the removal of hydrogen sulfide from industrial gases.** *Coke and Gas* 13, 229-34(1951).—*C.A.* 46, 11638*i*.

According to the following reaction: $2H_2S + SO_2 \rightleftharpoons 2H_2O + 3S$, H_2S was removed by adding SO_2 in small excess of the above reaction and passing the mixt. through a bed of alumina at 60-90°C at such a rate that it emerged from the chamber contg. the bed completely free of H_2S. The spent alumina was continuously withdrawn from the bottom of the reaction chamber for regenerative treatment, while regenerated material was continuously added at the top. Regeneration of spent alumina consisted of heating at 500°C by passing hot gases through the bed of alumina in the regenerating vessel.

7818. DAVANZO, P. **Dehydration of natural gas.** *Riv. combustibili* 5, 5-41(1951).—*C.A.* 45, 6821*h*.

Dehydration of natural gas by solid (Al_2O_3, SiO_2) and liquid adsorbents (concd. solns. of diethylene and triethylene glycol) necessary for economical pipeline operation were reviewed. Flow diagrams and operational characteristics of dehydrating plants were reported.

7819. HENDRY, R. **The control of the moisture content of air.** *Proc. Inst. Refrig.* (London) 48, 82-8(1951-52).—*C.A.* 47, 6193*c*.

Where the humidity was too low, it was recommended that a portion of the room air be passed through a heater and an adiabatic humidifier. If the humidity was too high, it could be reduced by wet cooling coils, absorption in $CaCl_2$ soln., or adsorption on silica gel or activated alumina.

7820. HORMATS, SAUL. **Charcoal for military respirators.** *Armed Forces Chem. J.* 5, No. 1, 34-6(1951).—*C.A.*, 45, 10437*b*.

Activation by $ZnCl_2$, K_2S, KCNS, and various gases was discussed and charcoal impregnation methods described.

7821. JESSOP, STUART M. **Dry fibrous filters.** *Armed Forces Chem. J.* 5, No. 1, 45(1951).—*C.A.* 45, 9921*i*.

Filters developed by the Chem. Corps for removing dust, toxic smokes, bacteria, spores, and radioactive particulates were described.

7822. PALTRIDGE, R.M. **Possible improvements in oxide purification practice.** *Natl. Gas Bull.* (Australia) 15, 5-9(Nov.-Dec., 1951).—*C.A.* 46, 7736*b*.

Boxes should be filled with an Fe_2O_3-sawdust mixt. of min. bulk d. and the moisture content adjusted to 15-20% by means of wetting agents, and kept as const. as possible by humidity control of the inlet gas and by water sprays *in situ* if necessary. The O_2 content of the inlet gas should be low and a backward rotation of boxes with second-box air admission used. Pelleted oxides were favored for high throughputs where back pressure rather than fouling causes purifier failure.

7823. SCHULTZ, ROBERT F. **Air-pollution-abatement activities.** *Proc. Air Pollution Smoke Prévention Assoc. Am.* 44, 107-10(1951).—*C.A.* 46, 5820*f*.

Fly-ash evolution from the boiler house was controlled by the installation of Aerotec collectors. The atm. in the sewer was tested by drawing samples through active charcoal or a cold trap. The liquid recovered contained large amts. of aromatic and chlorinated hydrocarbons, as well as some very odoriferous aliphatic high-boiling material contg. no Cl, and some aliphatic low-boiling compds.

7824. FAY, J.W.J. **Safe disposal of contaminated extract air from radioactive laboratories.** *Atomics* 3, 143-8(1952).—*C.A.* 46, 8532*b*.

As little as 1-10 p.p.m. of the total activity handled became airborne. Inhibition could be effected by the use of coarse filters and long air stacks. A filter which removed particles to 10μ normally will be sufficient to prevent deposition hazards. The dominant factor thus became the regulation of release of non-settling activity so as to not give rise to a breathing hazard, e.g., emission of not more than 50 mc. of Sr^{90} per day, or the equiv., from a 25-m stack. In the case of 0.5 mc. Pu^{239} the same stack could be used.

7825. FÖRCH, J.H. **Extracted blue earth as a filling for gas purifiers.** *Chem. Weekblad* 48, 88-90(1952).—*C.A.* 46, 6363*i*.

Extd. blue earth was made from exhausted Fe oxide used in the purification of coke-oven gas. Water treatment removed sol. thiocyanides, thiosulfates, and sulfites. After conversion with CaO and extn. of the $Ca_2Fe(CN)_6$ with water, the resulting $Fe(OH)_3$ was well suited for the absorption of H_2S.

7826. RATHMELL, B.L. AND BATEMAN, P.J. **Air drying by solid granular adsorbents.** *J. Inst. Heating Ventilating Engrs.* 19, 471-505, discussions 505-23(1952).—*C.A.* 46, 10704*g*.

Large com. driers with silica gel and activated alumina were described.

7827. THOMPSON, R.J.S. **Continental practice in the treatment of coal gas.** *Gas World* 135, No. 3529 Coking Sect., 37-41(1952).—*C.A.* 46, 5292*d*.

An account of Continental practice, largely German, including tar decantation under pressure, horizontal-tube primary coolers, centrifugal exhausters, and removal of H_2S from the gas. Dry purification was used for removing H_2S from the largest proportion of the gas.

7828. TURK, AMOS; SLEIK, HENRY, AND MESSER, PHILIP J. **Determination of gaseous air pollution by carbon adsorption.** *Am. Ind. Hyg. Assoc. Quart.* 13, 23-8(1952).—*C.A.* 46, 4709*f*.

A dual perforated, blower-canister unit, charged with activated charcoal of 6-14-mesh particle size with hardness of 80 and apparent d. of 0.42 g/ml, operated at a rate of 40 ft^3/min. could be used to sample gaseous atm. contaminants.

The concns. of single compds. could be calcd. from a detn. of the wt increased. Adsorbed material could be removed with steam for analysis of mixts. of compds. collected.

7829. GALLILY, I. **The adsorption of active gases from streaming air.** *Bull. Research Council Israel* 3, No. 1/2, 56-66 (1953).—*C.A.* 48, 5594^g.

The efficiency of adsorption of noxious gases (Cl_2) streaming through a bed of activated charcoal was tested under the special conditions of gas mask. Part of the mixt. of air + Cl was passed (at predetd. times) through appropriate absorption bottles where the Cl was bubbled through an aq. soln. of $Na_2S_2O_3$ + KI + starch.

V-7. Biochemical, Medical, and Pharmaceutical Applications

7830. BRUNNER, OTTO; BARONI, EUGEN, AND KLEINAU, WOLRAD. **Visual purple.** *Z. physiol. Chem.* 236, 257-62(1935).—*C.A.* 30, 117^3.

Freshly dissected retinas from the eyes of steers and pigs were extd. with abs. MeOH while carefully excluding air, the ext. was treated with an equal vol. of benzine and the soln. sepd. into 2 layers by addn. of H_2O. The benzine soln. of the pigment was adsorbed on Al_2O_3 and the pigment identified as β-carotene. The color change during adsorption and the light sensitivity of the adsorbate suggested the desirability of a comparison with visual purple.

7831. INGRAHAM, MARY A. AND STEENBOCK, HARRY. **The relation of microorganisms to carotenoids and vitamin A. II. The production of carotenoids by Mycobacterium phlei.** *Biochem. J.* 29, 2553-62(1935).—*C.A.* 30, 3461^2.

Chromatographic sepn. of the pigment in MgO gave at least a dozen bands. Kryptoxanthin, α- and B-carotene were identified and the presence of esters of lutein, zeaxanthin and azafrin was established.

7832. KARRER, P. AND SOLMSSEN, U. **Carotenoids of purple bacteria. I.** *Helv. Chim. Acta.* 18, 1306-15(1935).—*C.A.* 30, 1830^1.

The purple bacteria contained an entire series of previously unknown carotenoids which was sepd. into its components by chromatogrammatic analysis. The alc.-washed bacterial mass was extd. with CS_2 and the deep-red ext. was concd. and taken up in a ligroin-MeOH mixt. The insol. violet residue was crystd. from benzene and yielded 20 mg of glittering violet crystals of a new carotenoid, rhodoviolascin.

7833. WALDENSTROM, JAN. **An investigation of urinary pigments, especially the porphyrins by means of chromatographic analysis.** *Deut. Arch. klin. Med.* 178, 38-48 (1935).—*C.A.* 30, 8276^8.

The dark-red urine of a patient with acute porphyria was acidified with HOAc and extd. with ether. The brown ppt. was removed by filtration, and the urine filtered through a column of Al_2O_3 or talc. The first 10-20 ml came through colorless; the rest had the color of normal urine. The pigments were fractionally removed from the filter column by washing it first with 20% HOAc and then with 12% NH_3; the sepn. formed different colored zones.

7834. ACKERMANN, D. AND FUCHS, H.G. **Adsorption of nitrogeneous substances from aqueous solutions.** *Z. physiol. Chem.* 240, 198(1936).—*C.A.* 30, 5093^2.

Lloyd's reagent adsorbed nitrogenous substances from solns. contg. 5% H_2SO_4, thereby affording a sepn. about as effective as pptn. by phosphotungstic acid. The advantage of this reagent was its cheapness, especially if large quantities were to be used.

7835. BECKER, ERICH AND SCHOPF, CLEMENS. **Microchemical tests for pterins in insects.** *Ann.* 524, 124-44 (1936).—*C.A.* 30, 8166^5.

Xanthopterin was characterized by its adsorption behavior from 0.01% MeOH-HCl and aq. 0.004 *N* HCl on Al_2O_3 (a special microadsorption tube was described); this may be used as a semiquant. method. A further test was its behavior toward 20% H_2SO_4, in which it showed a slight but pos. red fluorescence. Differentiation from lactoflavin was also discussed. Erythropterin may be detected by adsorption from 0.004 *N* aq. HCl soln. (better than MeOH-HCl solns.)

7836. BROCKMANN, HANS. **The isolation of antirachitic vitamin from tuna fish liver oil.** *Z. physiol. Chem.* 241, 104-15(1936).—*C.A.* 30, 6423^1.

Vitamin D was obtained in concd. form from tuna-fish livers by 2 partitions between MeOH (90%, then 95%) and benzine, followed by adsorption on $Al(OH)_3$ in the presence of Indicator Red 33 which had the same adsorption properties as the vitamin and served as a marker in the chromatogram. Adsorption on $Al(OH)_3$ in the presence of Indicator Red, whereby a sharply defined colored zone was obtained, concentrated the vitamin D to a content of 25-30%.

7837. BROCKMANN, HANS AND HAASE, RUDOLF. **Dracorubin, the red pigment of "dragon's blood." I.** *Ber.* 69B, 1950-4 (1936).—*C.A.* 30, 6751^1.

Merck's pulverized Indian dragon's blood was first freed from insol. black-brown constituents by extn. with hot benzene. The deep yellow benzene soln. showed 3 absorption bands, by means of which the concn. of the pigment could be followed. The isolation of dracorubin was effected by chromatography. The greater part of it was adsorbed from benzene soln. in the upper section of the column, from which it was recovered as a violet-red powder. The bright red soln. of this crude product in $CHCl_3$ was further purified by another filtration through Al_2O_3.

7838. Dam, Henrik and Schonheyder, Fritz. **The occurrence and chemical nature of vitamin K.** *Biochem. J.* **30**, 897-901 (1936).—*C.A.* **30**, 5633^9.

A series of vegetables and animal tissues was tested quant. for vitamin K. Green vegetables were particularly good sources. The vitamin was concd. by removal of inactive materials from a light-petroleum ext. with 90% MeOH. By adsorption on $CaCO_3$ or sucrose, the vitamin was obtained in concns. up to 600,000 - 1,000,000 units per g.

7839. Daniel, E.V. and Beres, T. **Lipochrome in human blood serum.** *Z. physiol. Chem.* **238**, 160-2(1936).—*C.A.* **30**, 2210^2.

Chromatographic adsorption of the *epiphasic lipochrome* from 3 liters of serum on $Ca(OH)_2$ gave 4 bands, yellowish brown, rose, bright yellow and orange-yellow, resp. Since blood serum contained lycopene and other pigments, the colorimetric detn. of carotene was likely to give high values unless a chromatographic sepn. was performed.

7840. Euler, Hans v. and Malmberg, Maj. **Vitamins and catalysts in wheat embryo.** *Arkiv Kemi, Mineral. Geol.* **12B**, No. 14, 6 pp. (1936). —*C.A.* **30**, 3860^2.

Daily addns. of 1 g of embryo gave 1.8 g daily wt increase and the feeding of 0.5 g produced a definite growth. Chromatographic analysis and Lovibond detns. showed the presence of 5γ of carotenoid per g of embryo contg. scarcely more than 0.05γ of carotene, a quantity that is too small to account for the growth observed.

7841. Greene, R.D. and Black, A. **Extraction of vitamin B_1 from adsorbates.** *Science* **84**, 185-6 (1936).—*C.A.* **31**, 5827^1.

The best yields (not less than 90%) of vitamin from the adsorbate obtained in Seidell's method occurred when aq., aq.- EtOH or EtOH solns. of acid salts of C_5H_5N, quinoline, NH_2Ph, etc., were used as extractants. The salt solns. had an effect greater than that of acid or base alone.

7842. Heilbron, I.M. and Lythgoe, B. **Chemistry of the algae. II. The carotenoid pigments of Oscillatoria rubrescens.** *J. Chem. Soc.* **1936**, 1376-80.—*C.A.* **30**, 8230^2.

A convenient source of Myxoxanthin was the freshwater species *Oscillatoria* rubrescens. The epiphasic (petr. ether) carotenoids, on chromatographic analysis gave 3 pigmented zones, from the lowest of which β-carotene was isolated. The deep red zone on Al_2O_3 was changed to violet by washing with C_6H_6; color reactions were given.

7843. Koschara, W. **Isolation of a yellow pigment (uropterin) from human urine.** *Z. physiol. Chem.* **240**, 127-51 (1936).—*C.A.* **30**, 4878^6.

The urine was acidified and treated with Fuller's earth which adsorbed the greater part of the purines. Elution with 20% pyridine and evapn. of the eluate gave a brownish red ppt. of "purine fraction" which served as the starting material for the isolation of pigment. The isolation was effected by extn. with *N* NaOH, acidifying with HCl to ppt. uric acid, adsorption on Fuller's earth and elution with pyridine, pptn. with $AgNO_3 + NH_4OH$, then with $AgNO_3$, extn. with *N* HCl, adsorption and elution as before, evapn. of the pyridine, dissolving in phosphate buffer of pH 7.6, and chromatographic adsorption on frankonite KL.

7844. Lederer, E. and Moore, T. **Echinenone as a provitamin A.** *Nature* **137**, 996(1936).—*C.A.* **30**, 6042^1.

Echinenone, a pigment isolated from the sex glands of the sea urchin, was probably a monoketone occupying an intermediate position between β-carotene and semi-β-carotene. After preliminary sepn. from carotene by adsorption on Al_2O_3 and further purification, it was examd. for biol. activity as a provitamin A.

7845. Strain, Harold H. **Leaf xanthophylls.** *Science* **83**, 241-2 (1936).—*C.A.* **30**, 3026^2.

A mixt. of xanthophylls in aq. alc. was sepd. on Tswett columns.

7846. Willstaedt, Harry. **The pigments of the true orange agaric** *(Lactarius deliciosus L.).* **II.** *Ber.* **69B**, 997-1001 (1936).—*C.A.* **30**, 4852^3.

The blue pigment found in the fungus, along with the red-violet lactaro-violin, was prepd. in larger quantities but all attempts to make it crystallize failed. *Lactarius azulene* with some other natural *azulene*, and a soln. of the *camomile azulene (Chamazulene)* was prepd. by chromatography on Al_2O_3 of a petr. ether soln. of camomile oil. A mixt. of the 2 azulenes could not be sepd. in the Al_2O_3 chromatogram.

7847. Willstaedt, H. and Lindqvist, T. **The carotenoids of human serum and liver. I.** *Z. physiol. Chem.* **240**, 10-18(1936).—*C.A.* **30**, 5279^3.

The carotenoids from large quantities of serum (140-250 cc.) in 12 cases, and those of the liver in 4 of these cases, were sepd. chromatographically. Detns. of the yellow pigments in serum did not disclose the actual quantity of β-carotene unless recourse was had to chromatography.

7848. Zechmeister, L. and Tuzson, P. **The lipochrome of the water frog** *(Rana esculenta).* *Z. physiol. Chem.* **238**, 197-203 (1936).—*C.A.* **30**, 2644^5.

Chromatographic studies were reported on the carotenoid mixts. present in the liver, skin, ovary and *corpus adiposum* of the frog. The liver contained β-carotene, lutein and zeaxanthin, the skin carotene and xanthophyll esters, the ovary carotene, lutein and zeaxanthin, and the fat body mainly xanthophyll esters.

7849. Zechmeister, L. and Tuzson, P. **Mandarin pigment. II.** *Z. physiol. Chem.* **240**, 191-4 (1936).—*C.A.* **30**, 5262^2.

Further examn. of mandarin peels by an improved technique confirmed the finding of carotene, but the chief pigment was cryptoxanthin, $C_{40}H_{56}O$. The latter was spectroscopically indistinguishable from the polyene hydrocarbon but was readily sepd. and obtained cryst. by means of the Tswett column.

7850. Euler, H.v. and Schlenk, F. **Cozymase.** *Z. physiol. Chem.* **246**, 64-82 (1937).—*C.A.* **31**, 4349^9.

A cozymase prepn. was further purified by chromatographic adsorption or by pptn. of further impurities by $Pb(OAc)_2$ followed by pptn. of the cozymase with alc. The material was pure white, completely sol. in H_2O, showed no green fluorescence in alk. soln. and no blue fluoresence in acid soln.

7851. FISCHER, HANS AND HOFMANN, HANS J. **Porphyrins. XLI. The constitution of uro- and mussel-shell porphyrins. Proof of uroporphyrin III in congential porphyrinuria.** *Z. physiol. Chem.* 246, 15-30(1937).—*C.A.* 31, 4334^8.
The uroporphyrin from a case (petry) of *congential porphyrinuria* was shown by chromatographic analysis and comparison of m.p. to be a mixt. of uroporphyrins I and III.

7852. GRUNDMANN, CHRISTOPH AND TAKEDA, YOSHIHARU. **A new bacterial carotenoid leprotine.** *Naturwissenschaften* 25, 27(1937).—*C.A.* 31, 3955^7.
Leprotine was prepd. from acid-fast bacteria found in infectious material of a lepra case. The bacteria in glycerol-bouillon culture, killed at 60°C for 10 min., washed and dried over P_2O_5, ground and extd. with acetone gave a pigment which was sepd. after sapon. with alc. KOH by chromatographic analysis in benzine with Al_2O_3. The eluate of the main purple zone gave from benzene-MeOH thin copper-red needles of a hydrocarbon m.p. 198-200°C.

7853. BINKLEY, S.B.; MACCORQUODALE, D.W.; THAYER, SIDNEY A., AND DOISY, E.A. **The isolation of vitamin K₁.** *J. Biol. Chem.* 130, 219-34(1939).—*C.A.* 33, 8718^4.
Vitamin K_1 was isolated from artificially dried alfalfa meal or leaf meal in practically pure form. Decalso, Permutit and Darco were used as adsorbents and crystn. at low temps. or distn. and crystn. gave the pure vitamin.

7854. FRACHE, G. **The chromatographic method and its application in legal medicine.** *Zacchia* 3, Ser. 2, 330-47 (1939).—*C.A.* 38, 699^6.
Chromatographic adsorption and techniques were discussed. The chromatographic method permitted identification of traces of blood, by microscopic examn. of the spectrum produced by the adsorbed hematochromogen.

7855. HENNESSY, DOUGLAS J. AND CERECEDO, LEOPOLD R. **Determination of free and phosphorylated thiamine by a modified thiochrome assay.** *J. Am. Chem. Soc.* 61, 179-83(1939).—*C.A.* 33, 2164^8.
Materials interfering in the thiochrome method for detg. vitamin B_1 activity were efficiently removed by the use of a base-exchanging zeolite. The use of a more sensitive fluorometer allowed the accurate detn. of 0.1 μ g.

7856. IGA, YASUO. **The adsorption of dye on the blood corpuscles.** *Okayama Igakkai Zassi (Mitt. med. Ges. Okayama)* 51, 773-82(in Japanese)(in German, 783)(1939).—*C.A.* 37, 655^9.
Cattle blood corpuscles, centrifuged after defibrination of the blood, were washed several times with isotonic dextrose solution. These washed corpuscles were suspended in isotonic dye-sugar solution for 10 minutes, then centrifuged. The dye adsorbed by the corpuscles was estimated colorimetrically by determining the difference between the dye concentration of the original dye solution and that of the centrifuged clear supernatant liquid after removal of the corpuscles.

7857. IGA, YASUO. **Electrophysical studies on cell staining.** *Okayama Igakkai Zassi (Mitt. med. Ges. Okayama)* 51, 784-91(in Japanese)(in German, 791-2)(1939).—*C.A.* 37, 657^1.
The electrical charge of the blood corpuscles was diminished by dye adsorption. The absolute amount of dye in the diluted acid dye solution, which was adsorbed on the cells, was proportional to the molecular weight of the dye, the dynamic surface energy and the electrical conductivity of the solution or the diffusion potential of the dye in water, and was inversely proportional to the molecular concentration.

7858. OKAMURA, NAGAWO. **The isolation of adsorbed adrenaline from the blood corpuscles and the determination of adrenaline in the blood.** *Okayama Igakkai Zassi (Mitt. med. Ges. Okayama)* 51, 1047-62(in Japanese)(in German, 1062-4)(1939).—*C.A.* 37, 658^9.
Adrenaline was firmly adsorbed on the blood corpuscles both *in vitro* and *in vivo*. This bound adrenaline was not removed by a single washing but could be partially removed by repeated washing or under various experimental conditions.

7859. OKAMURA, NAGAWO. **The adsorption of adrenaline by erythrocytes in vivo and the concomitant regulation of the concentration of adrenaline in the blood.** *Okayama Igakkai Zassi (Mitt. med. Ges. Okayama)* 51, 1064-86, 1211-27 (in Japanese)(in German, 1087-8, 1227-9) (1939).—*C.A.* 37, $683^{2,6}$.
Intravenously injected adrenaline remained intact in the blood for a fairly long time. The adrenaline was adsorbed by the *erythrocytes* which played a large role as adrenaline regulators in the living organism.

7860. ALMQUIST, H.J. AND ZANDER, D. **Adsorbing charcoals in chick diets.** *Proc. Soc. Exptl. Biol. Med.* 45, 303-5(1940).—*C.A.* 35, 776^4.
The charcoal interfered more or less with the adsorption of the gizzard factor and vitamins A, G and K in the intestine.

7861. CANNAN, R.K. **The estimation of the dicarboxylic amino acids in protein hydrolysates.** *J. Biol. Chem.* 152, 401-10 (1940).
Amberlite IR-4 was used to separate the dicarboxylic amino acids from protein hydrolysates. The essential steps were the adsorption of the acids from the hydrolysate of a protein by a basic resin, followed by their elution from the resin with HCl. The soln. obtained contained no more than traces of amino acids other than the dicarboxylic acids.

7862. FERREBEE, JOSEPH W. **The urinary excretion of riboflavin; fluorometric methods for its estimation.** *J. Clin. Investigation* 19, 251-56 (1940).
Riboflavin, Vitamin B_2, occurred in urine in the form of uroflavin. An adsorption column (30 mesh floridin) procedure was presented for measuring the uroflavin content of urines. A vol of 1

to 10 cc. urine was required. The adsorbed uroflavin was eluted from the column with 20 ml aq. soln. of 20% pyridine in 2% acetic acid and detd. by its intense greenish-yellow fluorescence.

7863. Rosenthaler, L. **The effect of the concentration of the material and the acid content on the form of crystalline precipitates.** *Pharm. Acta Helv.* 15, 257-65 (1940).—*C.A.* 37, 4608^3.

In the pptn. of cryst. org. substances, especially *basic medicinals*, with $K_4Fe(CN)_6$, ppts. of different crystal form or amorphous ppts. were obtained, depending upon the conditions of pptn. The amorphous forms were obtained especially in concd. solns. contg. large amts. of acid.

7864. Waldschmidt-Leitz, Ernst and Turba, Fritz. **Method for the separation of peptide mixtures.** *J. prakt. chem.* 156, 55-64(1940).—*C.A.* 35, 1823^8.

The cleavage products of proteins were sepd. by means of adsorption through a column (60 mm high and 24 mm in diam.) of Filtrol-Neutrol and extn. with 3 parts C_5H_5N and 7 parts 2 *N* H_2SO_4 or 1 part of C_5H_5N and 9 parts of 0.66 *N* H_2SO_4; elution was continued until the ninhydrin reaction was absent and the arginine reaction was neg.

7865. Abkin, G.L. **The theory of protecting lyophobe with lyophile colloids.** *Trudy Moskov. Tekhnol. Inst. Legkoĭ Prom. im. L. M. Kaganóvicha* 1941, No. 2, 117-20.—*C.A.* 40, 2059^4.

The nucleus of a suspended colloidal particle was not covered entirely by either ions or mols. of a stabilizer. If the entire surface of the nucleus were covered either by ions or by protective particles, colloidal suspensions would be true solns. and would not age. When collision occurred between protected surfaces, the particles would rebound. The particles would not aggregate when an unprotected area of one collided with a protected area of the other; only when two unprotected areas collided would the particles aggregate.

7866. Cook, Elton S.; Walter, Elsie M.; Waring, Sister Mary Grace; Eilert, Sister Mary Redempta, and Rack, Frank J. **Effect of pH on adsorption by charcoal of factors increasing the respiration of yeast and liver.** *Studies Inst. Divi Thomae* 3, 139-45 (1941).—*C.A.* 38, 1760^6.

The factor in aq.-alc. exts. of bakers' yeast which stimulated respiration of rat liver slices was adsorbed on activated (Norit) charcoal from water at acid pH. It was readily eluted by alkali. The properties of the factor which stimulated respiration of yeast were more indefinite.

7867. Dubnoff, Jacob W. **A micromethod for the determination of arginine.** *J. Biol. Chem.* 141, 711-16(1941).—*C.A.* 36, 1627^8.

Arginine, sepd. from glycocyamine by adsorption on Permutit, was eluted by 3% NaCl and detd. colorimetrically by means of the Sakaguchi reaction. Elution was optimum with 2-5% NaCl. No interference from glycocyamine, NH_3 histidine, tyrosine, tryptophan, creatine or urea within stated limits was found.

7868. Hennessy, Douglas J. **Chemical methods for the determination of vitamin B_1.** *Ind. Eng. Chem., Anal. Ed.* 13, 216-18 (1941).—*C.A.* 35, 4050^1.

Accurate and rapid chem. methods were available for the detn. of vitamin B_1. The use of the synthetic zeolite, Decalso, as a preliminary step effectively eliminated interfering materials.

7869. Jensen, K. Kromann. **The production of stable charcoal tablets.** *Arch. Pharm. Chemi* 48, 33-5(1941).—*C.A.* 38, 2794^1.

The elaboration of a prescription for the production, by means of *Sterculia mucilage*, of charcoal tablets which retained their adsorptive power (tested with methylene blue).

7870. Kobozev, N.I. **Mechanism of the catalyzing influence of various catalysts. Catalytic activity and structure.** *J. Phys. Chem.* (U.S.S.R.) 15, 882-917(1941).—*C.A.* 36, 6070^7.

Catalysts were classified according to a structural principle developed from the theory of the active ensemble. The abs. activities and free energies of 22 catalysts were calcd. from their affinity for O_2 and the decompn. consts. of the products formed. The peculiar position of catalase and the relations between catalase, oxidase and peroxidase functions were discussed.

7871. Mitchell, Herschel K.; Snell, Esmond E., and Williams, Roger J. **Concentration of "folic acid".** *J. Am. Chem. Soc.* 63, 2284 (1941).—*C.A.* 35, 6608^8.

The term *"folic acid"* was applied to a product which had been isolated from spinach by adsorption on charcoal, pptn. with Pb and Ag salts and chromatographic adsorption on Fuller's earth; it contained N (no S or P) and had a mol. wt of about 500.

7872. Paget, Marcel and Tilly, Francois. **Adsorption of barbiturates by activated charcoals and its analytical application.** *Tráv. membres soc. chim. biol.* 23, 1381-2 (1941).—*C.A.* 37, 659^4.

Norit in 3 grades readily adsorbed barbiturates from urine. The adsorbed compound could be eluted with Et_2O or Me_2CO.

7873. Reichstein, T. and Euw, J. v. **Constituents of the adrenal cortex and related compounds. LIV. Separation methods, isolation of substance U and its partial synthesis from substance E.** *Helv. Chim. Acta* 24, 247-64E(1941).—*C.A.* 36, 5181^7.

After the isolation of more than 20 members of a series of related steroids from adrenal cortex exts., the sepn. of other related compds. became more difficult. Improvements in sepn. were obtained by chromatographing after acetylation. Previous chromatographic sepn. methods were improved by the use of very pure AcOEt for extn. and the sapon. of concentrates by $KHCO_3$ in aq. MeOH at room temp. to cleave any esters that might be present.

7874. TISELIUS, ARNE. **Adsorption analysis of amino acids and peptides.** *Arkiv. Kemi, Mineral. Geol.* 15B, No. 6, 5pp. (1941).—*C.A.* 36, 369².

About 35 amino acids and peptides were passed in 0.5% solns., and in the presence of NaCl, Na_2SO_4 or glycine buffer soln. of pH 9.9, through various prepns. of active charcoal and the specific retardation vol. (ml/g) of adsorbent detd. The values obtained varied from 0 for glycine to 122 for hippuric acid. A mixt. of 0.5% solns. of leucine, valine and alanine was troublesome to analyze by other methods, but the adsorption method of analysis gave a distinct sepn.

7875. TURBA, FRITZ. **The adsorption behavior of protein-degradation products. I. Chromatographic adsorption of basic amino acids on bleaching earths.** *Ber.* 74B, 1829-38 (1941).—*C.A.* 36, 5494⁷.

Diamino acids may be sepd. from other amino acids by chromatographic adsorption on activated bleaching earth (Filtrol-Neutrol); Floridin XXF extra could be used also with arginine and lysine. The eluting agent was an aq. soln. of C_5H_5N and H_2SO_4; an alk. soln. (e.g., $Ba(OH)_2$) could be used if only qual. data were desired.

7876. WALDSCHMIDT-LEITZ, ERNST; RATZER, JOHANN, AND TURBA, FRITZ. **Chromatographic separation of clupein according to its degradation stages.** *J. prakt. chem.* 158, 72-8 (1941).—*C.A.* 36, 503⁸.

A soln. (3.5 g of the dry cleavage products in 93 cc. water) was passed through a column of Filtrol-Neutrol, from which were then obtained fractions of the cleavage products by extn. with phosphate buffer solns., by extn. with pyridine-H_2SO_4 solns. of pH 4, or by division of the column of Filtrol-Neutrol. Three fractions were finally obtained, which had const. N/NH_2 quotients of approx. 17 (28.8% yield), approx. 9 (56.6% yield) and approx. 5 (13.4% yield). Four fractions had been obtained previously from the tryptic cleavage products of clupein, having N/NH_2 quotients of approx. 18, approx. 13, approx. 9 and approx. 5.

7877. AMAT, MIGUEL. **Colloidal chromic hydroxide and its precipitating properties.** *Rev. real acad. cienc. exact. fis. y nat.* (Madrid) 36, 62-5(1942).—*C.A.* 45, 4999*d*.

A large quantity of $Cr(OH)_3$, obtained by pptg. with NH_4OH, was added to a soln. of $Cr(ClO_4)_3$, then dialyzed until the outer liquid gave practically no test for perchlorate. The resulting prepn. could be concd. by evapn. at approx. 50°C, by keeping over concd. H_2SO_4, or by freezing. The final product may appear as a moist, compact mass, having a dull green color. When it was again brought into contact with water it yielded a perfect colloidal soln. which was transparent, and exhibited a beautiful deep-green color by reflection.

7878. BERGMANN, FELIX. **The mechanism of tumor production by chemical agents.** *Cancer Research* 2, 660-3 (1942).—*C.A.* 37, 938⁷.

The form and size of a carcinogenic hydrocarbon and its related heterocyclic compounds detd. its activity and substances which more or less closely resembled a given parent structure and also resembled it in action. The carcinogens were adsorbed in the living cell by an acceptor possessing a definite adsorption area, which detd. the upper limit for dimensions of active compds. The lower limit was detd. by the decrease in adsorbability with decreasing size of the molecule.

7879. BLOCK, RICHARD J. **A new method for separation of the basic amino acids from protein hydrolyzates.** *Proc. Soc. Exptl. Biol. Med.* 51, 252-3(1942).—*C.A.* 37, 899¹.

A method was described for sepn. of NH_3, arginine, histidine and lysine from the other constituents of protein hydrolyzates by use of synthetic ion-exchange resins (Amberlites). The bases were subsequently eluted from the resins with 7% HCl.

7880. BROWN, ETHAN A. AND BENOTTI, NORBERT. **The chemistry of pollen extracts. I. Studies with activated charcoal and ragweed pollen extract.** *Ohio State Med. J.* 38, 1011-12 (1942).—*C.A.* 37, 1151⁹.

7881. BUXTON, L.O. **Effect of carbon treatment of fish-liver oils. Vitamin-A destruction and peroxide formation.** *Ind. Eng. Chem.* 34, 1486-9 (1942).—*C.A.* 37, 1009⁶.

The destruction of vitamin A, as affected by the increase in rate and degree of peroxidation of fish-liver oils treated with activated carbon, was investigated. Samples of shark-, halibut-, and tuna-liver oils were treated with various percentages of activated carbon and the effects of the treatment on the vitamin-A potency and color were determined. The antioxidant content of fish-liver oils played a major role in their resistance to atmospheric oxidation.

7882. CEITHAML, JOSEPH J. AND KOCH, F.C. **Comparative gonadotropin assays and use of calcium phosphate as an adsorbent in concentration of follicle-stimulating activity from pituitary gland.** *Endocrinology* 31, 249-60 (1942).—*C.A.* 37, 432⁹.

Three pituitary preparations were studied: acetone-desiccated sheet pituitary powder (DSP); powder A, prepared by adding 4 volumes of ethanol to a 0.02 *N* NH_4OH extract to DSP at pH 5.0 to 5.4; powder EB prepared from A by adsorption on tribasic calcium phosphate, elution with dilute NaOH, and fractional precipitation with ethanol. Both A and EB were found free of glucuronic acid, but gave positive tests for common protein and amino acid tests, especially for reduced S.

7883. FREUDENBERG, KARL; WALCH, HANS, AND MOLTER, H. **The separation of sugars, amino sugars and amino acids. Its application to the blood group A-specific substance.** *Naturwissenschaften* 30, 87 (1942).—*C.A.* 37, 658³.

When a mixt. of glucose and glucosamine hydrochloride was passed through a column of the acid-exchange material Wofatit K or KS, glucosamine was adsorbed quant., while glucose was not adsorbed. All amino acids were adsorbed by acid exchangers, while base exchangers (Wofatit M) adsorbed only acid amino acids. Thus alanine and aspartic acid could be sepd. quant. Neutral and acid amino acids were eluted by dil. pyridine, glucosamine and basic amino acids by excess HCl and pyridine-HCl, or by NH_3.

7884. Gyani, B.P. and Ganguly, P.B. **Adsorption in relation to constitution. I. Adsorption of alkaloids by silica gel.** *J. Indian Chem. Soc.* 19, 453-60 (1942).—*C.A.* 37, 3990[4].

Alc. solns. (25 ml) of morphine, nicotine, brucine, quinidine, cinchonidine, quinine, piperine, caffeine (0.5 g in 100 cc. abs. alc.) and strychnine (satd. soln.) were shaken with 2-5 g silica gel, left until equil. was attained, and analyzed. The gel was activated by water washing for several days, drying at 100°C and heating to about 300°C for 3 hrs in a current of CO_2-free air. About 90% of the adsorption took place within 24 hrs. The exptl. results were not caused by chem. changes in the system (alc. was not oxidized to acids in the procedure adopted). The adsorption of the alkaloids followed Freundlich's equation. The temp. coeffs. of adsorption were detd. at 30°, 35°, 40°, and 45° C and the adsorption values were found to decrease by 30-50% for a temp. rise of 10°C.

7885. Hennessy, D.J. **A standard thiochrome assay for the determination of thiamine in cereal products.** *Cereal Chemists' Bull.* 2, No. 2, 25-9 (1942).—*C.A.* 39, 5343[8].

Thiamine from the filtered ext. was absorbed on Decalso in the described base-exchange tubes. Thiamine was removed from the Decalso by washing with KCl in dil. HCl. A portion of the effluent was put into separatory centrifuge tubes for conversion of thiamine to thiochrome by addn. of $NaOH\text{-}K_3Fe(CN)_6$ soln. and another portion for blank with addn. of NaOH.

7886. Henry, A.J. and Grindley, D.N. **Florescence and adsorption of stilbamidine and its estimation in biological fluids.** *Ann. Trop. Med. Parasit.* 36, 102-12 (1942).—*C.A.* 37, 2030[6].

By the use of filter paper or cellulose pulp and the markedly fluorescent properties of stilbamidine (4,4'-diamidinostilbene), method of detection and estn. was evolved for biol. fluid, the filter paper spotting method being subject to an av. error of 25%. The adsorption by cellulose pulp was a reversible adsorption process involving the free base only.

7887. Hoffmann, Walter. **The ultrachromatographic identification of quinosol and of halogen-substituted quinoline compounds in pharmaceutical preparations. The possibility and limitations of establishing a chromatographic system of medicinal products.** *Arch. Pharm.* 280, 442-51(1942).—*C.A.* 39, 1249[6].

Hydroxyquinoline was adsorbed from a soln. in EtOH in the upper layer of an Al_2O_3 column. The adsorption layer showed in ultraviolet light a yellow-green fluorescence, characteristic for the compd. and suitable for detn. Since quiniophene (yatren) and vioform give a similar adsorption band, hydroxyquinoline must be sepd. from mixts. by steam distn. from the neutral. soln.

7888. Némedy, Imre. **Decrease in value of tablets of medicinal charcoal dependent upon the pressure used in compression.** *Ber. ungar. pharm. Ges.* 18, 27-35 (1942).—*C.A.* 37, 5193[6].

Activated charcoal lost some of its activity in tablet form and this loss was dependent upon the pressure used and also on the solns. used in granulation. The loss was least if it was granulated with a soln. of acacia, H_2O and alc.

7889. Parfentjev, I.A.; Waldschmidt, A., and Weil, A.J. **Absorption of bacterial antigen from diphtheric toxin and toxoid by magnesium hydroxide.** *J. Immunol.* 44, 325-8 (1942).—*C.A.* 37, 179[7].

By treatment of diphtheric toxin and toxoid with suspensions of $Mg(OH)_2$, a selective absorption of bacterial antigen was effected without substantial loss of toxin or toxoid and without impairment of antigenicity.

7890. Roberts, James L. and Baldwin, I.L. **Spore formation by *Bacillus subtilis* in peptone solutions altered by treatment with activated charcoal.** *J. Bact.* 44, 653-9 (1942).—*C.A.* 37, 1464[6].

A greater percentage of *B. subtilis cells* sporulated in "Bacto" peptone broth treated with charcoal than in untreated peptone broth. The percentage of cells in the spore state was independent of the concn. of the treated peptone. The percentage of sporulation could also be increased by adsorption of the medium with kaolin, ferric hydroxide or Al hydroxide. Most effective adsorption by charcoal occurred at a pH of 3.0-5.0.

7891. Seddon, H.J. and Florey, H.W. **Filter cloth for controlling smell from plasters.** *Lancet* 242, 755 (1942).

Cloth treated with activated carbon dust prevented the diffusion of smell from wounds treated by the closed-plaster method. If, therefore, the affected part was completely enclosed in a bag made from the cloth, unpleasant smell was eliminated.

7892. Wieland, Theodor. **Quantitative separation of amino acids by exchange adsorption on aluminum oxide.** *Z. physiol. Chem.* 273, 24-30 (1942).—*C.A.* 37, 4364[8].

The effect of aq. solns. of cations of basic amino acids (carrying 2 pos. and 1 neg. charge) on Al_2O_3 was studied. If an aq. soln. of lysine or arginine, exactly neutralized with HCl, was passed through an Al_2O_3 column, the filtrate did not give a ninhydrin reaction, even on washing. The entire amt. of amino acids was adsorbed in the form of its cations. In application to org. acids, an Al oxide column pretreated with HCl was used. Aspartic and glutamic acids, in aq. solns. of their Na salts, were absorbed in certain narrow zones of the column. The neutral and basic amino acids, however, passed through the column readily.

7893. Wieland, Theodor. **Glutamic acid from tumors.** *Ber.* 75B, 1001-7 (1942).—*C.A.* 37, 4793[2].

The protein of the tumor was hydrolyzed with 3 parts of concd. HCl for 7 hrs, the soln. evapd.

to dryness *in vacuo*, the residue taken up to H_2O, neutralized and filtered from pptd. humus; the filtrate was chromatographed through acid Al_2O_3, which was freed from absorbed cystine by H_2S. The column was eluted with cold satd. $Ba(OH)_2$ and the Ba removed by H_2SO_4; the soln. was concd. and 2 fractions of glutamic acid—HCl were sepd.

7894. Wieland, Theodor. **Application of acidic and basic alumina columns to analysis of protein hydrolyzates.** *Naturwissenschaften* **30**, 374-6(1942).—*C.A.* 37, 5432^{8}.

The method was based on the adsorption of only aminodicarboxylic acids by (HCl-treated) Al_2O_3 and of only diaminocarboxylic acids by untreated Al_2O_3, neutral amino acids and histidine being unadsorbed. The Na salts of amino acids in 80% EtOH were adsorbed on the acidic Al_2O_3 and could be sepd. from glucose, which was not adsorbed under similar conditions. Application of the method to the hydrolyzates of caseinogen and other proteins yielded by boiling with 20% H_2SO_4 for 20 hrs or with concd. HCl for 12 hrs was described.

7895. Barton, D.H.R. and Jones, E.R.H. **Sterol group. XLV. Investigation of the homogeneity of sitosterol by oxidation with the Oppenauer reagent.** *J. Chem. Soc.* **1943**, 599-602.—*C.A.* 38, 1513^{8}.

Tall oil sitosterol was oxidized by the Oppenauer reagent [$(tert\text{-}BuO)_3$ Al in C_6H_6 and Me_2CO, refluxing 18 hrs]. The oxidized products were sepd. by chromatograph on a 3.6 × 150-cm column of Al_2O_3, good sepn. was obtained only by the use of 100 times as much adsorbent as adsorbate. Oppenauer oxidation, followed by chromatographic analysis of the ketones, was of considerable value for examg. the homogeneity of sitosterol and, in particular, for detg. the approx. proportion of sitostanol present.

7896. Fischer, R. and Iwanoff, W. **The use of various adsorbents for the detection, determination, and purification of organic, mainly physiologically active, compounds.** *Arch. Pharm.* **281**, 361-77 (1943).—*C.A.* 39, 5208^{7}.

The adsorption properties were detd. for 115 substances classified as alkaloids, sedatives, local anesthetics, plant exts., and miscellaneous on charcoal, Al_2O_3, Frankonite, Floridin, $CaCO_3$, koalin, talc, and lactose adsorbents from the solvents Et_2O, $CHCl_3$, C_6H_6, $(CH_3)_2CO$, EtOH, and H_2O in 1% soln. by use of 1-2 mg substance and 0.5 g adsorbent. The properties were usefully applied in the purification of substances in toxicological analysis.

7897. Gordon, A.H.; Martin, A.J.P., and Synge, R.L.M. **Partition chromatography in the study of protein constituents.** *Biochem. J.* 37, 79-86 (1943).—*C.A.* 37, 5436^{6}.

Acetylated amino acids and peptides were partitioned chromatographically. Analyses of the amino acid compn. of gelatin and wool were recorded.

7898. Gordon, A.H.; Martin, A.J.P., and Synge, R.L.M. **The amino acid composition of tyrocidin.** *Biochem. J.* 37, 313-18 (1943).—*C.A.* 38, 127^{5}.

With the method of chromatographic partition, the following amino acids were isolated (and identified as acetyl derivs.) from an acid hydrolyzate of tyrocidin: phenylalanine, leucine, proline, valine, tyrosine, ornithine and glutamic acid. In addn., tryptophan and aspartic acid were found also.

7899. Holford, Frances E.; Ludden, J.B., and Stevens, W.H. **Antibody response to hemoglobin adsorbed on aluminum hydroxide.** *J. Immunol.* 46, 47-58 (1943).—*C.A.* 37, 2805^{8}.

Human, sheep, rabbit, dog, and guinea-pig hemoglobins were adsorbed by $Al(OH)_3$. The degree of adsorption was detd. chiefly by the relative amounts in the mixt., secondarily by the pH and the character of the adsorbent (sulfate-containing preparations having less adsorptive capacity than sulfate-free).

7900. Karrer, P.; Keller, R., and Szonyi, G. **The reaction products of azobenzene-4-carbonyl chloride and α-amino carboxylic acids or their esters.** *Helv. Chim. Acta* 26, 38-50 (1943).—*C.A.* 37, 5969^{6}.

In chromatographic adsorption on basic $ZnCO_3$ from a 95% ligroin-5% C_6H_6 soln. the zones in order from the top of the column were Me ester of N-*p*-phenylazobenzoylglycine, Me ester of N-*p*-phenylazobenzoylalanine, leucine and Me ester of N-*p*-phenylazobenzoylvaline.

7901. Katzman, P.A.; Godfrid, M.; Cain, C.K., and Doisy, E.A. **The preparation of chorionic gonadotropin by chromatographic adsorption.** *J. Biol. Chem.* **148**, 501-7(1943).—*C.A.* 37, 5772^{7}.

Urine was acidified to pH 3.5 by glacial AcOH and percolated through a column contg. Permutit. Adsorption was complete if 10 liters of urine per hour passed through a column having a diam. of 4 in. and contg. 2 kg of Permutit. Elution was by 38% EtOH contg. 10% NH_4Ac. The hormone was pptd. from the eluate by 70-5% EtOH.

7902. Reimers, F. and Gottlieb, K.R. **Chromatographic analysis of alkaloid salts.** *Dansk Tids. Farm.* 17, 54-71(1943).—*C.A.* 38, 5640^{6}.

The following compds. were analyzed: the hydrochlorides of emetine, physostigmine, cocaine, pilocarpine, ethylmorphine, the hydrobromide of scopolamine with certain and quick results; the hydrochlorides of ephedrine, quinine, codeine, atropine sulfate, quinine sulfate, strychnine nitrate with a somewhat different method; narcotine, papaverine, codeine phosphate and oxydrine tartrate gave too high, apomorphine too low, results.

7903. Sakurai, Yoshito and Hori, Hiroe. **Adsorption capacity of acid clay. I. Adsorption of vitamin B_1.** *Bull. Inst. Phys. Chem. Research (Tokyo)* 22, 760-8 (1943).—*C.A.* 43, 7774*d*.

The amt. of impurities, temp., pH of the soln. and presence of org. solvents were considered as factors affecting the capacity of acid clay to adsorb vitamin B_1. The optimum conditions were pH 4.5, temp. as low as possible, and absence of of org. solvents.

7904. Sklow, Joachim. **Prolongation of sex hormone effects by adsorption on powdered carbon.** *Endocrinology* 32, 109-13 (1943).—*C.A.* 37, 1754^9.

Experiments with animal and plant carbons, kaolin, kieselguhr, Fuller's earth, Ca carbonate, benzoic acid, flexible collodion and Lloyd's reagent showed that only the carbons promised success. Estrone, estradiol benzoate and diethylstilbestol, 0.01 mg each, were dissolved in 2 cc. 96% Et alc., 4 mg carbon was added, and the solns. were evapd. to dryness during continuous agitation.

7905. Sollner, Karl and Carr, Charles W. **The structure of the collodion membrane and its electrical behavior. V. The influence of the thickness of dried collodion membranes upon their electromotive behavior.** *J. Gen. Physiol.* 26, 309-23 (1943).—*C.A.* 37, 1638^2.

In a series of detns. of concn. potentials across dried collodion membranes of varying thickness (3 to 160μ), the electromotive properties of the membranes depended upon the thickness. With electrochemically active collodion the thermodynamically possible max. concn. potentials were obtained with membranes only 10 μ thick, whereas with inactive collodion the concn. potentials increased from about 30 mv. to about 42 mv. as the membrane thickness increased from 3 to 20 μ, with no appreciable increase for thicker membranes.

7906. Swain, Lyle A. **Adsorption of vitamin A from fish-liver oils.** *J. Fisheries Research Board Can.* 6, 1131-8 (1943).—*C.A.* 37, 6822^9.

Liver oil of the dog fish *(Squalus suckleyi)* was used which had been washed with MeOH to remove any vitamin A alcohol that might be present. The wt of the material eluted was detd. after evapn. of the solvent. The alc. form of vitamin A was much more easily adsorbed than its esters, or than glyceryl and other esters of fat acids.

7907. Turba, Fritz; Richter, Margit, and Kuchar, Ferdinand. **Quantitative chromatographic separation of the monoaminomonocarboxylic acids.** *Naturwissenschaften* 31, 508-10 (1943).—*C.A.* 38, 4631^3.

Tryptophan was removed from the mixt. of aromatic and aliphatic acids by adsorption on "Wofatit M," a synthetic exchange resin. Tyrosine and phenylalanine were sepd. by adsorption on active charcoal; 0.5 g charcoal, pretreated with 1% HCN, was used for 5 mg of each amino acid. The aliphatic amino acid mixt. was sepd. by Al_2O_3 treatments. Glycine and serine were held by acid-treated Al_2O_3 if adsorbed from a HCOH (10%) soln. (Schramm method). Proline and alanine were sepd. by 50 g Al_2O_3 treated with 1 *N* AcOH and washed with 1:1 H_2O-EtOH at pH 7.0 (140 cc.). Valine-leucine mixts. were adsorbed by 4 g animal charcoal, treated with 1% HCN and valine eluted by 300 cc. M/15 phosphate buffer (pH 5.6).

7908. Ulrix, Forent. **Chromatography in the service of pharmacy.** *Bull. soc. roy. sci. Liège* 12, 108-23 (1943).—*C.A.* 42, 7486*h*.

The identification of pharmacologically active plant exts., tinctures, or dried materials, utilized a micro-chromatographic technique. A glass tube 6 cm by 2 mm, plugged with a 7-mm wad of cotton at one end, was inverted and filled by suction to a height of 2 cm with a paste prepd. from 20 g Al_2O_3 and 35 cc. alc. at 70°C. Tinctures were added to a height of 3 cm, while a 1-cm height of ext. was used. The solvent was drawn down by suction until it was flush with the top of the Al_2O_3 column, and the resulting color spectrum obtained served to identify the material.

7909. Wieland, Theodor and Wirth, Liselotte. **Quantitative separation of aspartic and glutamic acids with the acid aluminum oxide column.** *Ber.* 76B, 823-5 (1943).—*C.A.* 38, 2060^5.

Glutamic acid was eluted from the acid Al_2O_3 column by 0.5 *N* HCl more rapidly than aspartic acid, but the difference in elution velocities was not sufficient for a quant. sepn. With 0.5 *N* AcOH, however, glutamic acid was completely eluted when aspartic acid traveled down only a small fraction of a relatively short column. Al_2O_3 (Merck, standardized according to Brockmann) was filled (10 g) with gentle suction upon a little cotton in a 10-mm tube, 200 mm high, and the mixt. of glutamic and asparatic acids in a little water was run through it, followed by 0.5 *N* AcOH until the filtrate measured 50 cc., and the column washed with water. The AcOH filtrate was evapd. to dryness *in vacuo* and the residue taken up to 3.0 or 5.0 cc. of 2 *N* AcOH and the analysis made. The washed column was eluted with 0.5 *N* NaOH and the eluate (20 cc.), after acidification with a few drops of concd. HCl, was likewise evapd. *in vacuo* and the residue, taken up in 3.0 cc. water, analyzed.

7910. Andersen, A. Harrestrup. **Medicinal carbon.** *Dansk Tids. Farm.* 18, 21-47(1944).—*C.A.* 39, 4430^8.

As an antidote for ingested poisons, Merck's medicinal carbon had twice the adsorptive capacity of that of the Danish Pharm. Poisons, especially strychnine nitrate, morphine-HCl, atropine sulfate, nicotine, $HgCl_2$, and diethylbarbituric acid, were well and rapidly adsorbed. Sulfanilamide was adsorbed best at its isoelec. point.

7911. Applezweig, Norman. **Cinchona alkaloids prepared by ion exchange.** *J. Am. Chem. Soc.* 66, 1990(1944).—*C.A.* 39, 158^6.

The capacity of a 200-ml bed of Zeo-Karb for quinine from 1% H_2SO_4 was between 7 and 8 g before break-through; EtOH-NH_4OH was used as a combined regenerant and elution solvent. A crude totaquinine ppt. (20 g), purified by ion exchange, yeilded 2.5 g of white cryst. material.

7912. Archibald, Reginald M. **Determination of citrulline and allantoin and demonstration of citrulline in blood plasma.** *J. Biol. Chem.* 156, 121-42(1944).—*C.A.* 39, 721^4.

In the colorimetric detn. of citrulline with biacetyl monoxime errors were introduced by the presence of allantoin and urea. Interference by allantoin was prevented by adsorbing the citrulline with Amberlite at pH 6 to 7; allantoin was not adsorbed. The difference in chromogenic material before and after adsorption was a measure of the citrulline.

7913. CANNAN, R. KEITH. **The estimation of the dicarboxylic amino acids in protein hydrolyzates.** *J. Biol. Chem.* **152**, 401-10 (1944).—*C.A.* **38**, 2679[1].

A HCl-protein hydrolyzate was treated with Amberlite IR-4 until the mixt. had a pH of 7. The adsorbed dicarboxylic acids were eluted from the resin with 0.25 *M* HCl, the eluate contg. only traces of amino acids other than dicarboxylic was concd. *in vacuo*, clarified with Norit and evapd. to dryness. From this residue glutamic acid was obtained by crystn. Cryst. egg albumin, β-lactoglobulin and edestin were analyzed by this method.

7914. DEY, HEINRICH AND HAAR, HUGO. **Adsorption of atropine in drug mixtures.** *Arch. exptl. Path. Pharmakol.* **203**, 188-93 (1944).—*C.A.* 39, 3879[9].

Belladonna ext. and powd. belladonna leaves were ground with 10-300 times their wt of kaolin, MgO, "Adsorgan," or "Gastro-Sil." The mixts. were treated with 0.1 *N* HCl to simulate the action of gastric juice. Not all of the atropine was recovered.

7915. EDMAN, P.V. **The purification of hypertensin (angiotonin).** *Arkiv Kemi, Mineral. Geol.* **18B**, No. 2, 4 pp. (1944); *Nature*, **155**, 756 (1945).—*C.A.* 39, 3803[6].

Crude hypertensin was purified by chromatography on Al_2O_3. Before adsorption the crude material was extd. with glacial AcOH, the insol. residue was discarded. Al_2O_3 was prepd. by shaking 1 part with 5 parts of 1 *N* HCl, decanting the acid, and washing with H_2O until washings were neutral. The adsorbent was dried by suction and heated at 200°C for 1 hr for complete removal of HCl. The 90% MeOH soln. of hypertensin was adsorbed on a column 25 cm in height.

7916. ENGLIS, D.T. AND FIESS, H.A. **Conduct of amino acids in synthetic ion exchangers.** *Ind. Eng. Chem.* 36, 604-9 (1944).—*C.A.* 38, 3879[5].

The adsorption by column and by static methods of asparagine, glutamic acid, glycine, hydroxyproline, leucine, lysine. HCl, norleucine, phenylalanine and tryptophan was studied with the carbonaceous cation-exchanger, Zeo-Karb H, the resin cation-exchangers, Amberlite IR-1 and Amberlite IR-100, and the synthetic anion-exchangers, Amberlite IR-4 and De-Acidite. The H form of the cation exchangers adsorbed all of the amino acids; the Ca and Na forms showed little adsorption. Adsorption decreased at lowered pH. Anion-exchangers react with dicarboxylic but not with monocarboxylic monoamino acids, and a sepn. of these 2 groups of acids may be expected.

7917. FRIEDEN, EDWARD H.; MITCHELL, HERSCHEL K., AND WILLIAMS, ROGER J. **Folic Acid. II. Studies on adsorption.** *J. Am. Chem. Soc.* **66**, 269-71 (1944).—*C.A.* 38, 1547[5].

Elution of folic acid after adsorption from crude prepns. was much easier than from relatively pure solns. This behavior was apparently due to the presence of interfering substances which affected the manner of adsorption. A study of the adsorption isotherms of folic acid, riboflavin and thiochrome upon charcoal at low concns. showed that the adsorption process was of a dual nature, because the slopes of the isotherms changed markedly in the range covered.

7918. KOCH, JOHN M. **Analysis of petroleum oil-soluble sodium sulfonates by adsorption.** *Ind. Eng. Chem., Anal. Ed.* **16**, 25-8 (1944).—*C.A.* **38**, 698[4].

Percolation expts. showed that Na sulfonates could be adsorbed selectively from naphtha soln. and subsequently displaced completely from the adsorbent by MeOH. The sample was dissolved in petroleum naphtha, run through a column of calcined Attapulgus clay and the percolate evapd. and weighed to find the oil content. Results obtained on known blends of white oil and Na sulfonates showed good agreement.

7919. MCCREADY, R. M. AND HASSID, W. Z. **The preparation and purification of glucose 1-phosphate by the aid of ion-exchange adsorbents.** *J. Am. Chem. Soc.* **66**, 560-3(1944).—*C.A.* 38, 2633[8].

The phosphorolysis of starch in the presence of phosphate buffer and the pptn. of the inorg. phosphate were carried out, but the purification of the ester was accomplished by ion-exchange adsorbents. The reaction mixt. contg. the ester was first passed through a column of cation-exchange adsorbent. The effluent was then run through an aid adsorbing column. In this operation the Cori ester, being a strong acid with a high exchange capacity, was adsorbed, while the sol. impurities, including dextrins, proteins and weak org. acids, passed through unchanged. The glucose 1-phosphate was then eluted from the adsorbent with dil. alkali and isolated as the cryst. di-K salt.

7920. MITCHELL, HERSCHEL K.; SMELL, ESMOND E., AND WILLIAMS, ROGER J. **Folic acid. I. Concentration from spinach.** *J. Am. Chem. Soc.* 66, 267-8 (1944).—*C.A.* 38, 1547[3].

Details were given for adsorption on 3 charcoals, Lloyd reagent and Al_2O_3 and pptn. with Ag and Pb (many other adsorbents and precipitants were tested). All samples having a potency of 110,000 or greater pptd. in an amorphous state from acid soln., and recryst. attempts from warm H_2O also gave amorphous products. Quinine, brucine or even NH_4 salts gave semi-cryst. material on evapn. of the solvent on samples of potency 20,000 and up. Adsorption and fractionation from Al_2O_3 was a highly effective means of concn. only after the preliminary steps. Higher potency samples were readily adsorbed by Al_2O_3 but were not easily eluted.

7921. NAJJAR, VICTOR A. **Laboratory diagnosis of nicotinic acid deficiency. An improved method for the determination of F_2 (N-methylnicotinamide derivative) in urine.** *Bull. Johns Hopkins Hosp.* 74, 392-9 (1944).—*C.A.* **38**, 5519[8]

Inactive interfering material was adsorbed with charcoal from acid urine (HOAc). F_2 was adsorbed by activated zeolite and was eluted with KCl, and extd. from the KCl eluated with 1-butanol and KOH.

7922. Polis, B. D. and Reinhold, John G. **Determination of total base of serum by ion exchange reactions of synthetic resins.** *J. Biol. Chem.* 156, 231-6(1944).—*C.A.* 39, 721[9].

A cation-adsorbing resin (Amberlite IR-100), converted to the H-form produced upon contact with the cations in serum, an exchange in which H^+ ions from the resin were liberated in proportion to the cations taken up from the serum. The resulting soln. was distinctly acid and contained chloride, bicarbonate, phosphate, protein, etc., in the form of acid anions. This soln. was titrated with standard base, after aeration with CO_2-free air to remove any CO_2 present. Base present as bicarbonate was detd. separately by gasometric measurement of the CO_2-combining capacity of the serum.

7923. Potts, Albert M. and Gallagher, T. F. **Separation of oxytocic and pressor principles of posterior pituitary extracts.** *J. Biol. Chem.* 154, 349-56(1944).—*C.A.* 38, 5520[7].

A simple procedure was described for sepn. of the oxytocic and pressor principles from aq. ext. of desiccated posterior pituitary lobe. The pressor principle could be adsorbed on 70-mesh Decalso, whereas the oxytocic principle was not adsorbed. The pressor fractions were eluted with 10% NaCl soln. High yields of both pressor and oxytocic fractions could be obtained.

7924. Regna, Peter P. **The stability of penicillin during the stages of recovery.** *Trans. Am. Inst. Chem. Engrs.* 40, 759-65 (1944).—*C.A.* 39, 1018[4].

The penicillin in the broth was almost completely adsorbed on activated carbon and eluted with an 80% soln. of acetone in water. After filtration from the carbon, the acetone was removed by a water-immiscible solvent, the concd. aq. phase then acidified and the penicillin acid extd. into $CHCl_3$.

7925. Steinberg, Arthur. **New method of preventing blood coagulation.** *Proc. Soc. Exptl. Biol. Med.* 56, 124-7(1944).—*C.A.* 38, 5240[6].

A cation-exchanging phenol-formaldehyde resin with a polyhydric phenol base (Amberlite IR-100) was used to remove Ca from blood. The resin was treated with several successive portions of 5% NaCl soln. It was sterilized by autoclaving without affecting its activity. Twenty g of the resin was sufficient to prevent clotting of 150 cc. of blood. The used resin could be repeatedly regenerated for re-use by washing it with 2% Na_2CO_3 soln., then stirring it with 5% NaCl soln.

7926. Sweet, Walter J. and Sweeney, O. R. **Modification of blood by zeolites for transfusion purposes.** *Proc. Iowa Acad. Sci.* 51, 299-300 (1944).—*C.A.* 40, 2877[4].

Blood passed through a bed of zeolite entirely lost its property of coagulation. When examd. under a microscope it showed no evidence of having a corpuscular suspension structure, but was homogeneous. A sample of the zeolite-treated blood was set aside, under sterile conditions, and allowed to stand for several weeks at room temp. (summer heat, often as high as 100°F). There was no evidence of deterioration, and the blood appeared to be exactly the same as when set aside.

7927. Synge, R. L. M. **Analysis of a partial hydrolyzate of gramicidin by partition chromatography with starch.** *Biochem. J.* 38, 285-94 (1944).—*C.A.* 39, 1895[2].

Partition chromatography on silica gel gave poor quant. sepn., but the amino acids were found to travel as quite sharp bands in column chromatograms made with raw potato starch and developed with butanol satd. with water. Preliminary data were given on this technique. There were no indications that optical antipodes or racemates of any compd. travel at any different rates. Band rates for known samples of dipeptides in paper chromatography were tabulated.

7928. Taub, Abraham. **Surface active agents as germicides.** *Merck Rept.* 53, No. 3, 28-31 (1944).—*C.A.* 38, 6046[9].

When cationic agents (compds. in which the lipophilic groups are part of the pos. ion) were adsorbed upon bacteria, they exerted an inhibitor effect upon the metabolism and viability of the organisms. Recent studies indicated that bacteria function somewhat analogously to the base-exchange substances like Permutit and other zeolites. Experience showed that the cationic agents could not be utilized by the oral or parenteral route. The blood proteins, probably through ionic interaction, readily inactivated the cationic agents.

7929. Welsh, Llewellyn H. **Chromatographic purification and some properties of atebrin base.** *J. Am. Pharm. Assoc.* 33, 318-20(1944).—*C.A.* 38, 6499[2].

Purification of atebrin, prepd. from the com. $2HCl.2H_2O$ salt, was advantageously carried out chromatographically by allowing the free base to be adsorbed on activated Al_2O_3 from a C_6H_6 soln. Ultraviolet irradiation of the base produced a brownish to orange discoloration, shown chromatographically to be due to the formation of traces of several substances.

7930. Wieland, Theodor. **Separation of basic amino acids by adsorption on "Wofatit-C."** *Ber.* 77B, 539-41(1944).—*C.A.* 40, 5021[2].

In the adsorption of hexonic bases on strong acidic Wofatite -K or -KS, contg. SO_3H groups, all amino acids were adsorbed as cations. The acidity of Wofatite-C, contg. the CO_2H group, was so weakened that only basic amino acids were adsorbed, while neutral and acidic acids passed readily through the column. The sepn. was very specific. The column was eluted with dil. mineral acids, and, after removing the excess acid with H_2O, the column was ready for the next adsorption. Histidine, though uncharged, was adsorbed from a neutral soln. on basic Al_2O_3, the Na ions of the adsorbent reacting as Permutit, whereas arginine and lysine, present as cations, were interchanged with the Na ions.

7931. Wieland, Theodor and Fremercy, Herta. **Separation of the neutral amino acids through the Cu complexes by partition chromatography.** *Ber.* 77B, 234-7 (1944).—*C.A.* 39, 3256[3].

The partition coeff. of Cu valine between PhOH-$CHCl_3$ satd. with H_2O and H_2O-satd. PhOH-$CHCl_3$ (1:1) in 1% soln. was 0.1, that of Cu alanine 2.85. Hence, when a mixt. of a few mg of the 2 complexes in the least possible amt. of PhOH-$CHCl_3$ was poured on a column packed with 1 g silica-gel powder moistened with 1 cc. of PhOH-satd. water and suspended in a solvent mixt. richer in phenol, on development with the same mixt. there soon appeared 2 sharply defined blue zones which traveled down the column with different velocities. Iodometric Cu detns. of the more rapidly traveling zone, which emerged in 1-2 cc. as a deep blue soln., showed valine quantitatively.

7932. ARCHIBALD, REGINALD M. **Reported formation of urea from glutamine by liver extracts, and the preparation of glutamine free from arginine.** *J. Biol. Chem.* 159, 693-4(1945).—*C.A.* 40, 102^9.

A previous statement that small amts. of urea were formed on incubation of glutamine with liver ext. was wrong. The urea formed was due to the presence of some arginine in the glutamine prepn. Glutamine solns. free of arginine could be prepd. by an adsorption procedure using a column of Decalso.

7933. BALOCK, J. W. AND STARR, D. F. **Adsorption of methyl bromide and its residual effect on fruitfly mortality.** *J. Econ. Entomol.* 38, 481-3(1945).—*C.A.* 39, 5362^2.

In a steel drum with painted walls contg. wooden boxes and charged with MeBr at 3 lbs per 1000 ft^3, the wood adsorbed 36%, the paint 20% and the walls of the drum, when paint-free, about 5% MeBr. Window glass and asbestos board gave neg. adsorption values. A steel drum that had been charged with 3 lbs MeBr per 1000 cu. ft. was aired for various periods. Then adult Mexican fruitflies *(Anastrepha ludens)* were placed in the drum for 15 hrs. The mortality after a 3-day airing was 95%; after a 23-day airing it was 58%.

7934. BROWNLEE, G. W. **The assay of alkaloidal galenicals using the chromatograph. I. Preparations of** *belladonna, stramonium,* **and** *nux vomica. Quart. J. Pharm. Pharmacol.* 18, 163-71 (1945).—*C.A.* 40, 2270^9.

Chromatographic methods, using alumina for the assay of *belladonna, stramonium,* and *nux vomica* prepns., gave liquids for analysis which were cleaner, easier to manipulate, and readily extd. by solvents without emulsification. Analytical results compared favorably with those from official methods.

7935. BUC, SAUL R.; FORD, JARED H., AND WISE, E. C. **Improved synthesis of β-alanine.** *J. Am. Chem. Soc.* 67, 92-4 (1945).—*C.A.* 39, 1392^4.

Details were given of the liberation of the base from $H_2NCH_2CH_2CO_2H.HCl$ by passing the aq. soln. through a bed of De-Acidite or Amberlite IR-4; the yield of $H_2NCH_2CH_2CO_2H$ was 82-6% (based on $H_2NCH_2CH_2CO_2H.HCl$).

7936. CARTER, HERBERT E.; CLARK, R. K. JR.; DICKMAN, S. R.; LOO, Y. H.; SKELL, P. S., AND STRONG, W. A. **Isolation and purification of streptomycin.** *J. Biol. Chem.* 160, 337-42 (1945).—*C.A.* 40, 3485^8.

The prepn. of streptomycin-Cl and streptomycin-SO_4 as white, amorphous powders with activity of 600-900 units per mg was described. Surface culture filtrates of *Streptomyces griseus* with activity of 100-180 units per cc. served as starting material. This was clarified at pH 2 with 0.5% of carbon and the activity removed at pH 7 with 1% of carbon. The carbon was washed successively with H_2O, neutral EtOH, and neutral MeOH, and the activity then eluted by 2 or 3 extns. with 0.1 *N* HCl in MeOH. The active material could be pptd. directly from the combined HCl + MeOH as a light brown amorphous powder. This material was fractionated on a column: A faintly acid soln. (pH 6.3) of crude streptomycin-Cl in 70-80% MeOH was percolated over a H_2SO_4-washed alumina column (pH 5-6).

7937. CLEAVER, CHARLES S.; HARDY, ROBERT A. JR., AND CASSIDY, HAROLD G. **Chromatographic adsorption of amino acids on organic exchange-resins.** *J. Am. Chem. Soc.* 67, 1343-52(1945).—*C.A.* 39, 4844^8.

The responses toward several amino acids (glycine, alanine, arginine, histidine, and glutamic acid) of a cation-exchange and an acid-binding synthetic organic resin (Amberlite IR-100 and IR-4) were reported. The influence of the following factors was investigated: type of resin, particle size, length of adsorption column, rate of flow, and concn. of amino acid and H-ion in soln. The work included several binary and 2 ternary mixts., evidence regarding their separability being reported.

7938. CRUZ-COKE, E.; GONZALEZ, F., AND HULSEN, W. **The use of ionic exchange resins for the purification of penicillin and hypertensin.** *Science* 101, 340(1945).—*C.A.* 39, 2381^3.

By treating the crude hypertensin with the anionic resin Ionic A, several inactive substances (chromogens, polypeptides) were removed without affecting significantly the hypertensive activity. The cationic resin Ionic C adsorbed the active principle of hypertensin. By filtering the crude penicillin, first through Ionic C at pH 6-7, then through Ionic A at the same pH, a product was obtained which retained all the penicillin activity of the original material.

7939. DARLING, SVEN. **Chromatographic method for the determination of glutamic and aspartic acid in mixtures of different amino acids.** *Acta Physiol. Scand.* 10, 91-6 (1945).—*C.A.* 40, 2182^9.

Shake 2 g Al_2O_3 for 5 min. with 6 cc. *N* HCl, remove supernatant, and shake ppt. with H_2O until neutral to litmus. Fill an adsorption tube with the treated Al_2O_3. The amino acid soln. or a CCl_3CO_2H filtrate was neutralized to phenolphthalein with KOH and transferred to the adsorption tube. Suck through at a rate of about 30 drops per min. and rinse column with 15 cc. H_2O. The column was eluated with 3 cc. 3 *N* KOH and 20 cc. 0.05 *N* KOH and sucked dry. The eluate contained the dicarboxylic amino acids. By this procedure 503- micromol. amino acid could be detd.

7940. EWING, CLARE OLIN; POLITI, FRANK W., AND SHACKELFORD, CHARLES H. **Bentonite U.S.P. and magma bentonite N.F.** *J. Am. Pharm. Assoc.* 34, 129-34(1945).—*C.A.* 39, 3121^5.

The viscosity of bentonite suspensions was standardized: place 100 cc. of distd. water in a 250-cc. Erlenmeyer flask, add 5.00 g bentonite in divided portions, allowing each to settle before adding the next, stopper, shake vigorously to break up lumps; let stand 24 hrs, shaking occasionally to ensure uniform dispersion, bring to 25°C and shake vigorously for 1 min.; draw the suspension up to the base of the upper stem of a 10-cc. volumetric pipet and allow to discharge to the top of the lower stem; the time required should not be less than that required for similarly discharging at 50% by vol. soln. of glycerol in distd. water at 25°C.

7941. FULTON, J. D. AND GOODWIN, T. W. **The estimation, adsorption, and precipitation of stilbamidine (4,4'-diamidinostilbene).** *J. Pharmacol.* 84, 34-41(1945).—*C.A.* 39, 4431^9.

Stilbamidine was adsorbed little if any by blood cells. Stilbamidine in aq. soln. was pptd. more or less, depending on conditions, by serum proteins, Na citrate, CCl_3CO_2H, $HClO_4$, and HPO_3.

7942. GEMMELL, D. H. O. AND TODD, J. P. **Activated carbon for pharmaceutical purposes.** *Pharm. J.* 154, 126(1945).—*C.A.* 39, 2379^7.

Studies on charcoal indicated that the heavy-metals test of the U.S.P. was too severe and that a simple extn. and test was sufficient. Any charcoal would be sufficiently pure for pharm. purposes if it did not yield to the treated substances any impurities which would interfere with the purity of the same substances. The use of activated charcoal for the removal of pyrogens from parenteral solns. was discussed.

7943. GROLLMAN, ARTHUR. **Preparation of extracts from oxidized marine and other oils for reducing the blood pressure in experimental and human chronic hypertension.** *J. Pharmacol.* 84, 128-35(1945).—*C.A.* 39, 4686^7.

Fractional sepn. of the oil by distn. *in vacuo*, freezing, or distribution between 80% aq. EtOH and a hydrocarbon solvent partially effected a concn. of the active agent. By adsorption on a synthetic ion-exchanger resin (Amberlite IR-100) and desorption with 2% aq. NaOH after washing the resin free from oil with petr. ether, it was possible to obtain the active principle in aq. soln.

7944. HERR, DONALD S. **Synthetic ion exchange resins in the separation, recovery, and concentration of thiamine.** *Ind. Eng. Chem.* 37, 631-4 (1945).—*C.A.* 39, 3627^8.

Aq. thiamine (250 p.p.m.) was completely removed by passage through a 10-cm column of the ion-exchange resin Amberlite IR-100-H. The capacity of Amberlite IR-100-H for thiamine was about 168 mg/g. Complete adsorption of thiamine was also obtained with a synthetic zeolite, but activated alumina and Amberlite IR-4 adsorbed little or no thiamine. Riboflavin was nearly completely adsorbed on Fuller's earth and was adsorbed by Amberlite IR-100-H in a static, but not in a dynamic system. Complete sepn. of thiamine and riboflavin was, therefore, possible by flowing a soln. of the mixt. through Amberlite IR-100-H.

7945. HOCHBERG, MELVIN; MELNICK, DANIEL, AND OSER, BERNARD L. **Chemical determination and urinary excretion of the metabolite N^I-methylnicotinamide.** *J. Biol. Chem.* 158, 265-78 (1945).—*C.A.* 39, 2776^5.

Quant. recovery of added N^I-methylnicotinamide made use of adsorption on an activated zeolite column, elution with KCl, alkalinization of eluate, fluorescence development in BuOH, and measurement in fluorometer against standard similarly treated. Fifteen urine samples can be tested by a single analyst in one day.

7946. ISBELL, HARRIS. **The use of charcoal-treated peptone in microbiological assays.** *Science* 102, 671-2(1945).—*C.A.* 40, 2173^5.

Charcoal-treated peptone satisfactorily replaced the casein hydrolyzate in media used for assays of biotin, niacin, and pantothenic acid. Bacto-Difco peptone (100 g) was dissolved in 800 cc. distd. water. The pH was adjusted to 3.0 with concd. HCl. Activated charcoal (20 g) was added with stirring for 1 hr, the soln. filtered, and the pH readjusted to 3.0 with HCl. The process was repeated with 10 g of charcoal and the final filtrate should have no more than a faint tinge of color. The vol. was adjusted to 1 liter and the soln. preserved with toluene. Ten cc. of this soln. could be substituted for 5 cc. of casein hydrolyzate.

7947. KEMP, C. R. AND BANDELIN, F. J. **Modified base-exchange procedure and apparatus for determination of thiamine and riboflavin.** *J. Am. Pharm. Assoc.* 34, 306-9 (1945).—*C.A.* 40, 1192^4.

A portable cabinet with controlled lighting for use in base-exchange procedures was described The equipment needed for isolation of thiamine and riboflavin from mixts. was listed. Detailed directions were given for conducting the base exchange, and the advantages over the original procedure pointed out.

7948. KRASNOVA, V. S. **Chromatographic luminescent method of separation of cinchona alkaloids.** *J. Applied Chem. (U.S.S.R.)* 18, 86-9 (1945).—*C.A.* 39, 5399^7.

The cinchona alkaloids could be sepd. by chromatographic adsorption on silica gel; the quinine fraction may contain some quinidine. The method was rapid; prepn. of the chromatogram required 20-5 min., and the sepn. of quinine about 1 hr. The adsorption was made from $CHCl_3$-benzene solns. with examn. by ultraviolet light. Developing solns. were benzene-$CHCl_3$ or $CHCl_3$ with a few drops of EtOH.

7949. MATET, A. (MME.) AND MATET, J. **Diets containing active charcoal for rapid production of avitaminosis A; preparation of vitamin A-free diets.** *Bull. soc. chim. biol.* 27, 513-18 (1945).—*C.A.* 40, 5116[4].

Two % of "Prolabo" active charcoal added to ordinary rat diets readily produced avitaminosis A.

7950. MAYER, GERDA GERNSHEIM AND SOBOTKA, HARRY. **The color reaction of vitamin A on Acid Earths.** *Science* 102, 158 (1945).

In 1939 Emmerie and Engel discovered that vitamin A gave a dark blue color, and carotenoids a bluish green color, when adsorbed on Floridin SX used for the removal of vitamin A and carotenoids from serum extracts prior to the reductometric colorimetry of tocopherol. When adapting the above method to a photoelectric procedure, this observation was confirmed.

7951. MCCOLLOCH, R. J. AND KERTESZ, Z. I. **Pectic enzymes. VI. The use of an ion-exchange resin for the complete removal of pectin methylesterase from commercial pectinases.** *J. Biol. Chem.* 160, 149-54 (1945).—*C.A.* 40, 615[3].

Pectin methylesterase was removed from 2 com. pectinase prepns. by the action of a cation-exchange resin, and varying proportions of pectin polygalacturonase were recovered.

7952. MELNICK, DANIEL; HOCHBERG, MELVIN, AND OSER, BERNARD L. **Physiological availability of the vitamins. VI. The effect of adsorbents on thiamine.** *J. Nutrition* 30, 233-8 (1945).—*C.A.* 40, 1203[4].

The influence of the concomitant ingestion of Fuller's earth and of kaolin on the availability of thiamine to man was investigated. These materials were shown to adsorb the vitamin very readily from aq. soln. Human studies showed that whereas the availability of thiamine was markedly reduced by the Fuller's earth, no interference occurred when kaolin was taken along with thiamine. The latter adsorbent appeared to protect the vitamin during its passage through the gastrointestinal tract.

7953. SANGER, F. **Free amino groups of insulin.** *Biochem. J.* 39, 507-15 (1945).—*C.A.* 40, 5399[3].

The free amino groups of proteins and peptides readily formed derivs. with 2,4-$(O_2N)_2C_6H_3F$ at room temp. Since these derivs. were relatively stable to acid hydrolysis, hydrolysis of the substituted protein enabled isolation of 2,4-dinitrophenyl amino acid derivs. which were separable by partition chromatography. This was the basis of a new method which was applied to the identification and estn. of the free amino groups in insulin.

7954. SEGAL, HARRY L.; HODGE, HAROLD; WATSON, JAMES S. JR., AND SCOTT, W. J. MERLE. **A polyamine-formaldehyde resin. I. Its effect upon the pH of acidified solutions and the pH and pepsin of gastric juice in vitro. II. Its toxicity in rats: preliminary feeding tests.** *Gastroenterology* 4, 484-96 (1945).

Amberlite IR-4 was studied for its effect upon the pH of HCl, acidified milk, acidified colloidal $Al(OH)_3$ and gastric juice in vitro. The inactivation of pepsin by the resin depended upon the effect of the resin on the pH of the solution and not upon any intrinsic action on pepsin.

7955. SIMS, E. A. H. **Microdetermination of glycocyamine and arginine by means of a synthetic ion-exchange resin for chromatographic separation.** *J. Biol. Chem.* 158, 239-45(1945). —*C.A.* 39, 2776[4].

A micromethod for the detn. of glycocyamine and arginine in biol. fluids made use of the Sakaguchi reaction and employed ion-exchange resins with uniform properties. A special device to regulate small column down-flow was described which made possible chromatographic procedures involving the use of coarse-textured adsorbents.

7956. SPITZER, H. **Silica gel for the preservation of plant material.** *Australian J. Sci.* 8, 83-4(1945).—*C.A.* 40, 3564[9].

Activated silica gel was used successfully for dehydrating and preserving alkaloid-bearing leaves. An amt. of silica gel approx. 20 times the wt of the leaf sample was required.

7957. SUSSMAN, SIDNEY; MINDLER, A. B., AND WOOD, W. **Recovery of alkaloids by ion exchange.** *Chem. Industries* 57, 455, 549(1945).—*C.A.* 40, 429[3].

Recoveries of totaquine from cinchona bark and scopolamine from datura plants were effected by bringing the alkaloid-contg. ext. into contact with a cation exchanger, then treating the cation exchanger with aq. alkali and a solvent.

7958. VORONINA, L. G. **Comparative evaluation of medicinal charcoals from German army supplies.** *Farmakol. i Toksikol.* 8, No. 2, 43-6 (1945).—*C.A.* 40, 5883[1].

Of 5 German medicinal charcoals, only one met the German Pharmacopeia adsorption test. Two were able to detoxify strychnine, one only feebly. Granular carbons had lower adsorption capacity than the same carbons as fine powders.

7959. YEN, PIN CHUN. **Ammonium sulfate from urine by base-exchange method.** *J. Chinese Chem. Soc.* 12, 19-23(1945).—*C.A.* 40, 4183[6].

Natural and artifically prepd. zeolites were examd. by passing standard NH_4OH soln. through a vertical glass tube contg. the base-exchange material. Treated Chungking coal showed 6-7 times the exchange capacity of either of the zeolites. Urine was first treated with urease, then with the base-exchange material, acidified, filtered, and evapd. The yield was 80% $(NH_4)_2SO_4$, based on the original N-content of the urine.

7960. ALEXANDER, JEROME. **Catalysis in industry, biology, and medicine.** *Sci. Monthly* 62, 407-16(1946).—*C.A.* 40, 4157[2].

The discussion included: catalysts in living units and in inheritance, genic and non-genic; differentiation as explained by catalyst changes; heritable catalyst changes as a basis of evolution, or in the development of diseases, including cancer.

7961. ANDERSEN, A. HARRESTRUP. **The pharmacology of activated charcoal. I. Adsorption power of charcoal in aqueous solutions.** *Acta pharmacol. et toxicol.* 2, 69-78(1946).—*C.A.* 40, 7415^3.

From aq. soln. 1 g of *Carbo medicinalis Merck* adsorbed 1800 mg $HgCl_2$, 1000 mg sulfanilamide, 950 mg strychnine nitrate, 800 mg morphine-HCl, 700 mg atropine sulfate, 700 mg nicotine, 700 mg veronal, 150 mg medinal, 300-350 mg phenobarbital, 300-350 mg Na alurate, 300-350 mg dial, 300-350 mg Na evipal, 300-350 mg Ca phanodorn, 550 mg salicylic acid, 400 mg phenol, 300 mg alc., or 25 mg KCN from dil. soln. Of these amts. 90% was adsorbed in 1 min.

7962. APPLEZWEIG, NORMAN AND RONZONE, SILVIO E. **Ion exchange for extracting cinchona alkaloids.** *Ind. Eng. Chem.* 38, 576-9(1946).—*C.A.* 40, 4175^5.

Com. dried cinchona bark was macerated with 0.1 *N* H_2SO_4, which was repeatedly cycled through a sulfonated coal cation exchanger and back into the maceration tank. The exchanger was regenerated with 0.5 *N* NaOH and stripped with alc., the crude alkaloid being recovered by evapn. Rectified totaquine was obtained by pptn. from aq. soln. and over-all yield of 81.2% within 82 hrs obtained.

7963. AXON, ARNOLD. **Sterile cream bases using bentonite.** *Pharm. J.* 157, 377-8(1946).—*C.A.* 43, 2367*g*.

Addn. of 2% of bentonite to ointments allowed their sterilization without sepn. of oils, caused little change in pH, and hindered formation of ice on cooling to -5°C.

7964. BLOCK, RICHARD J. **The isolation and synthesis of the naturally occurring α-amino acids.** *Chem. Rev.* 38, 501-71 (1946).—*C.A.* 40, 5701^5.

A review of the methods which were being used or showed promise of use for large-scale prepn. of the naturally occurring α-amino acids.

7965. BLOCK, RICHARD J. **A new method for the preparation of basic amino acid concentrates from protein hydrolyzates.** *Arch. Biochem.* 11, 235-48 (1946).—*C.A.* 41, 1007*f*.

Concentrates of the basic amino acids were prepd. from the hydrolyzates of blood meal, casein, fibrin, whey residue, and alkali-sol. soy protein. The concentrates were obtained by using ion-exchange resins. Detailed studies were reported with several commercially available ion-exchange resins.

7966. DENT, C. E. **Detection of amino acids in urine and other fluids.** *Lancet* 251, 637-9 (1946).—*C.A.* 42, 6395*h*.

A 1-dimensional chromatographic method employing phenol as a solvent and adapted for use with body fluids was described; 25 mm^3 of urine or other fluid was applied across a strip of filter paper immersed in molten phenol. After the solvent had crept about 25 cm past the urine level, the paper was dried at 100°C, sprayed with 1% ninhydrin in BuOH, and heated at 100°C for 10 min.

7967. DOCK, W. **Sodium depletion as a therapeutic procedure: the value of ion-exchange resins in withdrawing sodium from the body.** *Trans. Assoc. Am. Physicians* 59, 282-5(1946).—*C.A.* 42, 4273*e*.

Rats, on a diet contg. less than 0.2% Na, excreted 3.3-5.1 mg Na daily in the feces. Addn. of Ionac C284 resin to make up 10-25% of the diet increased the daily fecal loss to 34-64 mg. The Na uptake in the gut was 20-30 mg/g of resin.

7968. ELSDEN, S. R. **Application of the silica gel partition chromatogram to the estimation of volatile fatty acids.** *Biochem. J.* 40, 252-6(1946).—*C.A.* 40, 6534^2.

A $CHCl_3$ soln. of several fatty acids (formic, acetic, propionic, butyric and valeric) could be resolved by a silica-gel partition chromatogram, with bromocresol green as indicator. This procedure could be used for the identification as well as detn. in mixts. of acetic, propionic, and butyric acids. Formic acid could not be detd. by the procedure and must be removed before the soln. was analyzed.

7969. EYSTER, H. C. **Effect of auxins on the action of diastase in vitro.** *Plant Physiol.* 21, 68-74 (1946).—*C.A.* 40, 1900^6.

The interaction of auxins and diastase of malt was investigated in vitro, both in isolated and activated charcoal systems. 3-Indolepropionic acid, 3-indolebutyric acid, 3-indoleacetic acid and a-naphthaleneacetic acid were used in concns. of 25 and 50 p.p.m. at 25°C. In the activated-charcoal systems 1 ml of 1% diastase was adsorbed upon 1 g of Norit A. Auxins retarded the action of isolated diastase and accelerated the action of diastase adsorbed on charcoal in the same order.

7970. FISCHBACH, HENRY; MUNDELL, MERLIN, AND EBLE, THOMAS E. **Determination of penicillin K by partition chromatography.** *Science* 104, 84-5 (1946).—*C.A.* 40, 5792^1.

Silica gel (25 g) was thoroughly macerated with 12.5-16.5 ml 20% K phosphate buffer of pH 6.4. Washed $CHCl_3$ was added to the mixt. which was then poured into a glass cylinder of 22 mm inside diam. The column was used at 10°C. Aliquots of the penicillins, extd. into $CHCl_3$ from pH 2.0 buffer at 0°C, were passed through the column, followed by cold $CHCl_3$ to give 2 50-ml aliquots of eluate. Anesthesia ether satd. with H_2O was used as further eluent in 25-ml portions. Progress of elution was followed by iodometric assay.

7971. GOODALL, R. R. AND LEVI, A. A. **A microchromatographic method for the detection and approximate determination of the different penicillins in a mixture.** *Nature* 158, 675-6 (1946).

A modified partition chromatogram for penicillin using a 30% phosphate buffer of pH 6-7 as the stationary phase was adapted to microscale. The apparatus must be kept at 0-5°C. After 20-24 hrs the disposition and approximate amount of each invisible penicillin zone was determined by biological technique.

7972. HELBIG, W. A. **Adsorption and elution as a concentrating process. Appendix II.** *Colloid Chemistry* 6, 1176-9(1946).—*C.A.* 40, 2039[5].

A large-scale com. application in production of penicillin was described.

7973. LJUNGBERG, SIXTEN. **Chromatographic assay of fluid extract of cinchona.** *Svensk Farm. Tid.* 50, 197-202, 219-22, 237-43(1946).—*C.A.* 40, 5206[9].

Dil. 1.5 g of the cinchona prepn. with 10 cc. 95% EtOH. Suck this soln. through 10 g Al_2O_3 in a glass tube 1 cm in diam. Elute with four 5-cc. portions of the same alc., dil. with an equal vol. of H_2O, and titrate with 0.1 *N* HCl using bromocresol green as indicator to a green intermediate color. Use a buffer soln. of pH 4.3 for color comparison.

7974. MARTIN, GUSTAV J. AND WILKINSON, JOHN. **The neutralization of gastric acidity with anion exchange resins.** *Gastroenterology* 6, 315-23 (1946).—*C.A.* 41, 6583*h*.

Amberlite IR-4 brought about 80% inactivation of pepsin at the pH of 0.1 *N* HCl and 64% inactivation of trypsin in vitro. It did not adsorb thiamine-HCl or riboflavin at the pH of the normal human stomach or intestinal tract (i.e., 1.5 and 8.5, resp.). Ascorbic acid was adsorbed at pH 1.5 but desorption was complete at the pH of the normal intestinal tract. Amberlite IR-4 showed a pronounced "mol." adsorption of NaCl (in HNO_3 but not in HCl) and of Na_3PO_4 (in HCl) at pH 1.5. This adsorption was reversible; at pH approx. 8.5, recovery was apparently quant.

7975. MUKHERJEE, S. AND DAS GUPTA, K. K. **Pharmacopeial kaolin.** *Quart. J. Pharm. Pharmacol.* 19, 21-7 (1946).—*C.A.* 40, 4478[7].

Numerous kaolin samples from different sources have been tested and found to differ greatly from one another in respect to adsorptive power, dispersibility, and sedimentation vol. The differences were due, at least in part, to the presence of other minerals in the kaolin samples. Kaolin for oral administration should have a strong adsorptive power. Actual measurement of the adsorbing capacity, e.g., for methylene blue, would be necessary, before a kaolin sample could be deemed to be of value for oral use.

7976. MUKHERJEE, S.; DAS GUPTA, K. K., AND BANERJEE, R. P. **Characteristics of magnesium trisilicate.** *Quart. J. Pharm. Pharmacol.* 19, 14-21 (1946).—*C.A.* 40, 4478[4].

The total antacid powers of samples of magnesium trisilicate and of mixts. of hydrated magnesia and silicic acid, detd. by the pharmacopeial method, were, in all cases, found to be concordant with the total basicities derived from the MgO contents. Synthetic magnesium trisilicate possessed a higher adsorbing power for methylene blue than for mixts. Silicic acid possessed weaker adsorptive power than either of them.

7977. MUTCH, N. **Dried alumina.** *Quart. J. Pharm. Pharmacol.* 19, 490-519 (1946).—*C.A.* 41, 3259*b*.

The potency of alumina as an anti-acid substance for clinical use in the stomach was defined in terms of its ability to raise the pH of 0.1 *N* HCl. The desiccant power of alumina was assayed in terms of its heat-reversible water content under standard conditions of humidity. Alumina sorbed acidic dyes freely but had little affinity for basic compds. With azurine the sorbate of γ-Al_2O_3 was red, that of bauxite was blue. When amorphous bauxite was treated with an aq. soln. of acidic dye, double decompn. took place with the release of Al and the formation of a simple Al compd. of the dye. This compd. imparted a characteristic color to the sorbate.

7978. RÉGNIER, JEAN AND BAZIN, SUZANNE. **Fixation by charcoal, without agitation, of salts of 2-diethylaminoethyl p-aminobenzoate mixed with sodium salts. Determination of the bases and of the acids.** *Ann. pharm. franc.* 4, 94-6 (1946).—*C.A.* 41, 2958*a*.

Two groups of solns. were studied: (1) 2-diethylaminoethyl p-aminobenzoate -HCl and Na isobutyrate, and (2) 2-diethylaminoethyl p-aminobenzoate isobutyrate and NaCl. With both single salts and mixts. the phenomena was governed by the simple rule of the necessity of neutralization of the elec. charges which, in the single salts, resulted in fixation in the mol. state.

7979. RÉGNIER, JEAN; BAZIN, SUZANNE, AND FÉRÉ, JACQUELINE. **Fixation of various salts of 2-diethylaminoethyl p-aminobenzoate by myocardium powder. Determination of the base and of the acid radicals.** *Ann. pharm. franc.* 4, 153-6 (1946).—*C.A.* 41, 4021*e*.

By using the same technique as previously, except for the substitution of myocardium powder for carbon as substrate, it was found that fixations of the base and acid were not parallel; at all concns. for the hydrochloride and at the lowest concns. for the isobutyrate, the base was adsorbed to a greater extent than the acids; the reverse was true with β-phenylpropionate and citrate. In addn. to the ionization of the adsorbing protein, a certain combination between anion and cation may be a contributing factor.

7980. SHAW, F. H. AND FORSHAW, A. **Estimation of adrenaline.** *Australian J. Exptl. Biol. Med. Sci.* 24, 53-5 (1946).—*C.A.* 40, 4849[6].

Previous biol. estns. of adrenaline were complicated by the presence of other pharmacologically active principles, and chem. estn. lacked specificity. Adrenaline was sepd. from accompanying drugs by selective adsorption on $Al(OH)_3$, and assayed both biologically and chemically. The method applied to adrenaline concns. from 0.2 to 1.0 μg.

7981. SILBERMAN, HENRYK AND SILBERMAN-MARTYNCEWA, SOFIA. **Chromatographic separation of bile acids. I. Separation of cholic and desoxycholic acids.** *J. Biol. Chem.* 165, 359-63 (1946).—*C.A.* 41, 58*f*.

A suitable chromophoric reagent for the esterification of the —COOH group was ω-bromo-*p*-methylazobenzene, which reacted with the Na salts of the acids with a yield of 85% or more of the corresponding esters. $MgCO_3$ proved a very satisfactory adsorbent for the colored esters dissolved in benzene. In the chromatogram, the ester of cholic acid was adsorbed on top as an orange-colored band; the desoxycholic ester was placed below and was lighter in color. A narrow, almost white band developed between these 2 bands of esters.

7982. SILCOX, HERBERT. **Production of streptomycin.** *Chem. Eng. News* 24, 2762-4(1946).—*C.A.* 41, 252*c*.

Streptomycin was produced by aerobic fermentation in 15,000-gal fermenters and filtered on pressure rotary precoat filters with advancing knives and H_2O washing. The filtrate was admixed with activated carbon and refiltered. The streptomycin-rich charcoal adsorbate was then washed with EtOH and eluted with acid-EtOH soln. The acid eluate was neutralized and concd., and the streptomycin pptd. by solvents as the crude hydrochloride, which was further purified to eliminate pyrogens and other toxic and undesirable constitutents.

7983. SPERBER, ERIK. **Electrolytic separation of basic, neutral, and acidic amino acids in protein hydrolyzates.** *J. Biol. Chem.* 166, 75-7 (1946).—*C.A.* 41, 1264*f*.

A procedure was presented for sepg. the different classes of amino acids by combining the adsorption procedure and electrophoresis. For the adsorption a protein hydrolyzate freed from acid was adsorbed with Amberlite IR-4 resin. This was placed in the middle cell of the app. By the addn. of more resin it was possible to prevent the pH from falling below 4.5. An example of a synthetic hydrolyzate contg. arginine, histidine, glycine, and glutamic acid was described. Losses of amino acids were very small. Ordinarily 2 runs were sufficient to complete the sepn. into acid, neutral, and basic amino acids.

7984. WILKINSON, JOHN AND MARTIN, GUSTAV J. **Physicochemical aspects of the action of anion exchange resins in biochemical systems.** *Arch. Biochem.* 10, 205-14(1946).—*C.A.* 40, 6510^2.

Peptic activity was markedly reduced in the presence of an amine-formaldehyde resin. The reduction in peptic activity was presumed to be due in part to the removal of pepsin by adsorption. The adsorption of chloride, phosphate, ascorbic acid, methylene blue by the resin was not of the "exchange" type, but rather of a "molecular" type, e.g., a typical Freundlich adsorption isotherm was obtained.

7985. ANDERSEN, A. HARRESTRUP. **The pharmacology of activated charcoal. II. Effect of pH on adsorption by charcoal from aqueous solutions.** *Acta Pharmacol. Toxicol.* 3, 199-218 (1947)(in English).—*C.A.* 42, 5557*d*.

Weak bases such as nicotine were most effectively adsorbed by medicinal charcoal (Merck) from dil. aq. solns. at an alk. pH. Weak acids (phenols, diethylbarbituric acid, salicylic acid) were best adsorbed at an acid pH. Ampholytes such as sulfanilamide were best adsorbed at the isoelec. point. The adsorption of a nonelectrolyte (EtOH) was unaffected by changes in pH. Weakly dissocd. metallic salts such as $HgCl_2$ were adsorbed least at strongly acid reactions where formation of complex ions was favored.

7986. BJÖRLING, CARL OLOF. **Adsorption analysis of alkaloid salts of multivalent acids.** *Acta. Chem. Scand.* 1, 392-402(1947)(in English).—*C.A.* 42, 5614*b*.

Adsorption of procaine-HCl (0.1200 g) in alc. (5 ml) on Al_2O_3, followed by elution with successive 5 ml portions of alc. (total 10-20 ml), gave quant. yields of the free base; the acid was retained by the adsorbent. Salts of procaine with HCl, HNO_3, AcOH, $CH_2ClCOOH$, PhCOOH, H_3BO_3 (1:1) gave quant. results. The salts of H_2SO_4, $(COOH)_2$, citric, and tartaric acids did not give complete recovery even after prolonged elution; this may be due to firmer binding between Al_2O_3 and the salts of polybasic acids. Addn. of equiv. amts. (0.25 ml) of 2 *M* aq. HCl or HNO_3 to the alc. soln. of procaine tartrate before adsorption yielded quant. elution. NaOH, KOH, and NH_4OH facilitated elution but yielded alkali-insol. tartrates which prolonged the time of elution.

7987. BOULET, M.; NELSON, J. A., AND MCFARLANE, W. D. **A rapid colorimetric method for the determination of lysine in protein hydrolyzates.** *Can. J. Research* 25B, 540-7 (1947); *Federation Proc.* 5, 148 (1946).—*C.A.* 42, 2302*h*.

Weigh out 700 mg Decalso, wash 3 times by decantation with 3% NaCl soln. then with water until free of Cl. Pour 25 ml water through a 75-mm funnel upon a pledget of cotton near the tip, follow with a suspension of the Decalso and place another pledget on top of the 10-cm column, and wash with 5 ml 10% pyridine. Reflux enough protein to contain 2-15 mg lysine for 24 hrs with 10 ml 6 *N* HCl for 24 hrs. Evap. to dryness under vacuum, take up in 10.00 ml 10% pyridine and filter. Pass 1.00 ml of this through the column. When a depth of 1 mm remains above the column pass 3 one-ml portions of 10% pyridine through the column, follow with 100 ml 10% pyridine and then with 4 ml water. All the amino acids will have passed through the column while lysine and arginine, which gives no color with the reagent, have been adsorbed.

7988. BRAECKMAN, P. **Suspensions of barium sulfate for x-ray work.** *Pharm. Weekblad* 82, 709-19 (1947) (English summary).—*C.A.* 42, 3133*d*.

The sedimentation velocity of $BaSO_4$ in solns. of 0.94-7.5% gum arabic in 0.01 *N* Na citrate showed that the peptizing agent had the strongest influence on the sedimentation of the smaller particles, while the viscosity of the medium played the most important role for the coarser ones. Better results were obtained if the $BaSO_4$ was evapd. together with the gum soln., and the residue powdered and suspended in the proper amt. of solvent. At pH 3 a mixt. of 10 parts $BaSO_4$ with 1 part of gum arabic gave best results.

7989. CHRISTENSEN, G. LINDHARD AND NENSEN, B. K. **A chromatographic-colorimetric method of identification of tinctures.** *Dansk Tids. Farm.* 21, 68-73 (1947).—*C.A.* 41, 4611*i*.

The conventional chromatographic technique was adapted for the chromatography of tinctures. Most of the tinctures of the *Pharmacopeia Danica* have been chromatographed and color reproductions given to aid in the identification of the respective prepns.

7990. DAGLISH, C. **Adsorption of vitamin B_1 from solutions of the pure substance.** *Quart. J. Pharm. Pharmacol.* 20, 257-63(1947).—*C.A.* 42, 1386*i*.

The conditions under which aneurine (vitamin B_1) could be quantitatively adsorbed and eluted from columns of zeolite appeared to have very wide limits. The zeolite must be activated by boiling, or treatment with hot AcOH and KCl solns. The KCl could be replaced by NaCl in the activation step provided the K salt was used in the eluting soln. The reverse was not true. Neither could Ca replace K in the eluting soln. Higher recoveries were obtained if activated zeolite columns were pretreated *in situ* with 5 ml of 3% AcOH immediately prior to the adsorption of the aneurine soln. Activated zeolites could be stored equally well dry or under water without loss of efficiency.

7991. DENT, C. E. **The aminoaciduria in Fanconi syndrome. A study making extensive use of techniques based on paper partition chromatography.** *Biochem. J.* 41, 240-53 (1947).—*C.A.* 42, 663*d*.

The developments in the technique of paper chromatography were discussed. The following free amino acids were found in the urine with the approx. amts. in a 24-hr specimen: cystine, aspartic acid, glutamic acid, serine (0.25 g), glycine (0.8 g), threonine (0.5 g), alanine (1.0 g), valine (0.5 g), leucine and (or) isoleucine (0.4 g), methionine (0.34 g), phenylalanine, tyrosine (0.5 g), arginine, citrulline, histidine, proline, hydroxyproline, and α-aminobutyric acid. Considerable amts. of a compd., probably serylglycylglycine, were also found.

7992. DUVE, C. DE AND SOMER, P. DE. **Treatment of penicillin solutions with adsorbent charcoals.** *Bull. soc. chim. biol.* 29, 367-9 (1947).—*C.A.* 41, 7684*e*.

Penicillin produced in a modified Czapek-Dox medium was more completely adsorbed from the medium at pH 5 by adsorbent charcoals and more completely eluted by org. solvents than was the case with penicillin produced in a corn steep liquor medium. If the corn steep liquor was treated with 2% of Norit and filtered before use, the rate of growth of the mold on the medium was nearly doubled, but the penicillin production was decreased 10-20%.

7993. FISCHBACH, HENRY; EBLE, THOS. E., AND MUNDELL, MERLIN. **Separation of penicillin by partition chromatography.** *J. Am. Pharm. Assoc., Sci. Ed.* 36, 220-3(1947).—*C.A.* 41, 7661*h*.

By use of the previously described partition chromatography procedure, penicillin K was detd. in a mixt. of penicillins. There was sufficient resolution of the other penicillins to permit the isolation and purification of a penicillin F. The results indicated that, at best, recoveries of 80-85% of penicillin dihydro F could be obtained under the conditions necessary for optimum resolution of all the penicillins, there being an unaccountable destruction of some of the penicillin dihydro F. Under standardized conditions the method gave reproducible results ± 2% for penicillin K.

7994. FUCHS, L. AND RIZZI, A. **Form of carbon unsuitable for medical uses.** *Scientia pharm.* 15, 21-4 (1947).—*C.A.* 42, 2401*g*.

Carbon intended for gas masks was unsuitable for medical use, because of its low adsorptive power and its content of Cu and water-sol. substances.

7995. GOODALL, R. R. AND LEVI, A. A. **A microchromatographic method for the detection and approximate determination of the different penicillins in a mixture.** *Analyst* 72, 277-90 (1947).

Various penicillins in a mixt. were sepd. by a micro partition chromatographic technique, based on differences in distribution of the penicillins between ether (mobile phase) and phosphate buffer (stationary phase) supported on a strip of filter paper. The sepd. penicillins were invisible, but after incubation in contact with an agar sheet, pre-inoculated with *B. subtilis* spore suspension, elliptical zones free from bacterial growth were clearly visible in the neighborhood of each active component. The technique was highly sensitive, 1 μl. of soln. (1 to 30 international units) being adequate for a qual. sepn.

7996. HAAS, ELISABETH. **Atropine and adsorbents in vivo.** *Arch. exptl. Path. Pharmakol.* 204, 369-74 (1947).—*C.A.* 44, 4195*g*.

Previous investigations have shown that atropine, l-hyoscyamine was destroyed by adsorbents, although even before its destruction it was so firmly held that only a slight amt. was released by 0.1 *N* HCl. Expts. were carried out on rats to det. to what extent l-hyoscyamine remained effective when administered with adsorbing powders. Results reported showed that, at most, half of the activity was retained.

7997. JOHNSTON, CARTER D. **Identification and chromatography of androgens as their 2,4-dinitrophenylhydrazones.** *Science* 106, 91 (1947).—*C.A.* 41, 6597*a*.

The 2,4-dinitrophenylhydrazones of testosterone, testosterone propionate, methyltestosterone, androsterone and dehydroisoandrosterone colored red, red, orange, yellow, and yellow, resp., were prepd. in 95-100% yield. When a mixt. of the hydrazones of testosterone and testosterone propionate was subjected to chromatographic adsorption, the constituents were readily sepd. and recovered in yields of 97 and 91% resp., the fractions being identified by m.p. after recrystn.

7998. KASHINSKIĬ, P. A. AND VESELOVSKIĬ, N. V. **Scheme for analysis of medicinal mud and the form of recording its results.** *Gidrokhim. Materialy (Hydrochem. Materials)* 13, 3-21 (in English, 21-2) (1947).—*C.A.* 45, 4405*b*.

The following inadequacies of the Shchukarev method were: (1) the amts. of "decompn. products of siliceous particles" were low by 30-70% or more, because silicic acid sepd. as a gel was not included; (2) results of mech. analysis were too high because of silicic acid gel; and (3) the contents of the adsorbed cations given were unreliable. Results of analysis obtained by several investigators were provided and a modified scheme of analysis, based on the Shchukarev method was presented.

7999. KOBOZEV, N. I. **The principle of ensemble and aggravation in catalysis. III. A superstructure factor of activity. (Aggravation effect in catalysis and kinetics.)** *J. Phys. Chem.* (U.S.S.R.) 21, 1413-33(1947)(in Russian). —*C.A.* 42, 5319*e*.

The catalytic activity of Fe^{+++} increased from the complex $Fe_3O_4.Al_2O_3$ to hemin-imidazole, the carboxylase activity of amines increased from CH_3NH_2 to carboxylase in which NH_2 was attached to a protein residue, etc. In gaseous unimol. reactions the reaction const. increased, and the energy of activation decreased, when the mol. wt increased. The effect of aggravation was proportional to $e\beta^M$, β being a const. and M the mol. wt of aggravating substance. The greater M, the smaller is the mass necessary for the given action.

8000. KOCHOLATY, WALTER AND JUNOWICZ-KOCHOLATY, RENATE. **Use of cation exchangers for the concentration and purification of antibiotics of basic nature.** *Arch. Biochem.* 15, 55-64(1947). —*C.A.* 42, 3020*b*.

Streptothricin was concd. by adsorption on Decalso, Amberlite, or Permutit. It was then eluted with NaCl soln. and the soln. was evapd. to dryness under reduced pressure. The residue was taken up in MeOH, and streptothricin was pptd. on the addn. of ether. The ppt. was taken up in H_2O, decolorized with charcoal, and lyophilized.

8001. KRAEMER, MANFRED. **A new antacid for peptic ulcers.** *Postgraduate Medicine* 2, 431-37 (1947).

Synthetic antacid resins did not have any untoward effect on the digestive tract. They caused neither constipation nor diarrhea. Since they were not absorbed, they did not alter the acid base balance of the body.

8002. KRAEMER, MANFRED AND LEHMAN, DAVID J. JR. **The treatment of peptic ulcer with anion exchange resins. A preliminary report.** *Gastroenterology* 8, 202-4 (1947).

It seems probable that synthetic resins will find a place in the treatment of peptic ulcer. They showed no ill-effects upon the gastrointestinal tract and were valuable substances for controlling gastric hyperacidity without the annoying side-effects of constipation and diarrhea. They cannot upset the acid-base balance of the blood.

8003. MARTIN, GUSTAV J. AND WILKINSON, JOHN. **Absorption by ion-exchange materials of putrefactive chemicals.** *Arch. Biochem.* 12, 95-100 (1947).—*C.A.* 41, 3137*f*.

Putrescine, histamine, pyramine, indole, and skatole were strongly absorbed on Amberlite IR-4 and on zeolite. The absorption curves followed the Freundlich isotherm. Adding Amberlite and zeolite to the diet of rats which contained indole and guanidine acetate, resp., reduced the no. of deaths from approx. 60 to 20%.

8004. MUKHERJEE, S. **Standards of pharmacopeial charcoal.** *Pharm. J.* 158, 66-7 (1947).—*C.A.* 41, 2537*i*.

Max. limit for ash should be higher than in the U.S.P., i.e., 7%, the upper limit of acid-sol. fraction should not be more than 2.0%. The U.S.P. XII method for testing for heavy metals was preferred to the Codex method; adsorption tests for water vapor, methylene blue, iodine, strychnine, and caramel should be incorporated. The standards for adsorptive power of 0.1 g charcoal should be complete adsorption from 20 cc. of 0.1% soln. of methylene blue and from 25 cc. of 2% caramel.

8005. OPPIKOFER, FRANZ. **The influence of an adsorbent (carbon) on the biological activity of garlic. An incompatibility to avoid.** *Schweiz. Apoth. Ztg.* 85, 849-50(1947).—*C.A.* 42, 2398*g*.

In the presence of moisture, allicine (the active constituent of garlic) was unstable. The juice of garlic when preserved, at 4°C, in a bottle with a glass stopper showed, at the end of 15 days, bacteriostatic activity of about 22.8 Oxford Units per cc. The effect of the juice on the growth of *Staphylococcus aureus* and *Escherichia* was completely annulled by the addn. of 5% carbon, but the odor of the juice was practically unaffected.

8006. PAPAGEORGE, EVANGELINE AND LAMAR, MARGARET VOGT. **A comparison of three thiochrome methods for urinary thiamine by a simplified base-exchange procedure.** *Arch. Biochem.* 14, 310-24 (1947).—*C.A.* 42, 1619*d*.

The detn. of thiamine by the thiochrome method was carried out by adsorption, elution, oxidation and extn. successively in the same vessel.

8007. QUICK, ARMAND J. **The quantitative relationship between calcium and prothrombin.** *Am. J. Physiol.* 148, 211-21 (1947).—*C.A.* 41, 2149*f*.

The Ca of dog and human blood was removed by means of Amberlite IR-100. With the plasma thus obtained, a direct quant. study of the effect of added Ca salts was made. The min. concn. of $CaCl_2$ required for max. prothrombin activity of human plasma was approx. 0.0012 M and for dog plasma 0.0004 M. The optimum or critical concns. for both human and dog plasma were below the level of the free or ionized Ca.

8008. SEGAL, HARRY L.; HODGE, HAROLD C.; WATSON, JAMES S. JR., AND COATES, HILDA A. **A polyamine-formaldehyde resin. III. Chronic-toxicity experiment in rats.** *Gastroenterology* 8, 199-201 (1947).—*C.A.* 41, 5988*b*.

Groups of rats were fed diets contg. 0, 0.5, 2, and 20% of Amberlite IR-4 for 8 months. Wt curves, urinary and blood studies, and autopsy observations indicated that in concns. of 0.5 and 2% of the diet the purified resin exhibited a very low order of toxicity. The rats receiving the 20% resin diet were essentially normal, with the exception of 3 rats in which changes were found in the mucosa and submucosa of the stomach. The over-all toxicity for rats of this resin appeared to be negligible.

8009. Smith, W. **Assay of Fuller's earth for montmorillonite content.** *Quart. J. Pharm. Pharmacol.* **20**, 367-72(1947).—*C.A.* **42**, 1396*g*.

A method of differentiating between genuine Fuller's earth and other types of earth, such as kaolin, by means of base-exchange capacity was given. Results were given for various earths submitted to the above test.

8010. Spears, Mary M. and Pfeiffer, Mildred C. J. **Anion exchange resin and peptic ulcer pain.** *Gastroenterology* **8**, 191-98 (1947).

The effect on peptic ulcer pain of an anion exchange resin was studied in a group of 30 patients, all but one experiencing pain relief. Relief of pain was not synonymous with healing of the ulcer. No serious toxic effects from the use of the resin were noted. An insoluble, non-absorbable anion exchange resin had speedy action and acid neutralizing powers, which inhibited pepsin activity, caused no acid rebound, no constipation and no removal of phosphate or chloride ions from the body fluids.

8011. Tappi, Guido. **The chromatographic separation of *p*-aminobenzoic acid from procaine.** *Gazz. chim. ital.* **77**, 115-16 (1947).—*C.A.* **41**, 7655*h*.

In neutral medium, silica gel did not adsorb *p*-$H_2NC_6H_4CO_2H$ but did adsorb procaine almost completely, even when their concns. were very different. Elution of procaine was easily carried out by dil. acids. Silica gel (through a sieve of 900 meshes/cm^2 and sepd. from too fine particles by silk of 8100 meshes/cm^2) was treated with boiling 5% H_2SO_4 for 15 min., washed with distd. water, placed in a column 20 ml long and 1 cm^2 cross-section; pass 5-30 ml of soln., to which had been added 0.5-3 ml of aq. phosphate buffer, through at the rate of 2 drops per min., washed by percolating distd. water, and detd. the *p*-$H_2NC_6H_4CO_2H$ in an aliquot part of the combined percolated liquor and wash water. Eluted the procaine with 2/3 *N* H_2SO_4 (3 treatments of 5 ml each, followed by washing with water).

8012. Wolfrom, M. L.; Weisbalt, V. I.; Kaiabinos, J. V., and Keller, O. **A galactogen from beef lung.** *Arch. Biochem.* **14**, 1-6 (1947).—*C.A.* **42**, 233*g*.

A galactogen ($[\alpha]_D$ + 18°C, H_2O) had been isolated from beef lungs by pptn. with EtOH. The prepn. was water-sol. (25.0 g/100 g H_2O) and had a relative viscosity of 1.43 (25°C, c 5, H_2O). Chromatographic and hydrolysis studies indicated that galactose was the only carbohydrate in the galactogen.

8013. Bennett, Edward L. and Niemann, Carl. **The use of ion-exchange resins in the isolation of blood group A-specific substances from hog gastric mucin.** *J. Biol. Chem.* **176**, 969-75 (1948).—*C.A.* **43**, 4316*e*.

"De Acidite" (Permutit) mucin gave undegraded "A" as active as that obtained from the same source by EtOH fractionation. The resins removed some of the assocd. substances leaving "A" in soln.

8014. Bersin, Th. and Loheyde, Inge. **Exchange adsorption in nonaqueous solutions. II.** ***cis*- and *trans*- Estradiol.** *Z. Physiol. Chem.* **283**, 275-6 (1948).—*C.A.* **44**, 6468*b*.

Dimethylaminoazobenzene-*Bolus alba* adsorbate (200 mg) was shaken with a 0.001 *M* soln. of both *cis*- and *trans*-estradiol in abs. benzene, centrifuged, and the extinction coeff. of the displaced dye detd. in a photometer. The cis form showed about 30% greater adsorption than did the trans.

8015. Chargaff, Erwin; Levine, Celia, and Green, Charlotte. **Techniques for the demonstration by chromatography of nitrogenous lipide constituents, sulfur-containing amino acids, and reducing sugars.** *J. Biol. Chem.* **175**, 67-71 (1948).—*C.A.* **43**, 264*g*.

For lipide constituents, hydrolyzates of the phosphatides were chilled, filtered, dried *in vacuo*, the residues taken up in various solvents, adjusted to pH 7, and 0.01 cc. submitted to unidimensional chromatography on filter paper strips. Presence of choline was shown by its conversion to choline phosphomolybdate followed by reduction to Mo blue, using butanol as a solvent. For serine and ethanolamine, the solvent butanol with ninhydrine was used, producing colored spots. Presence of reducing sugars was shown by the production of brightly fluorescent spots by condensation of these sugars with *m*-phenylenediamine, using various solvents (butanol, collidine, pyridine, or diacetone alc.). As little as 10 γ showed spots under a quartz lamp.

8016. Dasler, Waldemar. **Hydrolysis of steroid esters on activated alumina.** *Science* **107**, 369 (1948).

Partial hydrolysis of steroid esters during chromatography has been frequently encountered without being recognized. Recent work indicated that the *p*-phenylazobenzoates of sterols were more resistant to hydrolysis than some of the other esters when chromatographed on activated alumina.

8017. Dent, C. E. **Paper chromatography of amino-acids.** *Biochem. J.* **43**, 169 (1948).

The 2-dimensional filter-paper method of partition chromatography was applied, using solvents phenol and "collidine". The positions taken up by these substances on the paper square were shown. With additional tests the method could be applied to the identification of all the ninhydrin-reacting substances likely to be present in biological fluids. The ninhydrin color reaction as used here was pos. for many aliphatic amines and also for β-, γ-, δ-, and ε-amino-acids.

8018. Elmore, D. T. **Separation of pyrimidine nucleosides by synthetic resin ion-exchangers.** *Nature* **161**, 931 (1948).—*C.A.* **43**, 3423*h*.

Cytidine and uridine were sepd. from the aq. pyridine hydrolyzate of yeast ribonucleic acid using a column of the cation-exchange resin "Zeo-Karb 215.". Cryst. cytidine (71-78% recovery), was obtained by elution from the column with 0.1 *N* aq. NH_4OH and evapn. Cryst. uridine (about 99% recovery), was obtained from the percolate and aq. washing by evapn.

8019. EVANS, W. C. AND PARTRIDGE, M. W. **Partition chromatography of alkoloids I. Solanaceous alkoloids.** *Quart. J. Pharm. Pharmacol.* 21, 126-37 (1948).—*C.A.* 42, 7486*i*.

A simple method for the sepn. of hyoscine and hyocyamine by partition chromatography was described. The scope of the method when applied to the total alkaloids of *Datura stramonium* and *Atropa belladonna* was indicated. *Datura ferox* contained as principal alkoloids, hyoscine and meteloidine. A rapid method for the detn. of the thiocyanate radical in reineckates was described.

8020. GAGE, THOMAS B.; DOUGLASS, CARL D., AND WENDER, SIMON H. **The purification and estimation of quercetin by paper-partition chromatography.** *Proc. Okla. Acad. Sci.* 29, 64-7 (1948)(Pub. 1950).—*C.A.* 46, 3908*b*.

Sepn. of quercetin from a crude prepn. by paper chromatography in BuOH-AcOH-H_2O, leaching with EtOH, and spectrophotometric detn. via the absorption max. at 375 mμ gave a quant. recovery of quercetin within 2-3%. Interference by an impurity in the paper or solvents was noted.

8021. GAGE, THOMAS B.; GALLEMORE, CLARA, AND WENDER, SIMON H. **Chromatographic adsorption studies on certain flavones.** *Proc. Okla. Acad. Sci.* 29, 71-3(1948)(Pub. 1950).—*C.A.* 46, 3828*e*.

Talk, magnesol, silica gel, Al_2O_3, and $BaSO_4$ were tested chromatographically as adsorbents for one or more of the following flavones: quercetin, quercitrin, rhamnetin, xanthorhamnin, homoeriodictyol, *d*-catechol, rutin, and naringin. Al_2O_3 gave irreversible adsorption and talc none; the other three were satisfactory.

8022. GALAT, ALEXANDER. **Nicotinamide from nicotinonitrile by catalytic hydration.** *J. Am. Chem. Soc.* 70, 3945 (1948).—*C.A.* 43, 1411*c*.

IRA-400 (washed with 5% NaOH and freed of alkali), 10.4 g nicotinonitrile, and 75 ml H_2O, refluxed 1 hr, gave 86-90% nicotinamide, m.p. 128.5-9.5°C.

8023. GRIDGEMAN, N. T.; GIBSON, G. P., AND SAVAGE, J. P. **Chromatographic estimation of vitamin A in whale-liver oil.** *Analyst* 73, 662-8(1948).—*C.A.* 43, 3565*a*.

The chromatographic column consisted of a glass tube about 45 cm long and of 6-7 mm internal diameter drawn out and plugged with cotton wool at one end. The adsorbent was 100-200 mesh activated Al_2O_3. The unsaponifiable matter developed in well-defined zones. One zone consisted of vitamin A only. It was eluted by seriatim with polar solvents.

8024. HARRIS, R. J. C. AND THOMAS, J. F. **Isolation and separation of the pyrimidine nucleosides of yeast ribosenucleic acid.** *Nature* **161**, 931 (1948); *J. Chem. Soc.* **1948**, 1936-9.—*C.A.* 43, 144*e*, 2666*g*.

Uridine was sepd. from a nucleoside solution in one operation by an ion exchange method using a zeo-carb column. When a mixture of cytidine and uridine was percolated through the exchanger, cytidine was retained by the resin, and uridine alone appeared in the effluent. Washing with water recovered the uridine quantitatively, and the cytidine may subsequently be recovered by treatment of the resin with 2% aqueous pyridine.

8025. HATA, TOJU; KIKUCHI, TSUNEO, AND OGUCHI, HIROSHI. **Purification of penicillin by a chromatographic method. I. Chromatographic method with alumina. II. Chromatogram with silica gel.** *Kitasato Arch. Exptl. Med.* **21**, 246-50, 251-5 (1948).—*C.A.* **45**, 310*b*.

A single passage of a Q-176 strain of penicillin ext. through alumina (BL6-Nippon Alumina Co.) increased the γ/mg content from 264 to 984 and from 956 to 1210. Repeated passages gave no increase. The Nippon alumina was equal to alumina (Merck) for this purpose. Silica gel satd. with pH 6 phosphate buffer was inferior to alumina for the isolation of penicillin. The order of sepn. in the silica gel tower was, from top to bottom, penicillins X, G, F, and K.

8026. HOFMANN, H. AND NEUBAUER, M. **Medicinal charcoal and the differences in adsorption capacity of various charcoal preparations.** *Pharmazie* 3, 529-31(1948).—*C.A.* 43, 3974*f*.

The adsorption capacity of various animal and vegetable charcoals was compared with the I_2 and the methylene blue adsorption methods. The *in vivo* potency was based on the detoxifying power of coadministration with strychnine in frogs. The animal charcoals proved superior.

8027. HORNE, RAYMOND E. JR. AND POLLARD, ARTHUR L. **Identification of streptomycin on paper strip chromatograms.** *J. Bacteriol.* 55, 231-34 (1948).

The chromatographic method was apparently highly selective for streptomycin. The mechanism involved was a salting-out process. The paper strip method of studying salting-out effects at low salt concns. might be useful in biochem. fields other than antibiotics.

8028. INAGAKI, CHOTEN. **Use of thiamine of sweet potato.** *Shokuryô no Kagaku* (Sci. of Foods) 2, 2-3(1948).—*C.A.* 47, 2431*b*.

In one method of storing sweet potato by coarsely cutting it and pressing, pressed juice was left, from which thiamine was concd. by adsorbing on acid clay. Addn. of 0.2% acid clay to the centrifuged sweet potato juice produced after 1 hr an almost colorless dried concentrate contg. 300 γ thiamine per g clay.

8029. KARNOVSKY, M. L.; RAPSON, W. S., AND VAN RENSBURG, N. J. **The transesterification and chromatographic treatment of fish liver oils as a means of concentrating vitamin A.** *J. Am. Oil Chemists' Soc.* 25, 36-8 (1948).—*C.A.* 42, 4309*i*.

In the chromatographic sepn. of vitamin A the material (1 g) was dissolved in pure dry benzene (50 ml) and passed through a column of alumina 20 cm high and 8 cm in diam. for 1 hr. The column was washed until 65 ml of benzene had been collected in a 100-ml flask and after changing this for a tared receiver, a mixt. of 5% EtOH in benzene was then passed down the column. The solvent was removed under vacuum until const. wt was attained. The vitamin A content was then detd.

8030. Kasdon, S. Charles. **Anion exchange resins in the treatment of heartburn during pregnancy.** *New Engl. J. Med.* **239**, 575-7 (1948).

An anion exchange resin, identical to that used in the treatment of peptic ulcers, was investigated as a means of eliminating heartburn during pregnancy. Eighty-eight percent of patients treated experienced complete relief.

8031. Khorama, M. L. and Motiwala, D. K. **Anthelmintics. Isolation of calycopterin from** *calycopteris floribunda. Indian J. Pharm.* **10**, 98-9(1948).—*C.A.* 43, 3565*i*.

Benzene solns of pure calycopterin were chromatographed on various adsorbents with the following results: (1) Na_2CO_3, no adsorption. (2) Activated charcoal, all coloring matter, including calycopterin, was adsorbed and the filtrate was colorless. (3) Activated MgO; four zones were obtained: dark green, red, brown, and yellow. The filtrate was colorless. (4) Activated alumina; a dark brownish green zone was obtained and the filtrate was yellow. (5) Wood ash; the filtrate was yellow. All other colors, including calycopterin, were adsorbed.

8032. Kingsbury, A. W.; Mindler, A. B., and Gilwood, M. E. **Recovery of nicotine by ion exchange.** *Chem. Eng. Progress* **44**, No. 7, *Trans. Am. Inst. Chem. Engrs.* 497-500 (1948). —*C.A.* 42, 6060*e*.

Cigaret tobacco drier gases were passed through a scrubbing tower, the H_2O being recirculated to build up the concn. of nicotine. The soln. was then passed through a H-cation exchanger bed where the nicotine was removed. The nicotine was then extd. from the H-exchanger by a one-step recovery process or used directly as Nicotine Zeo-Karb, an insecticide. Nicotine alkaloid recoveries of 75% were reported. Virtually 100% of the nicotine was removed from the drier waste gases.

8033. Moss, J. N. and Martin, Gustav J. **Inhibition of lysozyme activity.** *Am. J. Digestive Disease* **15**, 412-14 (1948).—*C.A.* 43, 8405*h*.

Large quantities of lysozyme in human gastric juice taken from patients with peptic ulcers were inhibited by the adsorbents bentonite, activated carbon, a polyamine and ion exchange resin.

8034. Muirhead, E. E. and Reid, Allen F. **A resin artificial kidney.** *J. Lab. Clin. Med.* **33**, 841-44 (1948).

The artificial kidney consisted of a resin bed composed of nine parts of Amberlite IR-100 H and one part of Deacidite. The Amberlite was a typical cation exchange resin with exchange activity on $-O^-$, $-COO^-$, and $-SO_3^-$ groups. The Deacidite was a typical anion exchange resin with exchange activity on $\equiv N(H_3O)^+$ groups. A simple technique removed nitrogenous waste products. Removal of excessive amounts of cations may be attained by varying the conditioning of the resin.

8035. Naftalin, L. **Quantitative chromatographic estimation of α-amino acids.** *Nature* **161**, 763 (1948).—*C.A.* 42, 5938*g*.

The α-amino acids were estd. in quantities of 0.2μ in serum and blood by a procedure using filter paper treated with ninhydrin. The spots were cut out, dried, heated to various temps., extd., and the amino acid estd. in the Hilger Spekker absorptiometer.

8036. Newberger, S. H. **Analysis of mixtures of hydrocarbons, beeswax, and spermaceti.** *J. Soc. Cosmetic Chem.* **1**, 95-102(1948).—*C.A.* 42, 5167*i*.

A method and procedure for the analysis of mixts. of hydrocarbons, beeswax, and spermaceti based on chromatography were described and results of typical sepns. given. The method may be useful in detecting adulteration of beeswax or spermaceti by hydrocarbons.

8037. Oda, Hyohei; Shimizu, Hiroshi, and Nakayama, Yoshio. **Ion exchange synthetic resins. XIV. Separation of vitamin B_1.** *Chem. High Polymers* (Japan) **5**, 142-5 (1948).—*C.A.* 46, 1185*h*.

Vitamin B_1 was sepd. from rice-bran ext. by RCOONa-type resin (phenoxyacetate-HCHO). The simple adsorption capacity was 200 γ/g and adsorption efficiency 85%. H_2SO_4 (10 *N*) was the best desorbing liquid.

8038. Omote, Yoshimori. **Vitamins A and D and related substances by molecular distillation. I. Catalytic action of metals on Vitamin A.** *J. Chem. Soc. Japan, Ind. Chem. Sect.*, **51**, 115-16(1948).—*C.A.* 44, 9634*g*.

Squalus suckleyi liver oil, 3 cc., (acid value 0.5, I value 140, vitamin A units 5.9) was heated 10 min. at 200°C at a pressure of 10^{-2}—10^{-3} mm Hg with different metal plates (1 × 1 × 0.1 cm) immersed in the oil. The order of rates of catalytic decompn. of vitamin A was: Cr < Ni < duralumin, Al, Sn, P bronze < Ag, Cu, and Fe < brass, Pb < Zn.

8039. Phillips, D. M. P. **Rapid R_F measurement in chromatography.** *Nature* **162**, 29 (1948).

A device useful for the rapid measurement of R_F values on paper partition chromatograms was described.

8040. Phillips, Ralph W. and Van Huysen, Grant. **Dentifrices and the tooth surface.** *Am. Perfumer* **51**, 33-7(1948).—*C.A.* 42, 2401*h*.

$CaCO_3$, both extra heavy and standard drug, produced a marked abrasion of the tooth surface and therefore had little polishing action; $Ca_3(PO_4)_2$ and dicalcium phosphate were relatively inert in their polishing action. A mixt. consisting of Na metaphosphate and Ca phosphate proved superior in its ability to polish tooth enamel.

8041. Pratt, John J. Jr. and Auclair, Jacques L. **Sensitivity of the ninhydrin reaction in paper partion chromatography.** *Science* **108**, 213-14 (1948).—*C.A.* 42, 8237*f*.

Solns. were placed on the filter paper, run 28 hrs in water-satd. phenol in one dimension, dried, run for 60 hrs in the 2nd dimension in a water-satd. 1:1 mixt. of γ-collidine and 2,4-lutidine, and again dried. The paper was then sprayed with a 0.1% soln. of ninhydrin in BuOH and heated in an oven at 80°-100°C for 5 min. Data were tabulated on the min. quantity of compd. detectable (0.1 to 25γ), color of spot, and R_f (distance compd. moved along paper/distance the solvent moved) for both solvent systems and both directions.

8042. RAUEN, H. M. AND WOLF, L. **The adsorption of glutamic acid on aluminum oxide.** *Z. Physiol. Chem.* 283, 233-42(1948).—*C.A.* 44, 6228*a*.

Anionotropic Al_2O_3 had an adsorbing power of 1 glutamic acid unit when 1 g of dry substance adsorbed 1 mg glutamic acid. Different prepns. of Al_2O_3 had different adsorptive powers. The adsorption power could be increased 2.7-3.4 times by adding $AlCl_3$ to the Al_2O_3. The optimum adsorption towards glutamic acid was attained when the Al_2O_3 was treated with 6 *N* HCl and washed at pH 2.5-2.7. The rate of flow of the glutamic acid through the tube did not significantly affect the adsorption, but the concn. did. The optimum temp. was 16°-18°C.

8043. RILEY, VERNON T. **Application of chromatography to segregation studies of the agent of chicken tumor I (Rous sarcoma virus).** *Science* 107, 573-5 (1948).—*C.A.* 42, 6392*i*.

The virus-like agent of chicken tumor was sepd. from morphologically similar normal constituents of the ext. by means of a chromatographic system. The tumor agent was strongly but reversibly adsorbed on diatomaceous earth (Celite) in the presence of physiol. concns. of NaCl. The partially purified chick tumor ext. was prepd. in 0.9% saline (-0.8 log molar), adsorbed in microcolumns, then eluted with dil. NaCl solns. The virus agent showed typical chromatographic banding, being concd. at the top of the column, while N unassocd. with virus activity was distributed throughout the column and in the filtrate, producing further segregation.

8044. TOMARELLI, RUDOLPH M. AND FLOREY, KLAUS. **Use of papergrams in the study of the urinary excretion of radioactive sulfur compounds.** *Science* 107, 630-1 (1948).—*C.A.* 42, 6873*d*.

Urine (0.06 ml) was deposited (in 0.01 ml aliquots) on filter paper within an area 1 cm in diam. The paper partition chromatogram (papergram) was developed overnight with liquefied phenol, the phenol traveling down 11-14 inches from the top of the paper. After removal of the phenol by heating, the paper was treated with ninhydrin to outline the pathway followed by the urinary constituents. A strip 1 inch wide, enclosing all the colored areas, was then cut from the paper, mounted on a specially constructed slotted metal base, and the distribution of radioactivity along the strip detd. by means of a Geiger counter.

8045. UCHIDA, SHUN-ICHI. **Adsorption of penicillin from broth with active charcoal and its elution with acetone.** *J. Pencillin (Japan)* I, 566-7 (1948).—*C.A.* 43, 6789*d*.

Consts. for Japanese charcoals were given.

8046. VISCHER, ERNST AND CHARGAFF, ERWIN. **The separation and estimation of purines and pyrimidines in minute amounts.** *J. Biol. Chem.* 176, 703-14 (1948).—*C.A.* 43, 2668*a*.

The mixts. were sepd. by means of chromatography on paper strips; the no. and position of sepd. compds. was demonstrated by conversion to metallic salts; and the sepd. purines and pyrimidines were identified by the shapes of their ultraviolet absorption curves, and detd. by the extinction values. For development, the paper sheets were air-dried, and sprayed with 0.25 *M* $Hg(NO_3)_2$ in 0.5 *M* HNO_3, and placed in a bath of 0.5 *M* HNO_3 through which a stream of H_2O passed, or $Hg(OAc)_2$ might have been used instead of $Hg(NO_3)_2$. When the excess Hg salt was removed the strip was passed through $(NH_4)_2S$ soln.; well-defined black spots of HgS indicated presence of the purines.

8047. VOTA, ALEJANDOR SANTA PAU AND YUFERS, EDUARDO PRIMO. **Preliminary note on the preparation of alkaloids from Atropa belladona by chemical adsorption (ion exchange).** *Anales real soc. espan. fis. y quim.* 44B, 621-30 (1948).—*C.A.* 42, 8422*b*.

Four liters of 0.1 *N* H_2SO_4 were circulated 30 hrs through 500 g of the plant, the H_2SO_4 passed through towers contg. an ion-exchange resin, and returned to the circuit. Extn. of alkaloid was 95-97.5% complete. The alkaloid was removed from the resin by NaOH.

8048. WEISS, J. **Treatment of gastric and duodenal ulcers with anion exchange resins.** *Rev. of Gastroenterol.* 15, 826 (1948).

Clinical trials of an anion exchange resin on forty-four patients at the New York Montefiore Hospital for Chronic Diseases have added evidence of the value of a resin antacid in peptic ulcer therapy.

8049. ALPERT, SIDNEY AND MARTIN, GUSTAV J. **A comparative study of the inhibitory action of chemical agents on peptic activity.** *Am. J. Digestive Disease* 16, 10-14 (1949).—*C.A.* 43, 8405*g*.

The specific inhibitory power of an insoluble polyamine ion exchange resin was enhanced by the addition of small amounts of sodium alkyl sulfate, principally lauryl.

8050. ALVAREZ, DE LA VEGA, F. **Chromatography in galenical pharmaceutics.** *Galenica Acta (Madrid) Año* 2, 85-118 (1949).—*C.A.* 43, 8094*g*.

App., reagents, and methods in general were described and the various applications used in the detn. of alkaloids, glucosides, and other substances found in galenical prepns. were given in detail. A short outline was given for vitamins A, B, and C, estrone, barbiturates, and penicillin.

8051. BARDI, E. **Colloidal clays and their use in cosmetics.** *Riv. ital. essenze, profumi, piante offic., olii vegetali, saponi* 31, 210-12(1949).—*C.A.* 45, 4886*a*.

Methods of controlling the purity of montmorillonite clays were described.

8052. BERSIN, THEODOR AND LOHEYDE, INGE. **Exchange adsorption in nonaqueous solutions. III. Steroid hormones.** *Z. Naturforsch.* 4b, 195-9(1949).—*C.A.* 46, 10775*c*.

The exchange adsorption of steroids was detd. by means of the displacement of dimethylaminoazobenzene which had been adsorbed on bolus alba.

The amt. of the dye displaced by a soln. of the steroid in C_6H_6 was used as a measure of the basicity of the steroid. The activity of the polar groups in the binding of mols. could be arranged in the following series: carbonyl > carbonylalkoxyl > HO > ether.

8053. Bull, Henry B.; Hahn, J. Wilfrid, and Baptist, Victor R. **Filter-paper chromatography.** *J. Am. Chem. Soc.* 71, 550-3 (1949). —*C.A.* 43, 3057*c*.

Schleicher and Schüll 507 paper was used; 80% PhOH was the solvent and the max. color intensity was developed by using a soln. of 0.4 g ninhydrin, 10 g PhOH, and 90 g BuOH, followed by drying 10 min. at 90°C, and by placing the strip over a steam bath for 5 min. Each amino acid was identified by its R_F value. Arginine, serine, valine, glutamic acid, leucine, threonine, alanine, and lysine gave the same micromolar color values (within the pH range of 4-7.5) and 0.67 to 13.5 γ of these acids could be detd. with a probable error of ± 8.82%.

8054. Charonnat, R. and Leclerc, J. **Determination of the adsorbing power of activated charcoal.** *Ann. pharm. franc.* 7, 625-7(1949).—*C.A.* 44, 3765*i*.

The most accurate values in comparative tests were obtained when the concn. was so chosen that about 50% of the dissolved material was adsorbed: Dry the charcoal at 100°C, add 0.1 g to 10 cc. of an I_2 soln. and shake 30 min. Centrifuge, decant, add H_2O, and centrifuge again. Titrate the I_2 in the combined liquids. By use of I_2 solns. of different concns., the soln. giving 50% adsorption was detd. Charcoals of high activity corresponded to high concns.

8055. Chervenka, Charles H. and Wender, Simon H. **Preliminary studies on the use of amberlite resins in locoweed investigations.** *Proc. Okla. Acad. Sci.* 30, 150-3(1949)(Pub. 1951).—*C.A.* 46, 4177*i*.

Aq. locoweed exts., purified by dialysis, dehydration with alc. and C_6H_6, and chilling to remove resins, were passed through ion-exchange resins (Amberlite IRC-50 and IRC-400) and regenerated thence. Ultraviolet absorption spectra of the products indicated two or more substances present.

8056. Dernehl, C. U.; Nau, Carl A.; Frank, T. M., and Neidhardt, H. W. **Experimental studies on the action of silica gel catalyst administered to guinea pigs by inhalation.** *J. Ind. Hyg. Taxicol.* 31, 32-40(1949).—*C.A.* 43, 4401*b*.

When guinea pigs were exposed to an atm. contg. 450-500 million particles/ft^3 of air silica gel-Al_2O_3 dust, as used as a catalyst in petroleum processing, no silicotic fibrosis was produced; this indicated classification of the dust as physiologically inert.

8057. Di Gangi, Frank E. and Rogers, Charles H. **Adsorption studies of aureomycin hydrochloride on aluminum hydroxide gel.** *J. Am. Pharm. Assoc.* 38, 646-7 (1949).—*C.A.* 44, 1653*b*.

Colorimetric detns. of aureomycin-HCl were made by a Fisher Electrophotometer with a filter cell having a spectral band of approx. 425 mμ. It was found that $Al(OH)_3$ gel, given to control nausea and vomiting, adsorbed practically 100% of the aureomycin-HCl administered.

8058. Evans, W. C. and Partridge, M. W. **Partition chromatography of alkaloids. II. Australian Datura ferox and Indian henbane.** *J. Pharm. Pharmacol.* 1, 593-8 (1949).—*C.A.* 43, 9379*g*.

Australian-grown *Datura ferox* contained the alkaloids, hyoscine (0.06%) and meteloidine. The chief alkaloidal constituents of Indian henbane were hyoscine (0.016%), hyoscyamine (0.01%), and tropine (0.0015%). *Hyoscyamus niger* yielded hyoscine (0.028%), hyoscyamine (0.041%), and tropine (0.0025%).

8059. Foster, G. E.; Macdonald, J., and Jones, T. S. G. **Separation and identification of ergot alkaloids by paper partition chromatography.** *J. Pharm. Pharmacol.* 1, 802-10 (1949).—*C.A.* 44, 1229*h*.

The alkaloids were removed by extn. with 5% lactic acid and adjusted to 100 ml. The ext. was dild. with 1% lactic acid until 0.05 ml placed on a No. 1 Whatman strip and developed with BuOH-AcOH-H_2O mixt. gave a fluorescent spot approx. equal in intensity to that obtained with a erogonovine standard contg. 0.2-0.5 γ in 0.05 ml. Results with a series of standards on the same paper allowed estn. of the erogonovine content of the ergot.

8060. Fujiwara, M. and Shimuzu, H. **Microdetermination of riboflavin by synthetic ion exchange resin.** *Anal. Chem.* 21, 8, 1009-1011 (1949).

It was necessary to remove as completely as possible other fluorescing substances, which interfered with the yellow-green fluorescence due to riboflavin. For this purpose, a synthetic cation exchange resin was employed to adsorb riboflavin.

8061. Granberg, C. Boyd and Benton, B. E. **The use of dried bentonite as a disintergrating agent in compressed tablets of thyroid.** *J. Am. Pharm. Assoc.* 38, 648-51 (1949).—*C.A.* 44, 1645*i*.

Dried bentonite was found superior to starch as a disintergrating agent for thyroid tablets. Tests indicated that the presence of bentonite did not hinder the liberation of I_2 from its combination with thyroid.

8062. Haas, Karl. **The influence of adsorption on the concentration of homeopathic dilutions prepared by different methods.** *Pharm. Acta Helv.* 24, 265-310(1949).—*C.A.* 44, 2699*i*.

A review of previously reported work was given.

8063. Hill, Joseph M.; Haberman, Sol, and Guy, Ruth. **Further evidence for antibodies of the third order. Fractionation of agglutinins, blocking antibodies, and cryptoagglutinoids by physicochemical methods.** *Am. J. Clin. Path.* 19, 134-40 (1949).—*C.A.* 43, 3920*a*.

The globulins of Rh antibody-contg. serums were pptd. by ion-exchange resins. The globulin subfractions desired were obtained by dissolving the ppt. from 50 cc. of original serum in selected solns. of NaCl.

8064. Horrocks, R. H. and Manning, G. B. **Partition chromatography on paper. Identification of reducing substances in urine.** *Lancet* 256, 1042-5 (1949).—*C.A.* 43, 8426*h*.

Reducing substances found in the urine in clinical practice were identified and roughly estd. by means of partition chromatography with a butanol-acetic acid-H_2O mixt. Spots of urine were placed on strips of filter paper and allowed to stand in contact with the solvent for either descending or ascending chromatography for 24 hrs. Color was developed by spraying with benzidine, ammoniacal $AgNO_3$, aniline-hydrogen oxalate, or phloroglucinol reagents.

8065. Irwin, Leslie; Berger, Eugene Y.; Rosenberg, Benjamin, and Jackenthal, Roslyn. **The effect of a cation exchange resin on electrolyte balance and its use in edematous states.** *J. Clin. Invest.* 28, Part 2, 1403-11 (1949).

Cation exchange resins taken orally reduced the absorption of Na from the intestine. With such resins, a patient may satisfy his appetite for salt within reasonable limits without absorbing excessive amts. of Na and without accumulating edema. Its use in congestive heart failure and cirrhosis of the liver resulted in a diuresis of existing depots of fluid which did not reaccumulate while the resin was administered. K depletion and acidosis must be considered as possible hazards.

8066. Jindra, A. **Determination of alkaloids by exchange of ions.** *J. Pharm. Pharmacol.* 1, 87-94(1949).—*C.A.* 43, 4809*i*.

Dissolve 0.1-0.2 g of alkaloidal salt in 20 ml of alc. and pass through a prepd. column of Amberlite IR-4B synthetic resin. Wash the flask and the column with 50 cc. of alc. at 50°C. Titrate the alkaloid in the alc. with 0.1 *N* HCl. The method was applied to strychnine nitrate; atropine and ephedrine sulfates; morphine, brucine, quinine, and cinchonine hydrochlorides.

8067. Karnovsky, M. L. and Johnson, M. J. **Filter-paper chromatography of penicillin broths.** *Anal. Chem.* 21, 1125-32 (1949).—*C.A.* 43, 9366*g*.

Conditions for optimal resolution of individual penicillins were investigated. Whatman No. 1 filter paper ribbons 1.25 cm wide and about 45 cm long (below the spotting point) were impregnated with 20% K_2HPO_4 buffer of pH 6.2. Development of the chromatogram with water-satd. ether was carried out for 20 hrs in which time the ether front reached the end of a paper twice as long as the one actually used. Under these conditions the fastest moving common cryst. penicillin traveled approx. 35 cm. Humidification of the ribbons at room temp. for 15 min. was satisfactory.

8068. Kawanc, Yoshio. **Adsorption of penicillin with activated carbon.** *J. Fermentation Technol.* (Japan) 27, 177-81(1949).—*C.A.* 47, 1897*d*.

The adsorption of penicillin to activated charcoal followed the Freundlich's adsorption isothermal equation. Employment of 1-1.5% charcoal was satisfactory for 99% adsorption of penicillin from a broth of 200-300 u./cc. The adsorption equil. was reached in a short time; 99% in 10 min. with a broth of 200 u./cc., and in 10-20 min. with 500 u./cc. Activated charcoal (1 g) adsorbed at pH 6.0 in 40 min. 8151 u. penicillin (99.6%) from 100 cc. soln. of 81.81 u./cc. and 218,100 u. (26.6%) from 8181.0 u./cc.

8069. Kluener, R. G. **A paper chromatographic method for the quantitative estimation of penicillin entities.** *J. Bact.* 57, 101-9 (1949).—*C.A.* 43, 4322*e*.

The various penicillins possessed different distribution coeffs. between ether and phosphate buffer at a given pH, hence could be sepd. by paper strip partition chromatography. A direct visual result was obtained by incubating the ether-developed strips on agar seeded with *Staphylococcus aureus* 209 for 16 hrs at 37°C.

8070. Lecomte, J. and Fischer, P. **Estimation of arterenol in presence of adrenaline.** *Compt. rend. soc. biol.* 143, 1294-6(1949).—*C.A.* 44, 8054*h*.

The sample soln., contg. 200γ or more of adrenaline or arterenol was passed through a loose column of neutral permutite (Decalso) and the column washed with distd. water. Then 5 cc. of 0.1 *N* I_2 in K-phthalate buffer of pH 4 was passed through the column in 15 sec or less. The adrenaline was oxidized to iodoadrenochrome, and the latter washed out of the column and detd. photometrically. If the I_2 soln. passed through the column too slowly, some of the arterenol may be also oxidized.

8071. Leigh, T. **Partition chromatography of the tertiary amine salts of the penicillins.** *Discussions Faraday Soc.* 7, 311-16(1949).—*C.A.* 44, 10268*d*.

Mixed penicillins could be sepd. by partition chromatography between a stationary phase of H_2O and a tertiary amine on a silica gel column and an org. solvent as mobile phase. The acids were converted into amine salts and emerged in nearly pure form. Owing to instability of penicillin toward primary and secondary amines, only the tertiary amines Et_3N, 1-ethylpiperidine, and 1-ethylhexamethylenimine were used, and $(CH_2Cl)_2$, $CHCl_3$, AcOEt, and BuOH were tried as eluting agents. A suspension of 500 g silica gel in 1500 ml AcOEt was treated with 350 ml H_2O and 25 ml 1-ethylhexamethylenimine, the suspension charged into a chromatogram tube, and after settling (1 hr) 15 g cryst. penicillins in 100 ml AcOEt was added.

8072. Meyer, Kurt H. and Gibbons, G. C. **Starch. XLVI. Purification of amylopectin.** *Helv. Chim. Acta* 33, 210-13 (1949).—*C.A.* 44, 4274*d*.

Partially purified amylopectin could be freed of amylose by selective adsorption of amylose on stearic acid.

8073. Munier, Roger and Macheboeuf, Michael. **Microchromatography of the separation of alkaloids and of various biological nitrogen bases. I.** *Bull. soc. chim. biol.* 31, 1144-62(1949). —*C.A.* 44, 10259*g*.

Sepn. microchromatography on paper was applicable to the study of alkaloids under certain conditions. Certain non-alkaloid substances such as choline, betaine, and nicotinic acid formed spots also, but these were easily differentiated from the alkaloids because their partition coeffs. (R_f) were different. All alkaloids except the xanthines and trigonelline formed spots on paper in the presence of I_2 vapor. Three methods of detection were possible on the same paper: (1) examn. in ultraviolet light, (2) action of I_2 vapor, and (3) action of a reagent after evapn. of the I_2 vapor. The choice of solvent depended on the R_f of the alkaloid between the solvent phase and the aq. equilibrated phase.

8074. NICHOLAS, R. E. H. AND RIMINGTON, C. **Qualitative analysis of the porphyrins by partition chromatography.** *Scand. J. Clin. & Lab. Invest.* 1, 12-18 (1949).—*C.A.* 44, 2065*c*.

Paper partition chromatography was applied to the examn. of porphyrins. The most suitable solvent was lutidine in the presence of NH_3 vapor. The sepn. occurred according to the no. of carboxyl groups in the mol.

8075. PARTRIDGE, S. M. AND BRIMLEY, R. C. **Displacement chromatography on synthetic ion-exchange resins. II. The separation of organic acids and acidic amino acids by the use of anion-exchange resins.** *Biochem. J.* 44, 513-21 (1949).—*C.A.* 43, 8807*a*.

Three anion-exchange resins (Amberlite IR-4, Wofatit M, and D-Acidite B) in packed columns gave with glutamic acid boundary widths which were practically inversely proportional to the adsorptive capacity of the resins. With very slow rates of flow, some sepn. between glutamic and aspartic acids could be obtained with De-Acidite B, but the results were of doubtful value.

8076. PARTRIDGE, S. M. **Displacement chromatography on synthetic ion-exchange resins. III. Fractionation of a protein hydrolyzate.** *Biochem. J.* 44, 521-7 (1949).—*C.A.* 43, 8807*b*.

Tyrosine and phenylalanine together with sol. humin were first removed from the protein hydrolyzate by adsorption on ion-exchange resins. The 2 amino acids were later eluted with aq. phenol-acetic acid. Hydrolyzed com. egg albumin was fractionated on Zeo-Karb 215 by displacement with NH_4OH soln. and resolved on a flowing filter-paper chromatogram into 7 bands: (1) aspartic acid; (2) glutamic acid, serine, and threonine; (3) glycine and alanine; (4) valine and proline; (5) leucine, isoleucine, methionine, and cystine; (6) histidine and unidentified amino acids; and (7) lysine.

8077. PARTRIDGE, S. M. **Aniline hydrogen phthalate as a spraying reagent for chromatography of sugars.** *Nature* 164, 443(1949).—*C.A.* 44, 487*a*.

This reagent was much more selective for sugars than ammoniacal $AgNO_3$ and was extremely sensitive to *aldo-pentoses* and *aldo-hexoses*. Since it may be dissolved in moist butanol, migration of the sugar spots during the spraying process could be avoided. To prep. the reagent add aniline 0.93 g and phthalic acid 1.66 g to 100 ml of water-satd. butanol. After spraying, the chromatogram was heated for 5 min. at 105°C to develop the color.

8078. PARTRIDGE, S. M. **Separation of bases and amino acids by displacement chromatography on ion-exchange.** *Discussions Faraday Soc. No.* 7, 296-305 (1949).—*C.A.* 44, 7921*h*.

Amino acids could be sepd. on a preparative scale by displacement chromatography on a column of Zeo-Karb 215, a sulfonated phenolic cation-exchange resin. An amino acid mixt. sufficient to saturate about 0.5 of the column was adsorbed and then displaced with a soln. of a base having a higher affinity for the resin than any components of the mixt. The adsorption of the various amino acids on resin depended on the pH of the soln., and all naturally occurring amino acids were adsorbed.

8079. POETSCH, CHESTER E.; HIGUCHI, TAKERU, AND PARKS, LLOYD M. **Sabadilla alkaloids. II. Alkaloidal components of the petroleum ether extract.** *J. Am. Pharm. Assoc.* 38, 525-30 (1949).—*C.A.* 43, 9384*e*.

Some of the fractions were sepd. and purified by selective adsorption and elution from Al_2O_3 column and absorption spectra indicated fractions different from any previously reported alkaloids of sabadilla.

8080. RABINOVICH, M. S. AND KONOVALOVA, R. A. **Adsorption method of isolation of anabasine.** *Zhur. Priklad. Khim.* (J. Applied Chem.) 22, 995-1001(1949).—*C.A.* 45, 3560*g*.

Anabasine could be adsorbed from aq. media by numerous adsorbents affording a sepn. from resinous materials that accompanied the alkaloid in aq. exts. of *Anabasis aphylla*. The most active substances were silica gel, infusorial earth, gumbrin (Caucasian), and mid-Asiatic bentonite; kaolin was almost ineffective as is Permutit. Desorption was best done by treatment with dil. H_2SO_4, which after 3 cycles with $2N$ H_2SO_4 could desorb 84% of the base giving solns. contg. up to 6% of the alkaloid; the solns. acquired addnl. purification in this step, showing a considerable loss of color.

8081. REICHSTEIN, P. AND SHOPPEE, C. W. **Chromatography of steroids and other colorless substances by the method of fractional elution.** *Discussions Faraday Soc. No.* 7, 305-11(1949). —*C.A.* 44, 8286*g*.

The technique of fractional elution was described for the chromatographic sepn. of colorless substances. This was used with great success in the field of steroid chemistry, with Al_2O_3 as adsorbent. In a few cases difficulties were encountered: 17-Hydroxy 20-ketones, especially those of the 17-isopregnane series, undergo molecular rearrangement to give D-homoketones. This could largely be avoided by use of neutralized Al_2O_3 of low activity and dry solvents or by use of the 17-acetates.

8082. RILEY, VERNON T.; HESSELBACH, MARIE L.; FIALA, SILVIO; WOODS, M. W., AND BURK, DEAN. **Application of chromatography to the separation of subcellular, enzymatically active granules.** *Science* 109, 361 (1949).

Melanized granules (varying in size from 0.2 to 0.6 μ or more) of the Cloudman S91 and Harding-Passey mouse melanomas could be reversibly adsorbed on Celite Columns. The adaptation of chromatography to particulates ranging from virus to mitochondrial and bacterial size provided another method for separation and characterization of the particulate components of the cell.

8083. Schubert, Jack; Russell, Edwin R., and Farabee, Lawrence B. **Use of ion exchange for the determination of radioelements in large volumes of urine.** *Science* 109, 316-17, (1949). —*C.A.* 43, 4724*f*.

Radioyttrium $Y^{91}(10^{-4}M)$ was removed from 1 liter of urine with a recovery of $85 \pm 5\%$ by a 2-step method with a cation exchange resin.

8084. Smith, Arnold and Moxon, Alvin L. **Paper-partition chromatography for the separation of analogs of sulfur amino acids.** *Proc. S. Dakota Acad. Sci.* 28, 46-9(1949).—*C.A.* 45, 7920*b*.

Chromatograms were made of cystine, Se-cystine, methionine, and Se-methionine with phenol or BuOH as solvents. The *n*-BuOH mixt. did not move the cystine or Se-cystine from the origin, but was better than phenol for sepg. methionine from Se-methionine. In phenol the av. R_f (ratio of distance traveled by the amino acid to that traveled by the solvent) placed the Se analogs at an R_f value 0.02 higher than the S compds. Collidine and lutidine used as solvents showed greater R_f differences for both sets of analogs on one paper, but the actual vertical distance was small since the compds. rose only a short distance.

8085. Smith, E. Lester. **Biologically active substances in liver extract.** *Discussions Faraday Soc. No.* 7, 317-21 (1949).—*C.A.* 44, 7922*g*.

Chromatographic procedures used in the isolation of vitamin B^{12} were described. For adsorption from a crude aq. soln., shallow beds of charcoal only a few cm deep and up to 1 m or more in diam. were convenient on account of their capacity for rapid treatment of very large vols. contg. valuable but unstable compds. Partition chromatography on moist silica (60% H_2O) with BuOH (11-12% H_2O) or PrOH (10-25% H_2O) gave very satisfactory chromatograms of solns. contg. several % of B^{12}.

8086. Svendsen, A. Baerheim and Jensen, K. Briseid. **Chromatographic separation of aloin.** *Scientia Pharm.* 17, 118-20(1949).—*C.A.* 44, 5537*a*.

Warming aloin in air formed a red-violet material which did not give the tests for anthranol or for anthraquinone, but did give a sugar reaction. It was easily sol. in H_2O, moderately sol. in alc., and insol. in $CHCl_3$ and Et_2O. On chromatographic analysis of aloin dissolved in $CHCl_3$-Me_2CHOH mixt. with an Al_2O_3-H_2O column, the red-violet material was strongly adsorbed and only removed by MeOH.

8087. Vischer, Ernst; Zamenhof, Stephen, and Chargaff, Erwin. **Microbial nucleic acids: the desoxypentose nucleic acids of avian tubercle bacilli and yeast.** *J. Biol. Chem.* 177, 429-38 (1949).—*C.A.* 43, 3063*c*.

Cytosine, thymine, guanine, and adenine were detected, in different molar proportions, in avian tubercle bacilli and yeast by using chromatographic sepn. and spectrographic analysis.

8088. Voĭtko, L. M. and Kharin, A. N. **Investigation of the dynamics of sorption of essential oil of coriander from aqueous solutions on different kinds of carbon.** *Zhur. Priklad. Khim.* 22, 1237-48(1949).—*C.A.* 46, 5929*d*.

The static sorption of oil of coriander on 2 types of carbon was studied. Rates of feeding of the aq. solns. of coriander oil and the diam. of the carbon grains were the variables studied. In addn., expts. were made on carbon of mixed particle size under conditions approaching those found in industrial operations. The kinetic coeffs. of sorption of coriander oil on different kinds of carbon (birchwood, anthracite, and charcoal) obeyed the same relation to the sp. rate of feeding of soln. and to diam. of carbon particle, viz., $\beta = 0.0252\ (\alpha^{0.05}/d)$.

8089. Wenusch, Adolf. **What hopes can be based on nicotine filters?** *Rev. intern. tabacs* 24, 136, 142(1949).—*C.A.* 43, 9383*a*.

Filters of clay, cellulose, or silica gel were considered to hold back the nicotine contained in the smoke because the smoke had a lower physiol. effect. However, nicotine freely passed these filters. A combined action of nicotine and microparticles of resins in the smoke was postulated.

8090. Winters, James C. and Kunin, Robert. **Ion exchange in the pharmaceutical field.** *Ind. Eng. Chem.* 41, 460-3(1949).—*C.A.* 43, 4423*g*.

Amberlite IRC-50, a carboxylic-acid type cation exchanger, and IRA-400, a strongly basic anion exchanger, not only made it feasible to follow Cannan's method for separating amino acids into groups of the same charge type, and into acidic, basic, and neutral groups, but also provided a technique for sepg. the basic amino acids from each other.

8091. Albans, J.W. and Baker, P.B. **Paper chromatography in penicillin production control.** *Analyst* 75, 657-62(1950).—*C.A.* 45, 2147*f*.

The application of the method to culture filtrates and similar process samples was discussed. The construction of a large vessel for multiple analyses was shown.

8092. Awapara, Jorge; Landua, Alton J., and Fuerst, Robert. **Free aminoethylphosphoric ester in rat organs and human tumors.** *J. Biol. Chem.* 183, 545-8 (1950).—*C.A.* 44, 5997*f*.

Aminoethylphosphoric ester was identified in 23 organs of the rat and in several human tumors. It was isolated from beef spleen by means of paper chromatography and identified by the same means.

8093. Baker, P.B.; Dobson, F., and Martin, A.J.P. **Analysis of penicillin mixtures by paper chromatography of the hydroxamic acid derivatives.** *Analyst* 75, 651-6(1950).—*C.A.* 45, 2147*d*.

The method was based on the fact that the relatively stable hydroxamic acid derivs. of the various penicillins showed different partition coeffs. between isopropyl ether and isopropyl alc. and phthalate buffer, at a given pH, and could be sepd. by paper chromatography. A new app. for use with volatile solvents and heavily buffered papers was described. A direct qual. result was obtained by developing the chromatogram with dil. $FeCl_3$ soln.

8094. Bentley, H.R. and Whitehead, J.K. **Water-miscible solvents in the separation of amino acids by paper chromatography.** *Biochem. J.* 46, 341-5(1950).—*C.A.* 44, 10446*d*.

Aq. mixts. of relatively nonvolatile solvents (furfuryl and tetrahydrofurfuryl alc.) gave small sharp spots, but with more volatile solvents (lower alc., acetone, pyridine, tetrahydrofuran) satisfactory results could be obtained by capillary ascent. With solvents only partially miscible with water the compn. of the flowing solvent and of the cellulose-water complex varied within fixed limits and the effect becomes practically a true partition between solvent and water.

8095. Brink, Norman G.; Meisinger, Melvin A.P., and Folkers, Karl. **The activity of a hydrolyzate of adrenocorticotropic hormone in rheumatoid arthritis.** *J. Am. Chem. Soc.* 72, 1040-1(1950).—*C.A.* 45, 2633*d*.

Adrenocorticotropic hormone concentrate (1.233 g) digested in 250 cc. 0.05 *N* HCl with 132 mg pepsin and dialyzed 5 days against distd. water, yielded a clinically active product (0.605 g). Paper chromatograms of the dialyzate showed no pos. ninhydrin tests.

8096. Brody, Theodore M.; Voigt, Ralph F., and Maher, Frank T. **A chromatographic study of the anthraquinone derivatives of** ***Curaçao aloe.*** *J. Am. Pharm. Assoc.* 39, 666-9(1950).—*C.A.* 45, 1730*g*.

The trihydroxymethylanthraquinones have been isolated and sepd. from *Curaçao aloe* by the adaptation of existing chromatographic methods. The differentiation of an ext. on a magnesia-celite column was found to be a function of the concn. of that ext. and the compn. of the adsorbent mixt. Under identical conditions, exts. of aloin showed chromatograms similar to those of *Curaçao aloe* but socotrine and Cape aloe exts. could not be satisfactorily differentiated on the chromatographic column used.

8097. Brown, F. **Separation of the lower fatty acids as anions by paper chromatography.** *Biochem. J.* 47, 598-600(1950).—*C.A.* 45, 2821*i*.

Lower fatty acids as Na salts were placed on filter paper and the chromatogram allowed to run for several hrs (until the solvent boundary is about 20 cm below the starting line). After drying the position of the anions was revealed by spraying the paper with 0.04% bromothymol of pH 7.5. The anions gave yellow spots and the cations deep blue. The development mixts. consisted of alcs. with aq. NH_4OH.

8098. Brunner, Richard and Freidrich, Wilhelm. **The preparation of penicillin from penicillin-containing crude solutions by adsorption.** *Österr. Chem.-Ztg.* 51, 237-41(1950).—*C.A.* 45, 4410*i*.

The penicillin was adsorbed from the crude soln. at a pH of 3.0 and the adjustment to this value was made after the addn. of Carboraffin. A shaking time of a few min. was usually sufficient. A pronounced dependence on temp. was not observed; however, an adsorption at low temp. (5-10°C) was recommended. The presence of alcs. in the penicillin soln. increased the Carboraffin requirements. For the following elution of the penicillin the pH was increased and the range of 7.0-7.2 proved to be best. Butanol and acetone were used satisfactorily as extg. solvents. When the Carboraffin was pretreated with CO_2, better yields resulted.

8099. Bynyaeva, M.K. **Purification of penicillin by chromatographic method.** *Trudy Leningrad. Sanit. Gigien. Med. Inst.* 5, 138-48(1950).—*C.A.* 46, 10550*d*.

With suitable adsorbent it was possible to achieve a 3-fold purification of crude penicillin. Specially prepd. Al_2O_3 was used as the adsorbent, with either $CHCl_3$ or Et_2O as the solvent. The former gave dark brown, yellow, brown, and orange-yellow zones, while the latter gave dark brown, light brown, orange, and yellow zones. The dark brown zone carried no activity, while the light brown zone carried almost all penicillin activity. The orange zone had very little activity; the yellow zone was similar. The loss of penicillin in the chromatographic purification did not exceed 13-30%, especially at a low temp. (3°C).

8100. Carey, Z.E.; Markam, A.E.; Toomey, R.D., and McCarthy, J.L. **Separation of amino acids by ion exchange.** *Trend* 23, 17-20(1950).—*C.A.* 46, 7474*f*.

Arginine, cystine, and glutamic acid were sepd. on a sulfonated polystyrene. The capacity of the resin was 4.93 meq. of the exchangeable ion per g of oven-dried resin. In equil. expts., 100 ml of amino acid soln. contg 0.5 to 2.0 millimoles of amino acid was treated with 0.5 g of air-dried resin in the presence of 1 ml of toluene in rotating 250-ml bottles at 25° for 24 hrs. The soln. was then sepd. from the resin and the pH and amino acid concns. were detd. In the column expts. amino acids were dissolved in HCl at pH 1.5 and the soln. was passed through a resin column.

8101. Chilton, J. and Partridge, M.W. **Partition chromatography of alkaloids. III. Alkaloids of** ***Punica granatum.*** *J. Pharm. and Pharmacol.* 2, 784-95(1950).—*C.A.* 45, 3555*f*.

Substitution of Pyrex glass in No. 60 powder (7 g of glass for 1 ml of phosphate buffer) for kieselguhr permitted better chromatographic sepn. of the alkaloids from the adsorption column. Different samples of *Punica granatum* contained widely different proportions of pelletierine, pseudopelletierine, and methylisopelletierine.

8102. Cremer, Hans Diedrich and Tiselius, Arne. **Electophoresis of protein in filter paper.** *Biochem. Z.* 320, 273-83(1950).—*C.A.* 44, 7376*e*.

A method was described for studying 0.03-0.04 ml serum electrophoretically on filter paper. The paper was kept submerged under chlorobenzene. The rate of migration could be detd. and the various fractions sepd.

8103. Dalal, V.D. and Khorana, M.L. **Ephedra. II. Estimation of total alkaloids by chromatography.** *Indian J. Pharm.* 12, 173-4(1950).—*C.A.* 44, 11023*b*.

A chromatographic method was given which was less time-consuming than the B.P. 1949 method. Al_2O_3 was used as adsorbent and 90% EtOH as eluent.

8104. Davies, R.E.M. **Properties and uses of bentonite.** *Chemist & Druggist* 154, 458-60 (1950).—*C.A.* 45, 2148*c*.

8105. Doery, H.M.; Mason, E.C., and Weiss, D.E. **Estimation of streptomycin in fermentation broths.** *Anal. Chem.* 22, 1038-9 (1950).—*C.A.* 44, 11024*f*.

The procedure, suitable for plant control purposes, made use of the cation exchange resin, Amberlite IRC-50, combined with the maltol assay method. Adsorption at pH 9, and measurement of ultraviolet absorption at 322 mμ before and after hydrolysis with 4 *N* NaOH, yeilded results agreeing with biol. assays to within ±5%.

8106. Ebert, L. and Dircherl, A. **Quantitative microanalysis of gold-oleo solutions.** *Mikrochemie ver. Mikrochim. Acta* 35, 346-52(1950).—*C.A.* 44, 7711*d*.

For some years gold-oleo solns. have been used in therapy. The detn. of the Au content was made by dissolving about 0.9 g of sample in 10 ml of benzene, added in small portions, shaking with about 0.5 g of suitable Al_2O_3 to adsorb the Au sol, eventual soln. of the Au in HCl + $KClO_3$ with final iodometric detn. of the Au^{+++}. Excellent results were obtained in samples contg. about 0.3 mg of Au.

8107. Elkinton, J.R.; Clark, J.K.; Squires, R.D.; Bluemle, L.W. Jr., and Crosley, A.P. Jr. **Treatment of potassium retention in anuria with cation exchange resin.** *Am. J. Med. Sci.* 220, 547-52 (1950).

Cation exchange resins, administered orally or by rectum, lowered elevated serum K concentrations in 3 patients with renal insufficiency and obliguria or anuria. When the resin was not tolerated in the upper gastrointestinal tract, it may be given as an enema and significant amounts of K removed. Oral administration of $Al(OH)_3$, injection of Ca to prevent tetany during alkali therapy, and support of the circulation during treatment with the resins were indicated.

8108. Espen, J. van. **Chromatography. Its use in medicinal analysis.** *J. phar. Belg.* [*N.S.*] 5, 130-8(1950).—*C.A.* 44, 8054*b*.

8109. Fischer, Robert and Buchegger, E. **The determination of strychnine along with brucine (separately) in** *Semen Strychni* **by adsorption analysis.** *Pharm. Zentralhalle* 89, 146-50 (1950).—*C.A.* 46, 11582*g*.

Strychnine and brucine were detd. separately in 2-g samples of the drugs, *Semen Struchni* and *Faba Ignatii*, after extn. with $CHCl_3$ and alkali or with water and acid. The 2 alkaloids were adsorbed from trichloroethylene soln. on 10 g Al_2O_3 (Merck, series no. 95,581). Strychnine was then eluted with 70 cc. CCl_4 contg. 9% acetone and brucine with 25 cc. alc.

8110. Fischer, Robert and Buchegger, E. **Adsorption-analytical determination of cocaine-procaine mixture.** *Pharm. Zentralhalle* 89, 185-6(1950).—*C.A.* 45, 816*f*.

The sepn. of cocaine and procaine was possible with approx. 20 mg of the mixt. dissolved in CCl_4 and adsorbed over 5 g Al_2O_3 contained in an adsorption column of 9 mm diam. Then cocaine was eluted with 20 cc. of a mixt. of CCl_4 with 4.5% acetone, and procaine extd. by means of 20 cc. $CHCl_3$.

8111. Fischer, R. and Gull, H. **Use of adsorption agents in toxicological analysis.** *Mikrochemie ver. Mikrochim. Acta* 35, 63-79 (1950).—*C.A.* 44, 4827*e*.

Numerous expts. were made in detecting poisonous materials from biol. and partly decompd. materials with the idea that purification by adsorption might be accomplished to advantage. With active carbon moistened with glacial AcOH, excellent results were obtained with atropine, cocaine, strychnine, brucine, morphine, and its derivs., and veratrine. Al_2O_3 was excellent for colchicine (codeine and morphine) and Wofatit was good for aconitine.

8112. Franklin, A.E. and Quastel, J.H. **Paper chromatography of protein mixtures and blood plasmas.** *Proc. Soc. Exptl. Biol. Med.* 74, 803-8 (1950).—*C.A.* 44, 10001*i*.

Sepns. of protein components in two-dimensional chromatography were greatly facilitated by addn. of surface-active substances such as the "Tweens" or "Spans" or "Elvinols". Hemin was used as a protein marker, and 0.1 *M* sucrose soln. was used in the first dimension and 0.1 *M* NaK tartrate in the second dimension.

8113. Fujiwara, Motonori and Shimizu, Hiroshi. **Ion-exchange synthetic resins. XXVIII. Determination of vitamin B_2 by synthetic cation-exchange resin. Elution of vitamin B_2. XXIX. Determination of vitamin B_2 by synthetic cation-exchange resin. Removal of nonriboflavin fluorescent substances.** *Chem. High Polymers (Japan)* 7, 436-9; 440-3 (1950).—*C.A.* 46, 6692*g*.

Exptl. details for elution with pyridine were described. A process for the removal of nonriboflavin fluorescent substs. was described in detail.

8114. Gibbons, G.C. and Boissonnas, R.A. **Starch. XLVIII. The position of branching glycogen and amylopectin.** *Helv. Chim. Acta* 33, 1477-81 (1950).—*C.A.* 45, 887*e*.

By HIO_4 oxidation, followed by hydrolysis and detn. of the liberated glucose by paper chromatography, it was shown that amylopectin and glycogen contained less than one branching in the 2 or 3 positions for 40 branchings in the 6 position.

8115. Gilbert, G.A. and Swallow, A.J. **Dialysis. I. Application of ion-exchanger resins.** *Biochem. J.* 47, 502-5 (1950).—*C.A.* 45, 3436*f*.

To prep. resin cellophane, boil cellophane 1 min. in 10% (wt/vol.) aq. *m*-phenylene-diamine and allow to cool 45 min. Place in a 1:1 (vol.) mixt. of 40% HCOH and 10 *N* HCl at 0°C. Wash the cellophane in running water and rub off any resin formed. Immerse the cellophane in 0.5% (wt/vol.) $K_2Cr_2O_7$ contg. 0.15 *N* HCl for 30 min., then in *N* NH_4OH for 30 min. and wash in H_2O.

8116. GLISTER, G.A. AND GRAINGER, A. **Modified rapid technique for the separation and determination of penicillin types by partition chromatography on paper.** *Analyst* 75, 310-14(1950). —*C.A.* 44, 8056*f*.

Microstrips of filter paper impregnated with K phosphate buffer of pH 6.2 and a dose of 5 units penicillin per strip proved satisfactory . The strips can be developed with Et_2O satd. with water, 3-4 hrs at room temp.

8117. HAGDAHL, LENNART AND HOLMAN, RALPH T. **Displacement analysis of lipides. II. Increased separability of fatty acids by depressed solubility.** *J. Am. Chem. Soc.* 72, 701-5(1950).—*C.A.* 44, 4695*e*.

Adsorption isotherms for lauric and myristic acids in 95% alc. on a series of varied adsorbents were made. The depression of soly. of lauric, myristic, butyric, caproic, capric, and caprylic acids in alc. by admixture with water, or by lowering temp., increased adsorption and spread the isotherms. The lowered soly. caused by addn. of water increased separability of fatty acids as shown in frontal and displacement analysis. The best displacer found thus far for a fatty acid was its nearest homolog of lower soly. in a solvent which just dissolved the desired concn. of displacer.

8118. HALL, A.A. AND HORNISHER, C.J. **The effect of anion exchange resin on the healing time of duodenal ulcers.** *Gastroenterology* 16, No. 1, 181-87 (1950).

Of a group of fifty patients with duodenal ulcer craters, 33 were treated with a weak base anion exchanger (in ethical drug form) and 17 in the customary Sippy (colloidal aluminum hydroxide) regime. All fifty patients were treated similarly in all other respects. The av. healing time of the craters in the "anion exchange" patients was 19 days; for the control group, 33.7 days.

8119. HEDÉN, C.G. **A method for large-scale separation of amino acids on filter paper.** *Nature* 166, 999-1000(1950).—*C.A.* 45, 5073*c*.

Protein hydrolyzate (5 g) could be resolved to yield sufficient amts. of amino acids for detn. The hydrolyzate soln. was spotted along the edge of a large sheet and run at 5°C with BuOH:H_2O: AcOH, 5:5:1. The dried sheet was cut parallel to the solvent front into small sheets carrying suitable groups of amino acids. The banded amino acids in a small sheet were re-collected by eluting with H_2O till they formed a single band, lying at right angles to the original solvent front, near the side of the sheet.

8120. HUSSEY, C.V.; QUICK, ARMAND J.; STEFANINI, MARIO; CONSOLAZIO, C.F., AND SARGENT, FREDERICK, 2ND. **Effect of sodium citrate and heparin on removal of calcium from blood and serum by Amberlite.** *J. Biol. Chem.* 184, 105-8 (1950).—*C.A.* 44, 7448*f*.

Ca was completely removed from normal serum or $CaCl_2$ soln. by passing through a column of purified Amberlite IR-100. Adsorption of Ca was inhibited by Na citrate in proportion to its concn.; only about 25% of the Ca was removed in the presence of 0.04 *M* citrate. Heparin did not interfere with Ca adsorption.

8121. HUYCK, C. LEE. **Colloidal magnesium aluminum silicate as a suspending agent.** *J. Am. Pharm. Assoc., Pract. Pharm. Ed.* 11, 170-2 (1950).—*C.A.* 44, 6081*h*.

Bentonite and Mg Al silicate magmas were tested as suspending agents in calamine lotion and chalk mixt. When 4% Mg Al silicate magma was used in the lotion 10% H_2O sepd. and the relative viscosity was 3 in contrast to 17% H_2O sepn. and a relative viscosity of 2 when 5% bentonite was used. When the 4% magma was used in chalk mixt. 0.5% H_2O sepd. and the relative viscosity was 1 in contrast to 11% and a relative viscosity of 1 when the 5% bentonite magma was used.

8122. HUYCK, C. LEE. **Adsorption and liberation of ephedrine from ion-exchange resins.** *Am. J. Pharm.* 122, 228-30 (1950).—*C.A.* 44, 9626*f*.

Amberlite IRC-50 was a good adsorbing medium for a weak base such as ephedrine, while Dowex 50 was unsatisfactory for adsorption of ephedrine base.

8123. INOUE, YOSHIYUKI, AND NODA, MANJIRÔ. **Separation and identification of fatty acids. IX. Paper partition chromatography of hydroxamic acids.** *J. Agr. Chem. Soc. Japan*, 18, 294-8 (1950).—*C.A.* 45, 8449*f*.

As the chromogenic reagent, 10% $FeCl_3$ in EtOH was used. BuOH, EtOAc, and butyrone were convenient solvents. R_f values for 13 hydroxamic acids derived from the C_2-C_{22} satd, aliphatic acids (among them valerohydroxamic acid, light yellow, noncrystalizable syrup, a new compd.) were given with BuOH.

8124. JAMES, W.O. AND KILBEY, NATALIE. **Separation of noradrenaline and adrenaline.** *Nature* 166, 67-8(1950).—*C.A.* 45, 817*e*.

The bases were sepd. on paper chromatograms with a solvent prepd. by shaking 4 parts of BuOH, 1 part of glacial AcOH, and 5 parts of H_2O or from 5 g of CCl_3CO_2H, 100 ml H_2O, and 80 ml BuOH; the lower layer being rejected in each case. The indicator was 0.44% $K_3Fe(CN)_6$ dissolved in 0.2 *M* Na phosphate to give a pH of 8.3. The colors were pink with adrenaline and mauve with noradrenaline.

8125. JENSEN, K. BRISEID AND SVENDSEN, A. BAERHEIM. **Partition chromatography and quantitative separation strychnine and brucine.** *Pharm. Acta Helv.* 25, 31-6(1950).—*C.A.* 44, 5532*h*.

A procedure for the chromatographic sepn. and a detn. of strychnine and brucine in pure substances and in drug exts. was offered. The following were used in the detn: 25 mg of the alkaloids dissolved in 2 cc. $CHCl_3$-Et_2O mixt., 10 g kieselguhr, 3 cc. 0.2 *M* phosphate buffer (pH 7) as immobile phase, Et_2O as the mobile phase for the strychnine fractions and $CHCl_3$ for the brucine fractions, elution time 2-3 min. for 10 cc. After sepn., the alkaloids were titrated with 0.01 *N* HCl with bromocresol green as indicator.

8126. Jermstad, Axel and Jensen, Kjell Briseid. **Paper chromatographic separation and identification of organic plant acids with special reference to the acids occurring in Aconitum septentrionale.** *Pharm. Acta Helv.* 25, 209-29 (1950).—*C.A.* 45, 1726*c*.

Using a one-dimensional chromatographic sepn. on Whatman filter paper No. 1, the R_f values for the following org. plant acids in butanol-formic acid-H_2O and ethyl acetate-formic acid-H_2O were detd.: oxalic, tartaric, quinic, citric, malic, malonic, chlorogenic, succinic, aconitinic, fumaric, caffeic, anthranilic, and salicylic. The acids in concns. of 70-80 γ were identified by spraying the chromatograms with an alc. soln. of of Bromphenol Blue and also treating with solns. of $FeCl_3$, $KMnO_4$, and ammoniacal $AgNO_3$. The roots of *Aconitum septentrionale* were extd. and the following acids identified: aconitinic, malic, quinic, chlorogenic, and caffeic.

8127. Jindra, A. and Pohorský, J. **Determination of alkaloids by exchange of ions.** *J. Pharm. Pharmacol.* 2, 361-3 (1950); *Časopis Českého Lékárnictva* 63, 57-75(1950).—*C.A.* 44, 8054*c*; 46, 5785*c*.

Methods depending on ion exchange by chromatography with Amberlite IR4B were used for the detn. of arecoline-HBr, atropine-H_2SO_4, cocaine-HCl, codeine-H_3PO_4, homatropine-HBr, morphine-HCl, papaverine-HCl, pilocarpine-HCl, quinine-HCl and -H_2SO_4, scopolamine-HBr, and strychnine-HNO_3. Larger quantities of active constituent in galenical prepns. used in a semimicro method enabled a more accurate reading of the 0.01 *N* HCl consumed.

8128. Jones, Tudor S.G. **Paper chromatography. II.** *Chemist and Druggist* 153, 375-8(1950).—*C.A.* 44, 7708*e*.

Applications were discussed.

8129. Kawahara, Fred K. and Dutton, Herbert J. **Adsorption analysis of lipides. IV. Fractionation of cholesterol and ergosterol.** *J. Am. Oil Chemists' Soc.* 27, 161-4 (1950).—*C.A.* 44, 6169*e*.

The adsorption analysis of the cholesterol-ergosterol system was studied. Since previous purified substances were shown to be multicomponent by adsorption analysis on Al_2O_3, calcn. of the degree of sepn. of their mixt. involved certain approximations. Of the cholesterol originally placed on the column, it was calcd. that 48.4% was recovered with a purity of 98%.

8130. Kent, F.H. Naim and Amengual, B. Mateu. **Identification and separation of minute quantities of alkaloids by microchromatography on paper.** *Arch. farm. bioquím. Tucumán* 4, 333-43 (1950).—*C.A.* 45, 1724*b*.

The alkaloid or mixt., 1-50 γ, was deposited on the upper end of the paper strip with the aid of $CHCl_3$ and developed by downward traverse using a mixt. of BuOH 45, MeOH 5, and distd. H_2O 50% by vol. The dried strip was then sprayed with Dragendorff's reagent, Bouchardat's reagent, or other suitable reagent to locate the spots.

8131. Klose, A.A.; Stark, J.B.; Purvis, G.G.; Peat, Jean, and Fevold, H.L. **Ascorbic acid from walnut hulls.** *Ind. Eng. Chem.* 42, 387-91 (1950).—*C.A.* 44, 4638*c*.

Recovery of ascorbic acid from waste green walnut hulls produced an over-all yield of 25% (cryst ascorbic acid). Continuous, countercurrent extn. of the hulls was made in dil. aq SO_2 soln. The ext. was preserved with 0.2% SO_2 by wt. Amberlite IR-4 was used to adsorb the ascorbic acid from the ext. and elution with 0.1 *N* HCl acid soln. recovered 70% of the ascorbic acid in the ext. The eluates were concd. to 40 to 60% solids, decolorized with Norit A. A decolorized eluate contg. 23 g of ascorbic acid, at a purity of 36%, was concd. to 70% solids, and allowed to crystallize at 40°F for several days. Data on the feasibility of economically operating this process commercially for walnut-hull utilization were presented.

8132. Konovalova, A.A.; Platonova, T.F., and Konovalova, R.A. **Adsorption method of isolating cytisine.** *Zhur. Priklad. Khim.* 23, 506-11(1950); *J. Applied Chem. U.S.S.R.* 23, 529-34 (1950) (Engl. translation).—*C.A.* 46, 7288*h*.

Preliminary studies with several adsorbents showed that pure cytisine in 1% aq. soln. at pH 8.4 was best adsorbed (95.2%) by 20% (calcd. on wt of the soln.) bentonite, previously activated by heating with 20% H_2SO_4. Equil. was attained within 15 min. at 10°C. Over the pH range 2.4-8.4 adsorption was maximal (95.2-96.4%), but at pH 14 adsorption was only 41% complete. Data on mixed alkaloids from liquors prepd. by infusion of plant tissue showed as good adsorption as with solns. of pure cytisine. Cytisine was desorbed from bentonite; not at all by EtOH or $CHCl_3$; 5% by *N* HCl or H_2SO_4; ~ 60% by *N* NaOH or NH_4OH.

8133. Konovalova, A.A.; Platonova, T.F., and Konovalova, R.A. **Isolation of alkaloids by the adsorption method.** *J. Applied Chem. U.S.S.R.* 23, 927-31(1950) (Engl. translation). —*C.A.* 46, 4176*f*.

Salsoline and salsolidine were adsorbed from 0.5-1% aq. solns., pH 0.56, 6.1 and 8.8, by 20% (calcd. on vol. of the soln.) bentonite, activated by heating with H_2SO_4, giving 4% satn. of the adsorbent; adsorption was achieved by mech. shaking of the soln. with bentonite. Adsorption of alkaloids from liquors prepd. by infusion of pulverized above-ground portions of *Salsola richteri* with 1% H_2SO_4, required (for 0.33% soln.) 25-30% bentonite to give 1.2%.

8134. Kornberg, A. and Pricer, W.E., Jr. **The structure of triphosphopyridine nucleotide.** *J. Biol. Chem.* 186, 557-67 (1950).—*C.A.* 45, 195*g*.

A strong-base, quaternary-ammonium-type anion exchange resin was used to resolve the structure of triphosphopyridine nucleotide (TPN) by first purifying an adenosinemonophosphate fragment from the TPN by ion exchange chromatography. Ion exchange chromatography was also used to show that the adenosinemonophosphate was identical with adenylic acid (prob. adenosine-2-phosphate) and different from adenosine-3-phosphate.

8135. Kretovich, V.L. and Bundel, A.A. **Chromatographic separate determination of aspartic and glutamic acids.** *Doklady Akad. Nauk S.S.S.R.* 73, 137-40(1950).—*C.A.* 44, 10603*a*.

Samples (1 g) were treated with hot 96% EtOH. The anionotropic Al_2O_3 was prepd. from 10 g Al_2O_3 which was treated with 30 ml 6 *N* HCl, and washed to pH 2.5-2.7. The final product was heated with almost as much $AlCl_3$ for 24 hrs at 700°C to give the most active product. Adsorption was done in a (60 cm X 8-10 mm) packed tube at 16°-18°C, using 2-4 ml ext., washing with 50 ml H_2O satd. by H_2S, then H_2O, followed by elution of glutamic acid by 55 ml 0.5 *N* AcOH, then H_2O, and elution of aspartic acid by 5 ml 3 *N* KOH then 40 ml 0.05 *N* KOH. The separate eluates were decompd. as usual and the micro-detn. of N performed.

8136. Kritchevsky, David and Calvin, Melvin. **Paper chromatography of steroids.** *J. Am. Chem. Soc.* 72, 4330 (1950).—*C.A.* 45, 1840*d*.

Sepn. of cholesterol and cholestenone was achieved by using paper impregnated with Quilon (stearato chromic chloride) as the stationary phase and simple alcs. as solvents (MeOH, EtOH, and 8:2 EtOH-H_2O).

8137. LoGrippo, Gerald A. **Partial purification of viruses with an anion-exchange resin.** *Proc. Soc. Exptl. Biol. Med.* 74, 208-11 (1950).—*C.A.* 44, 7915*g*.

Ten g of dry Amberlite XE-67 (fine powder) added to 100 cc. of a 1% homogenized suspension of central nervous system tissue of mice infected with Lansing virus was shaken 20 min. and filtered. The filtrate was non-infective. The bulk of extraneous material was thereby removed quickly, simply, and without lengthy chemical procedures. The method was also applicable to the extraction of poliomyelitis virus from human feces.

8138. Lynam, C.G. and Weil, H. **A chromatographic repetition plant.** *Mfg. Chemist* 21, 288-90, 302(1950).—*C.A.* 44, 9590*f*.

Chromatography in industry was reviewed with a critical evaluation of the methods used to promote efficiency and reduce costs. Details were given for a system of radial chromatography, recycling, and elution which gave nearly continuous operation.

8139. Macció, Isidro. **Paper chromatography applied to the study of alkaloid-containing extracts.** *Rev. farm.* (Buenos Aires) 92, 107-8 (1950).—*C.A.* 45, 6347*d*.

EtOH exts. of *Bocconia pearcei* were fractionated on Whatman No. 1 paper and eluted with BuOH shaken with dil. AcOH. Three alkaloids were differentiated by their behavior in Wood's light and reactivity with Dragendorff reagent.

8140. Markham., R. and Smith, J.D. **Chromatographic studies on nucleic acids. III. Nucleic acids of five strains of tobacco mosaic virus.** *Biochem. J.* 46, 513-17 (1950).—*C.A.* 44, 10010*d*.

The purine bound sugar in 2 strains was shown by paper chromatography to be identical with ribose from yeast nucleic acid, and all the nucleic acids contained only adenine, guanine, cytosine, and uracil.

8141. Martin, Gustav J. and Alpert, Sidney. **Comparative capacity of adsorptive agents for endogenously produced toxic chemicals.** *Am. J. Digestive Diseases* 17, 151-4(1950).—*C.A.* 45, 825*i*.

—Adsorbents for skatole, indole, tyramine, putrescine-2 HCl, and histamine-2 HCl were studied.

8142. McChesney, E.W. and McAuliff, J.P. **Effects of some ion exchange resins on the mineral metabolism of rats.** *Am. J. Physiol.* 160, 264 (1950).—*C.A.* 44, 4948*i*.

All cationic exchange resins bound some Na and K in the intestine; when fed in the H^+ cycle they also bound some Ca, but this was not true of the resin fed in the NH_4^+ cycle. About 20 to 25% of the total capacity of the resin was utilized, with the ratio of binding of Na:K being nearly 2:1. It seemed likely that resins acted to relieve edema almost entirely by binding exogenous Na.

8143. Mesnard, P. and Devze, J. **Paper chromatography of digitalin.** *Bull. trav. soc. pharm. Bordeaux* 88, 109-14, 114-19 (1950).—*C.A.* 45, 7300*i*.

The method used was a modification of the reaction of Sanchez (without vanillin) by using HCl fumes to develop the color. The concd. HCl was warmed in a dish covered with an inverted funnel, at a distance of 4-5 cm. from it. The paper became brittle but was kept between 2 sheets of cellophane. With a solvent mixt. of AcOEt 20, and eucalyptol 1 part, digitalin Nativelle (com. digitoxin) gave 2 spots with R_f values 0 and 0.88 resp. If the chromatogram was developed again by using Me_2CO as solvent in a 2nd dimension, spot No. 1 was sepd. into 2 spots; representing the original heterosides and gitoxoside.

8144. Milne, G.R. and Todd, G.M. **Preparation of liquid human plasma by the kaolin process.** *J. Pharm. and Pharmacol.* 2, 831-4 (1950).—*C.A.* 45, 3555*a*.

Protein up to 1.54 g % was lost by adsorption on the kaolin, and 0.35 g % lost by passage through sterilizing asbestos pads. The min. standard for protein content in the British Pharmacopeia should be revised if the kaolin process is approved.

8145. Miura, Kazuo. **Paper-partition chromatography of amino acids. I. Copper salts of amino acids.** *J. Agr. Chem. Soc. Japan* 24, 369-71 (1950-51).—*C.A.* 46, 11040*a*.

Cu salts of amino acids were sepd. on a paper chromatogram with lutidine satd. with H_2O as the solvent. Spots on the chromatogram were detected by spraying successively 30% AcOH, and a soln. contg. *o*-toluidine 0.2 g, and NH_4SCN 0.5 g in 50 cc. Me_2CO. H_2O-insol. amino acids were tested in H_2O-pyridine (1:1) solns.; the presence of pyridine did not affect R_f values, but Cu pyridine gave an obscure spot. R_f values were: glycine 0.29, alanine 0.43, *DL*-valine 0.63, *L*-leucine 0.71, *D*-arginine 0.06, *L*-ornithine 0.04, *D*-lysine

0.05, *L*-histidine 0.15, *L*-proline 0.50, *L*-hydroxyproline 0.43, *L*-glutamic acid 0.44, *L*-aspartic acid 0.46, *L*-cystine 0.60, *L*-tryptophan 0.82, *DL*-methionine 0.64, *L*-phenylalanine 0.75.

8146. MULLER, ROBERT H. **Application of ion-exchange resins to the purification of certain viruses.** *Proc. Soc. Exptl. Biol. Med.* **73**, 239-41 (1950).—*C.A.* **44**, 5946*i*.

Nitrogenous impurities from suspensions of several neurotropic viruses by treatment were removed with Amberlite cation exchange resin.

8147. MUNIER, ROGER AND MACHEBOEUF, MICHEL. **Microchromatographic separation of alkaloids and various biological nitrogenous bases. II. Utilization of an acid solvent phase. Importance of the dissociation constants of alkaloids in chromatography.** *Bull. soc. chim. biol.* **32**, 192-212 (1950); *Compt. rend.* **230**, 1177-9 (1950).—*C.A.* **44**, 10260*a*; 8054*i*.

Alkaloid mixts. contg. bases whose dissocn. consts. lie between 10^{-3} and 10^{-10} form diffused and elongated spots in paper-adsorption sepns. with neutral solvents. Small addns. to the solvent of acids whose dissocn. consts. were close to those of the bases to be sepd. round the spots without increasing the R_f^{20} to values too close to 1. For the sepn. of scopolamine, atropine, and hyoscyamine (dissocn. const. 10^{-5}), a solvent contg. 100 ml BuOH, 14 ml AcOH, and sufficient water for satn. was used.

8148. MUNIER, ROGER AND MACHEBOEUF, MICHEL. **Preliminary experiments on paper microchromatography of various alkaloids with the use of liquid phases miscible with water.** *Bull. soc. chim. biol.* **32**, 904-7(1950).—*C.A.* **45**, 4881*f*.

A preliminary report on the sepn. of a mixt. of caffeine, theophylline, theobromine, xanthine, and trigonelline and of a mixt. of morphine, codeine, thebaine, atropine, scopolamine, brucine, and strychnine with an acidified 2:1 PrOH-H_2O mixt., a 3:1 Me_2CO-H_2O mixt., and dil. aq. NH_4OH as developing fluids.

8149. NOVELLIE, L. **Quantitative paper chromatography of amino acids.** *Nature* **166**, 1000(1950). —*C.A.* **45**, 5073*a*.

A study was made of several factors affecting recoveries from paper chromatograms, as detd. colorimetrically (ninhydrin method) after elution. The high variable blanks of untreated paper were avoided by extg. it 4 times with boiling 1% alkali hydroxide prior to chromatography. In the absence of solvent, the effect of heat on amino acids in chromatograms was negligible at 100°C, but at 150°C may lead to losses of 20-25%. In the presence of phenol, heating at 150°C for 15 min. led to considerable losses; at 100°C losses were still appreciable; but at 50°C recoveries were satisfactory.

8150. PARTRIDGE, S.M.; BRIMLEY, R.C. AND PEPPER, K.W. **Displacement chromatography on synthetic ion-exchange resins. V. Separation of basic amino acids.** *Biochem. J.* **46**, 334-40(1950).—*C.A.* **44**, 10446*e*.

Sulfonated cross-linked polystyrene resins proved of particular value for sepn. of histidine, lysine, and arginine, but not all resin samples were effective. Two resins with low degree of crosslinking gave sharp boundaries and showed excessive shrinking. Following certain expedients, columns were made by means of which leucine, histidine, lysine, and arginine were successfully sepd.

8151. PARTRIDGE, S.M. AND SWAIN, T. **A reversed-phase partition chromatogram using chlorinated rubber.** *Nature* **166**, 272-3 (1950).—*C.A.* **45**, 6456*h*.

N-2,4-Dinitrophenyl derivs. of various amino acids were sepd. by partition chromatography with 0.2 *M* citrate-phosphate buffer as the flowing solvent on columns prepd. by filtering a slurry of 10 g chlorinated rubber (Alloprene) in 4 cc. of a suspension of BuOH in buffer satd. with BuOH. Rates of movement depended on pH.

8152. PATSCHKY, A. **Chromatographic determination of vitamin C.** *Angew. Chem.* **62**, 50 (1950).—*C.A.* **46**, 9790*e*.

The 2,4-dinitrophenylosazones of ascorbic acid and accompanying sugars, etc., were adsorbed from acetone-alc. soln. on filter paper and developed by chlorobenzene and $CHCl_3$. The vitamosazone thus sepd was detd. colorimetrically in AcOH soln.

8153. PERNOUX, EMILE. **Use of the electron microscope in the study of catalyst supports.** *J. chim. phys.* **47**, 233(1950).—*C.A.* **44**, 7635*e*.

Treatment of kieselguhr with HNO_3 and HCl caused the formation of a silica gel. The gel was completely removed by reaction with 5% Na_2CO_3. Alk. treatment of raw kieselguhr dissolved only the smallest particles.

8154. RENFREW, ALICE G. AND PIATT, PAULINE C. **Paper chromatography of some synthetic pteridines.** *J. Am. Pharm. Assoc.* **39**, 657-9 (1950). —*C.A.* **45**, 1840*c*.

Partition chromatography on filter paper was used as a means for identification of synthetic pteridines, mainly substituted isoxanthopterins. In general, sepns. of 4-hydroxy and 4-amino analogs were possible. Xanthopterin dihydroxanthopterin, and leucopterin gave approx. R_F values of 0.5, 0.5, and 0.23, resp., on development with butanol-morpholine-H_2O and 0.7, 0.7, and 0.3, resp., with 3% NH_4Cl.

8155. ROMANO, CARLO. **Qualitative toxicological analysis of some alkaloids by paper chromatography.** *Minerva medicolegale* **70**, 172-4(1950).—*C.A.* **46**, 4741*b*.

A chromatographical method was suggested to detect aconitine, atropine, brucine, quinine, cocaine, ethylmorphine, morphine, sparteine, and strychnine. The alkaloids were used as their hydrochlorides dissolved in butanol contg. *N* HCl. The color of the stains was red-brown. Sensitivity: 70-80 γ; the specificity values (R_f) were 1.27, 1.06, 0.80, 0.90, 1.08, 1.02, 0.70, 0.50, and 1.02, resp.

8156. SAPARA, V. **Chromatographic separation of opium alkaloids.** *Časopis Českého Lékárnictva* **63**, 293-7(1950)(English summary).—*C.A.* **46**, 7709*f*.

Brockman's alumina sepd. codeine and morphine, narcotine, narceine, and thebaine which could be eluted with ether, chloroform, and methanol either alone or in mixts. The method was particularly suitable for sepn. of small quantities of alkaloids.

8157. Saunders, L. and Srivastava, R. **The adsorption of quinine by a carboxylic acid ion-exchange resin.** *J. Chem. Soc.* **1950**, 2915-19. —*C.A.* **45**, 1839*c*.

Adsorption of quinine on Amberlite IRC-50 in acid form, detd. polarimetrically with time, followed the relation $dx/dt = ka(a-x)/x^2$, where a was initial soln. concn. in millimoles/100 ml, x millimoles adsorbed by 5 g of resin, and t time in hrs. Data were obtained batchwise over 7 days and from column studies. Rate of adsorption depended on a and x, nature of solvent (50% EtOH solns. gave more rapid adsorption than pure EtOH), method of prepn. of acid form (alc. 2-*N*-acid being more effective than aq. 2-*N*-acid solns.), stirring, particle size of resin, and initial pH of soln. Alc. acid eluted more effectively than aq. solns. and *N* and 2 *N* NH_4OH solns. in 50% EtOH gave complete elution in a short time. The rate of adsorption of quinine was largely controlled by the rate of diffusion of quinine mols. through the resin.

8158. Segal, H.L.; Friedman, H.A.; Ellis, E.E., and Watson, J.S. **A polyamine formaldehyde resin. IV. Clinical evaluation in the treatment of duodenal ulcer.** *Am. J. Digest Diseases* **17**, 293-96 (1950).

Lab. studies indicated that an av. dose of 2 g of the weak base anion exchange resin employed was required to raise the gastric pH. Smaller doses might be effective with respect to the crit. pH and pepsin activity in the first part of the duodenum. Clinical remission of ulcer symptoms was experienced by 17 of 26 patients; three patients were benefited during treatment only.

8159. Segal, Harry L.; Miller, Leon L., and Morton, John J. **Determination of gastric acidity without intubation by use of cation-exchange indicator compounds.** *Proc. Soc. Exptl. Biol. Med.* **74**, 218-20 (1950).—*C.A.* **44**, 7915*i*.

A special cation was combined with a cation-exchange resin (Amberlite IRC-50 or Amberlite XE-96). This cation was displaceable only or mainly by H^+ and was readily absorbed from the stomach or small intestine, it was nontoxic and easily detectable in the blood, urine, or saliva. The prepn. of such a complex with quinine as the cation was described. The quinine was liberated and made available for absorption by gastric juice of pH 3 or lower. If quinine appeared in the urine within 2 hrs after ingestion of the complex the gastric juice contained free HCl, if it did not appear until later free HCl was absent.

8160. Solanki, Vithal N. and Basu, N.K. **Chromatographic assay of tincture cinchona.** *J. Sci. Research Benares Hindu Univ.* **1**, 149-52 (1950-51).—*C.A.* **46**, 4743*a*.

Add 10 ml of unknown to top of column filled with chromatographic alumina, and elute with 90% alc. till a few drops of elutriate, tested with Meyer's reagent, gave no turbidity. Conc. the elutriate and treat in accordance with The British Pharmacopeia, 1932.

8161. Svendsen, Anders B. and Jensen, Kjell B. **Paper chromatography of digitalis glycosides.** *Pharm. Acta Helv.* **25**, 241-7(1950).—*C.A.* **45**, 1726*a*.

The fluorescent reactions of 14 glycosides were reported. The R_f values for the same glycoside in $CHCl_3$, MeOH, and H_2O were given.

8162. Takagi, Seishi; Suzuka, Tomoji, and Imaeda, Kazuo. **Identification of sulfa drugs by paper partition chromatography.** *Japan. J. Pharm. & Chem.* **22**, 145(1950).—*C.A.* **45**, 4884*c*.

Utilizing the fact that sulfa drugs give peculiar coloration as Cu salts. a means was devised by which various sulfas could be isolated by paper partition chromatography, then identified by the application of $CuSO_4$. Sulfa drugs were dissolved in 10% NaOH, the Na salts pptd. by the addn. of EtOH and recrystd. from H_2O. Na salt solns. were dropped at one end of a filter paper 2 × 50 cm and developed by hydrous MeOH at approx. 25° by the ascending method. After development and drying, a 1% $CuSO_4$ soln. was sprayed from which colors developed. The observations were made easier by irradiation of ultraviolet rays.

8163. Thomas, Georges; Ransy, J.; Roland, P. and Bulcke, A. vanden. **Separation of ternary mixtures of sulfonamides by paper chromatography.** *J. pharm. Belg.* [N.S.], **5**, 263-9(1950).—*C.A.* **45**, 4406*f*.

The NH_3 soln. contg. 1 to 3 of the compds. sulfadiazine, sulfamerazine, sulfathiazole, and sulfamethazine was dropped from a weighing pipet (10-20 mg of soln. contg. about 30 γ of each compd.) onto a filter paper which was dried and placed over a dish contg. BuOH + NH_4OH. After 2-4 hrs the paper was placed over another dish contg. 2-3 cc. *N* HCl for 6-12 hrs. The zones can be compared with known chromatographs. The sepd. zones were eluted separately with 5 cc. *N* HCl immediately after addn. of the developer (1% *p*-dimethylaminobenzaldehyde in 3% HCl).

8164. Tschapek, W. and Garbosky, A.J. **The principles of adsorption of the Azotobacter.** *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* **3**, 102-4(1950).—*C.A.* **46**, 5768*d*.

The adsorption of *Azotobacter* by dispersed sand was investigated as a function of agitation time, bacterial nos., adsorbent quantity, pH, and electrolyte concn. The adsorption depended primarily on the electrokinetic potential of the bacteria and this potential depended on the pH of the soln. Hence, on pH > 7.2 when the electrokinetic potential was > 30 mv., the adsorption does not take place, but in the presence of the electrolytes which diminish the value of this potential the adsorption occurs with the same pH.

8165. Udenfriend, Sidney. **Identification of γ-aminobutyric acid in brain by the isotope derivative method.** *J. Biol. Chem.* **187**, 65-9 (1950).—*C.A.* **45**, 3446*c*.

Paper chromatograms of each of the radioactive derivs. were developed with BuOH satd. with *N* NH_4OH. The bands were located by radioautography, and each band was cut into several transverse segments. Each segment was eluted with water, transferred to a planchette, and dried. The elutions need not have been quant. since calcns.

were based on the ratio of one isotope to the other.

8166. Vaisman, G.A. and Yampol'skaya, M.M. **Use of organic exchange resins for quantitative determination of salts of organic acids in pharmaceutical analysis.** *Zavodskaya Lab.* **16**, 621-2 (1950).—*C.A.* **44**, 9624*g*.

Sulfophenolic resins were used for analyses of typical org. acid salts by passing the latter in aq. soln. over the cationite and titrating the free org. acid in the filtrate. Gluconic (titration in a closed vessel), sulfoguaiacolic (titrate using methyl orange), lactic, salicylic, and benzoic acids (use EtOH wash to remove the last 2 from the column) were readily detd.

8167. Vitte, G. and Boussemart, E. **Separation of vanillin and methylvanillin by paper chromatography.** *Bull. trav. soc. pharm. Bordeaux* **88**, 177-80 (1950).—*C.A.* **45**, 6971*f*.

Prep. the solvent from BuOH equilibrated with an equal vol. of 2% HCN soln. with 3 drops of NH_3 added to the sepd. clear BuOH layer. Centrifuge if not clear. Sat. the atm. with NH_3 from 15 cc. of concd. NH_3 in a beaker in the chamber. Allow the chromatogram to develop for 20 hrs at 20°, dry for 2 hrs at room temp., and treat to reveal the spots with $AgNO_3$ at 110°. The R_f values are 0.39 for vanillin and 0.57 for methylvanillin.

8168. Votá, Alejandro Santa Pau and Yúfera, Eduardo Primo. **Obtaining alkaloids by treatment with resins. I. Alkaloids of the belladonna.** *Farmacognosia* **10**, 81-99 (1950).—*C.A.* **45**, 309*d*.

Alkaloids were fixed by Zeo-Karb which was capable of fixing alkaloids at low pH. The alkaloid was displaced with 0.5 *N* NaOH soln., dissolved in 96% EtOH, and purified after distn. of EtOH. Recovery of alkaloid was 80-85%.

8169. Williams, T.I. **Chromatography in industry.** *Discovery* **1950**, 396-8.—*C.A.* **45**, 2117*g*.

Chromatography provided a convenient means of sepg. suitable mixts. E.g., castor oil could be freed from ricinoleic acid at the rate of 70 gal/hr in a suitable column. By pumping hexane through grasses, chlorophyll, β-carotene, and xanthophyll, could be sepd. Other uses were in the prepn. of streptomycin and in isotope sepn.

8170. Winters, J.C. **The ion exchange process. A new unit operation for the drug manufacturer.** *Drug and Allied Inds.* **36**, 19-24 (July, 1950).

New synthetic resin adsorbents have extended the usefulness of the unit operation beyond the treatment of water alone-largely because of their greater versatility, physical resistance, and exchange capacity. Advances in the production of amino acids, antibiotics, vitamins, alkaloids, proteins, enzymes, and hormones have been made.

8171. Wirts, C. Wilmer; Rehfuss, Martin E., and Wass, Beatrice. **The effect of an anion-exchange resin on gastric and duodenal secretions and gastric emptying.** *J. Clin. Invest.* **29**, 37-45 (1950).—*C.A.* **44**, 7445*d*.

The anion-exchange resin (Amerlite IR-4) was effective in neutralizing acid and inactivating pepsin in the gastric juice of both ulcer and nonulcer subjects after insulin and repeated histamine stimulation.

8172. Woodruff, H. Boyd and Foster, John C. **Analysis for vitamin B_{12} and vitamin B_{12a} by paper-strip chromatography.** *J. Biol. Chem.* **183**, 569-76 (1950).—*C.A.* **44**, 6467*a*.

Vitamins B_{12} and B_{12a} were estd. by combined microbiol. assay and paper-strip chromatography. A small correction factor was required to compensate for conversion of B_{12} to B_{12a} which might have taken place during the analysis.

8173. Barr, Martin and Guth, Earl P. **The preparation of five cation-saturated bentonites and the determination of their exchangeable cations.** *J. Am. Pharm. Assoc.* **40**, 9-12 (1951).—*C.A.* **45**, 3531*h*.

The cation-satd. bentonites of Na, K, Ca, Mg, and H were prepd. by ion exchange by using the appropriate acetate. The exchangeable cations were detd. by a modification of Mehlich's method.

8174. Barr, Martin and Guth, Earl P. **Cation-saturated bentonites as constituents of ointment bases.** *J. Am. Pharm. Assoc.* **40**, 13-16 (1951).—*C.A.* **45**, 3554*i*.

Ointment bases were prepd. with Na, K, Ca, Mg, H, and Volclay bentonites as major constituents. Sulfathiazole, phenol, and ammoniated Hg showed greater activity when incorporated in H bentonite than in the other bentonite bases.

8175. Bárta, Rudolf and Šatava, Vl. **Fine silica for pharmaceutical industry.** *Chem. Prumysl* **1** (26), 282-4 (1951).—*C.A.* **46**, 9792*e*.

A substitute for fissan-colloid (SiO_2 of 1-100 μ particle size, contg. 5% of adsorbed F) was found in the wastes in the manuf. of H_2SiF_6. After removing the excessive H_2SiO_6 and Fe and drying at 100°C, a fine powder of particle size slightly larger than fissan was obtained. It can be used by the pharmaceutical industry.

8176. Beran, Miloš and Šícho, Vladislav. **Paper chromatography of vitamin B_1.** *Chem. Listy* **45**, 154-6 (1951).—*C.A.* **45**, 9589*b*.

Vitamin B_1 in the paper chromatogram was transformed to thiochrome by treatment with NaOH and $K_3Fe(CN)_6$ and was detected by ultraviolet irradiation (blue fluorescence).

8177. Bergström, Sune and Sjövall, Jan. **Separation of adrenaline and noradrenaline by partition chromatography on a preparative scale.** *Acta Physiol. Scand.* **23**, 91-4 (1951).—*C.A.* **46**, 687*g*.

Add 0.1 *N* HCl to freshly distd. phenol. Mix 60 g Hyflo Super-Cel with 30 ml of the HCl phase to a homogeneous state; add about 250 ml of the phenol phase and pour the resulting slurry into a chromatographic tube. Apply gentle suction until the top of the column begins to dry. Pour sand on top (about 1 cm) and pipet the material to be chromatographed onto the sand. Add a mixt. of adrenaline and noradrenaline to the phenolic phase and an equiv. amt. of concd. HCl, shake well, and pour into the column. Fractions were collected every 15 min. The presence of adrenaline or noradrenaline in the fractions was ascertained by chromatography with phenol satd.

with 0.1 *N* HCl, and after drying the paper sprayed with $K_4Fe(CN)_6$.

8178. Bernstein, Theodore B.; Mosher, Anne L., and Mariella, Raymond P. **Purification of the active principle of short ragweed pollen.** *Science* **113**, 377-8 (1951).—*C.A.* **46**, 3217*h*.

The pollen (*Ambrosia elatior*) was dried, extd. with Et_2O, then with H_2O at 5°C for 18 hrs. The filtered aq. ext. was chromatographed on alumina, pH 5 to 6, then washed with H_2O and 11 fractions collected.

8179. Bevenue, Arthur and Williams, Kenneth T. **Further evidence indicating the specificity of the orcinol spray reagent for ketoheptoses on paper chromatograms.** *Arch. Biochem. Biophys.* **34**, 225-7(1951).—*C.A.* **46**, 9020*b*.

The colors produced by the modified Bial's reagent with 62 compds. representing a complete carbohydrate range were tabulated. Ketoheptoses gave a blue color and all other ketose sugars tested gave a yellow color. Aldoheptoses and all other compds. tested gave no color.

8180. Böhme, H. and Lampe, H. **Behavior of alkaloid salt solutions on alumina columns. I. Quinine hydrochloride.** *Arch. Pharm.* **284**, 227-39(1951).—*C.A.* **46**, 9260*f*.

Aq. quinine-HCl solns. were passed through columns of several com. Al_2O_3 samples. The filtrates were analyzed gravimetrically for alkaloid, Na^+, and Cl^-. Most of the Al_2O_3 samples were alk.; these held back the quinine as the result of the cation-exchange reaction,: $AlONa + [BH]^+ Cl^- \rightarrow$: $AlO[BH] + Na^+ + Cl^-$. Practically neutral aluminate-free Al_2O_3 columns retained the Cl^- from MeOH solns. of quinine; this is probably due to an anion-exchange reaction involving some AlOH groups on the surface of the absorbent.

8181. Bouchardy, M. **A study of some nonofficial tinctures with the aid of paper chromatography.** *Pharm. Acta Helv.* **26**, 360-9(1951).—*C.A.* **46**, 3213*i*.

With a suitable solvent (solns. of salts, acids, and mixts. of org. solvents and the soln.) for each tincture, chromatograms could be obtained which permitted the identification of the prepn. by paper chromatography. Chromatograms for the following prepns. were described: tinctures of crataegus, mistletoe, Indian chestnut, drosera, passion flower, and artichoke and dialyzates of artichoke and of hydrastis.

8182. Boulanger, Paul and Montreuil, Jean. **Nucleic acid studies. I. Quantitative paper chromatography of ribonucleotides. II. Quantitative paper chromatography of the pentose nucleotides of the nucleic acids of yeast and pancreas.** *Bull. soc. chim. biol.* **33**, 784-99 (1951).—*C.A.* **46**, 1608*i*.

The successful application of the method was described.

8183. Brady, Roscoe O. **Biosynthesis of radioactive testosterone in vitro.** *J. Biol. Chem.* **193**, 145-48 (1951).

Aliquots contg. approx. 50 γ of the recovered testosterone were chromatographed on paper. The combination of alumina chromatography and descending paper chromatograms performed with ligroin satd. with propylene glycol effected excellent sepn. from a large no. of related steroids.

8184. Bremner, J.M. **Alkaline decomposition of amino acids.** *Nature* **168**, 518(1951).—*C.A.* **47**, 245*g*.

In the course of an examn. of amino acid compn. of soil hydrolyzates by the paper chromatography technique, it was noticed that alk. hydrolyzates of soil contained greater amts. of α-aminobutyric acid and glycine than did acid hydrolyzates. Further studies of the effect of hot NaOH and $Ba(OH)_2$ on amino acids showed that threonine yielded glycine and α-aminobutyric acid, servine yielded glycine and alanine, and cysteine and cystine yielded alanine.

8185. Brindle, H.; Carless, J.E., and Woodhead, H.B. **Separation of alkaloids by paper chromatography. I. Solanaceous alkaloids. II. Water-insoluble alkaloids of ergot.** *J. Pharm. Pharmacol.* **3**, 793-813, discussion, 813-14(1951).—*C.A.* **46**, 1710*d*.

Paper buffered with .066 *M* citrate or phosphate was satisfactory for the sepn. of mixts. of atropine, hyoscine, and apoatropine with BuOH. The alkaloids were detected on the chromatograms by a soln. of 0.5% I in 1% KI or by a modified Dragendorff reagent. Certain solvent mixts. of $CHCl_3$, CCl_4, and (or) light petroleum gave R_f values for hyoscine near to unity while the atropine was only slightly sol. in the moving org. phase. Hyoscine accounted for 2-3% of the total alkaloids. With paper buffered between pH 2 to 5 with Et_2O as solvent ergometrine, ergometrinine, and the lysergic acids remained stationary while the water-insol. alkaloids of ergot were widely sepd. Ascending development was most suitable for quant. procedures.

8186. Brockmann, Hans and Musso, Hans. **Paper chromatography of glycine peptides.** *Naturwissenschaften* **38**, 11-12(1951).—*C.A.* **46**, 1841*a*.

In butanol, BuOH-AcOH, and BzOH the R_f values decreased with increasing no. of glycine groups, in PhOH the R_f values increased In cresol the sequence of increasing values was tri-, di-, tetra-, mono-, pentapeptide. In all cases the paper strip was sprayed with 0.1% soln. of ninhydrin in BuOH and heated to 100°C to develop the color. The glycine spot appeared first (violet); the others are at first yellow and change after 20 mins. to violet. The color intensity decreases with increasing chain length. Complete sepn. of the zones was obtained with cresol.

8187. Brüggemann, Johannes; Krauss, Walter, and Tiews, Jürgen. **Chromatographic separation of vitamins A and D.** *Naturwissenschaften* **38**, 562(1951).—*C.A.* **46**, 11586*d*.

Talcum, soaked in a $CHCl_3$soln. of $SbCl_3$ contg. some $SbCl_5$ and dried for 20 min. at 100°C, was used as adsorbent in a 6-cm height and 2-cm diam. column, supported by 16-cm height of potato starch. Potato starch held $SbCl_3$ back and allowed vitamins to go on. The column was moistened with $CHCl_3$ and the unknown mixt. freed of sterols by digitonin pptn., dissolved in 5 cc. $CHCl_3$, was run through the column. After washing with

$CHCl_3$ vitamin D was found in the eluate (91-97%) and vitamin A appeared as a sharp blue layer in the column.

8188. Brush, Miriam K.; Boutwell, R.K.; Barton, A.D., and Heidelberger, Charles. **Destruction of amino acids during filter paper chromatography.** *Science* **113**, 4-6 (1951).—*C.A.* **45**, 2523*b*.

Chromatograms of amino acids run with PhOH should not be dried above 27°C since drying at 60-105°C for 5 min. led to marked destruction. Radioautographs of 2-dimensional chromatograms of alanine-2-C^{14}, glycine-2-C^{14}, and tryptophan-β-C^{14} run with PhOH followed by lutidine showed that the amino acids were converted to compds. having high R_f values in both PhOH and lutidine.

8189. Capone, Antonio. **Colorimetric and chromatographic determination of ephedrine in combinations with other pharmaceutical products**. *Boll. chim. farm.* **90**, 465-72(1951).—*C.A.* **46**, 4743*e*.

Paper chromatography was successful by using for aq. solns. a perfusing liquid of BuOH satd. with H_2O and contg. 25 cc. EtOH/100 cc.; for solns. in oil a mixt. of equal parts BuOH, EtOH, and H_2O. The chromatogram was developed by exposure to I_2 vapors for 12 hrs. The following substances modified the ephedrine chromatogram: K sulfoguaiacolate; Ca camphosulfonate; Na benzoate; lactic acid; Na glycerophosphate; and KI. KBr, $CaCl_2$, $MgCl_2$, starch, talc, lactose, phenyldimethylisopyrazolone, Na_2HPO_4, barbital, KI, and Ca gluconate had no influence.

8190. Carless, J.E. and Woodhead, H.B. **Separation of alkaloids by paper chromatography.** *Nature* **168**, 203(1951).—*C.A.* **46**, 4741*f*.

The strongly basic solanaceous alkaloids and the feebly basic water-insol. alkaloids of ergot could be sepd. with buffered filter paper. Quant. estn. by elution of the alkaloid was not satisfactory.

8191. Carrasco, F. and Martín Panizo, F. **Extraction of ascorbic acid from fruits grown in Spain by means of anion-exchange resins.** *Anales real soc. españ. fís. y. quím.* **47B**, 751-8(1951).—*C.A.* **47**, 792*d*.

Two exchange resins, "Wolfatite M" (I.G. Farbenindustrie A.-G.) and "Ionac A-300" (American Cyanamide and Chem. Co.) were compared. Adsorption isotherms for HCl, HOAc, and oxalic acid were prepd. and similar general tests were used for comparison. Then comparisons were made of the take-up of ascorbic acid from a soln. protected against oxidation with SO_2. The second resin proved the more effective.

8192. Crokaert, R.; Moore, S., and Bigwood, E.J. **Chromatographic study of urinary pantothenic acid.** *Bull. soc. chim. biol.* **33**, 1209-13 (1951).—*C.A.* **46**, 6178*b*.

The pantothenic acid content of urine was estd. by detn. of the β-alanine liberated from it by acid hydrolysis. The sample was first passed through a column of acid-phase Dowex resin to remove pigments, metallic cations, org. bases, and peptides, then acidified to pH 1 with HCl and heated 60 min. at 100°C to hydrolyze the pantothenic acid. The soln. was evapd. to dryness and the residue, dissolved in buffer soln. of pH 3-5, was passed through a column of Na-phase Dowex resin to adsorb the β-alanine. The β-alanine was then eluted and detd.

8193. Dalsgaard, A. Torstensen and Olsen, Otto M. **Sterilization of medicinal charcoal.** *Svensk Farm. Tid.* **55**, 557-61(1951).—*C.A.* **45**, 9795*d*.

Charcoal could not be sterilized by heating in air at 140-60°C since it began to smoulder and smoke. It could be sterilized by autoclaving at 120°C for 20 min. or by heat-treatment in 61% alc. in closed containers at 100° for 30 min. After each method of sterilization, it must be dried at 60°C. The treatments did not affect the adsorption capacity.

8194. Denoël, A.; Jaminet, F.; Philippot, E., and Dallemagne, M.J. **Chemical and pharmacodynamic study of some alkaloids of Strychnos angolensis.** *Arch. intern. physiol.* **59**, 341-7 (1951).—*C.A.* **47**, 5627*f*.

The bark and roots of *S. angolensis* contained about 0.6% total alkaloids extractable with ammoniacal $CHCl_3$. After concn. *in vacuo* the residue was extd. with 0.5 *N* H_2SO_4, and this ext. was then made ammoniacal which caused an amorphous fraction A to ppt. The filtrate was re-extd. with $CHCl_3$, yielding fraction B. Upon paper chromatography with a BuOH-HCl-H_2O 50:7.5:17 solvent fraction A gave 2 spots with R_f values of 0.07 and 0.35. R_f values of pure alkaloids were: genostrychnine 0.86; brucine 0.7; α- and β-colubrine 0.87 and 0.84; vomicine 0.86; holstiine 0.91; retuline 0.94; tubocurarine 0.46; and hyaphorine, 0.85. Fraction A was richest in the component of R_f 0.07.

8195. Deuel, H.; Anyas-Weisz, L., and Solms, J. **Concerning the contact ion exchange between ion exchangers.** *Experientia* 7, 297-98 (1951)

A strongly acidic cation exchanger and a weakly basic anion exchanger were employed. The results showed a regenerative effect when the chloride form of the anion exchange resin was in contact with satd. solutions of CO_2. These models indicated that the generation of HCl from NaCl by weak acids could be effective only if selectivity existed between the ions.

8196. Dixon, H.B.F.; Moore, Stanford; Stack-Dunne, M.P., and Young, F.G. **Chromatography of adrenotropic hormone on ion-exchange columns.** *Nature* **168**, 1044-5(1951).—*C.A.* **46**, 6322*h*.

Active materials from adrenotropic hormone were satisfactorily chromatographed on Amberlite IRC-50 columns at a neutral pH and room temp. The chromatographic results showed that the ascorbic acid-depleting factor was a highly active, basic substance, readily separable under nonhydrolytic conditions from the protein which were the major constituents of the early prepns. of the hormone.

8197. FLANAGAN, T.L. JR.; SAX, M.F., AND HEMING A.E. **Toxicity studies on Amberlite XE-96, a carboxylic type exchange resin.** *J. Pharmacol. Exptl. Therap.* 103, 215-21 (1951).—*C.A.* 46, 630*d*.

Subacute and chronic toxicity studies were made on dogs and rats fed 3 to 5 g/kg daily doses of the purified ammonium salt of a carboxylic acid cation exchanger. No physiological changes were apparent after periods varying from one week to six months.

8198. FLECKENSTEIN, A.; GÜNTHER, H., AND WINKER, H.J. **Adsorption and cohesiveness of pharmacologically active alkaloid cations on the collodion membrane. Basic physicochemical experiment for "competitive inhibition."** *Arch. exptl. Path. Pharmakol.* 214, 38-54(1951).—*C.A.* 47, 2430*i*.

The potential across a collodion membrane contg. 0.01 *M* KCl and immersed in 0.001 *M* KCl was greatly decreased by a wide, variety of compds. Washing out the membrane restored the potential to more pos. values, the rate of restoration varying with the classes of compds. and within the groups. Sympathomimetic drugs, acetylcholine and related compds., histamine, coniine, veratrine, and nicotine were easily washed off the membranes, while sympatholytics, acetylcholine antagonists, antihistaminics, and local anesthetics were strongly held.

8199. FREEMAN, G. **Methods of obtaining large yields of human platelets as by-product of blood collection.** *Science* 114, 527-28 (1951).

Clinical and exptl. use of platelets has been limited by the expense and impracticality of obtaining them in quantity. Previous studies have indicated that when passed through a strongly acidic cation exchanger, the blood was rendered incoagulable, but that the platelets deposited on the resin bed. Now, by elution with saline soln., it was possible to recover the platelets. Morphological and physiological integrity of the platelets were preserved.

8200. FUCHS, L. AND PÖHM, M. **Paper-chromatographic investigation of the alkaloid mixtures of ergot. Preliminary report.** *Scientia Pharm.* 19, 232-5(1951).—*C.A.* 46, 4172*f*.

After chromatographic sepn. of the various alkaloid types, the ergotoxin group could be hydrolyzed and identified by the amino acids given on hydrolysis. A good solvent for the sepn. of iso-$BuCH(NH_2)CO_2H$ and $PhCH_2CH(NH_2)CO_2H$ was BuOH 1, $PhCH_2OH$ 1, H_2O 2.

8201. GIRI, K.V. **Circular paper chromotography for the separation of amino acids.** *Current Sci.* (India) 20, 295-6(1951).—*C.A.* 46, 6999*e*.

The Rutter disk technique was modified and applied to amino acids. Multiple development was effective in the sepn. of those not resolved by one solvent run.

8202. GIRI, K.V. AND PRASAD, A.L.N. **Detection of enzymes by the agar-plate method and its application to paper chromatography.** *Nature* 167, 859-60 (1951).—*C.A.* 45, 8586*i*.

Amylases were chromatographed on paper strips by the descending technique with EtOH or aq. Me_2CO as solvents. The enzyme on the dried, developed paper chromatogram was located by placing the strip on a thin layer of 2% agar contg. 1% starch, incubating 2 to 8 hrs, flooding the agar with 0.01 *N* I_2, and noting the position, in relation to the solvent boundary and starting positions, of violet or clear spots against the blue background.

8203. GLAZKO, A.J. AND DILL, W.A. **Color reaction distinguishing between adrenaline and noradrenaline on paper chromatograms.** *Nature* 168, 32,(1951).—*C.A.* 45, 10489*f*.

Samples were dissolved in CH_3OH contg. a min. quantity of HCl and then chromatographed. H_2O-satd. phenol was used as developer in a HCl atm. Paper chromatograms were dried and sprayed with a fresh prepn. of 0.5 g Na-β-naphthoquinone-4-sulfonate dissolved in 100 ml 0.2 *M* borate buffer of pH 8.9; the soln. had a final pH of 8.6. Noradrenaline gave an intense blue color in 15-30 min., adrenaline a pink color, and dihydroxyphenylalanine a yellow color.

8204. GRAF, E. **Adsorbent for the chromatographic determination of alkaloids.** *Arzneimittel-Forsch.* 1, 257-66(1951).—*C.A.* 46, 1710*b*.

Chromatographic detn. of alkaloids in alc. solns. was possible only under conditions that were not strictly reproducible. The adsorbent was sensitive to moisture, air, temp., and the normal plant constituents such as alkali nitrates, NH_4 salts, and amines. The total alkaloid content was liberated by means of alkali, the whole mass triturated to dryness with an adsorbent, preferably Al_2O_3, and finally eluted with a suitable solvent, preferably $CHCl_3$.

8205. GRAF, E. **Chromatographic determination of alkaloids.** *Deut. Apoth.-Ztg.* 91, 797-802 (1951).—*C.A.* 46, 1710*c*.

Chromatographic adsorption of alkaloids from alc. or dil. alc. solns. was unreliable. A combined adsorption-partition chromatographic method has been worked out for the German Pharmacopeia.

8206. HAKIM, ANWAR AND MIRIMANOFF, ANDRÉ. **Paper chromatography of some alkaloidal tinctures of the Swiss Pharmacopeia V.** *Arch. sci.* (Soc. phys. hist. nat. Genève) 4, 335-40(1951)(in French).—*C.A.* 46, 5258*h*.

Tinctures of nux vomica, hyoscyamus, belladonna, stramonium, aconite tuber, lobelia, and valerian were sepd. into their components by ascending uni-or bidimensional paper chromatography. The R_f values were talulated. In bidimensional work best results were obtained when the same solvent was reused for resolving in the second direction. Excellent sepn. of brucine and strychnine was achieved. R_f values were given for pure strychnine, brucine, atropine, scopolamine (XV), and hyoscyamine.

8207. HALPERN, A.; POWERS, J.V., AND BRODNEY, C.H. **Pharmaceutical properties of the kaolins.** *Bull. Natl. Formulary Comm.* 19, 33-41(1951).—*C.A.* 45, 8720*f*.

The present official standards for kaolin were not sufficient to properly classify and define it since variations were observed in four different samples, each of which met all of the official standards. Additional criteria to limit contamination, grit, and particle size distribution should be considered. Osmo-kaolin, an electrically purified product approached the ideal kaolin and was found to be superior in all tests.

8208. HAUSER, ERNST A. **Canamin clay and its properties. I, II.** *Can. Chem. Process Inds.* 34, 979(1950); 35, 123(1951).—*C.A.* 45, 7749*h*.

Particle size of this British Columbia colloidal clay (studied from a colloid. chem., medical, and veterinary viewpoint) was too small to permit well-defined electron photomicrographs. Its adsorption properties explain its reported healing effects. The natural deposit of Canamin clay was not of uniform compn., but contained, besides this highly colloidal Al silicate, some comparatively coarse quartz and mica particles.

8209. HEINÄNEN, PEKKA; NYYSSÖNEN, SAARA, AND TUDERMAN, LEO. **Paper chromatographic isolation of sulfonamides.** *Farm. Aikakauslehti* No. 5, 84-98(1951).—*C.A.* 46, 7286*g*.

The applicability of paper chromatography for detection of sulfonamides was demonstrated. R_f values were reported for a no. of sulfonamides, by using ascending chromatography, Whatman No. 1 paper, and a 3% ammoniacal butanol-water solvent. Vanillin-HCl served as the color developer. With addn. of NH_3 to the solvent, sharper spots were obtained and tailing was eliminated.

8210. HENNIG, ARNOLD J.; HIGUCHI, TAKERU, AND PARKS, LLOYD M. **Sabadilla alkaloids. III. Chromatographic separation of the water-soluble fraction. Isolation of a new crystalline alkaloid, sabatine.** *J. Am. Pharm. Assoc.* 40, 168-72(1951).—*C.A.* 45, 4889*f*.

The H_2O-sol. portion of sabadilla alkaloids was sepd. into 5 fractions by partition chromatography and from one of these fractions a new cryst. alkaloid was isolated and named *sabatine*. The alkanolamine was prepd. by hydrolysis and named *sabine*.

8211. HOLM-JENSEN IB. **Mercury-vapor-absorbing paint.** *Acta Pharmacol. et Toxicol.* 7, 201-19 (1951).—*C.A.* 45, 9888*h*.

Numerous substances were tested for ability to absorb Hg vapor from air at room temp. A water paint contg. pptd. ZnS was the most effective. It was superior to Au foil. The influence of variations in the method of prepg. the ZnS on its absorbent property was discussed.

8212. HUYCK, C. LEE. **Colloidal magnesium aluminum silicate as a suspending agent.** *J. Ala. Acad. Sci.* 21/22, 39-41(1951).—*C.A.* 46, 9252*g*.

Suspensions of 5, 4, and 2 1/2% colloidal Mg Al silicate were substituted for 5, 4, and 2 1/2 aq. magmas of bentonite in two pharmaceutical prepns. requiring suspending agents. The two test prepns. were Calamine Lotion and Chalk Mixt. (U.S.P.).

8213. ICE, CLARK H.; GAGE, THOMAS B., AND WENDER, SIMON H. **The use of filter-paper pulp in the separation of certain flavonoid compounds.** *Proc. Okla. Acad. Sci.* 32, 99-100 (1951).—*C.A.* 47, 5212*c*.

A mixt. of 2 flavonol glycosides (R_f values in BuOH-AcOH-H_2O 0.90 and 0.78) was sepd. by chromatography on a paper-pulp column with Me_2CO or preferably EtOAc as solvent and aq. solvent as eluent. Such columns were cumbersome for large-scale use.

8214. JAMINET, F. **Separation of local anesthetics by paper chromatography.** *J. pharm. Belg.* 6, 81-5 (1951).—*C.A.* 45, 9801*c*.

Anesthesine, stovaine, cocaine, pantocaine, and novacaine were subjected as HCl salts to ascending chromatography with iso-BuOH 50 cc. equilibrated with HCl 7.5 cc. and H_2O 13.5 cc., with the aq. acid layer to sat. the atm. After 19 hrs at 20° the R_f values detd. were 0.94, 0.96, 0.83, 0.54, and 0.21, resp.

8215. JINDRA, A. AND POHORSKY, J. **The determination of alkaloids by exchange of ions.** *J. Pharm. Pharmacol.* 3, 344-50(1951).—*C.A.* 45, 7299*b*.

Detailed descriptions of the app., reagents, prepn. of the ion-exchange column, and general micro and semimicro methods of assay were given. The methods were applied to cinchona bark, ipecac root, nux vomica seeds, belladonna herb, hyoscyamus herb, and their prepns.

8216. KANTOR, NATHAN; LEVINE, JOSEPH, AND FISHBACH, HENRY. **The role of anions on cation-exchange media.** *Antibiotics and Chemotherapy* 1, 586-7(1951).—*C.A.* 46, 6460*d*.

Histamine was displaced from an ion exchanger of cotton-acid succinate by maltol, Na ions, HCl, benzoic acid, and trichloroacetic acid; H_2SO_4, citric acid, and succinic acid were without effect.

8217. KARIYONE, TATSUO AND HASHIMOTO, YOHEI. **Microchemical detection of plant components. VI. Detection and colorimetry of flavonol derivatives.** *J. Pharm. Soc. Japan* 71, 433-6 (1951).—*C.A.* 45, 9799*a*.

Flavonol derivs., e.g., rutin, produce with Al^{+++} a sensitive yellow coloration which showed max. absorption at 2740 and 4160 A. The yellow coloration of flavonol was detd. by adding 0.75% $Al(AcO)_3$ at pH 3.74 and comparing with a standard K_2CrO_4 soln. Partition paper chromatography of flavonols, e.g., rutin, myricitrin, quercetin, quercitrin, myricetin, and morin, was carried out. After development with solvents (BuOH:H_2O:AcOH = 5:4:1 or PhOH:H_2O:AcOH = 40:9:1), flavonol spots were sprayed with 2.5% $(AcO)_3Al$, dried, and their R_f values measured.

8218. KARIYONE, TATSUO AND HASHIMOTO, YOHEI. **Microchemical detection of plant components. VII. Detection of alkaloids by paper chromatography.** *J. Pharm. Soc. Japan* 71, 436-8 (1951).—*C.A.* 45, 9799*b*.

Over 50 kinds of basic compds. were tested by paper partition chromatography with BuOH:H_2O:AcOH = 5:4:1 or PhOH:H_2O:AcOH = 40:9:1 as developing solvents. The paper was dried and sprayed with Dragendorf's reagent which had been dild. to 5 vols. for estn. of R_f values. Since some primary, secondary, and tertiary bases did not ppt. with this reagent, MeOH-KOH (5%) and MeOH-Me_2SO_4 (10%) were sprayed consecutively and heated at 70°C for

30 min. to complete *N*-methylation. This was then sprayed with 10% AcOH to neutralize excess alkali, followed by Dragendorf's reagent. All the bases could be identified in this way.

8219. KARIYONE, TATSUO AND HASHIMOTO, YOHEI. **Microchemical detection of plant components. VIII. Detection of organic dibasic acids by paper chromatography.** *J. Pharm. Soc. Japan.* 71, 439-41 (1951).—*C.A.* 45, 9799*d*.

Take 0.05-0.1 mg org. dibasic acid in a small test tube with 1-2 mg polyphenol, e.g., resorcinol, catechol, hydroquinone, phloroglucinol, or pyrogallol, add 1 drop concd. H_2SO_4, heat 5 min. in an oil bath at 130°C, dissolve with a small amt. of alkali, submit to paper-partition chromatography with the solvent BuOH:H_2O:AcOH = 5:4:1, and let stand for 4-5 days. The strongest fluorescence was shown by 1,2-dicarboxylic acids (citric, meleic, phthalic, succinic, and tartaric acids) and resorcinol.

8220. KATO, MASARU AND SHIMIZU, HIROSHI. **Fluorometric determination of nicotinamide by use of synthetic ion-exchange resins.** *Science* 114, 12-14(1951).—*C.A.* 46, 3459*g*.

Interfering substances were removed by successive purification with a carboxylic-type cation-exchange resin KH-4B and a strong-base-type anion-exchange resin IRA-400. Special tubes were described for carrying out the exchange reactions.

8221. KAWERAU, E. AND WIELAND, T. **Conservation of amino acid chromatograms.** *Nature* 168, 77-8(1951).—*C.A.* 46, 382*h*.

Stable chromatograms of amino acids were prepd. by developing the spots with ninhydrin in the usual manner and then spraying the blue spots with a Cu salt soln. to form stable red complexes. The red spots were exposed momentarily to NH_3 vapor to neutralize traces of free acid and the paper was dipped into a methyl methacrylate polymer. The ninhydrin reagent should not contain ions which can dissociate the Cu complex, i.e. citrate.

8222. KERR, S. E.; SERAIDARIAN, K., AND BROWN, G. B. **The utilization of purines and their ribose derivatives by yeast.** *J. Biol. Chem.* 188, 207-16 (1951).—*C.A.* 45, 4305*a*.

Strongly basic and strongly acidic ion exchange resins were employed for several purification steps. The cation exchanger removed excess alkali from dried yeast residue. In the sepn. of adenosine from soln., precipitation as the picrate was employed. The picrate was then dissolved by contacting it with the strongly basic anion exchanger. The incorporation of the purines, adenine and guanine, into the ribonucleic acid of rapidly growing yeast when offered as "labeled" purines, their nucleosides, or nucleotides was discussed.

8223. KORZYBSKI, T. **Paper chromatography of penicillins by means of simple equipment.** *Med. Doświadczalna i Mikrobiol.* 3, 16-24(1951). —*C.A.* 45, 7749*b*.

Rutter's method was applied to the sepn. of com. penicillin G and K.

8224. KROEGER, RUTH MOOTE AND DEKAY, H. GEO. **Measurement of gravity filtration.** *J. Am. Pharm. Assoc.* 40, 213-15(1951).—*C.A.* 45, 4970*e*.

A new app. was described for detg. the filtration speed of filter papers which approximated the normal filtration process and was satisfactory since any error factors could be standardized leaving the filter paper as the only variable affecting the filtration time.

8225. KUBO, TAKASHI. **Relation between the action of drugs and the adsorption activity.** *Folia Pharmacol. Japon.* 47, No. 2, 48 (1951). —*C.A.* 47, 4164*i*.

The adsorptive activities of active carbon, animal charcoal, alumina, and acid-clay toward methylene blue and $HgCl_2$ were studied. The activity of any mixed adsorbent was always larger than the sum of the individual activities. Diln. had little effect when the diln. was in the range of ± 20%. Addn. of tannic acid increased both the pigment and $HgCl_2$ adsorption by all of these adsorbents in the acidic region but in the neutral region it slightly increased that of alumina. Alum increased the pigment adsorption remarkably but decreased the $HgCl_2$ adsorption except that of active carbon. Ca lactate and $MgSO_4$ activated the pigment adsorption, particularly that of acid clay.

8226. LARGENT, EDWARD J.; BOVARD, PAUL G., AND HEYROTH, FRANCIS F. **Röntgenographic changes and urinary fluoride excretion among workmen engaged in the manufacture of inorganic fluorides.** *Am. J. Roentgenol. Radium Therapy* 65, 42-8(1951).—*C.A.* 45, 2605*b*.

Samples of urine obtained from employees of 2 factories in which inorg. fluorides were manufd. contained fluoride in concns. that ranged from normal levels of less than 1 mg per liter to abnormal levels as high as 28 mg per liter. Five workmen out of 16 who were examd. röntgenologically showed increases in bony d. These men had excessively and consistently higher concns. of fluoride in samples of their urine than did the employees whose bones were normal in d.

8227. LEACH, BYRON E. AND TEETERS, CHARLOTTE M. **Neamine, an antibacterial degradation product of neomycin.** *J. Am. Chem. Soc.* 73, 2794-7 (1951).—*C.A.* 45, 8595*h*.

Acid hydrolysis of neomycin, adsorption of the product on Amberlite IRC-50, elution, and chromatography yielded at least 33% *neamine*, $C_6H_{12-14}N_2O_3$ or possibly the dimer $C_{12}H_{26}N_4O_6$. Countercurrent distribution and paper chromatographic studies were made.

8228. LE GALLIC, PIERRE. **Influence of various adsorbents on the vitamin A activity of a diet containing casein and lard and devoid of any detectable carotenoids.** *Compt. rend. soc. biol.* 145, 1657-9(1951).—*C.A.* 46, 8731*c*.

Addn. of activated charcoal, Al_2O_3, or montmorillonite to the diet did not decrease the vitamin A effect.

8229. LUSSMAN, DONALD J.; KIRCH, ERNST R., AND WEBSTER, GEORGE L. **The separation of some of the cinchona alkaloids by paper partition**

chromatography. *J. Am. Pharm. Assoc.* 40, 368-70 (1951).—*C.A.* 45, 9219*d*.

The major alkaloids of cinchona were sepd. by paper partition chromatography, cyclohexanol or cyclohexanone being used with HCl as the solvent mixt. Identification was accomplished by means of R_F values detd. with pure samples and by fluorescence (quinine and quinidine) or the development of a colored compd. with K iodoplatinate reagent (cinchonine and cinchonidine).

8230. MARSH, MAX M. AND KUZEL, NORBERT R. **Separation and determination of crystalline vitamin B_{12} in synthetic vitamin mixtures.** *Anal. Chem.* 23, 1773-6 (1951).—*C.A.* 46, 3222*h*.

A mixture of a strongly basic anion and strongly acidic cation exchange resin was used to remove interfering materials from an aq. soln. of the vitamins prior to spectrophotometric determination. Removal of interferences by this technique was also employed following photodecompn. and heat decompn. of the mixts.

8231. MATHES, P. AND KLEMENTSCHITZ, W. **Paper chromatographic separation of tropine from its esters.** *Scientia Pharm.* 19, 235-6(1951).—*C.A.* 46, 4175*b*.

Old samples of tropine esters could be checked for hydrolysis since tropine differed markedly in R_f value. By using Schleicher and Schüll paper No. 598g, a mixt. of $EtO(CH_2)_2OH$ 70 and H_2O 30 parts, and an NH_3 atm., the following R_f values were obtained: tropine, 0.75; lactyltropine, 0.85; atropine, l-hyoscyamine, and homatropine, 0.90. From 12 to 15 hrs were required.

8232. MCCHESNEY, EVAN W. **Cation-exchange resins; their optimal potassium content for clinical use.** *J. Lab. Clin. Med.* 38, 199-209(1951).—*C.A.* 46, 3602*i*.

The effective *in vitro* capacity of a no. of commercially available cation-exchange resins was detd. by shaking them with 0.2 *N* phosphate buffer solns. of pH 6.4. Their effect in neutralizing gastric juice and their power to exchange alkali ions in this medium was also studied.

8233. MCCHESNEY, EVAN W.; DOCK, W., AND TAINTER, M. L. **Ion-exchange resins in edema.** *Medicine* 30, 183-95 (1951).—*C.A.* 45, 9741*b*.

Cation-exchange resins of carboxylic and sulfonic types, if ingested shortly before, after, or with the food, diverted from absorption, on a normal diet, about 28 mg Na, 39 mg K/g, and some Ca. These cations were exchanged for H or ammonium ions, producing a state of compensated metabolic acidosis. Resin feeding at a level of 50 to 100 g/day, in conjunction with a moderate Na intake, promptly alleviated cardiac edema, even where diuretics had failed.

8234. MESNARD, PIERRE AND DEVEZE, JACQUES. **Study of hydrolytic products of officinal digitaline by paper chromatography.** *Bull. soc. pharm. Bordeaux* 89, 85-91(1951).—*C.A.* 46, 2750*i*.

Digitoxose spots were sprayed with the reagent (*p*-dimethylaminobenzaldehyde 1, $Cl_3C_2O_2H$ 2 g, AcOH 80 cc., HCl 10 drops, H_2SO_4 15 drops), dried, and heated at 85-90°C to obtain a violet color on a yellow background. The reaction was sensitive to 1 γ. R_f values with 11 different developing solvents were given. The hydrolyzed heterosides could not be sepd. from the unhydrolyzed ones by paper chromatography.

8235. MOORE, STANFORD AND STEIN, W. H. **Chromatography of amino acids on sulfonated polystyrene resins.** *J. Biol. Chem.* 192, 663-81 (1951).—*C.A.* 46, 2119*c*.

On a 0.9 × 100-cm. column of Dowex-50, operated in the Na form, amino acids were eluted by the use of buffers of progressively increasing pH, from 3.4 to 11. In expts. with mixts. of amino acids simulating protein hydrolyzates, a sequence of buffers was developed which yields in a single chromatogram an effluent curve in which every component emerges as a discrete peak. The position of emergence of some of the less common amino acids and related compds. was detd. The resin columns had higher resolving power than starch columns and were more convenient to operate.

8236. MÜLLER, HELMUT. **Medicinal activated charcoals.** *Pharmazie* 6, 197-9(1951).—*C.A.* 45, 10503*i*.

For medicinal use the activated charcoals made from plant raw materials were better than those prepd. from animal raw materials.

8237. MUNIER, ROGER; MACHEBOEUF, MICHEL, AND CHERRIER, NICOLE. **Microchromatography of alkaloids and biological nitrogenous bases on paper previously treated with salts. I. Preliminary trials with phosphate-treated paper. II. Improvement of the acid solvent phase technique. Use of paper impregnated with a salt having the same anion as the acid acidifying the solvent phase.** *Bull. soc. chim. biol.* 33, 1919-29(1951); 34, 204-14 (1952).—*C.A.* 46, 9255*a*.

Filter paper was soaked in KH_2PO_4 soln. and dried, then used with the various solvent mixts. reported in previous papers. The sepn. of certain mixts. of alkaloids or other org. bases was improved in many cases. Paper previously soaked in 0.2 *M* NaOAc or 0.5 *M* KCl and dried gave improved results (more sharply defined spots) with BuOH contg. AcOH or HCl, resp., as solvent.

8238. NAGHSKI, J.; FENSKE, C. S. JR., AND COUCH, J. F. **Use of paper chromatography for the estimation of quercetin in rutin.** *J. Am. Pharm. Assoc.* 40, 613-16(1951).—*C.A.* 46, 1924*h*.

Quercetin was sepd. from rutin by its rapid mobility during paper chromatography and detd. spectrophotometrically in the eluate after reaction with $AlCl_3$. Modification of the developing solvent prevented interference by related flavonal compds.

8239. NYC, JOSEPH F.; MARON, DOROTHY M.; GARST, JOSEPHINE B., AND FRIEDGOOD, HARRY B. **Chromatographic separation of estrone, estradiol, and estriol.** *Proc. Soc. Exptl. Biol. Med.* 77, 466-9(1951).—*C.A.* 45, 8942*g*.

The 3 estrogens were adsorbed on a column of specially prepd. powd. vulcanized rubber (details given), then successively eluted with $MeOH\text{-}H_2O$ mixts. of different concns.

8240. PATTON, A. R. AND CHISM, PATRICIA. **Paper chromatography of browning reaction fluorogens.** *Nature* 167, 406(1951).—*C.A.* 45, 5057*g*.

Various combinations of glycine and D-glucose were refluxed and the paper chromatograms of the resulting browned solutions were prepd. Colorless bands, fluorescing in the ultraviolet, were detected. The bands did not coincide with glycine or glucose.

8241. PATTON, A. R. AND CHISM, PATRICIA. **Quantitative paper chromatography of amino acids.** *Anal. Chem.* 23, 1683-5 (1951).—*C.A.* 46, 2443*a*.

EtOH was superior to *n*-BuOH as a solvent for ninhydrin because the max. color development was faster, more uniform for different amino acids, and the rate of fading was the same for all amino acids. Max. color d. was obtained by spraying with 0.2% ninhydrin and drying in the dark for 18 hrs at room temp. Samples were detd. by comparison with known amts. of amino acids with a probe densitometer (Welch Densichron) in detg. the peak color d. by scanning a spot.

8242. PENMAN, W. R. **The use of a cation exchange resin in the management of the fluid retentions of normal and toxemic pregnancies: preliminary report.** *Am. J. Med. Sci.* 222, 193-96 (1951).

Eleven patients having fluid retention of pregnancy were treated with a blend of the ammonium and potassium salts of a pharmaceutical grade of a weakly acidic carboxylic cation exchanger. Fluid mobilization was achieved without limiting the patients' daily ingestion of sodium below two to three g.

8243. PROCHÁZKA, ŽELIMÍR AND KOŘÍSTEK, STANISLAV. **Bound form of ascorbic acid. III. A study of some properties of ascorbigene by means of paper chromatography.** *Chem. Listy* 45, 415-19 (1951).—*C.A.* 46, 4171*f*.

Aq. ext. of fresh cabbage was treated with activated charcoal which was then extd. with a mixt. of $CHCl_3$-EtOH (7:3). The ext. was evapd., the residue extd. with water, centrifuged, and evapd. *in vacuo* below 40°C. Ascorbigene contained in the ext. was identified on a paper chromatogram after hydrolysis with HCl as ascorbic acid (by means of I_2-starch reagent). Paper chromatography was carried out mostly in the system BuOH-AcOH-H_2O and in H_2O.

8244. RAO, P. S. AND BERI, R. M. **Analysis of sugars using paper chromatography (horizontal migration).** *Proc. Indian Acad. Sci.* 33A, 368-72 (1951).—*C.A.* 46, 9020*e*.

Two parallel cuts, 2 mm apart and 2 cm in length, were made equidistant from the center of a circular Whatman No. 1 filter paper connected by a single end cut, thus forming a tail, which was folded perpendicular to the plane of the paper and then clipped to a length of 1.5 cm. The appropriate sugar soln. was placed as a microdrop on the joint and air-dried. The solvent used for irrigation was placed in a Petri dish 15 cm in diam. and the center placed over this so that the tail could dip into the solvent. A glass plate covered the paper. The set-up was held at a definite temp. Various solvents were used, and R_f values for glucose, galactose, mannose, fructose, xylose, arabinose, rhamnose, lactose, and maltose were given (at 35°C, and in the case of PhOH at 20°C). Movement was very rapid and development required only 0.5-1.5 hrs (depending on the solvent).

8245. RAO, P. S.; BERI, R. M., AND RAO, P. RAMACHANDRA. **Analysis of sugars and uronic acids using paper chromatography (horizontal migration).** *Proc. Indian Acad. Sci.* 34A, 236-9(1951).—*C.A.* 46, 9020*g*.

The sepn. of glucuronic and galacturonic acids and their Ba salts was made. The solvents used were H_2O contg. PhOH, BuOH, *s*-collidine, *p*-cresol, and EtCOMe.

8246. REID, ALLEN F. AND JONES, FRANCES. **Fractionation of blood plasma proteins using ion-exchange resins.** *Ind. Eng. Chem.* 43, 1074-5 (1951).—*C.A.* 45, 7625*i*.

Large scale fractionation of blood plasma proteins previously involved low temp. A mixt. of a strong acid cation exchange resin in the H-form and a strong base anion exchange resin was employed. This mixt. removed the salts from a soln. of blood serum proteins at room temp. and at constant pH. As the salts were progressively removed, the various globulin fractions were precipitated. Laboratory tests indicated that the serum protein fractions were not denatured. Batchwise or multiplate column arrangement was suggested to permit commercial application.

8247. ROBERTSON, R. H. S. AND WARD, R. M. **Assay of pharmaceutical clays.** *J. Pharm. Pharmacol.* 3, 27-35(1951).—*C.A.* 45, 4882*f*.

Adsorption of methylene blue gave more reliable results in the detn. of cation exchange capacity than did the test with Ba^{++} exchange. Measurement of the apparent sp. gr. of the clay and observation of its color and reaction with a universal indicator soln. gave enough information to reduce the no. of dye adsorption tests required to establish the cation-exchange capacity. The chem. impurities in the highest grades of dye were not believed to be large or variable enough to invalidate a method which showed promise in the pharmaceutical assay of clays. Only the moisture content of the dye need be estd.

8248. ROBINSON, R. **Identification of sulfonamides by paper-partition chromatography.** *Nature* 168, 512-13(1951).—*C.A.* 46, 4747*f*.

Sulfonamides were chromatographed in acidic and basic solvents contg. *p*-dimethylaminobenzaldehyde. Identification was accomplished by comparing known and unknown sulfonamide spots on both chromatograms.

8249. RUDRA, M. N. AND CHOUDHURY, L. M. **Colorimetric determination of methionine.** *Analyst* 76, 432-3(1951).—*C.A.* 45, 8408*e*.

Hydrolyze the material by gently boiling 1 g of finely powd., air-dry sample with 5 ml of 6 *N* HCl for 24 hrs under reflux condensation. For pptg. basic amino acids, use pure phosphotungstic acid. Clarify with activated carbon. After the second centrifugation from the ice bath, decant off all of the supernatant liquid and neutralize to a light green color with bromocresol green indicator, by adding 5 *N* NaOH. Dil. to a known vol. (8 or 10 ml); filter through a dry filter, and use an aliquot for the test. To the aliquot portion add 2 ml of 5 *N* NaOH, 1 ml of 1% $Na_2Fe(CN)_5NO.H_2O$ soln., and heat 8 min. in a water bath at 40°C. Cool in an ice bath for 5 min. and add 2 ml of concd. HCl to develop a red color and detn. in a photoelec. colorimeter with filter no. 530.

8250. Sannie, Charles; Heitz, Suzanne, and Lapin, Henri. **Paper partition chromatography of steroid sapogenins.** *Compt. rend.* 233, 1670-2 (1951).—*C.A.* 47, 5627*b*.

Color reactions were given of steroid sapogenins with aromatic aldehydes or $SbCl_3$ by use of one dimensional chromatograms. Color developed by anisaldehyde, cinnamaldehyde, or vanillin was a yellow spot on white background, whereas with *p*-dimethylaminobenzaldehyde a rose spot on yellow-green background was formed. Cholesterol and ergosterol gave red or blue spots and the cardiac heterosides (cymarin and digitalin) gave blue spots.

8251. Schill, Göran and Ågren, Allan. **Evaluation of belladonna preparations.** *Svensk Farm Tid.* 55, 781-8, 797-805, 825-33 (1951).—*C.A.* 46, 6323*f*.

Partition chromatography offered the best possibility. As substrate for the stationary phase, columns of silicic acid, talcum, starch, SiO_2 and Kieselguhr were tried. The latter was found to be best.

8252. Schute, J. B. **Theory of paper chromatography.** *Pharm. Weekblad* 86, 33-42 (1951).—*C.A.* 45, 4113*d*.

The stationary phase, bound on a carrier, did not necessarily have the same properties as in the free state. Applied to paper chromatography this point of view extended the theory of Hanes and Isherwood.

8253. Schute, J. B. **Paper chromatography of alkaloids.** *Pharm. Weekblad* 86, 201-12 (1951).—*C.A.* 45, 8203*c*.

Results were given of chromatographic analyses of mixts. of atropine, apoatropine, scopolamine, and belladonnine; 5% NH_4OH was the mobile phase. The type of paper used and the moisture content of the paper were of great importance in the results. Temp., concn. of the substance, and degree of soaking of the paper had little effect on R_f; the water content was significant. If the paper was satd. in the vapor phase, the R_f was considerably lower than when the paper was air-dry. In using I_2 vapor to demonstrate alkaloids, several types of paper were so strongly colored by the I_2 vapor that the characteristic color of the alkaloid was masked.

8254. Scott, Dwight B. McNair and Cohen, Seymour S. **Enzymic formation of pentose phosphate from 6-phosphogluconate.** *J. Biol. Chem.* 188, 509-30 (1951).—*C.A.* 45, 4781*c*.

A weak base anion exchanger was employed to separate neutral and acidic carbohydrates produced in the enzymatic formation of pentose phosphate from 6-phosphogluconate. Fairly sharp separation of gluconic and 2-ketogluconic acids was obtained using 0.1 *N* HCl as eluant. The acids of various diphosphenylated fractions were adsorbed and eluted at pH 2 to give separations of gluconic and various reducing acids.

8255. St. John, C. V.; Flick, D. E., and Tepe, J. B. **Streptomycin and mannosidostreptomycin in fermentation broths.** *Anal. Chem.* 23, 1289-91 (1951).—*C.A.* 46, 691*e*.

Streptomycin and mannosidostreptomycin were rapidly sepd. from fermentation broths by the cation-exchange resin Amberlite IRC-50.

8256. Šugović, Mateja. **A new method for obtaining aluminum hydroxide gel for the preparation of adsorbed vaccine.** *Bull. soc. chim. Belgrade* 16, 105-17(1951)(French summary).—*C.A.* 46, 4324*i*.

Heat 88.0 g $(NH_4)_2SO_4$ in 10.5 liter H_2O to 78°C, add 1.940 liter of exactly 10% NH_4OH all at once, heat to 67-9°C, add 1534.0 g $Al(NH_4)(SO_4)_2.12H_2O$ in 5 liter H_2O, previously heated to 78°C, all at once, stir 5-10 min., allow to settle at 71-5°C and, after 15 min., filter *in vacuo* through cotton cloth, using several funnels; wash with H_2O at 65°C to remove SO_4^{--}, transfer the ppt. to a clean flask, adjust the vol. to 12.250 liter with H_2O, shake, and homogenize. The $Al(OH)_3$ gel had a pH of 7, an adsorbing power of 99.7% (on shaking, 17.50 ml of 0.077% aq. Congo red soln. was almost completely decolorized by 1 ml hydrogel, i.e., 1 ml hydrogel adsorbs 0.0134 g dye) and gave 1.88% ash.

8257. Suzutani, Toru. **Polarographic studies on adsorption from solutions; discontinuities in adsorption isotherms and the application of this phenomenon to the molecular-weight determination of proteins.** *Japan. J. Physiol.* 1, 213-32 (1951); *Sbornik Mezinarod. Polarograf. Sjezdu Praze, 1st. Congr., Pt.* I, 425-49 (1951)(in English).—*C.A.* 45, 6895*h*; 46, 9931*i*.

$Pb(NO_3)_2$ at several concns. was adsorbed by charcoal (0.35% suspension) and 0.1% suspensions of egg albumin, hemoglobin, and gelatin. Upon completion of adsorption (20 hrs. or more), free Pb ions were detd. polarographically (pH 7.0, Temp. 20.0 ± 0.1°). Adsorption isotherms for all proteins studied were steplike.

8258. Svendsen, Anders Baerheim. **Paper chromatography and determination of morphine in opium.** *Pharm. Acta Helv.* 26, 323-33(1951).—*C.A.* 46, 2751*e*.

The paper chromatographic-colorimetric method outlined for detn. of morphine in opium and tincture of opium was based upon the following principles: tincture of opium or an ext. of opium was paper chromatographed, and morphine eluted from the chromatogram and detd. colorimetrically with nitrite and ammonia.

8259. Svobodová, Sylva. **Paper chromatography of degradation products of riboflavin. III. Photolysis of lumiflavin.** *Chem. Listy* 45, 225-6 (1951).—*C.A.* 46, 373*e*.

Degradation of lumiflavin with light and oxidants was followed by paper chromatography. Several unidentified fluorescent spots were noticed in both cases.

8260. TAYLOR, R. G. **Filtration through sintered glass, with special reference to possible loss of medicament.** *Australasian J. Pharm.* 32, 118 (1951).—*C.A.* 46, 3213*c*.

Expts. showed that filtration of NaCl, $NaHCO_3$, and strychnine-HCl solns. in concns. normally used for injection, through sintered-glass filters of a grade used for clarification, did not appreciably lower the concn. Ca gluconate solns. were slightly weakened owing to crystn. on the filter. In all cases there was a small loss of total soln., lessened at reduced pressure.

8261. TORIBIO, ARTURO MOSQUEIRA AND OLLER, B. MARTINEZ. **New antiacid preparations.** *Anales real acad. farm.* 17, 491-502 (1951).—*C.A.* 46, 8326*f*.

Various methods were tried in the prepn. of an $Al(OH)_3$ sample suitable in antiacid medication. The spontaneous hydrolysis in moist air of a pure sample of $(EtO)_3Al$ was found to give a white powder of $Al(OH)_3$, 1 g of which neutralized 257 cc. of 0.1 *N* HCl following the procedure prescribed by U.S.P. XIII. The neutralization capacity of a mixt. (1 g) contg. 1 part of Mg trisilicate to 2 parts of $Al(OH)_3$ as prepd. above, was detd. The same method was used for a mixt. of 15 parts glycine and 35 parts $CaCO_3$. A mixt. of $CaCO_3$, $MgCO_3$, Mg trisilicate, and glycine was studied.

8262. VALENTIN, JOHANNES AND KIRCHÜBEL, GERTRAUDE. **Chromatographic adsorption analysis in pharmacy. VII. New method for determining the degree of activity of aluminum oxide. Separation of some colorless compounds.** *Arch. Pharm.* 284, 114-22(1951).—*C.A.* 45, 10488*e*.

The degree of activity of Al_2O_3 was detd. by passing a 0.1% petr. ether soln. of Sudan Red through it and measuring the width of the colored zone which was inversely proportional to the activity of the adsorbant. Org. compds. which react with $FeCl_3$ to give colored compds. could be made visible by first satg. the Al_2O_3 with an Et_2O soln. of $FeCl_3$.

8263. VENKATESH, D. S. AND SREENIVASAYA, M. **Ultramicropapyrography.** *Current Sci.* (India) 20, 156-7(1951).—*C.A.* 46, 4418*i*.

Partition chromatography of the order of 0.05 unit of penicillin was achieved by a cotton thread ascending chromatographic assembly. The thread was treated with benzene, water, takadiastase, water, alc., and ether successively, and then treated with 0.066 *M* phosphate buffer of pH 6.2, and air-dried. The thread was weighted, spotted with the test soln. about 10 mm above the bottom end, and placed in a solvent-satd. chamber. After equilibration, the thread was lowered to touch the elutant and development commenced. Bioassay of the air-dried developed thread was accomplished by bioautographic technique.

8264. VERHAAR, G. **Adsorption of cinchona alkaloids.** *Cinchona* (Arch. Kinacultuur) 11, No. 1, 150 pp. (1951).—*C.A.* 45, 9800*b*.

Tests of the adsorption of quinine sulfate, quinine-dihydrochloride, and cinchonine bisulfate on Norit charcoal showed that the highest capacity was reached by Medicinal Norit (x/m 400), next Supra Norit 150, and Norit PKO. The adsorption capacity reached the highest value in very dil. acid. Lowering the initial pH to 2.6 caused a decline in alkaloid adsorption. Activated Al_2O_3 and silica gel had very low adsorption values. In connection with the adsorption of quinine, cinchonine, quinidine, and cinchonidine on Norit Venale in C_6H_6, $CHCl_3$, and EtOH, the greatest adsorption occurred in C_6H_6 and the least in $CHCl_3$. In all cases Freundlich's rule proved valid. A study of the behavior of cinchona alkaloids in an adsorption column in the intermittent treatment of the column with an alkaloid soln. and dil. acid was made.

8265. VIRTANEN, ARTTURI I. AND MIETTINEN, JORMA K. **Estimation of volatile fatty acids and ammonia in silage by paper chromatography.** *Nature* 168, 294-5(1951).—*C.A.* 46, 1179*g*.

Butyric acid in silage could be detd. quite well from the effluent by means of paper chromatography, producing slightly more intense color than pure butyric acid in H_2O soln. To det. AcOH, distn. was necessary to eliminate lactic acid. Valeric, caproic, and propionic acids also might occur. NH_3 could be roughly detd. in optimum concn. between 1 and 10 γ with 2 vols. butanol and 1 vol. 6 *N* HCl for the solvent, drawing the strip rapidly through Nessler's reagent to develop the color.

8266. VITTE, G. AND BOUSSEMART, E. **Separation of local anesthetics by paper chromatography.** *Bull. trav. soc. pharm. Bordeaux* 88, 181(1951). —*C.A.* 45, 7299*g*.

Novocaine, butelline, cocaine, and orthoform were sepd. by ascending paper chromatography by using as the mobile solvent the alc. layer of a well-shaken mixt. of BuOH 50, AcOH 15, and H_2O 45 parts. The lower aq. layer was used to sat. the atm. in the chamber. The R_f values were 0.69, 0.90, 0.82, and 0.82 resp. The spots were revealed with Draggendorf's reagent and orthoform was identified with dild. $Fe(ClO_4)_3$ soln.

8267. VITTE, G. AND BOUSSEMART, E. **Separation of the alkaloidal constituents of a sirup by paper chromatography.** *Bull. soc. pharm. Bordeaux* 89, 83-5(1951).—*C.A.* 46, 2750*h*.

Ext. the alkalized sirup with 3 portions of Et_2O, wash the exts. with H_2O, and evap. Chromatographic development of spots deposited on paper showed that instead of codethyline and codeine the sirup contained only codeine.

8268. VOĬTKO, L. M. AND KHARIN, A. N. **Mechanism of the changing conditions of layers of carbon under different conditions of dynamic sorption of some essential oils from aqueous solutions.** *Zhur. Priklad. Khim.* 24, 509-19(1951); *J. Applied Chem. U.S.S.R.* 24, 557-67(1951)(English trans.).—*C.A.* 46, 8460*d*.

The range was detd. of a and d, for the sorption of essential oils from aq. solns., where a was the rate of flow of soln. and d the av. diam. of the carbon particles.

8269. WERLE, E. AND KOCH, J. **Separation of tobacco alkaloids by paper chromatography.** *Naturwissenschaften* 38, 333(1951).—*C.A.* 46, 3214*e*.

Mixts. of tobacco alkaloids dissolved in BuOH, satd. with H_2O, or in BuOH, iso-BuOH, or iso-PrOH with 10% AcOH and 20% H_2O were sepd. by chromatography in a vertical strip of filter paper. PhCH, collidine, or picoline were unsatisfactory as solvents. All solns. were adjusted to pH 7 with *N* HCl. The solns. were used in 1:100 concn., after 16 to 24 hrs contact (some at 0° to avoid evapn. of the alkaloid), the strips were dried, held for 10-20 min. in bromocyanogen vapor, and sprayed with 2% aniline in 0.066 *M* phosphate buffer soln. A more stable color resulted from 0.25% benzidine in 50% EtOH.

8270. WHITE, W. F.; FIERCE, W. L., AND LESH, J. B. **Pituitary adrenocorticotropin. II. Paper chromatography of pepsin-treated materials.** *Proc. Soc. Exptl. Biol. Med.* 78, 616-19(1951).—*C.A.* 46, 3220*e*.

Pepsin-treated adrenocorticotropic material was fractionated on paper with the system BuOH-AcOH-H_2O. The activity was found to be assocd. with a slow-moving ninhydrin-pos. area from which fractions having potencies of about 50 times standard were recovered. No further chromatographic resolution of these fractions was obtained by use of several other solvent systems commonly used for sepn. of amino acids and peptides.

8271. YONEHARA, HIROSHI; TOYAMA, TERUHIKO, AND SUMIKI, YUSUKE. **Purification of streptomycin. II Purification with cation-exchange resin.** *J. Antibiotics*(Japan) 4, Suppl. A, 14-19(1951). —*C.A.* 45, 9224*b*.

Phenolsulfonic type cation-exchange resin was treated with 10 times its vol. of *N* HCl and washed with distd. water. Streptomycin was adsorbed by the resin at pH 8.0 and the max. adsorption was 150 mg per g resin. It was eluted with *N* K_2SO_4 or KCl. The max. concn. in fractions of elutates was 5-10 times higher than the original soln.; however, the yield in these fractions was less than 50% and the other part appeared in further fractions at low concn.

8272. ALGERI, ELVERA J. AND WALKER, JOSEPH T. **Paper chromatography for identification of the common barbiturates.** *Am. J. Clin. Path.* 22, 37-40(1952).—*C.A.* 46, 3215*a*.

A study of the filter-paper chromatography of 10 commonly used barbiturates indicated that this method was useful for distinguishing individual barbiturates after quantitation by prevailing spectrophotometric procedures. The system found to be most satisfactory consisted of BuOH satd. with 5 *N* NH_4OH. The R_f values together with the mode of location of the spots served to characterize the barbiturate.

8273. ALLOUF, RAYMOND AND MUNIER, ROGER. **Microchromatographic separation on paper of nicotinic acid derivatives and *N*-methylpyridones.** *Bull. soc. chim. biol.* 34, 196-203(1952).—*C.A.* 47, 447*e*.

A method was described for the 2-dimensional chromatographic sepn. of nicotinic acid and amide, *N*-methylnicotinamide, trigonelline, tryptophan, *p*-aminobenzoic acid, *N*-methyl-2-pyridone-5-carboxylic acid and amide, and *N*-methyl-2-pyridone-3-carboxylic acid and amide.

8274. AOYAMA, MASATARO. **Indirect estn. of the genuine vitamin A content.** *Kitasato Arch. Exptl. Med.* 24, 415 (1952).—*C.A.* 47, 830*c*.

Chromatographic development on "BL6" Al_2O_3 of the unsaponifiable fraction of liver oil gave 5 absorption zones, the third of which corresponded to vitamin A alc. Each zone was fluorescent and showed blue to violet color on addn. of the Carr-Price reagent. The genuine vitamin A content was obtained by subtracting the total fluorescence of glycerol dichlorohydrin of the non-vitamin A fractions from that of the total unsaponifiable fraction. Since this development required 1.5 to 2 hrs, the vitamin A was largely lost while the non-vitamin A fractions remained unchanged.

8275. ASPINALL, G. O. AND TELFER, R. G. J. **The isolation of sucrose from the partial hydrolysis of the fructosan from Lolium perenne.** *Chemistry & Industry* 1952, 1244-5.—*C.A.* 47, 5706*i*.

Heating an aq. soln. of fructosan from perennial rye grass at 100°C for several hrs followed by sepn. of products first on charcoal columns and secondly on cellulose columns gave glucose, fructose, a mixt. of disaccharides, and a mixt. of higher oligosaccharides. The disaccharides were further sepd. on Whatman·3MM sheets yielding sucrose (not depressed with authentic sample of sucrose) and formed octaacetate. On graded hydrolysis and chromatographic sepn. a non-reducing trisaccharide gave fructose, sucrose, and a fructose contg. disaccharide.

8276. BAGGESGAARD-RASMUSSEN, H.; FUCHS, D., AND LUNDBERG, LISE. **Use of ion exchangers in analysis of salts of weak organic acids and bases.** *J. Pharm. Pharmacol.* 4, 566-72(1952). —*C.A.* 46, 9254*g*.

Strongly basic Amberlite IRA-400 was used for salts of alkaloids, antihistamines, and other weak org. bases. The eluted base was titrated with 0.1 *N* HCl in 50% EtOH medium with Bromophenol Blue indicator. Amberlite IR-100H was used for Na and Ca salts of org. acids. The eluted acid was titrated with 0.1 *N* alkali with phenolphthalein as indicator. Solvents for development and elution, and percentage recoveries were tabulated. The presence of neutral salts, e.g. NaCl, affected the results. Unsatisfactory results were obtained with physostigmine salicylate, histamine, carbacholine, homatropine-MeBr, and morphine.

8277. BERG, A. M. **Paper-chromotographic investigation of ergotoxine and ergotinine.** *Pharm. Weekblad* 87, 282-3(1952).—*C.A.* 46, 8325*d*.

A sepn. of ergotoxine into 3 components was obtained by means of circular chromotography with buffered filter paper (Schleicher and Schull 2043 B, McIlvaine buffer, pH = 3) and benzene with a soln. of 10% EtOH in H_2O. The bands were identified by comparison with similar bands of ergocryptine, ergocristine, and ergocornine. By the chromotographic analysis of ergotinine a band was discovered, identical with that produced by ergocristinine.

8278. BLASS, JUDITH. **Chromatographic study of Nuoc-Mam.** *Ann. inst. Pasteur* 83, 791-9 (1952). —*C. A.* 47, 3488*c*.

Nuoc-Mam was a fish hydrolyzate used as a condiment and food. All of the amino acids except histidine were detected by paper chromatography. Also 3 spots, probably of bacterial origin, which corresponded to α-aminobutyric acid, γ-aminobutyric acid, and possibly 5-aminopentanoic acid were detected. Another weak spot may be histamine. Before chromatography the salt was removed by pptn. with Me_2CO and acidified with HCl.

8279. BÖHME, H. AND LAMPE, H. **Behavior of alkaloid salts on aluminum oxide columns. II. The hydrochlorides of papaverine, narcotine, codeine, and atropine.** *Arch. Pharm.* 285, 175-87(1952).—*C. A.* 46, 10534*h*.

The behavior of the HCl salts of atropine ($K_b = 4.5 \times 10^{-5}$), quinine ($K_b = 1.0 \times 10^{-6}$), codeine ($K_b = 9.0 \times 10^{-7}$), narcotine ($K_b = 1.5 \times 10^{-8}$), and papaverine ($K_b = 8.0 \times 10^{-9}$), on Al_2O_3 columns was investigated to elucidate the relation between the base strength of an alkaloid and its reaction with Al_2O_3. The equil. $[BH]^+ + H_2O \rightleftharpoons B + [H_3O]^+$ (where *B* represented the alkaloid base) was displaced to the right to an extent which was inversely proportional to the K_b of the alkaloid. The soly. of the free base in the solvent was important; if the base was very sol., it would not be pptd. on the column.

8280. BORENSZTAJN, D. AND KURYLOWICZ, W. **Preparation of vitamin B_{12} concentrates from fermentation of Streptomyces strains.** *Med. Doświadczalna i Mikrobiol.* 4, 483-518(1952).—*C. A.* 47, 4551*i*.

Vitamin B_{12} was sepd. by adjusting the pH of the fermentation medium to 2.5-3.0 (with 3% H_2SO_4), heating at 65°C for 10 min., and centrifuging. The supernatant was filtered, mixed for 1/2 hr with 1% active charcoal, then centrifuged. This step was repeated. The charcoal, washed with 10 vol. H_2O, was eluted 4 times with 75% Me_2CO at pH 9.3 (adjusted with 1 *N* NaOH). The final vol. of Me_2CO was 1/5 of vol. of fermentation medium. Me_2CO was distd. after adjusting the pH to 7 (with H_2SO_4), the soln. concd. on a water bath, and filtered through a Seitz filter. Use of ion exchangers to remove excess of salts led to further concn. of the product which contained no pyrogens, proteins, and had no antigenic and no local irritating properties. The purity was demonstrated by paper chromatography.

8281. BOSCOTT, RONALD J. **The use of hydrotropic agents and electrolytes in paper chromatography.** *Chemistry & Industry* 1952, 472-3.—*C. A.* 46, 9010*h*.

Satd. aq. Na *p*-toluenesulfonate was used as the stationary phase for the paper chromatography of steroids to increase their water soly. for better sepn. A 20% KCl soln. at 34°C and at room temp. was found useful in sepg. acidic and phenolic compds.

8282. BRAUNSBERG, HANNELORE. **Purification of commercial samples of estrone.** *Nature* 169, 967-8(1952).—*C. A.* 46, 9798*d*.

Paper chromatography of the (*p*-nitrophenylazo) dimethoxyaniline ("Fast Black Salt *K*") derivs. of 2 com. samples of estrone showed small traces of an impurity which appeared as a blue spot with lower R_f value than the pink estrone dye. This substance could be removed from the estrone by means of partition chromatography on a "Celite" -NaOH column. Paper chromatograms, run before and after purification by our technique, showed that the impurity was completely removed by this means.

8283. BREUER, H. AND SCHREIBER, F. W. **The analysis of ammoniated dentifrices.** *Proc. Sci. Sect., Toilet Goods Assoc.* 17, 28-9(1952).—*C. A.* 46, 9785*a*.

A complete description of the method of analysis and procedure based on the use of an ion-exchange resin was given. The method offered a practical and simple way to separate NH_4 salts from urea in ammoniated dentifrices.

8284. BROWN, F. **Estimation of vitamin E. Separation of tocopherol mixtures occurring in natural products by paper chromatography.** *Biochem. J.* 51, 237-9(1952).—*C. A.* 46, 8326*b*.

Mixts. of racemic tocopherols were readily sepd. by using aq. EtOH (75% wt/vol.) as the mobile phase and Vaseline-coated paper as the stationary phase. The latter was prepd. by dipping Whatman No. 1. filter paper in a 2.5% (wt/vol.) of Vaseline in ether, and drying in the air. The β- and γ-isomers could not be sepd. since the R_f values were: α 0.50; β 0.72; γ 0.72; δ 0.84, but this was not serious. The β compd. was found only in wheat-germ oil. The presence of δ-tocopherol in soyabean oil was established by the chromatographic method. On the other hand, a substance in cocksfoot grass, which gave a color with diazotized *o*-dianisidine, was shown to be different from any known tocopherol, while in wheat germ oil a nontocopherol ferric-reducing substance was found which was not removed by sapon., adsorption, or crystn.

8285. BRÜGGEMANN, JOHANNES AND BRONSCH, KURT. **Model experiments for the use of adsorption agents in veterinary medicine.** *Monatsh. prakt. Tierheilk.* 4, 246-58(1952).—*C. A.* 46, 9805*c*.

Models were used to det. which physiol. important capillary materials were adsorbed by various types of charcoal. In addn. to bacteria and toxins other surface-active agents, such as intestinal content, trypsin, tryptophan, and carotene were always adsorbed by the adsorbents which, therefore, may be damaging to the patient.

8286. BUSH, I. E. AND TAYLOR, D. A. H. **Paper chromatographic examination of the cardiac aglycones of Strophanthus seeds.** *Biochem. J.* 52, 643-8(1952).—*C. A.* 47, 2938*f*.

Grind 1 g of the seed, ext. for 2 hrs with 150 ml MeOH in a Soxhlet, evap. to 25 ml, dil. with 5 ml H_2O, and ext. 3 times with 25 ml light petroleum. Reflux for 30 min. the aq. soln. dild. with 30 ml 0.1 *N* H_2SO_4, cool, ext. twice with 50 ml $CHCl_3$, and evap. to 5 ml. One drop of the ext. was sufficient for paper chromatography, in which aq. MeOH was used as the stationary phase. The spots were developed with a 1% 3,5-dinitrobenzoic acid in 0.5 *N* 50% (vol./vol.) aq. MeOH KOH.

8287. Castagnou, R. and Quilichini, R. **Chromatographic study of apiine and apiol.** *Bull. soc. pharm. Bordeaux* 90, 16-19, 20-4(1952).—*C.A.* 46, 7283*i*.

Color reactions of apiine and apiol were reviewed and applied to paper chromatographs prepd. by ascending development with different simple and mixed solvents. R_f values were detd. for apiine and apiol separately and in mixts.

8288. Chambers, M. A.; Zill, L. P., and Noggle, G. R. **The use of ion-exchange resins with glycosides.** *J. Am. Pharm. Assoc.* 41, 461-4 (1952).—*C.A.* 46, 11588*f*.

The sepn. of glycosides was due to the adsorption of the aglycon moiety rather than ion-exchange adsorption of the borate complexes.

8289. Chang, Hson Mou. **Separation of menthol from mint oils by fractional distillation and by chromatographic adsorption.** *Iowa State Coll. J. Sci.* 26, 181-2(1952).—*C.A.* 47, 2434*c*.

Crude menthol was sepd. from the resins in the residue by steam distn. Then digestion with H_2O produced U.S.P. menthol in 85% yield compared to 40-50% by freezing out. By chromatographic sepn. almost 100% of both menthone and menthol could be recovered. Mint oil was adsorbed on 100-200 mesh activated carbon and washed successively with: (1) 80 parts Skellysolve D to 20 parts CCl_4; (2) CCl_4; (3) CCl_4 + 10% menthol.

8290. D'Aló, F. and D'Aló, G. **Considerations on the mechanism of the enhancement of the activity of steroids by aluminum phosphate gel.** *Riv. ist. sieroterap. ital.* 27, 146-8(1952).—*C.A.* 46, 10548*i*.

According to recent studies on the activity of steroids (testosterone, testosterone propionate, methylandrostenediol) adsorbed on Al phosphate gel, the enhancement of the activity seemed to be related to some unknown factor, besides the adsorption rate and the degree of soly.

8291. Davis, Richard B.; McMahon, John M., and Kalnitsky, George. **Separation of D vitamins from other sterols by paper chromatography and the quantitative determination of 7-dehydrocholesterol.** *J. Am. Chem. Soc.* 74, 4483-4 (1952).—*C.A.* 47, 3520*h*.

The sepn. of the vitamins D_2 and D_3 (in 40-γ quantities) from a mixt. of cholesterol, 7-dehydrocholesterol, ergosterol, and sitosterol by chromatography on Whatman no. 1 filter paper impregnated with Quilon was described.

8292. Deshusses, J. and Desbaumes, P. **Determination of dyes in lip rouge, face paints, ointments, and brilliantines by chromatography with alumina disks.** *Mitt. Gebiete Lebensm. u. Hyg.* 43, 501-4(1952)(in French).—*C.A.* 47, 5076*a*.

The dyes in cosmetic fats were sepd. by using chromatography with Al_2O_3 disks.

8293. Doman, N. G. and Kagan, Z. S. **Determination of phosphorus esters by chromatographic distribution on filter paper.** *Biokhimiya* 17, 719-24(1952).—*C.A.* 47, 4795*f*.

The P esters were hydrolyzed directly on the chromatogram (linen filter paper) with alk. phosphatase prepd. from the duodenum of cattle. The best solvent for the chromatograms was a mixt. of 80 ml MeOH, 12.5 ml of 1.2*N* NH_4OH, and 27.5 ml H_2O. This solvent did not sep. glucose 1-phosphate and fructose 6-phosphate. Inorg. salts and impurities found in leaf exts. did not interfere. By developing parallel chromatograms, with and without enzymes, it was possible to differentiate between easily and difficultly hydrolyzable P esters.

8294. Dowler, M. Wilhelmina and Laughland, D. H. **Application of chromatography to estimation of vitamin A in low-potency fish oils.** *Anal. Chem.* 24, 1047-9(1952).—*C.A.* 46, 9790*d*.

A soln. of fish oil in Skellysolve B was placed on a 6 × 20 mm column of 120-mesh bone meal, previously extd. with Skellysolve B and acetone and dried at 110°C. Vitamin A esters were eluted with Skellysolve B and the free alc. with a soln. of 20% Me_2CO in Skellysolve B. Vitamin A content of the eluates was estd. from the absorption at 325 mμ.

8295. El Ridi, M. S. and Khalifa, K. **Chromatographic purification and ultraviolet spectrophotometric assay of strychnine in galenicals.** *J. Pharm. and Pharmacol.* 4, 190-6(1952).—*C.A.* 46, 5259*f*.

Pack 15 g of active Al_2O_3 to form a 14-cm adsorption column in a tube 25-30 cm × 1.3 cm, connect with suction, pour in 2 ml of liquid ext., apply gentle suction, and before the liquid begins to disappear from above the column add 86% EtOH in small portions to wash down the sides of the tube, then wash the column with larger amts. of 86% EtOH until the percolate was alkaloid-free (about 50 ml. of 86% EtOH). Transfer to a 100-ml flask, make to vol. with 96% EtOH, distil a 20-30 ml aliquot, dissolve the residue in 10 ml of 3% H_2SO_4, dissolve 0.5 g of $K_2S_2O_8$ (used to oxidize brucine) in the soln. by shaking, keep in a water bath at 60-70° for 1 hr, cool, transfer to a 100-ml flask with H_2O, mix, and filter through a dry paper and funnel into a dry flask. Det. the strychnine by measurement at 254 mμ.

8296. Erbring, H. and Wulf, W. **Paper chromatographic analysis as an aid in the investigation of the contents of plants. I. The contents of Hydrastis canadensis (together with the paper chromatographic analysis of the alkaloids berberin, hydrastin, hydrastinin, canadin).** *Kolloid-Z.* 125, 99-105(1952).—*C.A.* 46, 6326*f*.

Directions were given for the construction of a chromatographic chamber for 1 and 2 dimensional presentations. Fluorescence was used to investigate the variables in the detn.

8297. EVANS, W. C. AND PARTRIDGE, M. W. **Partition chromatography of alkaloids. IV. Assay of solanaceous drugs.** *J. Pharm. and Pharmacol.* **4**, 769-79, discussion, 779-80(1952).—*C. A.* 47, 1333*c*.

To det. hyoscine and hyoscyamine, remove the alkaloids from the crude drug mixed with $Ca(OH)_2$ by percolation with Et_2O. Evap. the Et_2O, dissolve in CCl_4, and develop on a column of kieselguhr (Hyflo Super-Cel or Celite No. 545) mixed with phosphate buffer pH 5.9-6.2 and CCl_4. Elute the hyoscine with Et_2O and then elute the hyoscyamine with $CHCl_3$. Det. the amt. of alkaloids by titration in Et_2O soln. with 0.005 *N* H_2SO_4 with const. stirring and with bromocresol green indicator.

8298. FRÉREJACQUE, MARCEL. **The digitalic poison of Menabea venenata.** *Compt. rend.* **234**, 1802-4(1952).—*C. A.* 46, 9262*i*.

By extg. dried, powd. roots with "soln. B," acetone recrystn., and chromatography, a white cryst., non-acid, non-acetylatable, non-reducing body was obtained. It gave no color tests of digitalics. MeOH extn. of roots gave a H_2O-sol. ext. This was extd. with ether, then $CHCl_3$; all 3 portions gave color tests of digitalics. Fractions were separately hydrolyzed, Al_2O_3 chromatographed, and every one yielded about 10% of digitoxigenin.

8299. FUJISE, SHINICHIRO AND TATSUTA, HARUO. **Paper chromatography of flavanones and related compounds.** *J. Chem. Soc. Japan*, Pure Chem. Sect. **73**, 35-6(1952).—*C. A.* 47, 3525*g*.

Paper chromatograms were examd. on liquiritin, hesperidin, sakuranin, isosakuranin, rutin, quercetin, and more than 20 samples of hydroxy chalcones and flavanones. The solvents used were $CHCl_3$ satd. with H_2O, AcOEt, BuOH + AcOH (4:1), PhOH, xylene + AcOH (1:3 and 3:1). The spraying reagents were aq. Na_2CO_3, aq. $FeCl_3$, Na_2CO_3, and diazotized $PhNH_2$, etc.

8300. GIRI, K. V.; KRISHNAMURTHY, K., AND VENKATASUBRAMANIAN, T. A. **Separation and identification of amino acids from protein hydrolyzates by circular paper chromatography.** *Current Sci.* (India) **21**, 11-12(1952).—*C. A.* 46, 6999*d*.

Circular paper chromatography was applicable to protein hydrolyzates when modified so that the butanol-AcOH was supplied by a small wick in a hole at the center of the paper. Histidine, aspartic acid, proline, leucine, lysine, threonine, phenylalanine, arginine, methionine, glutamic acid, glycine, serine, valine, isoleucine, alanine, cystine, and tyrosine were identified in a casein acid hydrolyzate.

8301. GIRI, K. V. AND RAO, N. A. N. **Circular paper chromatography. I. A technique for the separation and identification of amino acids.** *J. Indian Inst. Sci.* **34**, 95-105(1952). —*C. A.* 46, 9019*f*.

8302. GORE, D. N. AND ADSHEAD, J. M. **Observations on the paper partition chromatogram as applied to the detection of alkaloids.** *J. Pharm. and Pharmacol.* **4**, 803-9; discussion 809-10(1952).—*C. A.* 47, 1894*d*.

By using the descending technique and solvent systems contg. BuOH 40-AcOH 10-H_2O 50, BuOH 10-HCO_2H 1-H_2O 10, and BuOH 10-$C_2H_5CO_2H$ 1-H_2O 10, R_f values were reported for the following alkaloids and a salt of each: atropine, brucine, cocaine, codeine, diamorphine, homatropine, hyoscine, hyoscyamine, physostigmine, pilocarpine, quinine, and strychnine. The alkaloids were revealed by spraying the chromatogram with 0.2% I soln. Fading rates, colors, and other characteristics of the developed spots were discussed.

8303. GRIEG, ARNE. **Paper chromatographic separation of barbituric acids.** *Nature* **170**, 845 (1952).—*C. A.* 47, 3759*a*.

After development of chromatograms the dried paper was sprayed with 0.5 *N* NaOH and dried again. It was then brought in firm contact with a fluorescent screen and placed in front of an ultraviolet lamp with the paper facing the light. A low-pressure Hg lamp and a filter letting through a monochromatic light of about 2537 A. and a screen which fluoresced in this light was used. Since the barbituric acids absorbed very highly at a pH 9-10, the zones were seen as dark spots on the fluorescent screen. The method was very sensitive and could be used for the detection of other substances absorbing ultraviolet light.

8304. GRIFFON, HENRI AND ROMANO, CARLO. **Toxicology of strychnine and brucine. I. Chromatographic separation of strychnine from some of its derivatives and from brucine.** *Ann. pharm. franc.* **10**, 497-514 (1952).—*C. A.* 47, 2938*d*.

Unidimensional paper chromatography with ascending solvent was combined with bidimensional treatment, in which the undeveloped chromatogram from the first method was dried and subjected to chromatography by turning the paper at an angle of 90° and using another solvent. The solvent in the first case was Me_2CO 150, Et_2NH 10, and H_2O 40 cc. To prep. a solvent that fixed strychnine but permitted chromatography of brucine, mix a soln. of 30 cc. HCl in 200 cc. of BuOH with a soln. of 10% $K_4Fe(CN)_6$ 50, glycerol 5, and EtOAc 5 cc. and, after standing, filter the upper, org. layer. Bidimensional chromatography was carried out with Me_2CO and BuOH.

8305. HALL, NATHAN A. **Clarification of glycyrrhiza fluidextract U.S.P.** *Am. J. Pharm.* **124**, 43-7(1952).—*C. A.* 46, 6321*g*.

Sedimentation with bentonite 1:1500 resulted in a clear percolate, easily filterable without the use of filter-aid. Comparison of finished fluidexts. made with and without the use of clarifying agents revealed no marked difference in appearance or taste when clarifying agents were used. Bentonite clarification also seemed to improve the stability of the finished fluidext.

8306. HIGUCHI, T. AND PATEL, K. P. **Separation and analysis of aspirin-phenacetin-caffeine combination by partition chromatography.** *J. Am. Pharm. Assoc.* **41**, 171-3(1952).—*C. A.* 46, 6323*d*.

Phenacetin and caffeine were sepd. by a chromatographic column and detd. spectrophotometrically in the eluate.

8307. Higuchi, T.; Patel, K. P.; Bonow, E. R., and Landsman, J. **Chromatographic separation and determination of mixtures of *p*-hydroxybenzoate esters.** *J. Am. Pharm. Assoc.* 41, 293-5(1952).—*C. A.* 46, 7940*f*.

A method of sepg. and detg. constituents of these mixts. was based on their preliminary extn. from the product, sepn. of the component esters by chromatography, and detn. of the individual constituents by ultraviolet spectrophotometry.

8308. Husa, W. J. and Littlejohn, Oliver M. **Some pharmaceutical uses of activated charcoal.** *J. Am. Pharm. Assoc., Pract. Pharm. Ed.* 13, 412-14(1952).—*C. A.* 46, 9251*h*.

There was a definite relationship between the packing of the sample into a capsule and the settling of the sample in a graduate. Trituration of the charcoal seemed to make the particles repel each other more, and less could then be packed into a capsule. In charcoal and pepsin combinations, pepsin was adsorbed to some extent on the charcoal, which will still meet the National Formulary requirements. Charcoal could be wetted with propylene glycol (37.5 cc. per 100 g of charcoal) and then be easily packed into a smaller capsule by the "punching" method.

8309. Hüter, Friedrich. **Differentiation between adrenaline and arterenol in the paper chromatogram with the aid of fluorescence analysis.** *Arzneimittel-Forsch.* 2, 91-2(1952).—*C. A.* 47, 6605*i*.

Autoxidation of adrenaline in very dil. soln. gave adrenochrome. This was then oxidized to the colorless 1-methyl-3,5,6-trihydroxyindole, which had in very small amts. (1 γ or less) a bluish and in larger amts. a green, fluorescence. Arterenol gave an oxidation product with blue fluorescence.

8310. Izmaĭlov, N. A. and Shostenko, Yu. V. **Adsorption method of isolation of substances from dilute solutions. II. Some peculiarities of molecular adsorption from a stream of solution.** *Zhur. Priklad. Khim.* 25, 602-9 (1952).—*C. A.* 47, 6706*c*.

The adsorption of caffeine from aq. soln. on granulated anthracite coal showed that the process was in accord, within wide limits of velocity of the flowing soln., with the laws established for adsorption of gases. For a caffeine soln. there existed a limiting rate of flow of the soln. past the adsorbent at which the max. satn. of the adsorbent still corresponded to its static activity; there also existed a critical flow rate above which the max. adsorption no longer depended on flow rate. The processes appeared to be connected with diffusion within the pores of the adsorbents. The independence of max. adsorption of flow rate appeared in the present case to arise above 2400 liters/hr/m^2.

8311. Jakubec, J. **Identification of sulfonamides by paper chromatography.** *Čzechoslov. Farm.* 1, 43-7(1952).—*C. A.* 46, 9789*c*.

The sepns. obtained by BuOH alk. with 1% NH_3 and BuOH alk. with 0.1% Et_2NH and by acidified BuOH were compared. Alkalization of BuOH with Et_2NH was more effective than with volatile NH_3. The R_f values of the following prepns. were given: sulfadiazine, sulfadimidine, sulfaguanidine, sulfanilacetamide, sulfanilamide, sulfanilcarbamide, sulfapyridine, and sulfathiazole.

8312. Jensen, Kjell Briseid. **Paper chromatographic separation and fluorometric determination of gitoxigenin, gitoxin, and purpurea glycoside B.** *Acta Pharmacol. et Toxicol.* 8, 110-16(1952).—*C. A.* 46, 10538*c*.

The compds. were sepd. by one-dimensional chromatography on filter paper by using a 5:5:1 $CHCl_3$-H_2O-MeOH mixt. At 22°C gitoxin and gitoxigenin traveled together; at 17°C all 3 substances sepd.

8313. Jentzsch, K. **Paper chromatographic separation of solanum alkaloids. Separation of atropine (hyocyamine), scopolamine, tropine, and scopoline.** *Scientia Pharm.* 20, 216-23 (1952).—*C. A.* 47, 4552*e*.

The alkaloids were sepd. downward for 12 hrs on Whatman No. 1 paper in an atm. satd. with concd. HCl (dild. 1:1) which had been shaken with a 1:1 mixt. of $CHCl_3$ and BuOH. At 23°C the R_f values were for atropine 0.89, scopolamine 0.79, tropine 0.50, and scopoline 0.30. The least observable amt. was about 10 γ. The developer was a modified Dragendorff's reagent made by dissolving 7 g of KI and 1.5 g of $BiONO_3$ in a boiling mixt. of 18 ml H_2O and 3 ml 4 *N* HCl, cooling, adding 1.5 g I, and dilg. with an equal vol. of H_2O. Before use, 2 ml of this soln. was mixed with 3 ml 25% HCl and made up to 130 ml with H_2O.

8314. Jermstad, Axel and Waaler, Tor. **Paper partition chromatography of analgesics and antipyretics.** *Dansk Tidsskr. Farm.* 26, 205-11 (1952).—*C. A.* 47, 4551*g*.

Paper chromatographic analyses of acetanilide, acetylsalicylic acid, aminopyrine, phenazone, and phenacetin were described. As solvent system was used a mixt. of petr. ether (b.p. 65-70°C) 25, MeOH 10, C_6H_6 20, and H_2O 0.5 parts by weight. The following R_f values were found: acetanilide 0.4, acetylsalicylic acid 0.05, aminophenazone 0.67, phenacetin 0.45, and phenazone 0.32. The spots were developed either with $FeCl_3$ or Millons reagent.

8315. Jindra, A. and Motl, O. **The determination of antihistaminics by means of ion-exchange chromatographic method.** *Československ. farm.* 1, 632-7(1952).—*C. A.* 47, 5071*e*.

Some ethanolamines (antihistamine, Substance III(325), and Probedryl) and some ethylendiamines (Antistine, Neo-Antergan, and Phenergan) were detd. with Amberlite IRA-400 and by titration of the free bases.

8316. Jindra, A. and Rentz, J. **Determination of local anesthetics by ion exchange.** *J. Pharm. Pharmacol.* 4, 645-7(1952).—*C. A.* 46, 10540*d*.

The acid component of local anesthetics (20-50 mg) was adsorbed on a column of 8-10 g of Amberlite IRA-400 from soln. in 20 ml of a mixt. of H_2O 5, and 95% EtOH 15 ml, and the bases were eluted with 30 ml of hot EtOH(96%) and titrated with 0.1 *N* HCl. The method was applied successfully to procaine, larocaine, tutocaine, nupercaine, amylocaine, amethocaine, and diocaine. Most deviations from the theoretical content were less than 0.5%.

8317. Jindra, A. and Rentz, J. **The determination of sympathomimetic amines by exchange of ions.** *Českoslov. farm.* 1, 625-30(1952).—*C. A.* 47, 5071*g*.

Ephedrine, amphetamine, Privine, ephetonal, and Pervitin were estd. on Amberlite IRA-400. Amines contg. a phenolic OH could not be estd. in that way.

8318. Klementschitz, W. and Mathes, P. **Paper-chromatographic separation of some coca alkaloids.** *Scientia Pharm.* **20**, 65-9 (1952).—*C. A.* 46, 9781*g*.

If cocaine and ecgonine were chromatographed upward together on Schleicher and Schüll paper No. 2043a in a 6-liter chamber at 20°C (5° changes produced only ± 3% changes in R_f) with mixts. of H_2O and $(CH_2OH)_2$ no sepn. was obtained in an atm. satd. with H_2O alone. To sep. cocaine-HCl, ecgonine, benzoylecgonine, and tropacocaine-HCl, Schleicher and Shüll paper No. 2043b and a mixt. of MeCOEt 30, H_2O 5, C_5H_5N 0.5, H_2O and $(CH_2OH)_2$ 1.5, and ligroine 3.5 parts were used. The atm. was satd. with the solvent mixt. The atm. made a difference.

8319. Kopaczewski, Wladislas. **The role of biochemical factors in the passage of hydrosols through a lipide barrier.** *Compt. rend.* 234, 1491-3 (1952).—*C. A.* 46, 6464*d*.

The capillary ascension of aq. solns. on filter paper through a 6 cm layer of oil was studied. Concns. of 0.1-0.5% of the following compds. were used: Quillaja saponin, Na gentisate, thiosinamine, acetylcholine chloride, tannin (in EtOH soln.), atropine H_2SO_4, camphor, nicotine, pilocarpine-H_2SO_4, adrenaline, Na salicylate, methyl-4-esculoside, and *L*-ascorbic acid.

8320. Koštíř, J. V. and Přistoupil, T. I. **Separation of creatinine and glycocyamidine by paper chromatography.** *Českoslov. farm.* 1, 647-9(1952).—*C. A.* 47, 5071*c*.

A mixt. of PhOH (satd. with H_2O), BuOH, and H_2O (1:1:2) and Whatman 1 or Schleicher-Schüll 605 paper were used for sepn. of creatinine, glycocyamidine, creatine, and Na pyruvate. Detection was made by means of Jaffé reaction.

8321. Koštíř, J. V.; Rybář, D. J.; Oulehla, B.; Hais, I. M., and Beran, M. **Alkaloids of ergot. VII. Distinguishing ergot containing ergotamine from that containing ergotoxine by means of chromatography of hydrolyzates of alkaloids.** *Českoslov. farm.* 1, 621-5(1952).—*C. A.* 47, 5071*h*.

The isolated raw alkaloids were hydrolyzed with NaOH, and the resulting keto acids were identified by paper chromatography either free (mixt. of BuOH and NH_3 as solvent, detection with a soln. of o-$C_6H_4(NH_2)_2$ in Cl_3CCOOH) or after conversion into 2,4-dinitrophenylhydrazones (mixt. of EtOH and $C_6H_5CH_2Cl$ as solvent, detection with NaOH). Dimethylpyruvic acid in the hydrolyzate proved that the alkaloids were of the ergotoxine group and the pyruvic acid of the ergotamine group.

8322. Kressman, T. R. E. **The practical possibilities of ion exchange. I. The separation of ions. II. Ion exchangers in chemical analysis. III. Ion exchange in the organic, biochemical, and medical fields. IV. New processes and materials.** *Mfg. Chemist* 23, 93-5, 98, 149-51, 160, 194-7, 241-3 (1952).—*C. A.* 46, 8903*e*.

Separation of rare earths and fission products, amino-acids, those depending upon differences in ionic size, and dyes were discussed. The characterization and preparation of some ionic species for analysis were outlined.

8323. Lawday, Dorothy. **Detection of digitalis glycosides on paper chromatograms.** *Nature* 170, 415-16(1952).—*C. A.* 47, 5075*e*.

The glycoside soln. was applied to the starting line with a micropipet in a spot not more than 0.5 cm in diam. The chromatogram was then developed until the solvent front had run 30 cm. The dried chromatogram was treated with a 20% soln. of $SbCl_3$ in dry, alc.-free $CHCl_3$, and the paper was heated for 3-5 min. at 70°C. The glycoside color and sensitivity (γ) in visible light and color and sensitivity (γ) in ultraviolet light were given: digitoxin, red-mauve, 0.75, red, 0.25; gitoxin, mauve to gray, 0.75, apple green, 0.25; digitoxigenin, pale turquoise blue 1.0, neg.,—; gitoxigenin, orange-yellow, 0.75, bright orange, 0.25.

8324. Lederer, M. and Siberman, H. **The separation of thiouracil and some of its alkyl homologs by paper chromatography.** *Anal. Chim. Acta* 6, 133-4(1952)(in English).—*C. A.* 46, 7476*b*.

A mixt. of thiouracil, methylthiouracil, and propylthiouracil could be sepd. by paper chromatography with AmOH/water, and the spots shown up with I_2 vapors or by spraying with dichlorobenzoquinonechloroimide and alkali.

8325. Lens, J.; Wijmenga, H. G.; Wolff, R.; Karlin, R.; Winkler, K. C., and Haan, P. G. de. **Vitamin B_{12}. III. The assay of vitamin B_{12}.** *Biochim. et Biophys. Acta* **8**, 56-65(1952).—*C. A.* 46, 6325*c*.

It was found that after the addn. of KCN, purified liver-exts. could be chromatographed on Al_2O_3, the vitamin B_{12} being collected as a single band which could be measured spectrophotometrically.

8326. Levi, Leo and Farmilo, Charles G. **Determination of narcotics by ion-exchange.** *Can. J. Chem.* 30, 793-9 (1952).—*C. A.* 47, 3518*e*.

Codeine, phosphate, morphine sulfate, methorphinan hydrobromide, and the hydrochlorides of methadone, phenadoxone, alphaprodine, cocaine, pethidine, diamorphine, dilaudid, morphine, and papaverine were quantitatively detd. with a precision of ± 1.6% by ion-exchange chromatography. A weakly basic anion exchanger (Amberlite IR-4B) was employed. The method was found to be applicable to pharmaceutical preparations and narcotic seizures, provided these did not contain additional ionizable material.

8327. Ludwig, B. J.; Holfeld, W. T., and Berger, F. M. **Cation-exchange properties of alginic acid.** *Proc. Soc. Exptl. Biol. Med.* 79, 176-9 (1952).—*C.A.* 46, 4319*c*.

Alginic acid possessed Na- and K-ion exchange properties that compared favorably with those of a carboxylic-type cationic exchange resin. *In vitro* at pH 7.6 it took up 4.2 milliequiv. Na$^+$/g. The total cation adsorption from solns. contg. K$^+$ and Na$^+$ was also 4.2 milliequiv./g and the ratio of Na/K taken up approximated that present in the soln. The adsorption of Ca^{++} by alginic acid was irreversible and independent of pH.

8328. Luis, Policarpo. **A case of detection of DDT in viscera.** *Rev. asoc. bioquím. argentina* 17, 334-8(1952).—*C.A.* 47, 6821*c*.

The viscera of a poisoned person did not contain alkaloids but an aromatic residue of insecticidic properties. Chromatography on alumina: sodium trisilicate left a soln. of a pure substance which gave the tests for DDT and which after recrystn. from Me$_2$CO:AcOH:H$_2$O 1:1:1 had the microcrystallographic properties of DDT.

8329. Mariella, Raymond P.; Bernstein, Theodore B., and Mosher, Anne L. **Some purification studies on ragweed pollen.** *Bol. col. quím. Puerto Rico* 9, 15-24(1952)(in English).—*C.A.* 47, 1331*f*.

The dry, clean pollen of short ragweed, *Artemisia artemisiaefolia elatior,* and of giant ragweed, *A. trifida*, contained, resp., nonvolatile Et$_2$O-sol. lipides 11.8 and 15.3, water-sol. ext. 26.4-27.0 and 18.5%. The nonsaponifiable portion of the lipides was chromatographed on basic alumina from petr. ether. It amounted to 1.8 and 2.0% of the lipides. The aq. exts. were chromatographed on acidic alumina; the coloring material was adsorbed; the colorless, active material ran through. It was arbitrarily cut into fractions which were tested for skin-activity and N content.

8330. McChesney, Evan W. **Neutrality regulation mechanisms in rats receiving sulfonic ion-exchange resin.** *Proc. Soc. Exptl. Biol. Med.* 79, 531-4 (1952).—*C.A.* 46, 5718*b*.

Rats receiving acid-form sulfonic resin responded by increasing their urinary output of acid phosphate and NH$_3$, but not in amts. sufficient to compensate for their fecal alkali loss. Those receiving moderate amts. of K-form resin showed little change in acid-base balance, while those on high K-resin intakes showed a partially compensated alkali retention.

8331. Melichar, M.; Žáček, H., and Smečka, V. **Bentonite of Czechoslovakia.** *Československ. farm.* 1, 203-4(1952).—*C.A.* 46, 10541*g*.

The Czechoslovakian product differed from bentonite USP XIII in its darker color and in pH of its suspensions.

8332. Merklen, Félix Pierre and Masseyeff, René. **Adsorption of albumin as a cause of error in the quantitative estimation of serum proteins by electrophoresis on filter paper.** *Compt. rend. soc. biol.* 146, 1905-8 (1952).—*C.A.* 47, 10601*a*.

Some of the albumin fraction was adsorbed and firmly held by the paper; this resulted in trailing throughout the length of the path of protein travel. The effect was greater with the thicker papers. A thin paper such as Whatman No. 1 was preferred.

8333. Miller, Howard and Kraemer, D. M. **Benzidine reagent in paper chromatography.** *Anal. Chem.* 24, 1371-2(1952).—*C.A.* 46, 11017*d*.

The R_f values and colors produced by spraying paper chromatograms of 20 inorg. compds. and 19 org. compds. (sugars and related compds.) with benzidine were given. The sprayed chromatograms were dried for 30 min. at 85°C to bring out the colors. Compds. were listed which did not react with benzidine: inorg. compds. (17), carbohydrates (10), amino acids and derivs. (38), and miscellaneous (30).

8334. Mizuno, Kimiaki. **Detection and determination of sulfapyrimidines by means of partition chromatography.** *Ann. Repts. Takeda Research Lab.* 11, 1-7(1952).—*C.A.* 47, 4796*c*.

A mixt. of sulfapyrimidines could be sepd. into each component by paper partition chromatography when Atkin's buffer soln. (pH 10 with H$_3$BO$_3$ and Na$_2$CO$_3$) was used as a stationary phase and BuOH with the buffer soln. as a mobile phase; it was also made by starch column partition chromatography with the same solvent system with exptl. error ± 5%.

8335. Morice, Isobel M. and Shorland, F. B. **The isolation from shark (Galeorhinus Australis)-liver oil of a multibranched C_{18}-saturated fatty acid fraction.** *Chemistry & Industry* 1952, 1267-8.—*C.A.* 47, 4048*g*.

Repeated crystn. of approx. 800 g hydrogenated Me esters from Me$_2$CO at −35°C, and the sol. portion fractionated at approx. 0.1 mm gave a fraction whose equiv. corresponded to a *Me ester of a C_{18}-satd. acid.* The fraction was chromatographed on Al$_2$O$_3$, eluted with light petr., and gave a first fraction, 2.82 g, which was saponified (some unsatd. unsaponifiable material was removed) to give 2.29 g of acid.

8336. Mukerji, B.; Ghosh, B.; Karkun, J. N., and Sadhu, D. P. **The chromatophorotropic hormone of the pituitary. I. Preliminary studies on the source and properties of the hormone.** *Indian J. Med. Research* 40, 243-9(1952).—*C.A.* 47, 2941*a*.

Melanophore hormone (intermedin) was assayed by an *in vitro* method employing isolated frog skin. The activity in an ext. representing 1 mg of a dried whole pituitary powder per cc., was chosen to equal 100 units of the hormone. Kaolin and charcoal adsorbed the hormone completely and Ca phosphate only slightly. Fuller's earth, Permutit, and kieselguhr accentuated the activity.

8337. Müting, Dieter. **Qualitative color reaction for the differentiation of amino acids on filter paper.** *Naturwissenschaften* 39, 303 (1952).—*C.A.* 47, 6820*i*.

For about 25 different amino acids characteristic colors were obtained on filter paper by spraying with 0.02% Folin reagent (1,2-naphthoquinone-4-sulfonic acid, Na salt) in 5% aq. Na_2CO_3 and drying at room temp. The same colors were also obtained by spraying of paper chromatograms of protein hydrolyzates. The color differentiation was better than with ninhydrin, especially for proline and hydroxyproline. The sensitivity was almost equal to that with ninhydrin.

8338. Novelli, Armando. **Identification of mixtures of sulfonamides by paper chromatography.** *Anales direc. nacl. quím.* (Buenos Aires) 5, No. 9, 7-9(1952).—*C. A.* 47, 5073*c*.

Binary or ternary mixts. of sulfathiazole, sulfaguanidine, sulfamerazine, sulfadiazine, sulfanilamide, sulfapyridine, and sulfamethazine could be sepd. and identified by their R_f values on Whatman No. 1 paper sprayed with a soln. contg. 1.0 g aminobenzaldehyde, 3 ml concd. HCl, and 100 ml H_2O. The solvents used were BuOH, AcOH, and H_2O (50-10-40) and BuOH, concd. NH_4OH, and H_2O (40-10-50). The pure compds. or tablets were prepd. by extn. with sufficient 1% NH_4OH soln. (vol./vol.) to give a concn. of 0.1 g/100 ml. A drop of the supernatant was placed on the paper and allowed to develop for 24-30 hrs at 20 ± 2°C.

8339. Paris, René A. **Paper chromatography of some flavone derivatives.** *Bull. soc. chim. biol.* 34, 767-72(1952).—*C. A.* 47, 4250*b*.

Results were summarized of expts. with 41 flavone derivs., by using BuOH-AcOH mixt., EtOAc, *m*-cresol, and $PhOH-H_2O$ as solvents. Sepns. were readily effected.

8340. Pérez Argilés, V. and Bastero Beguiristain, J. M. **Chromatography in legal medicine.** *Arch. med. exptl.* (Madrid) 15, 129-40(1952).—*C. A.* 47, 5308*b*.

The pigments of hair were sepd. chromatographically after treating the hair with 5% KOH below 60°C. Alkaloids contained in visceral exts. could be sepd. chromatographically, but ultrachromatography was not practical. Blood pigments and degradation products of hemoglobin were successfully detd. by this method.

8341. Ransy, J. **Chromatographic and spectrophotometric determination of vitamins of the B complex.** *J. pharm. Belg.* 7, 224-9(1952).—*C. A.* 46, 9258*i*.

Vitamins B_1 and B_2 were sepd. from B_6 and PP by paper chromatograms developed with H_2O-satd. BuOH. The sepd. groups were eluted from the paper and the solns. read in a spectrophotometer. Formulas for calcn. permitted detns. within ± 5%.

8342. San, Go Lam and Ultée, A. J. Jr. **Paper partition chromatography of sulfonamides.** *Nature* 169, 586(1952).—*C. A.* 46, 11050*c*.

Sulfonamides contg. an unsubstituted amino group were detected by diazotization (30-sec exposure to oxides of N) and coupling. Sulfonamides contg. a carboxyl group were detected by spraying with an indicator.

8343. Sannié, Charles and Lapin, Henri. **Paper chromatography of steroid sapogenins.** *Compt. rend.* 235, 581-2(1952).—*C. A.* 47, 5627*e*.

A developer consisting of a mixt. of gasoline (b.p. 100-125°C), $CHCl_3$, and HOAc 100:4:1 or 100:40:4 could be used to sep. steroid sapogenins. A compd. with an iso side chain at C_{17} traveled faster than the normal isomer, and an A/B cis compd. faster than the trans isomer. Compds. with α-OH seemed to travel faster than the β-isomers. Kammogenin and agavogenin were only separable after acetylation. The compds. were spotted by color tests.

8344. Schill, Göran and Ågren, Allan. **Separation of hyoscyamine and scopolamine.** *Svensk Farm. Tid.* 56, 55-7(1952)(in English).—*C. A.* 46, 6324*b*.

Hyoscyamine-HCl was sol. in $CHCl_3$ whereas scopolamine-HCl was not. This fact was utilized in a chromatographic sepn. of the two alkaloids. A soln. of hyoscyamine and scopolamine in $CHCl_3$ was poured through a column contg. 4 ml *M* HCl and 15 g kieselguhr. The column was eluted with 350 ml $CHCl_3$. The ext. contained hyoscyamine-HCl which was converted into the base by being passed through a second column contg. 4 ml *M* Na_2CO_3 and 15 g kieselguhr, this column was washed with 50 ml $CHCl_3$. Scopolamine was extd. from the first column with 200 ml $CHCl_3$ satd. with NH_4OH. The sepn. may be incomplete if less than 350 ml $CHCl_3$ was used. The same method could be used for the alkaloids in belladonna prepn.

8345. Scholl, A. W.; Bubernak, Joseph, and Galford, Robert R. **Carcinogenic effects of pyrolyzed hydrocarbons from internal-combustion-engine exhaust fumes.** *Proc. W. Va. Acad. Sci.* 23, 79-83(1952).—*C. A.* 47, 291*f*.

A preliminary report on chromatographic sepn. of combustion products of internal-combustion engines. Carcinogenic evaluation in mice was in progress.

8346. Schultz, Otto Erich and Gmelin, Rolf. **Paper chromatography of mustard oil drugs.** *Z. Naturforsch.* 7B, 500-6(1952).—*C. A.* 47, 3520*d*.

Crucifer seeds were ground and extd. with boiling MeOH. The exts. were chromatographed with $BuOH-HOAc-H_2O$ mixts. and *iso*-$BuOH-HOAc-H_2O$. Spots were detected in ultraviolet light, which showed characteristic changes on exposure to NH_3 or spraying with dil. KOH and were due to various pigments, sinapine, and sinapic acid. The glucosides were detected with 1% $Ag(NH_3)_2^+$ or 10% Cu^{++}. Mustard oil glucosides were also chromatographed in the form of thiourea derivs. and detected by $Ag(NH_3)_2^+$.

8347. Schultz, Otto Erich and Gmelin, Rolf. **Isolation of the glycoside of Lepidium sativum in the pure state by column chromatography on cellulose powder.** *Arzneimittel Forsch.* 2, 568-9(1952).—*C. A.* 47, 4048*a*.

A concd. ext. obtained by extn. of defatted seeds with MeOH was made into a paste with cellulose powder, dried, and chromatographed on a cellulose column with $BuOH:AcOH:H_2O$ 40:10:50. Fractions of 100 drops were collected. The glycoside appeared in fractions 21-28. After evapn. to dryness *in vacuo*, the residue was crystd. from a small vol. of H_2O.

8348. SEGAL, H. L. **Gastric analysis. Diagnostic value of intubation and tubeless techniques.** *Clin. Med.* 59, 207-12 (1952).

A quininium exchange indicator compd. produced by replacing the hydrogen ions on a cation exchange resin with quininium ions was fed to the patient and urine samples taken at specific intervals. The quinine present in the urine was extracted with ether and aq. sulfuric acid. Comparison with standards permitted detn. of the amt. of gastric acidity.

8349. SHANKAR, K. AND BARD, R. C. **The effect of metallic ions on the growth and morphology of Clostridium perfringens.** *J. Bact.* 63, 279-90 (1952).—*C. A.* 46, 5131g.

By use of a cationic exchange resin (Permutit H), a metal-deficient complex medium was obtained, which was used to det. the major ion growth requirements of Clostridium perfringens. For optimum growth, Ca^{++}, Mg^{++}, Fe^{++}, Na^{+}, and K^{+} were required, but not Zn^{++}, Co^{++}, or Cu^{++}. None of the latter metallic ions could replace those required for growth.

8350. SHEWAN, J. M.; FLETCHER, L. I.; PARTRIDGE, S. M., AND BRIMLEY, R. C. **Nitrogenous extractives from fresh haddock muscle: fractionation with ion-exchange resins.** *J. Sci. Food Agr.* 3, 394-8(1952).—*C. A.* 47, 4517*d*.

An aq. alc. ext. of fresh haddock muscle was fractionated by displacement chromatography with ion-exchange resins. The presence was demonstrated of Me_3NO, creatine, creatinine, $MeNH_2$, Me_2NH, NH_3, anserine, aspartic acid, glutamic acid, serine, threonine, proline, glycine, alanine, valine, leucine, cystine, phenylalanine, tyrosine, β-alanine, histidine, methylhistidine, lysine, and arginine.

8351. SHIBATA, SHOJI AND TAKIDO, MICHIO. **Evaluation of crude drugs. II. Paper chromatographic studies of rhubarbs. I.** *J. Pharm. Soc. Japan* 72, 1311-4(1952)(in English).—*C. A.* 47, 1335*g*.

Various com. specimens and certain fresh rhizomes and roots of cultivated rhubarbs were compared by paper chromatography. Nearly all specimens examd. contained the following main anthraquinones: chrysophanol, physcion (emodin monomethyl ether), emodin, and rhein, either in free or combined form.

8352. SHU, P. AND THORN, J. A. **Carbon and oxidation-reduction balances and the estimation of fermentation efficiencies of aerobic fermentations.** *Can. J. Botany,* 30, 252-65(1952).—*C. A.* 46, 8809*b*.

An app. and method for prepg. carbon and oxidation-reduction balances of aerobic fermentations were described. The method was successfully applied to citric acid and ustilagic acid fermentations.

8353. SMITH, E. LESTER AND ALLISON, D. **Paper chromatography of radioactive penicillin.** *Analyst* 77, 29-33(1952).—*C. A.* 46, 3222*g*.

Bisynthetic S^{35}-penicillin was chromatographed on buffered paper strips. The distribution of the penicillins along the strips was assessed.

8354. STERNBURG, JAMES AND KEARNS, C. W. **Chromatographic separation of DDT and some of its known and possible degradation products.** *J. Econ. Entomol.* 45, 505-9(1952).—*C. A.* 47, 1322*b*.

Recoveries of 90-100% from the Et_2O ext. of insects were made by chromatographic sepn.: Plug the end of a 12-mm chromatographic tube with cotton, fill it to a depth of 5 or 6 cm with activated alumina (Alcoa, grade E-20, 80-200 or 48-100 mesh); only alumina which does not catalytically dehydrochlorinate DDT should be used. Evap. the Et_2O ext. of the insects, take up the residue in 5 ml petr. ether (b.p. 30°-60°C) and introduce into the alumina column; repeat with 2 more 5-ml portions of petr. ether, then add 60 ml petr. ether. Collect the eluate.

8355. STROUD, S. W. **Determination of 2,4-dichlorophenoxyacetic acid.** *Analyst* 77, 63-7 (1952).—*C. A.* 46, 3460*b*.

A rapid and accurate procedure was described for sepg. and detg. 2,4-dichlorophenoxyacetic acid in a mixt. of chlorinated phenoxyacetic acids. It was based on a sepn. by partition chromatography between ether and strong phosphate buffers on a kieselguhr column and titration of the carboxylic acid groups. Only 10-20 mg of sample was needed.

8356. SVENDSEN, ANDERS BAERHEIM. **The detection of natural cumarin in plants by paper chromatography. IV.** *Pharm. Acta Helv.* 27, 44-8 (1952).—*C.A.* 46, 9255*i*.

By means of microsublimation and paper chromatography the following cumarins were found in the roots of *Pimpinella magna* and *P. saxifraga:* pimpinellin, isopimpinellin, bergapten, isobergapten, umbelliferon, and an unidentified cumarin deriv.

8357. SVENDSEN, ANDERS BAERHEIM. **Investigation of the identity of galenic preparations with the aid of paper chromatography.** *Dansk Tids. Farm.* 26, 125-33 (1952).—*C. A.* 46, 11578*h*.

Survey of the techniques used in the paper chromatography of morphine-contg. preparations.

8358. TANAKA, KUNIYOSHI AND SUGAWA, TOSHIO. **Ergot alkaloids by paper partition chromatography. I. II.** *J. Pharm. Soc. Japan* 72, 616-20, 620-3 (1952).—*C. A.* 46, 9782*b*.

Alkaloids contained in ergots were detd. by use of paper partition chromatography. Development of the chromatogram with BuOH acidified with AcOH gave ergometrine or elymoclavine, agroclavine, and peptide-type alkaloids in different positions which gave characteristic coloration with the Ehrlich reagent; ergometrine and elymoclavine were separately detd. by development with C_5H_5N-BuOH soln. By application of this procedure to total alkaloids extd. from natural ergot, a no. of alkaloids were found to be present. The peptide-type alkaloids contained in ergot were decompd., and the amino- and α-keto acids were examd. by paper partition chromatography.

8359. THIES, H. AND ZAUNER, S. **Regularities of the adsorption of alkaloid salts on aluminum oxide. I. Adsorption isotherms of quinine hydrochloride and morphine hydrochloride.** H. *Arch. Pharm.* **285**, 191-201 (1952).—*C.A.* **46**, 10535*b*.

In general, adsorption by Al_2O_3 of the basic portion of alkaloid salts in soln. did not take place. Al_2O_3 appeared to act indirectly by H and OH ion exchange at the :AlOH groups; this freed the alkaloid bases which were then pptd. since their soly. was much lower than that of their salts. The :AlOH groups can dissoc. as follows: $AlO^- + H^+ \rightleftharpoons :AlOH \rightleftharpoons :Al^+ + OH^-$. In the presence of alkaloid salts, the same type of ion exchange took place except that H^+ ions were removed from the more highly dissocd. alkaloid salts in preference to water; this caused pptn. of the bases as soon as the soln. is satd. If the alkaloid salt solns. were sufficiently concd., the entire Na of the adsorbent was exchanged with H^+ ions, decreasing the OH^- concn. of the soln. so much that the dissocn. $:AlOH \rightleftharpoons :Al^+ + OH^-$ became appreciable and resulted in a measurable exchange of OH^- against the anion of the alkaloid salt.

8360. THIES, H. **Regularities of the adsorption of alkaloid salts on aluminum oxide columns. II. Anion exchange on aluminum oxide.** *Arch. Pharm.* **285**, 224-30(1952).—*C.A.* **47**, 827*d*.

The adsorption by Al_2O_3 of anions from alkaloid HCl solns. depended on the ability of exchangeable AlOH groups to dissoc. and thus on the pH of the soln. The pH of the adsorption system, on the other hand, was regulated by the alkaloids since it depended on their soly. and dissocn. consts.

8361. TULUS, RASIM. **Ion-exchanging substances.** *Kimya ve Sanayi* **26-7**, 349-56(1952).—*C.A.* **46**, 11577*h*.

The practical use and theory of ion exchangers in technical and pharmaceutical chemistry were discussed.

8362. TYLER, V. E. JR. AND SCHWARTING, A. E. **The separation of the ergot alkaloids by paper partition chromatography.** *J. Am. Pharm. Assoc.* **41**, 354-5(1952).—*C.A.* **46**, 9782*a*.

Conventional paper partition chromatography, in which H_2O was the stationary phase, did not sep. the ergotoxine and ergotamine alkaloids since they followed the solvent front of the wash liquid. By substituting an org.-aq. system for the H_2O a partition coeff. favoring the stationary phase was achieved. The use of acidic wash liquids assured the stability of the alkaloids.

8363. VARMA, K. C.; BURT, J. B., AND SCHWARTING, A. E. **Chromatographic analysis of some terpenes.** *J. Am. Pharm. Assoc.* **41**, 318-20(1952). —*C.A.* **46**, 7942*e*.

The columnar techniques of frontal, elution, and displacement analysis were applied to terpenes and terpene mixts. The first appeared to be the better method for the sepn. of terpenes and was most effective when one terpene was in high concn. Petr. ether was very useful in the sepn. of menthol and menthone, but the qual. analysis of the eluate was difficult.

8364. VAVRUCH, IVAN. **A chromatographic study of amino acids in sugar-beet protein.** *Sugar* **47**, No. 5, 35-6(1952).—*C.A.* **46**, 7349*g*.

The amino acids were prepd. from fresh press juice by mixing with an equal vol. of 95% MeOH at 4°C, centrifuging, hydrolysis with trypsin, adsorption on a sulfonated, strongly acid cation-exchange resin, elution with 7 *N* NH_4OH, treatment with activated carbon, and evapn. on a water bath. Portions of 5 microl. of soln. in a small amt. of H_2O were chromatographed in 1 and 2 dimensions with various solvents and solvent mixts., and the chromatograms spotted with ninhydrin and other reagents. The amino acids were identified by controls with known amino acids and mixts. of them.

8365. VÉLON, PIERRE AND MEDYNSKI, GUY. **Determination of hydrocarbons (in cosmetics) by chromatography and selective solubility.** *Industrie parfum.* 7, 198-200(1952).—*C.A.* 47, 5075*h*.

The total hydrocarbons in cosmetics were sepd. from other substances present by an Al_2O_3 column and the liquid hydrocarbons from the solid hydrocarbons by soly. in MeEtCO. It was first necessary to remove the pigment particles since these may obstruct the Al_2O_3 column. The petr. ether soln. was passed through a column (3 cm in diam., 22 cm high) of Al_2O_3, and the effluent was evapd. to dryness.

8366. WAGNER, JOHN G. AND HARRIS, LOYD E. **A phytochemical investigation of the fruit of Maclura pomifera. III. Color tests, paper chromatography, and infrared spectra of lurenol, lupeol, and their derivatives.** *J. Am. Pharm. Assoc.* **41**, 500-504(1952).—*C.A.* **46**, 11585*a*.

The infrared spectra of lurenol, lurenyl acetate, lupeol, and lupeol acetate were detd. Small quantities of these compds. were sepd. and detd. by paper chromatography.

8367. WANKMÜLLER, ARMIN. **Paper chromatography of pharmaceuticals.** *Naturwissenschaften* **39**, 302-3 (1952).—*C.A.* **47**, 7161*b*.

Examples were given of analysis of pharmaceuticals by paper chromatography: Ladogal, Supronal, Amindan. The R_f values detd. were compared with those of alleged constituents.

8368. WICKSTRÖM, ALF AND SALVESEN, BJARNE. **Separation and identification of barbiturates by paper partition chromatography.** *J. Pharm. Pharmacol.* 4, 98-102(1952).—*C.A.* 46, 4742*e*.

Exptl. results were reported for the following barbituric acid derivs.: 5,5-diallyl, 5,5-allylisopropyl, 5,5-ethycyclohexenyl, 5,5-methylcyclohexenyl-1-methyl, 5,5-diethyl, 5,5-ethylphenyl, 5,5-ethyl(methylbutyl), 5,5-ethylphenyl-1-methyl; and for the thiobarbituric acid derivs.: 5,5-allylisopropyl, 5,5-ethylcyclohexenyl. R_f values for 5,5-diallyl, 5,5-allylisopropyl, 5,5-ethylcyclohexenyl, 5,5-methylcyclohexenyl-1-methyl, 5,5-allylisopropyl, and 5,5-ethylcyclohexenyl at 18-20°C for descending chromatograms with the alk. mobile phases of the indicated solvent systems were: toluene 100:H_2O 30: pyridine 50, all about 0.95; toluene 100:10% NH_3 50, all except 5,5-methylcyclohexenyl-1-methyl about 0.0; $CHCl_3$ 100:H_2O 20:pyridine 40, all about 0.92.

8369. WICKSTRÖM, ALF AND SALVESEN, BJARNE. **Separation and identification of sympathomimetic amines by paper chromatography.** *J. Pharm. Pharmacol.* 4, 631-5 (1952).—*C.A.* 46, 10539*d*.

Adrenaline was dissolved in 5% AcOH to make a 0.5% soln. The other free amines were applied in EtOH or Et_2O soln. on the starting line on a 56 × 20 cm sheet of Whatman No. 1 paper; 25-50 γ in 5-10 microliters being used. The org. phases of the following solvent systems were used: BuOH:H_2O:AcOH (95%), 40:50:10; BuOH:toluene:H_2O:AcOH (95%), 100:100:50:50; AcOEt:H_2O:AcOH(95%), 30:30:10; $CHCl_3$:H_2O:AcOH(95%), 100:50:40. Spray the air-dried chromatograms with 0.5 g of bromocresol green in 100 ml of EtOH to indicate the amines as blue spots on a greenish yellow background which will turn yellow in AcOH vapors. The R_f values with the indicated solvents were tabulated.

8370. YAMPOL'SKAYA, M. M. **Determination of potassium arsenite in the presence of tinctures by the use of cation-exchange adsorbents.** *Aptechnoe Delo* 1952, No. 3, 9-11.—*C.A.* 47, 4043*g*.

K_3AsO_3 was detd. in tinctures from a variety of plant sources (quinine bark, eucalyptus, sunflower, etc.) without preliminary destruction of the org. matter. The solns. were adjusted to pH 10-12 with NaOH and passed through a cationite column (20-5 g resin for typical sample), the latter being washed down with 50 ml H_2O until acidity was removed. The filtrate was analyzed conventionally. The resin removed the coloring and extractive substances very satisfactorily, and recovery of better than 99.5% of As was achieved.

8371. ZÂFIR, MÂLIK. **The selective adsorption of cyclic sulfur compounds.** *Folia Pharm.* 2, 128-31(1952)(in French).—*C.A.* 47, 3523*e*.

The substance present in com. C_6H_6 which was responsible for imparting a red color to aq. acid was removed by adsorption on talc. Talc also removed the color from the acidulated water. The substance could be eluted from talc with EtOH.

8372. BAYLY, R. J. AND BOURNE, E. J. **A new method for the paper chromatography of oligosaccharides.** *Nature* 171, 385-7(1953).—*C.A.* 47, 5294*d*.

The R_f values of oligosaccharides were increased (8-fold for disaccharides) by converting them to *N*-benzylglycosylamine derivs. The sugar soln. was spotted only once, dried, and a 2nd superimposed spot made with 10% benzylamine in MeOH. After heating at 85°C for 5 min. the chromatogram was run descendingly by using the upper phase of a 40:10:49:1 or 40:12:20:1 mixt. of BuOH:EtOH:H_2O:concd. NH_4OH. More H_2O in the solvent gives better resolution in some cases. The spray was 0.25% ninhydrin in alc.

8373. BITMAN, JOEL AND SYKES, J. F. **Chromatographic separation of estrone, estradiol, and estriol.** *Science* 117, 356-8 (1953).—*C.A.* 47, 6602*i*.

A condenser-type chromatographic tube (internal diam. 10.8 mm, circulating H_2O 24°C) contg. C_6H_6—NaOH—Celite 535 (25 ml, 3 g, and 2.4 ml 2.3 *N*, resp.) was charged with aliquots of C_6H_6 solns. of cryst. estrone, estradiol, and estriol (2-10 γ). Estrone appeared in the eluate after a forerun of 30 ml of C_6H_6. Complete recovery was obtained in the next 80 ml. Estradiol appeared after a clear zone of 10 ml of eluate and was recovered in the next 90 ml of eluate. Application of N_2 pressure to the column completed the elutions in a few min. Estriol was not eluted from this system.

8374. BÜCHI, J. AND FURRER, F. **The use of new ion-exchange resin adsorbents for the assay and isolation of alkaloids.** *Arzneimittel-Forsch.* 3, 1-10(1953).—*C.A.* 47, 5635*d*.

The detn. of quinine and total alkaloids in cinchona bark and exts. by the use of ion-exchange resins, (Duolite C-10) was described in detail.

8375. CASTEEL, HELEN WARREN AND WENDER, SIMON H. **Identification of flavonoid compounds by filter paper chromatography. Additional R_f values and color tests.** *Anal. Chem.* 25, 508-9 (1953).—*C.A.* 47, 6311*e*.

Paper chromatographic techniques were extended by the detn. of R_f values for a no. of flavonoid compds. not yet reported in the usual solvent systems. Since the colors produced by chromogenic sprays often aided in the tentative classification of an unidentified flavonoid pigment into one of the major subdivisions of flavonoid compds., the colors produced by these sprays were also detd. for the newly studied flavonoids.

8376. FREDEEN, F. J. H.; ARNASON, A. P., AND BERCK, B. **Adsorption of DDT on suspended solids in river water and its role in black-fly control.** *Nature* 171, 700-1(1953).—*C.A.* 47, 7150*c*.

DDT assocd. with suspended solids in river water gave excellent results in the control of black flies. Fast-flowing rivers in which the water was turbid at the time of treatment might be treated similarly, and perhaps in certain clear-water streams and rivers, finely divided inorg. material with DDT-adsorptive properties could be added along with the larvicide and kept in suspension.

8377. FUJITA, AKIJI AND AOYAMA, MASATARO. **Free and esterified vitamin A in fish oils; chromatographic separation and colorimetric determination.** *J. Biochem. (Japan)* 40, 151-6 (1953).—*C.A.* 47, 5470*g*.

A chromatographic method, devised for detg. free and esterified vitamin A separately, was given using an alumina column.

8378. FUJITA, AKIJI AND AOYAMA, MASATARO. **Colorimetric and fluorometric determination of vitamin A in fish-liver oils; chromatographic**

separation of vitamin A and nonvitamin A materials in the unsaponifiable matter. *J. Biochem.* (Japan) 40, 157-68 (1953).—*C.A.* 47, 6601*g*.

The contents of true vitamin A and fluorometrically active non-vitamin A were estd. separately. For the indirect method estn. of the value of fluorometrically-active nonvitamin A, evap. 5 ml of the C_6H_6 est., dissolve the residue in 2 ml of ligroin, pour into an alumina column, develop with 50 ml of an acetone-ligroine mixt. (1:9), det. the positions of sepd. fractions under ultraviolet irradiation (usually 5 zones appear). *Direct method*—Evap. 5 ml of the C_6H_6 ext. of unsapond. substances, dissolve the residue in 2 ml of ligroine, sep. 5 zones on a chromatographic column of alumina, rinse the column content twice with 2 ml of C_6H_6, and det. the estd. vitamin A colorimetrically or by fluorometric titration.

8379. GRANT, ERNEST W. AND HILTY, WYNE W. **The separation of morphine from codeine by means of ion exchange.** *J. Am. Pharm. Assoc.* 42, 150-2(1953).—*C.A.* 47, 5633*a*.

Morphine could be sepd. from codeine by a strongly basic, quaternary amine-type anion exchanger. Because of its phenolic structure morphine exchanged with the resin while codeine was washed through the column and detd. by titration.

8380. GROTE, I. W. AND WOODS, MARIBELLE. **Antacids. IV. Adsorption effects of various aluminum antacids upon simultaneously administered anticholinergic drugs.** *J. Am. Pharm. Assoc.* 42, 319-20 (1953).—*C.A.* 47, 7110*a*.

As measured by the reduction in acute toxicity in mice, $Al(OH)_3$ magmas showed marked adsorption effects with atropine sulfate, homatropine hydrobromide, and belladonna alkaloids as sulfates but not with monatropine methyl bromide.

8381. HAENNI, EDWARD O.; CAROL, JONAS, AND BANES, DANIEL. **Colorimetric determination of α-estradiol in estrogenic mixtures using partition chromatography.** *J. Am. Pharm. Assoc.* 42, 162-7(1953).—*C.A.* 47, 5633*d*.

A method for the detn. of α- and β-estradiols in complex mixts. contg. the estrogenic ketosteroids as well as other estrogenic diols was described; this method utilized a stock iron-Kober reagent dild. with 1*N* HCl, a simple chromatographic partition system consisting of 0.4*N* NaOH as immobile solvent fixed on Celite, and C_6H_6 as the mobile solvent.

8382. HAENNI, EDWARD O.; CAROL, JONAS, AND BANES, DANIEL. **Partition chromatography of some estrogenic diols.** *J. Am. Pharm. Assoc.* 42, 167-72(1953).—*C.A.* 47, 5633*f*.

The effects of alkali concn., flow-rate, temp., and degree of packing were given concerning the operation of a partition chromatographic system (consisting of NaOH soln. fixed in Celite as the immobile phase and C_6H_6 as the mobile phase) for the sepn. of certain estrogenic diols. Temp. effects were very marked. Partition coeffs. as detd. from these columns were reported for α- and β-estradiols, α- and β-dihydroequilins, and β-dihydroequilenin.

8383. HUTCHINS, HASTINGS H. AND CHRISTIAN, JOHN E. **Sulfonamide separations based on ion-exchange chromatography in combination with radioactive techniques.** *J. Am. Pharm. Assoc.* 42, 310-14(1953).—*C.A.* 47, 7163*g*.

A method was described which was suitable for the assay of sulfonamides and their derivs. in pure form as well as in pharmaceutical prepns. It consisted of adsorption on an ion-exchange resin, followed by the chromatographic elution and the measurement by isotope diln. technique of the individual sulfonamides.

8384. JOLLÈS, GEORGES AND FROMAGEOT, CLAUDE. **Isolation of lysing proteins from rabbit spleen.** *Biochim. et Biophys. Acta* **11**, 95-101 (1953).—*C.A.* 47, 8166e.

A fine particle size carboxylic acid cation exchanger was employed in the chromatographic sepn. of lytic proteins from the spleen of rabbits. The protein was obtained from the spleen by exhaustion with water and precipitation by acetone, alkali, and flavianic acid.

8385. KLEE, FLORENCE C. AND KIRCH, ERNST R. **Determination of morphine in opium with the aid of an adsorption column.** *J. Am. Pharm. Assoc.* 42, 146-50(1953).—*C.A.* 47, 5632*i*.

An app. was described in which morphine was extd. from opium with boiling MeOH and immediately sepd. from interfering and colored substances on a Florisil column by elution with the same solvent.

8386. KOHLSTAEDT, K. G.; MARTZ, B. L.; GRIFFITH, R. S., AND HELMER, O. M. **Clinical experience with mixtures of anion- and cation-exchange resins.** *Ann. N.Y. Acad. Sci.* 57, 260-72 (1953). —*C.A.* 48, 3556*e*.

A report on the clinical effect of a resin mixt. in the treatment of congestive heart failure, cirrhosis and ascites, and essential hypertension. The mixt. contained 59% carboxylic resin in the H^+ form, 29% of the same resin as its salt, and 12% of a polyamine anion exchanger.

8387. LEVINE, JOSEPH; SELZER, GEORGE, AND WRIGHT, WILLIAM W. **Chemical determination of mannosidostreptomycin and dihydromannosidostreptomycin.** *Anal. Chem.* 25, 671-3(1953).—*C.A.* 47, 6311*g*.

The mannosido content of streptomycin and dihydrostreptomycin was detd. by converting the mol. to the neutral mannoside and 2 basic products, streptidine and methyl streptobiosaminide dimethyl acetal or methyl dihydrostreptobiosaminide, resp. An ion-exchange resin was used to adsorb the basic products. The methyl mannosido in the effluent liquid was converted to its dinitrophenyl osazone. This was dissolved in aq.-alc. alkali hydroxide giving a purple soln., the intensity of which was measured spectrometrically at 556 mμ.

8388. LEVY, A. L. AND CHUNG, DAVID. **Two-dimensional chromatography of amino acids on buffered papers.** *Anal. Chem.* 25, 396-9(1953).—*C.A.* 47, 6309*h*.

Previous solvent systems for 2-dimensional chromatography of amino acids, e.g. collidine-phenol-0.3% NH_3, had disadvantages such as irregularly shaped spots, lack of reproducibility, incomplete sepn., discoloration of the paper, and unpleasant odor. The solvent system described (4:1:5 BuOH-AcOH-H_2O, 1:1 *m*-cresol-phenol, pH 9.3, borate buffer) overcame these difficulties, allowing completion of the chromatogram in 40 hrs.

8389. LINDBERG, BENGT AND WICKBERG, BÖRJE. **The chemistry of lichens. III. Disaccharides from Umbilicaria pustulata.** *Acta Chem. Scand.* 7, 140-2(1953)(in English).—*C. A.* 47, 5628*f*.

Arabitol, mannitol, umbilicin, α,α-trehalose, and sucrose were isolated from *Umbilicaria pustulata*. The solvent was evapd. *in vacuo*, the residue treated with H_2O, the undissolved material filtered, excess basic $Pb(OAc)_2$ added to the aq. soln., the ppt. sepd., excess Pb pptd. with H_2S, the soln. passed through an Al_2O_3 column, and the eluate evapd. to dryness to give 7, 21, and 0.5 g, resp., from the Me_2CO and the 2 MeOH exts. The carbohydrate fraction from the Me_2CO ext. in 70 cc. 1% EtOH was absorbed on the top of a 23 × 3.3 cm column of equal parts by wt. Carbon and Celite, and the column washed with 1 liter 1% EtOH, 500 cc. 10% EtOH, and 1 liter 50% EtOH. The 1% EtOH eluted a crude mixt. of arabitol and mannitol (2.5 g) and the 10% EtOH crude umbilican (2.8 g), from which 1.8 g pure, umbilican-octaacetate could be obtained by acetylation.

8390. MOERLOOSE, P. DE. **Paper chromatography of quinine alkaloids.** *Mededel. Vlaam. Chem. Ver.* 15, 13-18(1953).—*C. A.* 47, 6604*i*.

The best sepn. of quinine and quinidine took place by a 2-dimensional chromatogram with 5% aq. NH_3 in one direction and 5% aq. pyridine in the other. By eluting with 10% H_2SO_4 and measuring the fluorescence, a detn. could be carried out in concns. of 1-20 γ. The alkaloids were located on a duplicate strip by means of Dragendorf's reagent.

8391. NORTHCOTE, D. H. **Sorption of water vapor by yeast cell wall and other polysaccharides.** *Biochim. et Biophys. Acta* 11, 471-9 (1953).—*C. A.* 47, 12515*c*.

The sorption and desorption isothermals were detd. at 26°C, and in some cases at 45°C, for yeast, rabbit liver, Mytilus edulis and Helix-pomatia glycogens, yeast glucan, yeast mannan, and dextran (Leuconostoc mesenteroides). A monohydrate of the water and the hexose units of the polysaccharides was suggested in which the water was assocd. with one or both of the secondary hydroxyl groups on C atoms 2 and 3 or 2 and 4; a pair of adjacent secondary hydroxyl groups was not essential for hydrate formation.

8392. PAULSON, JACK C. AND DEATHERAGE, FRED E. **The mechanism of protein hydrolysis by ion-exchange resin catalysis.** *J. Biol. Chem.* 205, 909-15 (1953).—*C. A.* 48, 3422a.

In the course of the dil. acid hydrolysis of bovine serum albumin and edestin by ion-exchange catalysis (Dowex 50), differences were observed among the rates of release of the various acidic and neutral amino acids. Substitution or blocking of the amino group greatly increased the resistance of albumin to hydrolysis. Fixation of the protein substrate on the resin's surface, by combination with the basic groups was essential to the activation of the peptide linkages.

8393. PEARSE, H. L. AND NOVELLIE, L. **South African tobaccos. I. Preliminary identification of amino acids and other constituents.** *J. Sci. Food Agr.* 4, 108-12(1953).—*C. A.* 47, 5638*d*.

The free amino acid content of tobacco leaves was detd. by passing the juice through ion-exchange resins, elution, and paper chromatography of the eluate. Other methods of purification of the juice for paper chromatography were unsuccessful. The following free amino acids were found, though not all were present in all of the exts. tested: aspartic acid, asparagine, glutamic acid, glutamine, serine, threonine, alanine, tyrosine, proline, γ-aminobutyric acid, valine, phenylalanine, leucine, tryptophan, β-alanine, histidine, and lysine.

8394. PORTER, R. R. **Partition chromatography of insulin and other proteins.** *Biochem. J.* 53, 320-8(1953).—*C. A.* 47, 4045*f*.

Two-phase mixts. were used; they were prepd. from $(NH_4)_2SO_4$, Cellosolve, and water with kieselguhr as support for the stationary phase in the partition chromatography of ribonuclease. Other similar systems were adapted for partitioning proteins, consisting of liquid 2-phases using a variety of glycol esters, water, and org. or inorg. solvents. In the partitioning of insulin, 3 systems were employed; they consist of water, Butyl Cellosolves, and Na or K phosphate. Insulin, prepd. chromatographically, either from crude or cryst. material, behaved as a single component and the recovery was nearly 100%.

8395. RAO, TARA AND GIRI, K. V. **Circular paper chromatography. III. R_f values of amino acids and peptides.** *J. Indian Inst. Sci.* 35A, 77-92(1953).—*C. A.* 47, 4249*a*.

The optimum solvent used for the chromatography of amino acids was an *n*-butanol, AcOH, H_2O mixt. (40:10:50 vol./vol.). The influence upon R_f values of amino acid concns., temp., distance moved by the solvent, and distance of the initial spot from the center were examd. Only the latter two had any significant effect on R_f values.

8396. RICHTER, JOHN W.; AYER, DONALD E.; BAZEMORE, ALVA W.; BRINK, NORMAN G., AND FOLKERS, KARL. **Pituitary hormones. V. The purification of corticotropin-B by ion-exchange techniques.** *J. Am. Chem. Soc.* 75, 1952-3 (1953). —*C. A.* 48, 5098*h*.

Corticotropin-B was exchanged on columns of weakly acidic carboxylic acid ion exchange resin buffered with Na^+. Inert materials were eluted by washing with aq. pyridine and aq. acetic acid. The active principle was then eluted with dilute HCl after which it was recovered free of organic salts as the hydrochloride. Activity of the hydrochloride was in the range 250 to 300 units/mg. Purification may also be carried out on columns of oxycellulose. Sulfonic acid cation exchangers were not satisfactory.

8397. Scholz, E. and Hagedorn, P. **Investigation of medicinal mixtures with paper electrophoresis. III. Paper chromatography of galenic tinctures.** *Deut. Apoth. Ztg.* 93, 81-2(1953). —*C.A.* 47, 4044*e*.

A Whatman no. 1 paper strip, 4 cm wide and 30 cm long, was wetted with electrolyte soln. The substance to be tested was applied as a band 3 cm wide, the strip was immersed at both ends into the electrolyte soln., and a d.c. of 110 v. was applied. Sulfonamides could be sepd. in 0.1 *N* NaOH and made visible by diazotization with 2-naphthol. Caffeine-quinine or antipyrine-aminopyrine mixts. were analyzed in 0.1 *N* H_2SO_4 and developed with I_2, flavone mixts. (in 0.1 *N* NaOH) were sprayed with $Pb(OAc)_2$ and observed in ultraviolet light.

8398. Swintosky, Joseph V. and Kennon, Lloyd. **The preparation of powdered carboxymethycellulose and linseed acids.** *J. Am. Pharm. Assoc.* 42, 505(1953).—*C.A.* 48, 4775*c*.

The Na salt of carboxymethycellulose was converted to the free acid by means of an Amberlite IR-120 ion-exchange column, and the soln. was spray-dried to form a water-dispersible powder. Powd. linseed acid was prepd. by extg. clean flaxseed with aq. HCl, pptg. the gum with alc., passing a 2% soln. of the pptd. gum through the ion-exchange column, and spray-drying. The linseed acid to be treated with the ion exchange resin was obtained by extraction of flaxseed with aq. HCl and pptn. with EtOH.

8399. Yampol'skaya, M. M. **Determination of some pharmaceutical preparations in the pure state and in medicinal mixtures with the aid of ion-exchange adsorbents.** *Aptechnoe Delo* 2, No. 1, 17-21(1953).—*C.A.* 47, 5631*a*.

Cation-exchange resins could be successfully used for detn. of tecodine, arecoline bromide, trypaflavine, rubrocol, bigumal, phenamine, vitamin B_1, carbocholine, and sergosine. The results agreed within a few tenths of a percent with those obtained by methods prescribed by the U.S.S.R. Pharm. In the general procedure 5 g of the resin, swelled with H_2O, was regenerated by washing with 3% HCl, washed with distd. H_2O, and a soln. of 0.03-0.05 g of the specimen in 10 ml H_2O was passed through the bed at 2-3 drops/sec. After washing down with 30-40 ml H_2O until wash waters were free of acid reaction, the liberated acid was titrated with standard alkali.

V-8. Agricultural Uses—Soils

8400. Prianishnikov, D. **Estimation of the absorbed bases in soils.** *Landw. Vers. Stat.* 79-80, 667; *J. Chem. Soc.* 103, II, 339 (1913). —*C.A.* 7, 3181.

Both $NH_4C_2H_3O_2$ and 3.2% NH_4OH were suitable for detg. the amt. of absorbed K_2O. For detg. the amt. of absorbed NH_3 in soils it was found that by digesting the soil 10 times with 5% KCl and distg. the soln. with MgO, results were obtained which agreed most nearly with the older methods. Expts. with barley showed that the K_2O of zeolites was almost completely unavailable when alone; in contact with nutritive salts or $CaCO_3$, it was easily assimilated.

8401. Hissink, D. J. **The adsorption processes in soils.** *Intern. Mitt. Bodenk.* 12, 81-172 (1922).—*C.A.* 17, 1100.

The exchangeable bases were considered to be on the surface of the particles of clay and of the humus complex in an adsorbed condition. The cations were principally Na and K, the Ca and Mg compds. being little ionized. A method was developed to sep. the bases exchangeable by neutral salts, the acid-sol. bases, and $CaCO_3$. The investigation of a large number of soils indicated that in clay soils there was a very low content of acid sol. Ca and Na. The avs. were 0.27 and 0.25%, resp., while the K and Mg were 1.34 and 0.826%, resp. Humus soils contain the largest amt. of their bases in exchangeable form.

8402. Hissink, D. J. **Base exchange in soils.** *Trans. Faraday Soc.* 20, 551-66 (1925).—*C.A.* 19, 1022.

The action of neutral salts on soils produced an equil. very quickly. Three minutes sufficed to replace all Ca. A method was described for distinguishing between the bases replaced by neutral salts and those removed by strong acids. An unsatd. condition brought about an acid reaction more readily with a humus soil than with clay. The degree of unsatn. in soils was detd. approx. by a cond. titration using $Ba(OH)_2$. A simple titration of a series of samples using increasing quantities of $Ba(OH)_2$ on a certain quantity of soil may also be used.

8403. Kelley, W. P. and Brown, S. M. **Replaceable bases in soils.** *California Agr. Expt. Sta., Tech. Paper* 15, 39pp. (1925).—*C.A.* 19, 3341.

The replaceable bases of several neutral or slightly alk. soils from California were mainly Ca, Mg in smaller quantities, and very small quantities of K and Na. Alkali soils were characterized by a relatively large amt. of replaceable Na and a correspondingly low amt. of replaceable Ca. The acid soils examd. were characterized by a low total content of replaceable bases, and by the presence in replaceable form of Al, Fe or Mn. Dil. HCl displaced the bases, but may attack other constituents. The replaceable bases were considered to be present not in a state of phys. absorption, but as chem. compds., probably as complex aluminosilicates which had been formed through weathering.

8404. Kelley, W. P. and Brown, S. M. **Base exchange in relation to alkali soils.** *Soil Science* 20, 477-95(1925).—*C.A.* 20, 1295.

The more important types of alkali soils found in the U.S.A. were: (1) Soils whose replaceable Ca and Mg have been substituted mainly by Na.

(2) Soils in which the substitution of Na has taken place to a limited extent. (3) Soils low in replaceable Na and high in Ca and Mg. salts. In the practical reclamation of these soils group (1) will require special treatment in large amts., preferably Ca Salts. Group (2) may be benefited by such special treatments but the application need not be so large. Group (3) may be improved by mere flooding and drainage.

8405. PAGE, H. J. AND WILLIAMS, W. **Studies on base exchange in Rothamsted soils.** *Trans. Faraday Soc.* **20**, 573-85 (1925).—*C. A.* **19**, 1022.

The surface soils of the fertilized plots which received no K salts were greatly reduced in exchangeable K while those to which K salts were added showed a significant increase. Farmyard manure produced the largest exchangeable base content in the surface soil of any treatment and was slightly less in the subsoil. The exchangeable K present in the plots treated with K was much less in the surface 18 in. than the excess of K added over that removed in crops during the course of the expt. Liming greatly increased the exchangeable Ca. The pH values also increased in a somewhat similar order.

8406. SAINT, S. J. **The relation between the pH value, the lime requirement and the thiocyanate color of soils.** *Trans. Faraday Soc.* **20**, 594-8 (1925).—*C. A.* **19**, 1022.

The thiocyanate test for CaO requirement or pH values of soils could not be readily made quant. The thiocyanate color, pH value, and $CaCO_3$ requirement obtained in analyses of 33 soils were tabulated and the correlation of the values was relative only. The intensity of color was dependent upon the acidity, texture of the soil, amt. of org. matter and Fe present.

8407. PAGE, H. J. **Nature of soil acidity.** *Trans. 2nd Comm. Intern. Soc. Soil Sci.* **1926A**, 232-44, 1928.—*C. A.* **22**, 1002.

The absorbing complex of the soil was an insol. colloidal acid (or acidoid), assocd. with surface-active basic and H cations. The existence of replaceable Al^{+++} in the complex and the possibility of OH^- adsorption were the debatable points.

8408. KELLEY, W. P. AND BROWN, S. M. **Base unsaturation in soils.** *Proc. Intern. Congr. Soil Sci.* **1**, 491-507 (1927).

The amt. of replaceable base that a soil gained by treatment with an excess of Ca or $Ba(OH)_2$ was a true measure of its content of replaceable H^+. The NH_4Cl method, as applied before and after the treatment of the soil with alkali-earth hydroxide, gave a close approximation to this quantity with the soils studied. The Ca-exchange complex was practically neutral and, therefore, non-hydrolysable. The unsatd. complex, on the other hand, was acid owing to the nature of its ionization. The exchange capacities of heavy clay soils varied between wide extremes.

8409. KERR, H. W. **The identification and composition of the soil aluminosilicate active in base exchange and soil acidity.** *Soil Science* **26**, 385-98(1928).—*C. A.* **23**, 1198.

The base-exchange material of soils was confined largely to the clay fraction and seemed to be so intimately mixed with other colloidal material that it was impossible to sep. it by sp. gr. methods. By employing the contents derived according to the base-exchange equil. theory, it was possible to identify active aluminosilicates from different sources. The equil. const. seemed to be characteristic of each compd. involved in base exchange. The soil from which the active org. matter was completely removed by gentle ignition gave a value for K agreeing very closely with samples of a clay material (bentonite) and differing markedly from the values found for the true zeolites tested.

8410. MERKLE, F. G. **The influence of fertilizer treatments on the content of exchangeable cations in Hagerstown silt loam.** *Soil Science* **26**, 377-83(1928).—*C. A.* **23**, 1206.

Soils repeatedly fertilized with chem. fertilizers or with org. manures underwent significant changes in the quantity and proportion of replaceable cations. Liming tended to saturate the absorption complex with Ca. A part of the K applied in chem. fertilizers was retained in the acidoid complex. NH_4 from soils may be retained and constitute a large percentage of the total adsorbed cations.

8411. MARTIN, J. C. **Effect of crop growth on the replaceable bases in some California soils.** *Soil Science* 27, 123-36(1929).—*C. A.* **23**, 3043.

The quantities of exchangeable bases in clay or silty-clay loam soils were generally much higher than in sandy loam soils. Nine of the 12 soils, which supported 2 barley crops with a 10-year fallow period intervening, showed significant decreases in K. The content of total bases was not significantly altered by these decreases in K, because Ca and Mg, which comprised 90% of the total, remained const.

8412. PARKER, F. W. **The determination of exchangeable hydrogen in soils.** *J. Am. Soc. Agron.* 21, 1030-9(1929).—*C. A.* **24**, 452.

Four methods for detg. the amt. of exchangeable H in soils were studied. The H content of a soil was assumed to be equal to the difference between the exchange capacity of the soil and its content of exchangeable bases. Exchangeable H was detd. by titrating the soil to pH 7.0 with $Ba(OH)_2$, by detg. the amt. of H replaced by leaching the soil with neutral $Ba(C_2H_3O_2)_2$, and by conductometric titration. The difference method, titration to pH 7.0, and the $Ba(C_2H_3O_2)_2$ method gave similar results for exchangeable H when compared on 12 soils. The conductometric titration method was unsatisfactory for the detn. of exchangeable H.

8413. Chapman, H. D. and Kelley, W. P. **The determination of the replaceable bases and the base-exchange capacity of soils.** *Soil Science* **30**, 391-406(1930).—*C.A.* **25**, 551.

Soly. and decompn. processes in soils rendered the detn. of exchangeable bases somewhat inexact. The base-exchange capacity of the soil could be detd. by digesting and leaching the sample with *N* $AcONH_4$ soln. This soln. brought about approx. complete replacement of H ions without the necessity of treating the sample with an excess of alkali. Neutral MeOH was useful for the removal of the occluded electrolyte. The adsorbed NH_4^+ could be accurately detd. by aeration in the presence of Na_2CO_3.

8414. McGeorge, W. T. **Base-exchange property of organic matter in soils.** *Ariz. Agr. Expt. Sta., Tech. Bull.* **30**, 181-213 (1930).—*C.A.* **25**, 161.

The exchange capacity of highly org. soils was approx. a linear function of the % of carbon in the soil. There was no relation between the N or N-C ratio and the exchange capacity of highly org. soils. Base exchange in highly org. soils took place in chemically equiv. proportions. With H_2O_2 as a reagent for destroying org. matter in soils, the loss in exchange capacity was approx. a linear function of the amt. of org. matter destroyed. This loss in exchange capacity was due to a destruction of the org. matter which functioned in base-exchange reactions.

8415. Schollenberger, C. J. and Dreibelbis, F. R. **Analytical methods in base-exchange investigation on soils.** *Soil Science* 3, Book 30, 161-173, (1930).

Ammonium acetate as a base exchange salt, leaching, as a means of extracting exchangeable cations, exchanged hydrogen, Ca, Mg, Alkalies, Al, Mn, exchangeable NH_4^+ were discussed.

8416. Vageler, P. and Woltersdorf, J. **Base exchange and acidity in soils. II. Preliminary experiments on permutites.** *Z. Pflanzenernahr. Dungung u. Bodenk.* **15A**, 329-42, **16A**, 184-204 (1930).—*C.A.* 24, 5407.

The base-exchange phenomena and the treatment of permutite and soil with acid and bases on the bases were discussed. A math. formulation of the laws governing the satn. of a sorption complex and the removal of bases from a complex was given.

8417. Wiegner, G. **Some physiochemical properties of clays. II. Hydrogen clay.** *J. Soc. Chem. Ind.* **50**, 103-12T(1931).—*C.A.* 25, 3218.

H^+ readily entered into a clay, but left with great difficulty. Micelles contg. a preponderance of H^+, whether in the inner or outer swarm, increased the H^+ concn. of the dispersion medium. The dispersion medium, after removal of suspended particles, had a const. H^+ concn. independent of the no. of particles dispersed in it. Analogously the introduction of particles contg. a preponderance of active OH^- increased the alkalinity of the dispersion medium. Ionic exchange expts., together with cataphoretic measurements and quant. measurements of the dispersion effect, showed that the solid micelle consisted of 3 parts, the micron or ultramicron, the inner ionic swarm and the outer, oppositely charged ionic swarm.

8418. Hissink, D. J. **The reclamation of a part of the Zuyder Zee.** *Trans. Sixth Comm. Intern. Soc. Soil Sci.*, **A**, Pt. A: 177-87, (1932).

The original soil was of a dark color, owing to the presence of ferrosulphide (FeS), and very wet, containing an average of 172 g water per 100 g dry matter. In addition to the drying and de-salting processes, the soil had to undergo another change; the original sodium-magnesium clay soil, had to be changed into a calcium clay soil.

8419. Gapon, E. N. **Theory of exchange adsorption in soils. I.** *J. Gen. Chem.* (U.S.S.R.) **3**, 144-52, 153-8, 159-63(1933).—*C.A.* **28**, 4149[6].

For an adsorbent in contact with a liquid or gaseous phase contg. mols. of substances M_1 and M_2, both of which could be adsorbed, the mass action law imposed the following equil. conditions: $F_2C_1/F_1C_2 = K$, where F_1 and F_2 were the areas of the adsorbent surface occupied by M_1 and M_2, and C_1 and C_2 were their resp. concns. From this, $1/\Gamma = (1/\Gamma_0)\ [1 + (1/K)\ (C_1/C_2)]$, where Γ_0 was max. no. of M_1 mols. that could be adsorbed (assumed to be proportional to the sum of F_1 and F_2), and Γ was the no. of adsorbed mols of M_2 (supposedly proportional to F_2). By plotting $1/\Gamma$ against C_1/C_2, a rectilinear adsorption isotherm was obtained from which the value of $1/\Gamma_0$ could be detd.

8420. Kelley, W. P. **The so-called solonetz soils of California and their relation to alkali soils.** *Am. Soil Survey Assoc., Rept. 14th Ann. Meeting, Bull. No.* **15**, 45-52(1934).—*C.A.* **28**, 4515[1].

The concn. of water-sol. salts was low except in the B_2 and C horizons of certain solonetz soils of Calif. Salts of Na predominated in the water-sol. fraction of the 7 profiles examd. Replaceable bases were 2-3 times greater in the B than the A horizons and were chiefly Ca and Mg. The exchangeable Mg increased and the exchangeable Ca decreased with depth. With one exception, the B_1 horizons were neutral or slightly alk. and the B_2 horizons which contained $CaCO_3$, were strongly alk. Fusion analyses showed decrease of SiO_2 and increase of Al_2O_3, Fe_2O_3 and MgO with depth, which was in agreement with the observed clay content and silica-alumina ratios of the profiles.

8421. Kelley, W. P. and Brown, S. M. **Principles governing the reclamation of alkali soils.** *Hilgardia* **8**, 149-77 (1934).—*C.A.* **28**, 6902[3].

Alkali soils contained either an excess of sol. salts or abnormal amts. of replaceable (adsorbed) Na. The clay and humus of normal soils were combined with Ca. With alkali soils, sol. Na salts tended to bring about replacement of Ca by Na and thus produce chem. and phys. conditions that were extremely adverse to plant growth. Hence successful reclamation of alkali soils depended upon the removal of the sol. salts and the replacement of the adsorbed Na by Ca.

8422. Volk, N. J. **The fixation of potash in difficultly available forms in soils.** *Soil Sci.* 37, 267-87(1934).—*C.A.* **28**, 4817^5.

Alternate wetting and drying of soils treated with sol. K salts caused rapid fixation of K in a non-replaceable form. Ten alternate wettings and dryings sufficed to cause max. fixation. When kept continuously moist very little fixation took place. Of the soil separates, the ultra-clay fractions contained the lowest percentages of K, but had by far the greatest K-fixing power. Fixation was dependent upon the nature as well as the quantity of colloids present. K fixation was reduced by leaching soils with *N* HCl and was increased by leaching with Na_2CO_3. The addn. of $Ca(OH)_2$ to soils usually increased K fixation. Synthetic mixts. of alumina gel, silica gel, $Ca(OH)_2$ and sand did not fix K.

8423. Alten, F. and Kurmies, B. **The physical-chemical rules for the cation exchange in mineral soil.** *Ernahr. Pflanze* **31**, 401-7 (1935).—*C.A.* **30**, 1485^7.

8424. Jacob, A.; Hofmann, U.; Loofmann, H., and Maegdefrau, E. **Chemical and x-ray investigations on the mineral sorption substance in soils.** *Beiheft Z. Ver. deut. Chem. No.* **21**, *Angew. Chem.* **48**, 585-6 (1935).—*C.A.* **29**, 8197^9.

The following properties of soils were detd.: ratio of sesquioxides to SiO_2, ratio of Al_2O_3 to SiO_2, behavior on treating with concd. HCl and X-ray patterns. The results indicated that mixed gels were not the media of exchange adsorption in soils. It was concluded that the base exchange in soils was effected by the cryst. minerals kaolinite and montmorillonite and a clay mineral, x, which needed further investigation.

8425. Mattson, Sante and Gustafsson, Yngve. **The chemical characteristics of soil profiles. II. The mutual interaction of podzolic materials.** *Lantbruks-Hogskolans Annaler* **2**, 1-30 (1935).—*C.A.* **29**, 5564^6.

The isoelec. point and the power to bind acid and base varied greatly for materials contained within the podzol profile. For comparison the theoretical capacity of ampholytes to neutralize acid or base was calcd. for varying dissocn. consts. Curves were plotted representing concn. of salt or amts. of base or acid in combination at different H-ion activities. Strong ampholytes appeared no stronger than weak ampholytes because of the mutual neutralization of acidic and basic groups in ampholytes whose K_aK_b product was high, K_a and K_b representing dissocn. consts. for acid and base, resp. The electrochem. properties of ampholytes and amphoteric colloids were not governed alone by pos. or neg. charges from an excess of cations or anions, but were modified by ions or inner salts ("zwitter ions") which existed in max. concn. at the isoelec. point.

8426. Puri, Amar Nath. **Estimating exchangeable calcium and other cations in soils.** *Soil Science* **42**, 47-59 (1936).

The method of estimating exchangeable Ca in calcareous soils consisted in shaking the soil with 0.05 *N* Na_2CO_3 in *N* NaCl. The decrease in the concentration of CO_3 ions was equivalent to exchangeable Ca in the soil. Exchangeable Ca in calcareous soils could also be detd. by shaking a known wt of the soil with a definite mixt. of K or NH_4 oxalate-acetate-carbonate. $CaCO_3$ was insol. and the decrease in the concentration of oxalate ion was equivalent to exchangeable Ca. Soils containing gypsum required a preliminary treatment with excess $BaCO_3$ when the $CaSO_4$ was converted into $BaSO_4$ and $CaCO_3$, and thus rendered insoluble.

8427. Rost, C. O. **Characteristics of some morphological solonetz soils of Minnesota.** *J. Am. Soc. Agron.* **28**, 92-105 (1936).

The exceptional features of the profiles were the very low amount of exchangeable Na and the very high amounts of exchangeable Mg found in the complex of the B horizon. Ordinarily the Ca and Mg accounted for 90% or more of the exchangeable bases and of this the exchangeable Mg comprised 0.5 to 0.75. The average percentage of exchangeable Na in the same horizon was approx. 3.0 and was lower than would be expected if the soils were classified as solonetz. Those for exchangeable Mg, on the other hand, were much higher than would be anticipated.

8428. Kelley, W. P. **Reclamation of alkali soils.** *Calif. Agr. Expt. Sta., Bull.* **617**, 40 pp. (1937).—*C.A.* **32**, 7628^9.

Alkali soils contained either an excess of sol. salts or of adsorbed Na and reclamation depended upon the removal of these excesses. Black alkali soils contained both sol. carbonate and adsorbed Na. When drainage conditions were favorable, these constituents were removed by applying the proper amt. of gypsum, S, $FeSO_4$ or alum, and then leaching. The application of 1000 lb per acre gave as good results as larger amts. The effect of S was dependent on its oxidation and several months were required for max. effects. The application of stable manure and the culture of such alkali-resistant crops as Bermuda grass or Melilotus alba were valuable aids to reclamation.

8429. Mattson, Sante and Gustafsson, Yngve. **The electrochemistry of soil formation. I. The gel and the sol complex.** *Kgl. Lantbruks-Högskol. Ann.* **4**, 1-54(1937).—*C.A.* **32**, 5127^1.

The functions of org. matter, Al, Fe and silicic acid and the interaction of colloidal hydroxides and acids were discussed. The anionic and cationic sol complexes, obtained at different pH values in the exts. from various mixts. of soil and humus, were studied with respect to compn. and isoelec. point. A min. of solvation was found at a pH corresponding to the isoelect. point of the gel complex in the mixt. Above this pH the sol complex was anionic and more acidic than the gel complex, whereas it was cationic and more basic than the latter at a lower pH.

8430. Mattson, Sante and Wiklander, Lambert. **The equi-ionic point and the point of exchange neutrality of soils.** *Kgl. Lantbruks-Högskol. Ann.* **4**, 169-89(1937).—*C.A.* **32**, 4706^7.

The "equi-ionic" point of a soil was defined as that pH of a soln. which was unaffected by the addn. of the soil in its completely unsatd. condition. At this point the abs. capacities of the soil to bind acid and base were equal and the net capacity to bind acid or base was equal to zero. The point of exchange neutrality was defined as that pH of a soil suspension which was unaffected by the addn. of a neutral salt. The ultimate pH was defined as the reaction of the completely unsatd. or electrodialyzed soil.

8431. Albrecht, W. A. and McCalla, T. M. **The colloidal clay fraction of soil as a cultural medium.** *Am. J. Botany* 25, 403-7(1938).—*C.A.* 32, 8656^5.

Water-insol. ions adsorbed on clay were available as nutrients to plants. Electrodialyzed H-clay was treated successively by addns. of Mg, PO_4, K, Ca and NH_4. This prepd. clay of known base-exchange compn. was used in aq. suspensions as nutrient media for Rhizobium and soybeans. The method permitted accurate chem. control in studies of the interrelations between soil and plants. Plant growth was more normal than when culture soln. methods were used.

8432. Lutz, J. F. **The effect of iron on some physiochemical properties of bentonite suspensions.** *Soil Sci. Soc. Am., Proc.* 3, 7-12 (1938).—*C.A.* 33, 5108^9.

Electrodialyzed bentonite suspensions were treated with $FeCl_3$ solns. equiv. to 12.5-250% satn. Proportionally more Fe was adsorbed at lower than at higher concns. Increased adsorption of Fe was assocd. with increased adsorption of Cl, but the relationship was not linear. The increase in anion-exchange capacity of soils high in exchangeable iron may influence fixation of P and other anionic fertilizer materials. Swelling of the dry colloid and hydration of the suspension were more nearly proportional to the Cl/Fe ratio than to the Fe adsorbed.

8433. Mehlich, Adolf. **Use of triethanolamine acetate-barium hydroxide buffer for the determination of some base-exchange properties and lime requirement of soil.** *Soil Sci. Soc. Am., Proc.* 3, 162-6 (1938).—*C.A.* 33, 6504^7.

The buffer capacity of com. triethanolamine contg. about 15% diethanolamine and 2.5% monoethanolamine was greatest at 0.1 *N* concn. between pH 7.5 and 8.3. The extg. soln. was prepd. by dilg. 500 ml of triethanolamine to 9 liter, adjusting to pH 6.0 with HOAc, adding 350 g $Ba(OH)_2 \cdot 8H_2O$, filtering and adjusting to exactly 0.2 *N* Ba by addn. of distd. water. The final soln. should have pH 8.15. The base-exchange capacity and exchangeable H was detd. by shaking 10-25 g of soil with 50 ml of extg. soln., filtering and leaching with 50 ml of extg. soln. Exchangeable H was detd. by titrating the ext. and the exchange capacity was detd. from the amt. of Ba remaining in the soil after leaching with distd. water and replacing the Ba by 0.5 *N* HOAc.

8434. Puri, Amar Nath and Asghar, A. G. **Titration curves and dissociation constants of soil acidoids.** *Soil Sci.* 45, 359-67(1938).—*C.A.* 33, 6498^2.

Increasing amts. of NaOH were added to 5-g portions of de-based soil and equil. was reached in 48 hrs with intermittent shaking. The pH values did not change much after contact of alkali with soil for 4 to 8 hrs. Hydroxides of other univalent ions such as LiOH, KOH and NH_4OH gave titration curves similar to, but not identical with, those obtained with NaOH. The end point was not sharp and must be reached at different pH values when different alkalies were used. With weak acids, neutralization with a strong base took place between 2 definite pH values. The pH for monobasic acids was 4. The inflection in the curve indicated that the soil acid was dibasic.

8435. Fireman, Milton and Bodman, G.B. **The effect of saline irrigation water upon the permeability and base status of soils.** *Soil Sci. Soc. Am. Proc.* 4, 71-7 (1939).—*C.A.* 35, 245^1.

Percolation of Yolo clay with salt-free water decreased its content of exchangeable bases throughout the column. Loss of NH_4 absorptive capacity occurred in the Yolo soil. The percentage decrease of K and Na in the Aiken soil and Na in the Yolo soil was greater than for other cations. Leaching the soils with water contg. 4000 p.p.m. of $CaCl_2$ + NaCl with a Ca:Na ratio of 1:6 increased the percolation rate. The total change in permeability was not identical with changes in sections of the soil column.

8436. Jenny, H. and Ayers, A.D. **The influence of degree of saturation of soil colloids on the nutrient intake by roots.** *Soil Sci.* 48, 443-59 (1939).—*C.A.* 34, 2989^3.

Base exchange was related to the degree of satn. of soil colloids. The exchangeability of adsorbed K decreased with decreasing degree of satn. The nature of complementary ions markedly affected the relationships. For instance, a K, Ca clay released nearly as much K at 40% satn. as at 100%, while a K, Na clay released markedly less K as degree of satn. was decreased. Clay particles having an effective settling diam. of less that 0.2μ were sepd. from Yolo clay loam. These colloids were leached with salt solns. or electrodialyzed with subsequent addn. of hydroxides. The base-exchange capacity varied from 59 to 67 milliequiv. per 100 g. A satd. soln. of CO_2 replaced a smaller percentage of the K present as the degree of satn. was decreased.

8437. Jenny, H. and Overstreet, R. **Cation interchange between plant roots and soil colloids.** *Soil Sci.* 47, 257-72(1939).—*C.A.* 33, 7457^5.

Data given were on the effect of colloidal clay suspensions on the mineral compn. of plant roots. Low-salt barley roots had a pronounced capacity to retain K ions against distd. H_2O. The roots were active in absorbing K from KCl solns. Dil. clay suspensions carrying absorbed Na, NH_4, or H ions pulled out K from normal low-salt roots and the reduction in the K level of the root depended on clay concn., particle size, and nature of the absorbed cation. Ca-bentonities, in the concns. used, did not greatly affect the K status of the roots.

8438. Kelley, W.P. **Effect of dilution on the water-soluble and exchangeable bases of alkali soils and its bearings on the salt tolerance of plants.** *Soil Sci.* 47, 367-75(1939).—*C.A.* 33, 8878^2.

The total amt. of Na removed from an alkali soil by displacement procedure was sometimes slightly smaller than that removed by extn. with a soil-water ratio of 1:5. The difference was not sufficiently great to cause serious errors in so far as practical agriculture was concerned. One of the soils showed 34.6 milliequivs. of Na per 100 g by displacement and 39.1 milliequivs. in an aq. ext. (soil-H$_2$O ratio 1-3.2). H$_2$O-sol. Ca and Mg were less affected by diln. than was Na. Among the common ions of alkali soils, the total amts. of bicarbonate and sulfate were likely to be the most markedly affected by diln., whereas chloride and nitrate were but little affected.

8439. MALQUORI, ALBERTO. **Determination of the base-exchange capacity of soil.** *Ricerca sci.* **10**, 562-3 (1939).—*C.A.* 34, 206^5.

A table was given with a comparison of 6 methods and 2 types of acid soils, and in addn. 3 of the methods applied to a clay-lime soil pH 7.6.

8440. MURPHY, H.F. **The role of kaolinite in phosphate fixation.** *Hilgardia* **12**, 343-82 (1939).—*C.A.* 34, 2999^7.

Kaolinite when ground to colloidal dimensions had a high phosphate-fixing capacity. The fixation was greatest at acid reactions and this indicated that the H$_2$PO$_4$ ion was the most favored phosphate ion for the reaction. An increase in base-exchange capacity accompanied the increase in phosphate fixed. Even a little kaolin in soils, if in a colloidal condition, would bind the phosphate and make it unavailable to plants. Bentonite had a much lower capacity to fix P in an inaccessible form for plant growth than did colloidal kaolinite. The results explained why soils with a kaolinic type of clay had a high capacity to fix phosphate and a low phosphate availability as measured by plant growth.

8441. PAGE, J.B. AND BAVER, L.D. **Ionic size in relation to fixation of cations by colloidal clay.** *Soil Sci. Soc. Am. Proc.* **4**, 150-5(1939). —*C.A.* 35, 246^8.

The fixation of K by drying may be related to the size of the K$^+$ and contraction of the variable lattice of the montmorillonitic clay minerals. Bentonite colloid did not fix K as readily as Miami colloid, and the fixed K was slightly affected by the concn. of the replacing ion. Large cations such as (C$_2$H$_5$)$_2$NH$^+$ prevented the lattice sheets from coming together on drying and prevented fixation of K. Univalent and bivalent cations with ionic sizes close to the size of certain free spaces within the lattice were closely correlated with susceptibility to fixation.

8442. STOUT, P.R. **Alternations in the crystal structure of clay minerals as a result of phosphate fixation.** *Soil Sci. Soc. Am. Proc.* **4**, 177-82 (1939).—*C.A.* 35, 251^4.

Ground kaolinite and halloysite fixed 300-400 millimols. of phosphate per 100 g of air-dry material. Bentonite of about the same base-exchange capacity fixed insignificant amts. of P. Measurement of water losses from the system kaolinite + KH$_2$PO$_4$ accounted for the exchange of PO$_4$ ions for OH of the crystal lattice. The relative abilities of kaolinite and bentonite to fix phosphate were related to the OH$^-$ available for exchange. Kaolinite ground to less than 1 μ diam. was amorphous to X-rays when phosphated. Removal of the phosphate by leaching at pH 9 followed by washing with HCl at pH 3-4 restored the X-ray pattern.

8443. GRAHAM, E.R. **Primary minerals of the silt fraction as contributors to the exchangeable-base level of acid soils.** *Soil Sci.* **49**, 277-82(1940).—*C.A.* 34, 5585^3.

Definite transposition was shown of Ca from the crystal lattice of finely ground anorthite, hornblende and augite to the ionic atm. of colloidal clay. Microcline and biotite were but little affected by the action of H$^+$ of colloidal clay. The H of acid Putnam clay released 3.4% of the total Ca of anorthite in 107 days, as compared to 0.03% of the total Ca by simple hydrolysis in 70 days. During this metathesis reaction, the pH of the colloidal clay changed from 3.3 to 5.7. Any soil void of Ca feldspars would necessarily be unable to maintain a high exchangeable-Ca level. In the absence of such soil-forming minerals Ca must be added in the form of limestone of fertilizers.

8444. HENDRICKS, S.B. AND ALEXANDER, L.T. **Semiquantitative estimation of montmorillonite in clays.** *Soil Sci. Soc. Am., Proc.* **5**, 95-9 (1940).—*C.A.* 35, 8176^4.

Competition ratios of adsorption of Ca^{++} and NH$_4^+$, H$^+$ and C$_5$H$_{10}$NH$_3^+$ (piperidine ion) and H$^+$ and Ce^{+++} were detd. for various montmorillonites and micaceous samples. The H$^+$, Ce^{+++}, distribution was most useful for estn. of montmorillonites, since these took up more Ce^{+++}; micaceous samples took up more H$^+$ from solns. of equivalent concn. of these ions. The relative proportion of each mineral present in mixts. could be estd. from the absorption ratios and the total exchange capacity. The estimate agreed within 10% with the ratio detd. by thermal methods.

8445. MATTSON, SANTE AND WIKLANDER, LAMBERT. **The "amphoteric" double layer and the double ionic exchange in soils.** *Trans. Faraday Soc.* **36**, 306-19 (1940).—*C.A.* 34, 2990^6.

The highly amphoteric soils, such as the brown and red earths of the Unden series of profiles from Sweden, adsorbed and exchanged, simultaneously, large quantities of anions and cations at or near the pH at which equiv. amts. of anions and cations were adsorbed. It was found that this exchange took place according to the mass law as expressed by the Donnan equil.

8446. MATTSON, SANTE AND WIKLANDER, LAMBERT. **The laws of soil colloidal behavior. XXI. A. The Amphoteric points, the pH and the Donnan equilibrium. B. Experimental.** *Soil Sci.* **49**, 109-34, 135-53 (1940).—*C.A.* 34, 4201^5.

The soil pH, the concn. and compn. of the soil soln., and the capacity of the soil to bind base at a given pH were interdependent variables. A study of the influence of humus upon the reactions of laterite soil was made by adding 2.5, 5.0 and 10.0% of humus acidoid, then detg. the pH in H$_2$O and in increasing concns. of Na$_2$SO$_4$ and BaCl$_2$. The pH in H$_2$O was lowered, the exchange alky. in Na$_2$SO$_4$ was reduced. This gave rise to pronounced maxima in exchange alky. in dil. solns. Exchange acidity in $BaCl_2$ was increased and this increase was greater in concd. soln.

8447. Penman, H.L. **Gas and vapor movements in the soil. I. The diffusion of vapors through porous solids.** *J. Agr. Sci.* 30, 437-62 (1940). —*C.A.* 35, 1165^9.

The dependence of the coeff. of diffusion, D, upon the porosity, S, of a granular solid was investigated. For steady state conditions, with CS_2 and acetone vapors, a curve connecting D/D_0 and S could be drawn which was independent of the nature of the solid, its moisture content and, within limits, its texture. For a limited range of values of S ($0.0<S<0.7$) a good approximation was $D/D_0 = 0.66S$.

8448. Penman, H.L. **Gas and vapor movements in the soil. II. The diffusion of carbon dioxide through porous solids.** *J. Agr. Sci.* 30, 570-81 (1940).—*C.A.* 35, 2255^9.

A detailed description of an app. for measuring the rate of diffusion of CO_2 through granular solids was given and its method of operation described. The results obtained on this app. for CO_2 conform to the curve connecting D/D_0 and S previously obtained for CS_2 and acetone (D=coeff. of diffusion and S=porosity). By the application of the equation $D/D_0=0.66\ S$ to a discussion of soil aeration, it was shown that at all porosities the rate of diffusion of CO_2 from soil was sufficient to account for normal respiration without invoking the assistance of meterological changes.

8449. Radu, I.F. **The base-exchange capacity of soils.** *Bodenkunde u. Pflanzenernahr.* 21/22, 574-580(1940).—*C.A.* 37, 2115^4.

Expts. on adsorption of NH_4 from N NH_4OAc (adjusted to various pH values 4-10) showed only slight but regular increases with pH for bentonite, but large increases for brown kaolin. A plot of adsorptive capacity vs. pH of the reagent soln. was a good basis for conclusions as to the nature of the soil colloid, whether predominantly montmorillonitic or kaolinitic.

8450. Scheffer, F. and Schachtschabel, P. **The determination of the sorption capacity of organic materials in soils.** *Bodenkunde u. Pflanzenernahr.* 21/22 , 643-55 (1940).—*C.A.* 37, 6793^9.

Methods of detg. the sorption capacity of soils were compared and the following procedure recommended: To 5 or 10 g soil in a beaker add, resp., 1 or 2 drops of AcOH and 15 or 30 cc. 15% H_2O_2, cover, let stand 1 hr on water bath, evap. to dryness and repeat the process with 15 cc. H_2O_2. Wash the treated soil into a small filter tube with 0.1 N NH_4 acetate and continue until the washings total 250 cc. Wash out the excess NH_4 acetate with 250 cc. 96% EtOH, exchange the sorbed NH_4 for KCl by treating with 250 cc. 0.2 N KCl and det. NH_4 in an aliquot of the filtrate by the method of Parnas. Deduct this value from the similar one for the untreated soil.

8451. Schlenker, Frank S. **Plant growth in culture solution and availability of ions adsorbed on permutite and aniline black.** *Am. J. Botany* 27, 525-9 (1940).—*C.A.* 34, 7989^9.

Various cations were adsorbed on permutite and various anions were adsorbed on Demineralite. Mixts. were prepd. and suspended in water to simulate different nutrient solns. Plant growth in these suspensions was more satisfactory than in similar nutrient solns.

8452. Barbier, Georges and Coic, Yves. **The mechanism of the absorption of inorganic materials by the plant.** *Compt. rend. acad. agr. France* 27, 729-37 (1941).—*C.A.* 40, 4459^7.

Selective ionic absorption among plants was studied by growing peas in sand cultures supplied with a basic fertilizer and various K/Ca ratios. The absorption of ions by certain cellular constituents, ionic exchange, played an important part in selective absorption phenomena as well as phenomena in antagonism.

8453. Bourne, C.L.C. **Some preliminary experiments on phosphate fixation in British Guiana sugar-cane soils.** *Brit. Guiana Dept. Agr., Sugar Bull.*, No. 10, 50-61 (1941).—*C.A.* 36, 1428^4.

With addns. of 500 p.p.m. of P_2O_5 to numerous soils, the percentage fixation of added P_2O_5 ranged from 40 to 90. Fixation of P_2O_5 by acid soils was not affected by progressive increases in addns. of $CaCO_3$ in quantities sufficient to change the normal pH values from 4.07-4.56 to 6.34-7.56.

8454. Bray, R.H. and Dickman, S.R. **Adsorbed phosphates in soils and their relation to crop responses.** *Soil Sci. Soc. Am. Proc.* 6, 312-20 (1941).—*C.A.* 37, 993^9.

Increase of time and concentration influence phosphate adsorption in at least 2 ways: (a) the total amount adsorbed increased, and (b) some of the phosphate became "more tightly adsorbed", i.e., a secondary reaction occurred. Extraction with NH_4F in neutral and acid solutions provided a means of fractionating the soil P into 3 fractions: Fraction 1 corresponded to the replaceable phosphate, and fractions 2 and 3 corresponded to the "more tightly" adsorbed phosphate which slowly changed to fraction 1 as fraction 1 was removed. A 4th fraction or "acid-sol." phosphate was considered to be such forms as rock phosphate, apatite and similar Ca and Mg compounds, as well as Fe, Al or Mn phosphates.

8455. Johnson, A.L. and Norton, F.H. **Fundamental study of clay: Preparation of a purified kaolinite suspension. I.** *J. Am. Ceram. Soc.* 24, 64-9 (1941).—*C.A.* 35, 1952^9.

Org. matter was removed by H_2O_2 and NaOH digestion, followed by an electrodialysis treatment to remove other inorg. salts and to prep. a clay-water suspension. After NaOH was added, viscosity and titration values were given, in curve form, for (*a*) a regular water-washed Florida clay, (*b*) the same clay after electrodialysis and (*c*) after thorough cleaning by the method here given. If the sample contained lignite, a clean clay exhibited *rheopexy* at certain concns. of NaOH.

8456. Johnson, A.L. and Norton, F.H. **Fundamental study of clay. II. Mechanism of deflocculation in the clay-water system.** *J. Am. Ceram. Soc.* 24, 189-203(1941).—*C.A.* 35, 5267^3.

Small traces of sol. salts or adsorbed ions present in com. clays had important influences. If it was assumed that kaolinite developed active areas on the formation of colloidal particles resulting from fracture parallel to the *c*-axis, which areas were then capable of preferential adsorption of the hydroxyl group, the following conditions must be fulfilled in order that max. dispersion of clean slip may result: (*a*) univalent cations must serve as the countercharges and (*b*) the medium must contain a slight excess of hydroxyl ions, that is, it must be alk. When Ca^{++} ions were present with clays, Na silicate would deflocculate the clay better than Na_2CO_3 owing to the greater soly. of $CaCO_3$ over Ca silicate. If Mg^{++} ions, however, were present as sol. salts, Na_2CO_3 should be as effective as Na silicate on the basis of soly. data.

8457. LAATSCH, W. **The fixation of phosphoric acid by clays.** *Bodenkunde u. Pflanzenernahr.* 23, 17-31 (1941).—*C.A.* 36, 4949[6].

NH_4 zeolites and NH_4 clays sorbed PO_4 ions from K phosphate solns. This anion sorption increased with P_2O_5 and H-ion concn. Bicarbonate ions displaced the sorbed PO_4 ions from the colloid surfaces; SO_4^{--} and Cl^- favored the fixation. The fixation of PO_4 ions by Ca montmorillonite followed the same rules as the fixation by NH_4 clays. The pptn. of PO_4 ion as an insol. Ca salt was not observed (probably because the sorption of PO_4 ion by Ca clays was very rapid).

8458. MARSHALL, C.E. AND BERGMAN, W.E. **The electrochemical properties of mineral membranes. I. The estimation of potassium-ion activities.** *J. Am. Chem. Soc.* 63, 1911-6 (1941).—*C.A.* 35, 5772[4].

Data were given for the charge on the following membranes (expressed as an ionic activity) as related to the temp. of drying: Ca-, H- and K bentonite; for the membrane (bentonite) potentials with the following salt solns.: $CaCl_2$ and $MgSO_4$; and for the effect of pH and large anions (acid phthalate, *p*-toluenesulfonic acid and *p*-nitrophenol). The results indicated that K^+ activities could be detd. in the absence of other univalent cations with a precision within 5% at pH values above 4. A high degree of reproducibility was possible with com. Wyoming bentonite from which all particles larger than 200 mu in equiv. spherical diam. had been removed by supercentrifuging.

8459. MATTSON, SANTE AND KOUTLER-ANDERSSON, ELISAVETA. **The acid-base equilibrium in vegetation, straw and humus. I. Acids, acidoids and bases and their decomposition. II. Acids, acidoids and bases in relation to soil type.** *Lantbruks-Hogskolans Ann.* 9, 1-26, 27-37(1941). —*C.A.* 37, 4765[9].

Studies were reported of mature leaves and needles, straw and green plant substance before and after preserving for a year under aerobic and anaerobic conditions and with and without leaching. In the aerobic series the pH increased rapidly on account of the destruction of the org. acids. The higher the content of bases and acids the more pronounced was this increase. If the content of bases was low or there was much leaching, the pH declined later because of the formatio of acidoids. There was a linear relationship between the H-ion activity and the content of acidoids of the electrodialyzed cured straw and its residue after decompn. The pH, acidity, content of bases, acidoids and org. acids, final pH and exchangeable acidity were detd. in a series of brown earth and podzol soils.

8460. NIKIASHKINA, P.I. **The availability of adsorbed potassium.** *Pedology* (U.S.S.R.) 1941, No. 5, 74-80 (German summary).—*C.A.* 39, 4423[5].

Podzol, degraded chernozem, and red soil samples were satd. with K by using a mixt. of KCl and CH_3COOK. The soil was used as a source of K in growing barley in 1:1 sand-soil mixture. The adsorbed K in podzols was less available than in the other soils tested.

8461. RATHJE, WERNER. **The phosphates. II. Neutral and basic phosphates of the alkali earth metals.** *Ber.* 74B, 342-9(1941).—*C.A.* 35, 4922[8].

The insol. phosphates of Ca, Sr, Ba and Mg were prepd. by the method of "acidimetric pptn." Stoichiometrically equiv. solns. of an alk. earth salt and KH_2PO_4 were added to boiling water in 0.5-cc. portions, followed by sufficient NaOH soln. to keep the mixt. neutral to indicators (bromothymol blue, methyl red and phenolphthalein). Time was allowed after each addn. for the reaction to complete itself. The compn. of the salt pptd. was indicated by the relative amts. of KH_2PO_4 and NaOH used; e.g., in the formation of a triphosphate, $9MCl_2 + 6KH_2PO_4 + 12NaOH \rightarrow 3M_3(PO_4)_2 + 6KCl + 12NaCl + 12H_2O$, the PO_4^{---} -NaOH ratio was 1:2; if a hydroxyapatite was formed, $10MCl_2 + 6KH_2PO_4 + 14NaOH \rightarrow 3M_3(PO_4)_2.M(OH)_2 + 6KCl + 14NaCl + 12H_2O$, a 3:7 ratio occurred. By this procedure it was found that Mg and Ba formed the triphosphates $Mg_3(PO_4)_2$ and $Ba_3(PO_4)_2$, and Ca and Sr formed the hydroxyapatites $Ca_3(PO_4)_2.Ca(OH)_2$ and $Sr_3(PO_4)_2.Sr(OH)_2$.

8462. RATHJE, WERNER AND GIESECKE, FRIEDRICH. **The phosphates. III. Hydroxy-fluo-apatite, the mineral in rock phosphate.** *Ber.* 74B, 349-56 (1941).—*C.A.* 35, 4923[2].

The occurrence of OH, F, Cl, Br, I, SO_4 and CO_3 in natural phosphates has been confirmed by a study of the stability of these compds. in the presence of water. The OH group in artificial hydroxyapatite was displaced by F, SO_4 and CO_3 in concns. above the soly. products of the Ca salts. On the other hand, when hydroxyapatite was treated with F^-, SO_4^{--} and CO_3^{--} below the soly products of their Ca salts, the appearance of an alk. reaction indicated the formation of a definite compd. A new form of hydrofluoxyapatite, isomorphous with hydroxyapatite, was prepd., stable in the presence of water.

8463. RATHJE, WERNER. **The phosphates. IV. Neutral and basic phosphates of some heavy metals.** *Ber.* 74B, 357-62(1941).—*C.A.* 35, 4923[4].

The principle of "acidimetric pptn." was used in the prepn. of the tertiary phosphates of certain heavy metals. NaOH was added to the reaction mixt. in such amts. as to provide the proper environment required by the ppt. Cd, Mn, Fe^{++}, Co, Ni and Cu were pptd. as triphosphates, $M_3(PO_4)_2$; Al, La, Ce and Bi as neutral phospates, MPO_4; Zn and Pb as hydroxyapatites, $3M_3(PO_4)_2 \cdot M(OH)_2$. In order to ppt. $FePO_4$ free from $Fe(OH)_3$, H_3PO_4 solns. were used to repress OH^-.

8464. SCHACHTSCHABEL, P. **Inorganic sorption carriers of soils.** *Bodenkunde u. Pflanzenernähr.* **23**, 1-17 (1941).—*C.A.* 36, 4948^7.

Equal parts of $BaCl_2$ and $MgCl_2$ was a more suitable mixt. for the detn. of the inorg. sorption carriers of soils than a soln. of Ca acetate NH_4 acetate. The ion layer of montmorillonite (in equil. with the mixed soln.) consisted of 57% Ba and 43% Mg; with mica the proportion of Ba ions reached 91%. The sorption capacity of kaolins in soils was low; it was the same as that of montmorillonite.

8465. TADOKORO, TETSUTARO; NISHIDA, MASAO; MAKINO, YOSHIO; ITO, KEIZO, AND SASAKI, TAKESHI. **Stimulant for cane-sugar formation in plants. VIII. IX. X.** *J. Agr. Chem. Soc. Japan* **17**, 97-100, 641-3 (1941); **18**, 269-72 (1942).—*C.A.* 45, 4067*i*.

Sugars of the sugar cane increased when urea was used as N fertilizer. With sugar beets, sugars increased, but ascorbic acid decreased when urea, K_2CO_3, and some adsorbent (active carbon or Fuller's earth) were applied. On the soils of Formosa the yield of sugar of sugar cane was high in non-fertilized areas or in areas of little N and much K. Application of urea and adsorbent gave results similar to those with a small amt. of N fertilizer, i.e. the sugar in the cane increased. Thus, the addn. of adsorbent, the restriction of N fertilizer, and the application of K fertilizer had similar good effects on the formation of cane sugar. The action of the stimulant for cane-sugar formation, i.e an unidentified coloring substance found in the culture soln. of bacterium and fungus, and in the soil of citrus-producing areas (lumiflavin also had the same stimulating action), was greater when combined with the application of urea and adsorbent.

8466. BASU, J.K. AND TAGARE, V.D. **Availability of phosphates in calcareous soils of the Bombay-Deccan in relation to sugar-cane yields and quality of juice.** *Proc. 11th Ann. Convention Sugar Tech. Assoc. India* **1942**, **I**, 15-18.—*C.A.* 37, 6072^8.

The soils contained 3-12% $CaCO_3$; 80-100% of added P_2O_5 became unavailable as carbonate-apatite in the unfertilized soil, but gave increased yields if fertilizer was also added.

8467. COLEMAN, RUSSELL. **Utilization of adsorbed phosphate by cotton and oats.** *Soil Sci.* 54, 237-46 (1942).—*C.A.* 37, 999^7.

Ability of oats and cotton to feed on phosphates adsorbed by kaolinitic and montmorillonitic clays was determined in pot experiments with sand and nutrient solution. A known amount of phosphate was adsorbed by the clays against acid and alkaline extracting solutions, and its availability was measured by both crop yields and plant analyses. The plants grew well on relatively small amounts of phosphates held by either of the clays and, in most cases, utilized 30 to 40% of the adsorbed phosphate present. The results indicated that large amounts of P that heretofore had been considered fixed were available to plants.

8468. GOLDEN, L.B.; GAMMON, N., AND THOMAS, R.P. **A comparison of methods of determining the exchangeable cations and the exchange capacity of Maryland soils.** *Soil Sci. Soc. Am. Proc.* 7, 154-61 (1942).—*C.A.* 37, 6073^9.

Ten different soils were studied for displaceable bases and the total exchange capacity. The solns. tested were *N* NH_4-acetate, NH_4-formate, NH_4Cl, Ba acetate, Ba formate, $BaCl_2$, Mn acetate, $MnCl_2$, K acetate, KCl, 0.5 *N* AcOH, 0.05 *N* HCl, 0.2 *N* cupric acetate and boiling NH_4Cl. The Ba salts were absorbed in large quantities by the exchange complex but when absorbed did not displace equiv. amts. of other cations. The K^+ was highly absorbed by the exchange complex. The manganous and cupric acetate solns. gave good and consistent total exchange capacity values for rapid uses. The acetate anion gave the highest and most consistent results for both displaced bases and the total exchange capacity.

8469. GOLLAN, JOSUE JR. AND CODONI, M.R. **The cation-exchange capacity of soil fractions.** *Anales assoc. quim. argentina* **30**, 146-57 (1942).—*C.A.* 37, 1818^8.

Soil was sepd. into 2 fractions, one containing particles greater than 2 μ, the other less. The cation-exchange capacity was practically zero in the 2 μ fraction, but varied within wide limits in the other fraction. Fractions contg. particles greater than 2 μ which had appreciable exchange capacity, contained aggregates and clumps of particles smaller than 2 μ.

8470. HARADA, MITSURU. **Weathering of eruptive rocks. VIII. New color reactions for clay minerals.** *J. Agr. Chem. Soc. Japan* **18**, 707-13 (1942); *Bull. Agr. Chem. Soc. Japan* **18**, 57-8 (1942)(in German).—*C.A.* 45, 8940*a*.

Montmorillonite could be detected by the dark blue color obtained by adding in succession 5 ml of 2% borax soln., 20 mg of *p*-phenylenediamine-HCl and a little HCl, by the blue color obtained by adding 5 ml of 0.5% metol soln., 5 ml of 10% NaOAc + 10 mg MnO_2 per g of sample, or by the blue color obtained with benzidine-HCl and NH_4OH. Halloysite and kaolinite could be identified by the violet color obtained with benzidine-HCl, MnO_2, and citric acid.

8471. HEINZE, E. **A contribution to the chemical investigation of soils, especially the sorption complex.** *Bodenkunde u. Pflanzenernähr.* 26, 331-62 (1942).—*C.A.* 37, 4172^1.

The soil sample was taken so that the bedding was not disturbed while transferring the sample to a membrane filter for treatment with reagent solns. The solns. used were 0.2 *N* NH_4Cl, 0.2 *N* K_2SO_4, and 1 *N* Ca acetate. The content of materials detd. in the 0.5 liter of filtrate, was used for the calcn. of limiting values and content of sol. salts. Substances detd. in a series of soils showed a regularity of relationships.

8472. Kelley, W.P. **Modern clay researches in relation to agriculture.** *J. Geol.* 50, 307-19 (1942).—*C.A.* 37, 709^8.

The montmorillonite, halloysite and kaolin groups of minerals were most important. Base-exchange and phys. properties depended largely on the nature of the cryst. material present.

8473. Rathje, Werner. **The phosphates. VI. The phosphate equilibrium in the soil.** *Bodenkunde u. Pflanzener nähr.* 28, 129-59 (1942).—*C.A.* 37, 4178^9.

Hydroxyapatite, isomorphous mixts. of hydroxyapatite and fluorapatite, mixts. of $AlPO_4$ and and $Al(OH)_3$ and $FePO_4$ and $Fe(OH)_3$ were prepd. by the method of acidimetric pptn. without contamination by secondary phosphates. Satd. solns. of the apatite in pure water, pH 6.7, could be prepd. by shaking 8 hrs at room temp. or at 95°C and contained, resp., 0.6 and 1.9 mg P_2O_5 per liter. The soly. of the hydroxyapatite and the above hydroxyfluorapatite in water and in very dil. solns. of strong acids and bases increased with the H-ion concn. The soly. of hydroxyapatite was about double that of hydroxyfluorapatite contg. 35% fluorapatite and 4 times that of hydroxyapatite with 70% fluorapatite. The P_2O_5 concns. of the soil soln. and those optimal for growth of many plants were of the same order of magnitude as those called for by the soly. equilibria of the hydroxyfluorapatites and the coexisting sesquioxide phosphates.

8474. Schlenker, Frank S. **Availability of adsorbed ions to plants growing in quartz sand substrate.** *Soil Sci.* 54, 247-51 (1942).—*C.A.* 37, 997^1.

Essential fertilizer ions (N, S, P, K, Ca, and Mg) adsorbed on either zeolite or aniline black, and mixed with quartz sand, supported the growth of either soybeans or kidney beans and successive crops of corn and buckwheat. Comparative experiments showed that the use of adsorbed ions produced greater plant growth than equivalent fertilization with soluble salts. In general, crop yields, in terms of either fresh weight or height, paralleled fertilization.

8475. Staǐkov, Ts. **The occurrence of difficultly soluble magnesium salts that affect the exchangeable magnesium.** *Bodenkunde u. Pflanzenernähr.* 28, 105-18 (1942).—*C.A.* 37, 4181^9.

Various horizons of the profiles of several soils were leached with *N* NaCl or NH_4Cl until all exchangeable Mg was removed or with 0.05 *N* HCl until no further Mg was dissolved. The fact that all 3 solvents removed practically the same amt. of Mg from neutral soils indicated that these soils contained no Mg difficultly sol. in H_2O, that affected the exchangeable Mg. From alk. soils these solvents extd. amts. of Mg increasing in the order NaCl, NH_4Cl, HCl.

8476. Yano, Takeshi; Chikamorti, Kinichiro; Mizuno, Shunji, and Sano, Kimio. **Fertilizing experiments to determine the three-element requirements of cane sugar in the Zirin district, Taiwan.** *J. Soc. Trop. Agr. Taihoku Imp. Univ.* 14, 243-53 (1942).—*C.A.* 42, 2382*f*.

The highest yield of cane sugar in the Zirin district, Formosa, was obtained when the required 3 elements N, P, and K, were supplied through fertilizers in the ratio 100:6:16. Of the three, N was the most important, but when used alone, the yield was about half as much.

8477. Bodman, Geoffrey B. and Day, Paul R. **Freezing points of a group of California soils and their extracted clays.** *Soil Sci.* 55, 225-46 (1943).—*C.A.* 37, 4172^6.

A distinct correlation existed between clay content and moisture content at a const. moisture potential. This influence became progressively less as the energy level diminished. Different soil clays displayed widely differing moisture-potential curves. The curves for the clays were between those for the natural soils on the one hand and those for bentonite and kaolinite on the other. The surface properties, extent of surface, and structural configuration were very much the same for colloids from soils of related origin.

8478. Bray, R.H. **Rapid tests for measuring and differentiating between the adsorbed and acid-soluble forms of phosphate in soils.** *Com. Fertilizer* No. 1, 66, 30-6 (1943).—*C.A.* 37, 5813^9.

Adsorbed P was detd. as follows: Place 1 g air-dried soil in a flat-bottomed 15 1/2 × 50 mm glass vial, add 7 ml of a soln. of 0.03 *N* NH_4F in 0.025 *N* HCl, close with cork stopper, shake 1 min. and allow to settle for over 1/2 hr until the supernatant liquid is clear. Add 0.25 ml acid NH_4 molybdate soln. (100 g NH_4 molybdate in 850 ml distd. H_2O added slowly with stirring to a second soln. of 1700 ml concd. HCl in 160 ml H_2O), stir carefully with glass rod without disturbing the soil in the bottom of the tube. Stir with a bright tin rod. Read the colors by looking through the tube at an angle of about 45° at a white paper lying horizontally. Standard phosphate solns. could be used for comparing the colors.

8479. Graham, E.R. and Albrecht, W.A. **Nitrate absorption by plants as an anion-exchange phenomenon.** *Am. J. Botany* 30, 195-8(1943).—*C.A.* 37, 3797^8.

Maize plants on a substrate of low N content grew equally well when extra N was added adsorbed on resin (Amberlite IR-4) and when N was added in water-sol. form. When plants were growing actively and water-sol N was leached from cultures given N in this form, N deficiency resulted. Leaching of cultures contg. adsorbed N produced no effect on growth.

8480. Joffe, J.S. and Kunin, R. **Mechanical separates and their fractions in the soil profile. II. The cation-exchange properties and pedogenic implications.** *Soil Sci. Soc. Am., Proc.* 8, 386-7(1943)(Published 1944).—*C.A.* 39, 372^8.

The low exchange capacity of the same separates in the A and B as compared with that of the C horizon of 2 soil types indicated degradation of the exchange complex. In the clay fractions the higher exchange capacity of the A horizon was due to the organo-mineral gels and to the residual org. matter. There seemed to be no difference in the exchange capacity of the different sized clay fractions. Montalto clay fractions had an exchange capacity similar to that of laterite. There was no difference in the exchange capacity of the clay fractions in the B and C horizons. In the solodized chernozem, bentonite-like minerals probably account for the high exchange capacity.

8481. LAATSCH, W. **Adsorption of phosphoric acid in soil.** *Kolloid-Z.* 102, 60-6 (1943).—*C.A.* 37, 6074⁶.

Ca permutites adsorbed PO_4 ions from alkali phosphate solns., as did also Ca montmorillonites. Humic acid added to Ca clays decreased such adsorption and could release already sorbed phosphate.

8482. MARSHALL, C.E. **Cationic activities, exchangeable bases and uptake by plants.** *Soil Sci. Soc. Am., Proc.* 8, 175-8(1943)-(Published 1944).—*C.A.* 39, 575⁷.

The relationship between the chem. environment of the plant root and the compn. of the plant was reexamd.

8483. PERKINS, ALFRED T. AND KING, H.H. **Phosphate fixation by soil minerals: mica and related groups.** *Soil Sci. Soc. Am., Proc.* 8, 154-8 (1943).—*C.A.* 39, 378².

Major phosphate fixation by this group of minerals seemed to depend on structural or anionic Al (AlO_3^-), while minor amts. of phosphate fixation depended on cationic aluminum or magnesium (Al^{+++} or Mg^{++}) and possibly the hydroxyl radical. It appeared that phosphate fixation was accompanied by the spreading of the space lattice.

8484. RAYCHAUDHURI, S.P.; SULAIMAN, M. AND BHUIYAN, A.B. **Physicochemical and mineralogical studies of black and red soil profiles near Coimbatore.** *Indian J. Agr. Sci.* 13, 264-72 (1943).—*C.A.* 42, 6479*h*.

The base-exchange capacities of both soils and clay fractions decreased after treatment with Na_2S-oxalic acid, and those of the residues from the black soils and clay fractions after Truog's treatment were higher than those of the residues from the red soils and clay fractions. The base-exchange capacities of the black soil were higher than those of the red. The org. C content and the C/N ratio were higher for the black soils than the red, but the total N percentages were about equal.

8485. RICH, C.I. AND OBENSHAIN, S.S. **Effect of certain soil treatments on the cation-exchange properties and organic matter content of Dunmore slit loam.** *Soil Sci. Soc. Am., Proc.* 8, 304-12(1943)(Published 1944).—*C.A.* 39, 375⁵.

Fertilizer and cropping practices which tended to increase crop yields at Blacksburg, Va. also tended to increase soil org. matter and cation-exchange capacity. There was a significant pos. correlation between org. matter content and cation-exchange capacity of the soil. Superphosphate, rock phosphate, muriate of potash and farm manure had little or no effect on soil reaction. $(NH_4)_2SO_4$ caused a reduction of the pH and exchangeable Ca and Mg and an increase in exchangeable H.

8486. SINGH, DALIP AND CHAWLA, DEV. RAJ. **Base exchange studies. II. Variation in the content of exchangeable bases affecting plant growth.** *Indian J. Agr. Sci.* 13, 368-76(1943).—*C.A.* 42, 3513c.

Parts of an original soil sample were exhaustively leached with neutral solns. of the chlorides of Na, K, Ca, and Mg, and these artificially satd. soils were mixed in various proportions with the original; max. displacement of Ca with 90.04, of Na 94.4, Mg 88.24, and K 86.09%. A large proportion of the citric acid-sol. K was constituted by exchangeable K ions that surrounded the clay particles. The percentage of mineral matter taken up by the plants was greatest from the K and least from the Ca soils. In general, the base that was in excess was absorbed the most. Na increased the absorption of K, and Mg increased absorption of K and Na.

8487. ALBAREDA HERRERA, J.M. AND GUTIÉRREZ RÍOS, E. **Equilibrium of exchange cations in profiles of Spanish soils.** *Anales fis. y quim (Madrid)* 40, 365-78(1944).—*C.A.* 44, 258*b*.

The displacement of exchange cations from higher strata to lower in soil samples from five regions in Spain was studied. In the humid regions the sol. salts and the ratios of Na/Ca and (Na + K)/(Ca + Mg) increased with depth; in the arid regions they decreased with depth according to opposite washing effects which descended in the first case and ascended in the second.

8488. CASSIDY, N.G. **Exchangeable sodium and the physical properties of soils.** *Queensland J. Agr. Sci.* 1, No. 1, 140-56 (1944).—*C.A.* 39, 145⁴.

The chem. effect of an irrigation water upon a soil was shown to depend primarily on the (Ca + Mg) / (Na + K) value of the water. Exchangeable Na only affected soil structure adversely when it constituted about 15% of total exchangeable bases. Deterioration was then rapid as Na increased.

8489. HAMPL, JAN. **The influence of silicon dioxide on the accessibility of phosphoric acid in soil.** *Chem. Listy* 38, 125-7(1944).—*C.A.* 44, 5505*f*.

SiO_2 was not directly assimilated by plants. It adsorbed colloids and K salts in soil and thus made a portion of phosphoric acid in soil available to plants.

8490. HOOVER, C. DALE. **The fixation of potash by a kaolinitic and a montmorillonitic soil.** *Soil Sci. Soc. Am., Proc.* 9, 66-7(1944) (Pub. 1945).—*C.A.* 40, 1259⁷.

Quant. data was obtained on the fixation of K from KCl and K_2HPO_4 in 2 soils whose fine clay mineral fractions were predominantly montmorillonite and kaolinite, resp. K was applied at 4 rates and the soils were then stored moist, and sampled after 1-, 3-, 9-, and 24-month periods. Both soils fixed approx. as much K in 1 month as they fixed over longer periods of time, although there was some tendency for slight increases in fixation of K with time by the kaolinitic soil. An important relationship between free Fe and Al in montmorillonitic and kaolinitic clays and an increase in base-exchange capacity resulting from the absorption of P_2O_5 were indicated.

8491. HULL, H.H. AND STEVENS, N.E. **Changes in pH and in base-exchange properties of cranberry soils following the use of alkaline water.** *Soil Sci.* 58, 405-8(1944).—*C.A.* 39, 1714^7.

Irrigation of cranberry peat soils for 2 yrs. in the greenhouse with alk. water increased the pH of Bennett peat 1 unit and the pH of Durphee soil 1.4 units. The amts. of exchangeable Ca and Mg and the base-exchange capacity increased markedly in all samples. The percentage base satn. also showed considerable rise.

8492. MALQUORI, ALBERTO. **Behavior of humus in clay-bearing soils. I. Influence of humus on the swelling of clays.** *Ann. chim. applicata* 34, 99-110 (1944).—*C.A.* 41, 3239*i*.

Measurements of the swelling of clay-bearing soils in H_2O, before and after treatment with H_2O_2, proved that the presence of humus reduced the amt. of swelling. The humates fixed by the cations from the clay represented the org. material most active in interfering with the swelling of the argillaceous colloids present in soil.

8493. MALQUORI, ALBERTO. **The behavior of the organic matter in clay soils. II. Base-exchange capacity of the organic matter and of the humic acid, and its relations to the base-exchange capacity of the clay.** *Ann. chim. applicata* 34, 111-26 (1944).—*C.A.* 42, 6029*g*.

The total base exchange capacity of the soils was detd. In the new method the soil remaining on the filter was washed with H_2O. As soon as the excess KCl was completely removed, the K humate began to dissolve, yielding a brown soln. When the washings became colorless, the soil on the filter was resatd. with NH_4^+ by means of 0.1 *N* NH_4Cl soln., followed by washing with 80% MeOH of pH 7. The NH_4 was then replaced by K through treatment with KCl soln., and the NH_4 was detd. in the filtrate with HCHO. The base-exchange capacity detd. by the H_2O_2 method was around 300 mg equivs. in 100 g of org. matter, that by the new method around 500 mg equiv. in 100 g of humic acid. The base-exchange capacity of clay soils was an additive property only if the mobile humates alone were considered; if that of the humus combined with sesquioxides was used, the result was smaller than that calcd.

8494. MARSHALL, C.E. **Exchangeable bases of two Missouri soils in relation to composition of four pasture species.** *Missouri Agr. Expt. Sta., Research Bull.* No. 385, 60 pp. (1944).—*C.A.* 40, 2566^2.

A base-exchange investigation of the Putnam silt loam and Lindley silt loam showed that apart from differences in exchangeable Ca, Mg, Sr, K, and Na, the Mn reserves were differently distributed in the 2 soils. The Lindley had a large amt. of exchangeable Mn, but relatively large amts. were liberated by acid treatment. Expts. on limited exchange against acid showed that Na treatments produced a well-marked complementary-ion effect whereas K, Mg, and Ca treatments did not. Uptake of Mn by the crops depended largely on the pH of the soil, and on the exchangeable Mn present. Uptake of Na and K was but little affected by addns. of Ca or Mg to the soil, but Na addns. definitely increased the K content of the crops. The total cations per 100 g dry matter calcd. in equivs., were relatively const. under the several treatments.

8495. MATTSON, SANTE. **The pedography of hydrologic soil series. V. The distribution of potassium and phosphorus and the calcium/potassiu ratios in relation to the Donnan equilibrium.** *Lantbruks-Högskol. Ann.* 12, 119-29 (1944-45).—*C.A.* 39, 4422^3.

The Ca/K ratio varied with the satn. of the soil and with the strength of the acidoids. The univalent cations were relatively better adsorbed by an unsatd. than by a satd. soil and at a given pH the univalent cations were relatively better adsorbed by a weak acidoid than by a strong acidoid. A dil. soln. attached to the micelles had the same effect as a concd. external soln.: both favored the adsorption of the univalent ions.

8496. MATTSON, SANTE AND KARLSSON, NILS. **The pedography of hydrologic soil series. VI. The composition and base status of the vegetation in relation to the soil.** *Lantbruks-Högskol. Ann.* 12, 186-230 (1944-45).—*C.A.* 39, 4422^6.

"Excess base," Ca, Mg, K, P, N, pH, acidity, and percentage of base satn. were detd. in 56 species from the Dala brown earth and the Unden and Annerstad podzol series, the latter including several raised bog species. Although the pH was more alk. the brown earth did not contain more base content and the percentage base satn. was about as high as in the peat. The ratios Ca/Mg, Ca/K, and Mg/K in the soils were reflected in the plants. There must be a critical soil pH for each plant species at which the roots lose cations through protolysis and exchange faster than they can be accumulated by the absorption and assimilation of physiologically alk. salts.

8497. MATTSON, SANTE; SANDBERG, GUSTAF, AND TERNING, PER ERIK. **Electrochemistry of soil formation. VI. Atmospheric salts in relation to soil and peat formation and plant composition.** *Lantbruks-Högskol. Ann.* 12, 101-18 (1944-45).—*C.A.* 39, 4421^5.

The ratio of Ca to Mg in a series of soils ranging from Dala brown earth to a raised bog was detd. to find the effect of receiving water directly as rain ("ombrogenic") as contrasted with receiving water from contact with soil minerals. "Semiombrogenic" (excessively leached) soils were the intermediate members. The Ca/Mg ratios were: Dala brown earth, 40 soil samples 8.43, 30 plant species 2.58; Under podzol, 20 soil samples 1.80, 12 plant species 1.71; Annerstad podzol, 1 peat sample 0.87, 13 plant species 1.46; Ramna bog, upper, ombrogenic layer 0 to 260 cm., 27 samples 0.48; lower layer 260 to 360 cm., 10 samples 1.38, 3 plant species 1.34.

8498. MUKHERJEE, S.K. **Contribution of clay, silt, and sand fractions and organic matter of some Indian soils towards their base-ex-**

change capacities. *Indian J. Agr. Sci.* 14, 137-9 (1944).—*C.A.* 42, 2699*i*.

The base-exchange capacities (b.e.c.) of the clay, clay silt, sand, and org. matter of 4 Indian soils were detd. by the $Ba(OAc)_2$-NH_4Cl method. The clay, clay silt, and sand were obtained as in the mech. analysis of soil, but without H_2O_2 pretreatment. The b.e.c. of these fractions, except sand, was detd. both before and after treatment with H_2O_2; from the difference in b.e.c. in the 2 cases and the loss of ignition, the b.e.c. of org. matter was calcd. Clay was found to make the highest contribution to total b.e.c., org. matter was 2nd. The org. matter assocd. with clay had a higher b.e.c. than that assocd. with either silt or soil.

8499. Perkins, Alfred T. and King, H.H. **Phosphate fixation by soil minerals. III. Particle size.** *Soil Sci. Soc. Am., Proc.* 9, 61-5 (1944).—*C.A.* 40, 661^8.

A study was made of the relation of particle size (less than 150 μ) of various minerals to phosphate fixation in the pH range where crops grew. The coarse particles of quartz were inert; the fine particles fixed all the phosphate added. The coarse particles of hematite had low activity; the fine particles fixed about 12 times as much phosphates. With musovite, phlogophite, and biotite the increase in fixation by the fine particles in relation to the coarse particles was 20 times or more.

8500. Ushikoshi, Ikuo. **Studies on the planting of the cane sugar. I. Inoculation with azotobacter.** *J. Soc. Trop. Agr. Taihoku Imp. Univ.* 16, 122-8 (1944).—*C.A.* 42, 2706f.

By inoculating the soil with *Azotobacter vinelandii* and *A. chroococcum* the N fixation in soil and the growth of soil bacteria increased. The crop of the cane-sugar plants increased 4-7% and the yield of refined sugar 10% or more.

8501. Aldrich, D.G.; Parker, E.R., and Chapman, H.D. **Effects of several nitrogenous fertilizers and soil amendments on the physical and chemical properties of an irrigated soil.** *Soil Sci.* 59, 299-312(1945).—*C.A.* 39, 3614^4.

The soils of citrus plots were treated annually with such nitrogenous fertilizers as $Ca(NO_3)_2$, $NaNO_3$, $(NH_4)_2SO_4$, urea, and manure over a 16-year period. Water-stable aggregates were lowest when $(NH_4)_2SO_4$ was added and highest with manure. Addns. of $NaNO_3$ markedly increased both H_2O-sol. and exchangeable Na and decreased aggregation. Repeated addns. of $(NH_4)_2SO_4$ resulted in sufficient accumulation of exchangeable NH_4^+ seriously to impair the phys. properties of soil. Rather small increases in exchangeable Na may result in serious impairment of water penetration and related properties. When gypsum was applied with $NaNO_3$, more favorable structural conditions resulted.

8502. Allaway, W.H. **Availability of replaceable calcium from different types of colloids as affected by degree of Ca saturation.** *Soil Sci.* 59, 207-17(1945).—*C.A.* 39, 2836^2.

Soybean seedlings were used to measure the availability of Ca. The order of availability of the replaceable Ca from the various colloids was peat > kaolinite > illite and Wyoming bentonite > Mississippi bentonite. In every colloid the availability of the replaceable Ca was increased by increases in percentage Ca satn. The 2 bentonites (good examples of the montmorillonite group) showed a difference in the replaceability and the availability to plants of their replaceable Ca.

8503. Chandler, Robert F. Jr.; Peech, Michael, and Chang, C.W. **The release of exchangeable and nonexchangeable potassium from different soils upon cropping.** *J. Am. Soc. Agron.* 37, 709-21(1945).—*C.A.* 40, 154^8.

Upon continuous cropping with clover the exchangeable K content of the test soils decreased very rapidly at first, then more gradually until a certain level was reached, when the K-supplying power of the soil was detd. largely by the rate at which the nonexchangeable K was converted into the exchangeable form. The dry wts and the K content of the plants of the successive crops were closely assocd. with the amt. of exchangeable K in the soil. The K content of the plants decreased upon continuous cropping.

8504. Coutts, J.R.H. **Effect of veld burning on the base-exchange capacity of a soil.** *S. African J. Sci.* 41, 218-24(1945).—*C.A.* 39, 5024^9.

The base-exchange capacity of a soil was scarcely altered by heating the soil to 250°C, but heating to 250-500°C caused about 20% reduction in buffering capacity. The influence upon base-exchange capacity of veld burning under field conditions was very small and probably transitory.

8505. Fujimoto, Charles K. and Sherman, G. Donald. **The effect of drying, heating, and wetting on the level of exchangeable manganese in Hawaiian soils.** *Soil Sci. Soc. Am., Proc.* 10, 107-12 (1945)(Pub. 1946).—*C.A.* 41, 2190^f.

A gradual increase of exchangeable Mn occurred when soils were air dried. Oven-drying and steam-sterilization in a no. of soils increased the exchangeable Mn from a few p.p.m. to approx. 3000 p.p.m. The release of Mn was increased with increasing incubation temps. At lower temps. the length of incubation influenced the release of exchangeable Mn. When soils were moistened to approx. the moisture content of max. field capacity, the level of exchangeable Mn was decreased gradually.

8506. Hoyos, Angel de Castro. **A new method of determining the base-exchange capacity of soils containing carbonates.** *Anales fís. y quím.* (Madrid) 41, 284-90 (1945).—*C.A.* 43, 8081^h.

The sample (5g) was placed in a 100ml flask and 0.5 *N* AcOH added in 50 cc. portions until all carbonates present were decomposed. To the residue after filtn. was added 50 ml *N* $Ba(OAc)_2$ (pH 7), and the mixt. permitted to stand 24 hrs with occasional stirring. It was filtered again and treated with four 50 ml portions of $Ba(OAc)_2$, filtered, and washed with 30 ml 96% alc.; 50 ml NH_4Cl soln. was then added, and the mixt. allowed to stand 10 hrs. It was filtered again, the filtrate this time being collected, and treated again with 300 ml NH_4Cl soln. in 50 ml portions. The total filtrate collected after treatment with the NH_4Cl was evapd. slightly, a few drops of HCl was added, and the Ba contained in the filtrate was detd. and the milliequiv. of Ba adsorbed detd. This corresponded to the base-exchange capacity of the soil analyzed.

8507. Mehlich, Adolf. **Effect of type of soil colloid on cation-adsorption capacity and on exchangeable hydrogen and calcium as measured by different methods.** *Soil Sci.* 60, 289-304 (1945).—*C.A.* 40, 1621^1.

With colloids of hydrous mica and the 2:1 lattice type, the cation-adsorption capacity was virtually the same with all the methods studied. The NH_4OAc method yielded lower values with colloids of the org. and the 1:1 lattice type than those obtained by the other methods. An org. soil at first satd. with Ca contained greater amts. of H after treatment with NH_4OAc. More ammonium ions remained adsorbed from NH_4OH than from NH_4OAc. Adsorption of Ba from $Ba(OAc)_2$ was greater in the presence of $CaCO_3$. With colloids of the 1:1 lattice type and the org. soils the degree of satn. was consistently higher when detd. by the NH_4OAc method. The efficiency of the Ba and NH_4 ions in replacing Ca was about the same for the mineral colloids and it was appreciably less with NH_4 for org. soils.

8508. Ross, Clarence S. and Hendricks, Sterling B. **Minerals of the montmorillonite group: their origin and relation to soils and clays.** *U.S. Geol. Survey, Profess. Paper No.* **205-B**, 23-77(1945).—*C.A.* 40, 6025^3.

Detailed mineralographic studies of over 100 selected specimens of montmorillonite group minerals were summarized and coordinated. Formulas of a special type were used to express the compositions of the various recognized members of the group. Other sections were devoted to reviews of nomenclature, crystal structure, base exchange, thermal analysis, optical properties, electron microscopy, synthesis, and origin and occurrence.

8509. Aderikhin, P.G. **The function of colloids in the adsorption of phosphoric acid by soils.** *Potchóvédénié* 1946, 550-4; *Chimie & industrie* 58, 377 (1947).—*C.A.* 42, 4297*f*.

Positively charged $Fe(OH)_3$ colloids exhibited a high adsorption capacity for P_2O_5 anions. Negatively charged colloids (humus) exhibited the same property, but to a lower degree. Colloidal soils adsorbed notably less P_2O_5 than gels. Adsorption increased with intensity and completeness of coagulation. Humus colloids adsorbed an appreciably lower proportion of P_2O_5 from Ca monophosphates than from Na monophosphates.

8510. Albrecht, W.A. **Plant nutrition and the hydrogen ion. V. Relative effectiveness of coarsely ground and finely pulverized limestone.** *Soil Sci.* 61, 265-71 (1946).—*C.A.* 40, 3554^2.

The use of 10-mesh limestone, 100-mesh or pulverized limestone, $CaSO_4$, and $CaCl_2$ as Ca fertilizers for establishing sweet clover showed that the smaller applications of the 10-mesh limestone were relatively most effective as measured in corn yields. The mechanism of the action of limestone in the soil was discussed.

8511. Ayres, A.S.; Takahashi, M., and Kanehiro, Y. **Conversion of nonexchangeable potassium to exchangeable forms in a Hawaiian soil.** *Soil Sci. Soc. Am., Proc.* **11**, 175-81(1946) Pub. 1947.—*C.A.* **42**, 2376*g*.

A 4.5-yr study was made of the conversion of nonexchangeable K to available forms in Poamoho soil, the conversion being brought about by continuous cropping to Napier grass without the addn. of K. Levels of K in the plants decreased during the first 2.5 yrs of cropping, after which there was little change. The release of K from nonexchangeable sources in the soil was very great, ranging from 3400 to 4200 lb K_2O per acre, depending upon the treatment, for the 4.5 yr period.

8512. Bottini, E. **The adsorption compounds of soils in relation to their reaction and the chemical fertility grade.** *Annuar. ist. sper. chim. agrar. Torino* **16**, 63-87 (1946).—*C.A.* **43**, 5891*f*.

In acid and neutral soils the adsorbed K^+ and NH_4^+ were found in equiv. quantities (1 milliequiv. per 300 g soil); in alk. soils K^+ prevailed over NH_4^+. Also PO_4^{-3} and NO_3^- were found stoichiometrically equiv. (1 milliequiv. per 1000 g soil), but much lower than the cations because of the prevalence of electroneg. colloids. Total adsorbable quantities of ions were: K^+ and NH_4^+ 4-13 and 3-12 milliequivs. %/g soil, resp., (except for alk. soils where the NH_4^+ adsorption prevailed), NO_3^- and PO_4^{-3} 1-4 and 4-12 milliequivs. %/g soil, resp., (PO_4^{-3} was not merely adsorbed but also chemically fixed).

8513. Chaminade, Raymond. **The existance and the conditions of formation of compounds by the adsorption of phosphorus humus complexes.** *Compt. rend.* **223**, 168-70 (1946).—*C.A.* **41**, 242*f*.

A pptd. calcium phosphate in the presence of the calcium-humus complex gave rise to the formation of complexes with humus and with H_3PO_4. Such complexes were easily formed in nonacid soils. The P-humus complex was dispersible, and its stability varied inversely with the P_2O_5 content.

8514. Chaminade, Raymond. **Compounds of phosphate and humus.** *Ann. agron.* **16**, 229-40 (1946).—*C.A.* 41, 5245*f*.

When Ca phosphate was pptd. in the presence of Ca humate, a combination formed which contained humate and P_2O_5. Conditions under which this compd. could be formed occurred frequently in alk. soils. These compds. dispersed in water at pH values at which Ca phosphates were most nearly insol.; thus at pH less than 8.0, more than 5g P_2O_5 per liter was found after centrifuging one of these phosphate-humate solns. X-ray spectrography failed to show the cryst. pattern of $Ca_3(PO_4)_2$.

8515. Chernov, V.A. and Belyaeva, N.L. **The nature of soil acidity.** *Pedology* (U.S.S.R.) 1946, 593-603.—*C.A.* 41, 2828*i*.

Red loams (krasnozem), podzolic soils, humic acid, ascangel, and kaolinite were tested for their capacity of keeping adsorbed Ca in the presence of H or Al. Al was more effective in replacing Ca than H. As the adsorbent became more basic, more Al was sorbed. To demonstrate the exchangeability of Al some podzolized soils were treated with Al salts, the excess removed and the adsorbed Al replaced with KCl. It was pointed out that in acid soil the Ca was replaced by Al.

8516. DAS, S.; MUKHERJEE, S.K.; SEN, ABHISWAR, AND VISWANATH, B. **Indian soils. III. Base-exchange properties.** *Indian J. Agr. Sci.* 16, 234-45 (1946)—*C.A.* 42, 3111*f*.
Detns. of pH, exchangeable-base content, and exchangeable-base capacity were carried out on samples taken at different depths in 43 soil profiles from different parts of India. Exchangeable Ca, Mg, Na, and K in that order were predominant. Mg was high in black and black-cotton types of soils and Na was high in the saline soils. $CaCO_3$ was present in 33 of the profiles. The remainder were acidic and had a lower base-exchange capacity.

8517. GHANI, M.O. AND ISLAM, M.A. **Phosphate fixation in acid soils and its mechanism.** *Soil Sci.* 62, 293-306 (1946).—*C.A.* 41, 1364*c*.
Two soil samples were treated with each of 3 P carriers, and incubated at optimum H_2O content for varied periods. The available P was extd. with HOAc and detd. As the amt. of P added was increased, the available P increased, but not in the same proportion. As the time of contact between the P compd. and the soil increased, the available P tended to decrease for 2 weeks then remained nearly const. At the start of the incubation period 45 and 85% of the added P was fixed. As the contact period increased to 6 weeks, these values rose to 70 to 95%, resp.

8518. HEWITT, ERIC J. **Use of water purified by synthetic resin ion-exchange methods for the study of mineral deficiencies in plants.** *Nature* 158, 623(1946).—*C.A.* 41, 2777*h*.
The use of demineralized water held considerable possibilities for large-scale trace element research.

8519. JENNY, H. **Adsorbed nitrate ions in relation to plant growth.** *J. Colloid Sci.* 1, 33-47(1946).—*C.A.* 40, 3502^6.
Nitrate ions absorbed on the ion-exchange resin Amberlite IR-4 acted as a reservoir of nitrates available for plant growth. At high concns. adsorbed nitrate was superior to $NaNO_3$. The degree of satn. of the Amberlite by nitrate had a marked effect on plant growth, and at low degrees of satn. growth was nil. The addn. of soil to Amberlite contg. adsorbed nitrate released substantial amts. of nitrate. The exchangeability of adsorbed nitrate had a complicated relationship to the degree of satn. Amberlite IR-4 in H_2O contained adsorbed OH^-.

8520. JUNG, E. **The fine structure of humus substances. (A). Rontgenographic investigations on humus substances. (B). The question of the fine structure of humic acids.** *Z. Pflanzenernahr., Dungung u. Bodenk.* 37, 2-16(1946).—*C.A.* 41, 5772*f*.
X-ray investigations on brown coal, peat, soil humus from black earth formations, and the humic acids obtained therefrom showed the "high moor" peat to be amorphous and the other humus substances to contain slight amts. of cryst. carbon in an amorphous org. groundmass. Coking tests were made with the humic acids. It was concluded that the humic acids were not cryst., but rather consisted of crystallites of graphite structure (the proportion of which varied depending on the conditions of formation) in an amorphous-mesomorphous groundmass.

8521. KURTZ, TOUBY; DETURK, ERNEST E., AND BRAY, ROGER H. **Phosphate adsorption by Illinois soils.** *Soil Sci.* 61, 111-24(1946).—*C.A.* 40, 3551^2.
P adsorption by soil was detd. by measuring the P_2O_5 concn. of solns. of known concns. after they had been in contact with the soil. Adsorption curves for 4 soils at different ratios were similar in shape. Adsorption by Muscatine silt loam was not complete after any particular time interval but the rate of reaction did decrease. The amts. of phosphate which could be removed by water in successive extns. decreased and the easily acid-sol. fraction increased. The bulk of the added phosphate was retained in the adsorbed form from which it was displaced by the fluoride ion in a neutral soln.

8522. MARSHALL, C.E. AND AYERS, ALVIN D. **Clay membrane electrodes for determining calcium activities.** *Soil Sci. Soc. Amer.* 11, 172-74 (1946).
With the exception of the differences in sensitivity to monovalent and divalent cations exhibited by the H-bentonite, none of the membranes tested showed a selectivity for any individual cation such as was shown for H^+ by certain glass membranes. If membranes were available which have different permeabilities for the cations concerned, it will be possible to extend the usefulness of the method to mixtures. Complete Ca-H titration curves were obtained for three concentrations of Putnam clay. Bentonite was electro-chemically similar to Putnam clay.

8523. MATTSON, SANTE. **Effects of liming on leached, acid soils.** *Kgl. Lantbruks-Högskol. Ann.* 13, 196-222 (1946) (in English).—*C.A.* 41, 826^h.
A somewhat podzolized loamy moraine on red gneiss had been excessively treated with lime 60 years earlier. It was well drained and subject to annual pptn. of 700 mm (27 in.), and as a consequence all sorts of deficiency symptoms were exhibited. The effect of leaching was tried in the lab. with similar results. The limed soil became more basic with increasing depth; the virgin soil became more acid. The exchangeable Mn had been greatly reduced by the lime. Hay grown on the limed soil contained much less Mn than the grass grown on the uncultivated podzol. The Ca, Mg, and the Ca/Mg, and Ca/K mass ratios of exchangeable ions had become excessive.

8524. MATTSON, SANTE AND LARSSON, KARL GUSTAF. **The laws of soil colloidal behavior. XXIV. Donnan equilibria in soil formation.** *Soil Sci.* 61, 313-30(1946).—*C.A.* 40, 5179^7.
Soils having a low cation-exchange capacity should, other things being equal, contain a higher proportion of exchangeable univalent cations than soils having a high exchange capacity. The more unsatd. a soil, the greater should be the pro-

portion of exchangeable univalent cations. Among the leached soils the proportion of alkali cations should be greatest in the highly unsatd. soils possessing weak acidoid properties, whereas the proportion of alk.-earth cations should be greatest in the slightly leached, satd. soils possessing a high exchange capacity. These conclusions were supported by exptl. work and analytical data from various sources.

8525. MEHLICH, ADOLF. **Soil properties affecting the proportionate amounts of calcium, magnesium, and potassium in plants and in hydrochloric acid extracts.** *Soil Sci.* 62, 393-409 (1946).—*C.A.* 41, 3563*g*.

The influence of the type of colloid and the degree of Ca satn. on the percentage release of Ca by H was studied. In a bentonite colloid-sand mixt., having a cation-adsorption capacity of 4.8 milliequivs., the amts. of Ca released at 28 and 99% Ca satn. were resp., 0.14 and 0.95 milliequivs.

8526. MENCHIKOVSKY, FELIX. **Effect of the nature of exchangeable bases on soil porosity and soil-water properties in mineral soil.** *Soil Sci.* 62, 169-81 (1946).—*C.A.* 40, 7468^3.

The total cations of a gray soil from the northern part of the Jordan Valley ranged from 34 milliequiv. per 100 g dry soil in the 0-25-cm layer to 31 milliequiv. in the 75-100-cm layer. The Na/Ca ratio varied in the same order from 5.6 to 12.9. The corresponding values for the hygroscopicity were 8.61 and 10.64, both figures being expressed in percentage of dry soil. Exchangeable K and Ca showed a decrease with depth in the Jordan Valley gray soil. Values for the former decreased from 0.41 milliequiv. per 100 g dry soil in the 0.25-cm layer to zero in the 75-100-cm layer, while the latter varied from 26.6 to 18.3 milliequiv. per 100 g in the same layers. Exchangeable Na and Mg in the same soil showed an increase with depth. The Na varied from 1.50 to 2.34 milliequiv., while the Mg varied from 5.47 to 10.31 milliequiv. per 100 g dry soil.

8527. MICHAEL, E. AND OSSENBERG, H. **The sorption of calcium compounds in the soil.** *Z. Pflanzenernähr., Düngung u. Bodenk.* 37, 16-39 (1946).—*C.A.* 41, 5659*i*.

Shaking tests were carried out with a Dahlem soil and with the naturally occurring mineral, montmorillonite. Ca compds. were retained in the soil in amts. which varied very widely. The amt. of Ca adsorbed from the chloride and the acetate was insignificant. Only slight amts. were adsorbed from the bicarbonate and the lactate. On the other hand, very much larger amts. were adsorbed from the hydroxide without any corresponding displacement of other bases. Ca^{++} and OH$^-$ were adsorbed in equiv. amts. The greater adsorption of the hydroxide was not a peculiarity of Ca. Other hydroxides, e.g., those of K$^+$ and NH$_4^+$, showed the same behavior toward the soil, although to different degrees. The OH ions were to be regarded as the cause of the higher cation adsorption; their effect extended also to other added cations. Preliminary treatment of the soil to remove carbonates, phosphates, and org. substances did not essentially change the adsorption of Ca.

8528. PETERSON, J.B. **The role of clay minerals in the formation of soil structure.** *Soil Sci.* 61, 247-56(1946).—*C.A.* 40, 3550^7.

Montmorillonite formed gel-like globules which varied in resistance to dispersion in water according to the conditions of the expt. Kaolinite had no apparent effect on the state of aggregation that developed in a puddled Tama soil. Montmorillonite markedly increased the amt. of material resistant to wet-sieving but only when enough of the clay had been added to give it a dominating role in the mixt.

8529. RANEY, W.A. AND HOOVER, C. DALE. **The release of artificially fixed potassium from a kaolinitic and a montmorillonitic soil.** *Soil Sci. Soc. Am., Proc.* 11, 231-7(1946)Pub. 1947. —*C.A.* 42, 2380*f*.

The montmorillonitic soil (Susquehanna) fixed large percentages of the K applied. A greater quantity was fixed when the soil was air-dried after the storage period and prior to leaching than when the soil was leached while still moist. K fixation was insignificant in the kaolinitic soil (Orangeburg) in contrast to the montmorillonitic soil. The kaolinitic soil contained larger quantities of applied K still in the exchangeable form when the soil was air-dried after the period of storage than when the soil was leached while still moist. In those soils contg. artificially fixed K there was a greater quantity of K released to the exchangeable form than in the untreated soils.

8530. RICHES, J.P.R. **Use of synthetic resins in the estimation of trace elements.** *Nature* 158, 96(1946).—*C.A.* 40, 6536^5.

Trace elements could be isolated from plant digests by the use of synthetic resins. A column of bed volume 1 ml packed with Amberlite IR-100 was washed and classified, and taken through successive exchange cycles with *N* HCl and *N* NH$_4$Cl solns. Two ml of a soln. contg. Cu, Cd, Ni, Zn, and Mn salts (each in approx. 4 × 10^{-4} *M* concn.) was introduced to the purified column and the adsorbed cations eluted with HCl. In the presence of *N* NH$_4$Cl the cations were fully retained, but appeared in the first effluent fractions; in the presence of *N*/10 salt solns. the cations were fully retained. *N*/10 HCl displaced only the Cd in the eluate, while *N* HCl liberated Zn, Mn, Cu, Ni, and Cd, thus showing that it should be possible to isolate the cations by varying the nature and concn. of the soln. used in eluting the adsorbed cations. Cations may be sepd. from interfering anions during passage through a column.

8531. RIEHM, H. **Determination of the adsorption capacity of the soil in mass investigations according to H. Riehm and its significance, especially for the evaluation of the lactate value.** *Z. Pflanzenernähr., Düngung u. Bodenk* 37, 61-74(1946).—*C.A.* 41, 6648*f*.

A rapid method was given for the detn. of the T value, which was expressed in milliequivs. per 100 g of soil. Consideration of the T value instead of the type of soil was admissible only if a relation existed between the T value and the phosphoric acid adsorption. Such a relation was established on the basis of data on 210 soils of widely varying origin. For the estn. of the lactate no. it was recommended that instead of the group "sandy soils", all soils having a T value up to 7.5 be grouped together; instead of "middle soils," soils having T values of 7.6-15 be used, and instead of "heavy sandy soils," all soils having T values above 15 be used.

8532. Schroeder, W.T.; Davis, J.F., and Shafer, John, Jr. **Deionized water not a suitable substitute for distilled water in boron studies.** *J. Am. Soc. Agron.* 38, 754 (1946).—*C.A.* 41, 1279*g*.

B-deficiency symptoms appeared 5 weeks after the emergence of Detroit Dark Red beets in minus-B distd.-water nutrient soln. No B-deficiency symptoms appeared in minus-B deionized-water nutrient or either of the complete nutrient solns. used.

8533. Sergeev, E.M. **New developments in methods of determining heat of wetting of soils and soil materials.** *Pedology* (U.S.S.R.) 1946, 289-300.—*C.A.* 41, 825*f*.

The construction of the calorimeter permitted the use of soil samples without disturbing the structure. The factors influencing the heat of wetting of soils were discussed. The temp. of the detn. was of great importance. At 4°C the detn. gave the highest value.

8534. Sieling, Dale H. **Role of kaolin in anion sorption and exchange.** *Soil Sci. Soc. Am., Proc.* 11, 161-70 (1946) (Pub. 1947).—*C.A.* 42, 2378*g*.

Kaolin could be activated for anionic sorption by ball-milling or by heating with alkali. The active constituent of ball-milled and alkali-activated kaolin was believed to be a hydrous alumina such as γ-AlOOH. The Al_2O_3 of ball-milled kaolin sorbed phosphate and arsenate in practically equiv. amts. from the more dil. solns. of these ions; however, from the more concd. solns. the sorption of arsenate far exceeded that of phosphate. The amt. of either anion sorbed was dependent upon the reaction of the equil. soln. and the initial concn. The lower the pH within the range of 3.0 to 7.0, the greater the sorption and the higher the concn. at any fixed pH, the more of the anion was sorbed per unit of Al_2O_3. Freshly pptd. hydrous Al_2O_3 sorbed phosphate and arsenate in greater quantities than an equiv. quantity of Al_2O_3 contained in ball-milled kaolin.

8535. Stanford, G. and Pierre, W.H. **The relation of potassium fixation to ammonium fixation.** *Soil Sci. Soc. Am., Proc.* 11, 155-60(1946)Pub. 1947.—*C.A.* 42, 2380*c*.

The occurrence of K fixation under moist soil conditions was not limited to calcareous soils, but also took place to a measurable extent in certain acid soils when large amts. of K were supplied. The fixation reaction reached equil. within 24 hrs in a calcareous Webster soil. The soil to water ratio influenced appreciably the rate of fixation during the initial steps of the reaction, but after 24 hrs the influence was only slightly apparent. Extn. of the calcareous Webster soils with ammonium acetate or acid extn. destroyed their capacity to fix K.

8536. Tendeloo, H.J.C.; Vervelde, G.J., and Voorspuij, A.J.Z. **Electrochemical behavior of ion-exchange compounds. II. Pontential measurements on plant roots and their bearing on ion uptake by plants.** *Re. trav. chim.* 65, 539-44 (1946) (in English).—*C.A.* 41, 4047*c*.

By assuming that the non-diffusible ion originated from a substance which behaved as a weak acid, the concn. of its anion being therefore not const. but depending on the pH, fairly good agreement was found between the calcd. and exptl. values for the potentials of plant roots. The relation between the ion concns. just inside the wall of the plant root and that of the surrounding soln. could be described by the Donnan equil. K accumulated when the root was immersed in KCl soln. and a 100-fold diln. of the outer soln. resultec in no more than a 5.5-fold diln. inside the cell wall.

8537. Thorne, D.W. **Calcium carbonate and exchangeable sodium in relation to the growth and composition of plants.** *Soil Sci. Soc. Am., Proc.* 11, 397-401(1946)(Pub. 1947).—*C.A.* 42, 3888*f*.

With a Ca-satd. clay mixed with sand the growth of Stone tomato plants was somewhat inversely proportional to $CaCO_3$ concn. in the culture medium. The decreased growth was assocd. with increases in Ca and decreases in K and P concn. in the plants. The growth and compn. of tomato plants were also studied in colloidal clay cultures in which 3 levels of $CaCO_3$ were mixed in combination with 4 different ratios of exchangeable Na to Ca. Growth decreased with increasing degrees of Na satn. and the effects of Na were accentuated by the presence of $CaCO_3$. In the presence of $CaCO_3$ exchangeable Na was less effective in increasing P uptake than in its absence.

8538. Trenel, M. **Nature and importance of the "exchangeable acidity" of soil.** *Z. Pflanzenernähr., Dungung u. Bodenk*, 37, 305-21(1946); *Chimie & industrie* 59, 169(1948).—*C.A.* 42, 7469*f*.

H^+ ions could in no way be held responsible for growth-inhibition phenomena. On the other hand, they rendered possible the absorption of nutritive principles by the roots. A pH below 5 ensured the soly. of toxic Al. This toxicity, which produced important assimilation troubles, was specific. It was not related to the assimilation of P_2O_5 and was not suppressed by the presence of CaO.

8539. Tsyurpa, I.G. **The kinetics of exchange reactions of cations.** *Pedology* (U.S.S.R.) 1946, 309-14.—*C.A.* 41, 826*g*.

Chernozem soil, kaolinite, and askanite (montmorillonite-like) were satd. with Ca and the speed of replacement of it was studied by use of NH_4Cl of different concns. The speed of replacement of cations depended on the structure of adsorbent. The replacement took place faster on colloids contg. kaolinite. The exchange reactions started at the surface and then penetrated into the colloids.

8540. Yasue, Yasunobu. **Insecticidal effect of silica gel.** *Science* (Japan) 16, 40-1(1946).—*C.A.* 45, 10468*a*.

The insecticidal properties of silica gel, SiO_2 (quartz sand), and diatomaceous earth were tested against *Calandra sasakii* and *Tribolium ferrugineum*. Silica gel was the most active; diatomaceous earth and quartz sand were next. They were tested by using fine powder for fasting insects, or by adding 1% to the fodder of the insects.

8541. ALEIXANDRE FERRANDIS, VICENTE. **Base-exchange capacity and curves of loss on ignition of some Spanish clays.** *Anales inst. espan. edafol., ecol. y fisiol. vegetal* 6, 455-74 (1947).—*C.A.* 42, 5595*e*.

The red clay fraction was extd. by sedimentation from a series of 13 soils from Valencia where the mean annual rainfall was 166.9 mm. and the av. temp. 16.1°C, and from Malaga where the mean annual rainfall was 508.5 mm. and the av. temp. 18°C. Base-exchange capacity varied directly with the loss on ignition at 700°C. After ignition the base-exchange capacity was reduced 80 to 90%. The ratios SiO_2/R_2O_3, and SiO_2/Al_2O_3 showed no relation to the base-exchange capacity.

8542. ANTIPOV-KARATAEV, I.N.; KADER, G.M., AND FILIPPOVA, V.N. **Nature of the uptake of ions by clays and soils. III. Uptake of univalent and bivalent cations of chernozem soil and humic acid.** *Kolloid, Zhur.* 9, 315-24 (1947).—*C.A.* 43, 7618*b*.

Soil satd. with cation K_1 was shaken with a soln. of the chlorides of K_1 and K_2 in which the ratio $K_1{:}K_2$ varied between 1:9 and 9:1. If the final concns. of K_1 and K_2 in the soln. were C_1 and C_2, and the amts. in the soil were X_1 and X_2, the $X_1C_2/X_2C_1 = k$, the "equilibrium const.". The uptake was reversible and k was independent of $K_1{:}K_2$ for the pairs $K{:}NH_4$($k = 2.6$), Ca:Mg (3.3), and Ca:Ba (0.77), all on a chernozem, 100 g of which satd. 44-45 milliequiv. $K_1{:}K_2$ for Ca:Mg on a Ca humate from peat, for K:Na and Ca:Pb on chernozem, and also for Ca:Cu on chernozem when the exchange occurred in an alk. soln. The uptake was irreversible for Ca:Hg, Ca:Cu (in H_2O) and Ca:Al (at pH 4.3-7) on chernozem, i.e., Hg, Cu, and Al could not be displaced by Ca.

8543. ARMIGER, W.H.; HILL, W.L.; PINKERTON, CECIL; LAKIN, H.W., AND ROBINSON, W.O. **Composition and fertilizer value of spent phosphate catalyst from the petroleum industry: "Solid phosphoric acid catalysts" and copper, pyrophosphate catalysts.** *J. Am. Soc. Agron.* 39, 318-26(1947).—*C.A.* 41, 4879*e*.

The "solid phosphoric acid catalysts" tested contained in addn. to silica, P_2O_5 24-64, H_2O 6-19, and R_2O_3 0.2-2%. In greenhouse tests with 3 of these spent catalysts, growth response of spring wheat to the catalysts was nearly as good as that to double superphosphate. The Cu pyrophosphate catalysts contained P_2O_5 12-38 and Cu 17-24%. They were essentially Cu pyrophosphate suspended on charcoal. More than 85% of the P and 55-99% of the Cu were sol. in the official soly. test for available phosphates in fertilizers.

8544. ARNON, DANIEL I. AND GROSSENBACHER, EARL A. **Nutrient culture of crops with the use of synthetic ion-exchange materials.** *Soil Sci.* 63, 159-82 (1947).—*C.A.* 41, 5661*f*.

Tomato plants were grown through the fruiting stage and lettuce for a period of 6 weeks in sand culture to which nutrients were supplied as adsorbed ions on Amberlites. Comparisons were made with sand culture and with water-culture nutrient solns. Exts. of sand mixed with Amberlite nutrients showed pH values from 3.30 to 4.28. The Ca and Mg in Amberlites were shown to be insufficiently available for good growth. In some expts. K and nitrate were supplied by daily irrigations of dil. KNO_3 soln., but all other nutrients were furnished by Amberlites. A discussion of contact effects between roots and solid particles was given.

8545. BARBIER, GEORGES AND TROCME, SERGE. **The colloidal properties of humic acids formed under various conditions.** *Compt. rend.* 224, 1582-3(1947).—*C.A.* 41, 6108*g*.

Four humic acids were studied as to dispersion, flocculation, ion exchange, and adsorption on clay. Aq. suspensions of humic acids were prepd. by decalcification, treatment with NH_4OH pptn. with HCl, and dialysis; 4 samples of humus of increasing age were used: liquid manure aged for 3 months, compost aged for 3 yrs, peat, and lignite. Little difference was observed in the capacity of the acids for bases. All were adsorbed on lime clays.

8546. BEAR, FIRMAN E. **Cations for canning crops.** *Food Packer* 28, No. 2, 76,78 (1947).—*C.A.* 41, 7608*i*.

A discussion of the cation exchange system in soils.

8547. CHAMINADE, R.; SEGALEN, P., AND VISTELLE, R. **The effect of humus on the conversion of phosphate ion in a lateritic soil.** *Ann. agron.* 17, 530-5 (1947).—*C.A.* 42, 2701*g*.

Neubauer tests were performed on 100-g samples of a soil taken from near Tananarive in Madagascar to which were added weighted portions of humus extd. from a temp. zone soil by 3% $(NH_4)_2C_2O_4$. The humus was pptd. by HCl and added to the soil as the Ca salt. Added P_2O_5 was not available to the plants unless humus was present.

8548. CHAMINADE, R. AND VISTELLE, R. **The role of humus in soils. The effect of humus on the fixation and mobility of phosphate ion in soils.** *Ann. agron.* 17, 536-44 (1947).—*C.A.* 42, 2701*e*.

Samples and columns of soils with selected addns. of the Ca salt of humus extd. from soil were percolated with solns. of phosphates of various concns. The residual P_2O_5 in the solns. was detd. chemically, and the columns were dissected to det. the depth of penetration. The amt. taken up by the soil increased with successive perfusion to a max. and then declined. The acidity of the perfusing $H_4Ca(PO_4)_2$ solns. eventually decompd. the compds. formed by the initial fixation and thus caused the decline.

8549. COHEN, W.H. AND KNIGHT, B.H. **Adsorption phenomena in soils with special reference to their surface area.** *J. Soc. Chem. Ind.* (London) 66, 357-64 (1947).—*C.A.* 42, 2041*g*.

Malachite green oxalate in 1:10,000 solns. was adsorbed by 0.25 g of over-dried soil. The residual color of the solns. was measured in a photoelec. colorimeter. The time of contact was about one hr, with shaking and standing overnight. Results for 32 soils ranged from an almost pure sand to an almost pure clay. Then 8 soils were sepd. into coarse fractions by sieving (A.S.T.M.) and 8 fine fractions each by sedimentation. The surface area of each fraction of the 8 soils was detd. by air permeability. The adsorption of dye on these fractions was found to depend on the physicochem. nature of the clay minerals present and on the surface area.

8550. DEAN, L.A. AND RUBINS, E.J. **Anion exchange in soils. III. Applicability to problems of soil fertility.** *Soil Sci.* 63, 399-406(1947).—*C.A.* 41, 7604*e*.

In acid soils, phosphate tended to accumulate as an exchangeable anion. The amts. of exchangeable phosphate which acid soils contained were not, however, necessarily a reliable index of the fertility status of these soils, since the anion-exchange capacity, the pH, and the amts. of other forms of P were also contributing factors.

8551. GULVADY, SHARDA; RAO, K. SUBBA, AND RAO, B. SANJIVA. **Hysteresis in sorption. XVI. Sorption of water in some Indian soils and soil fractions.** *Proc. Indian Acad. Sci.* 25A, 229-34 (1947).—*C.A.* 41, 5359*d*.

Sorption-desorption curves on H_2O vapor at 30°C showed negligible sorption for the sand fractions, coarser than 0.02 mm; whereas the silt fraction, 0.02 to 0.002 mm, and the clay fraction, finer than 0.002 mm, showed appreciable sorptions. Treatment with H_2O_2 to remove org. matter reduced the sorptive capacity. Black cotton soil showed a sorption of 18 g per 100 g of activated soil compared with 8 g for the red laterite soil.

8552. HELLERMAN, YA. M. **Some data on the mechanism of mineral nutrition of plants by adsorbed ions.** *Compt. rend. acad. sci. U.R.S.S.* 55, 543-6(1947).—*C.A.* 42, 4244*c*.

In expts. in which plants were grown in nutrient solns. with and without activated carbon, more Ca, P, and Cl were taken up in the presence of the carbon. It was suggested that accumulated org. substances around the roots, root secretions and intermediate products of their decompn. by bacteria, were adsorbed by the carbon; this freed the active adsorbing surface of the roots. The presence of materials in soils capable of adsorbing org. substances probably similarly improved the mineral nutrition of plants.

8553. ICHIKAWA, CHIKABUMI. **Reaction (acidity) and exchangeable lime of soils of mulberry fields.** *Nôgaku (Sci. Agr.)* 1, 35-41(1947).—*C.A.* 44, 3188*h*.

Seventy soil samples from 30 prefectures of Japan were tested. The pH of the soils was 4.6-5.7, av. 5.4; these soils were not extremely acid. Sandy loam averaged pH 5.5 and clay-loam averaged pH 5.4. The org. matter content was low, 0.93-28.82%, av. 8.72%. Hydrolytic acidity (with Ca acetate) was 1.0-15.5, av. 3.1. Exchangeable acidity (Daikubara's method) was 0.9-24.6, av. 5.6. Exchangeable Al_2O_3 plus Fe_2O_3 sol. in *N* KCl was found to be greater in the more acid soils than in the less acid soils (0.006-0.142%, av. 0.029%).

8554. JACOB, K.D.; WARD, F.N.; HILL, W.L., AND PINKERTON, CECIL. **Report on phosphoric acid: neutral ammonium citrate and 2% citric acid solutions as solvents for alpha phosphate.** *J. Assoc. Offic. Agr. Chemists* 30, 529-48(1947).—*C.A.* 41, 7615*a*.

The important phosphate-bearing constituents of "alpha phosphates" were α-$Ca_3(PO_4)_2$, glass, and apatite; crystals of $Ca_3(PO_4)_2$ and apatite were often imbedded in the glass. Hydroxyapatite, a compd. which has low fertilizing value and which was probably formed as an intermediate in the prepn. of alpha phospate, was more than 50% sol. in citric acid but only about 25% sol. in NH_4 citrate. Citric acid soly. was usually, but not always, higher than the citrate soly. In the case of alpha phosphate with less than 0.5% F, the av. difference for 33 samples was 3.4% of the total P.

8555. JOFFE, J.S. AND LEVINE, A.K. **Fixation of potassium in relation to exchange capacity of soils. II. Associative fixation of other cations, particularly ammonium.** *Soil Sci.* 63, 151-8 (1947).—*C.A.* 41, 4264*i*.

The data showed that out of 42.7 mg of Ca added to a sample of bentonite, 43.2 mg was recovered. The amts of Ba added to samples of H-bentonite and Montalto H-colloid were, resp., 1.87 and 1.87 milliequivs., while the amts. recovered were resp., 1.87 and 1.84 milliequivs. The amts of NH_4, fixed by a natural Wyo. bentonite at 47° and 74°C were, resp., 0.18 and 0.46 milliequivs., while the amts of K fixed by the same material at identical temps. were, resp., 0.52 and 0.69 milliequivs.

8556. JOFFE, J.S. AND LEVINE, A.K. **Fixation of potassium in relation to exchange capacity of soils. III. Factors contributing to the fixation process.** *Soil Sci.* 63, 241-7 (1947).—*C.A.* 41, 5661*c*.

Increasing quantities of Ca diminished the quantities of K fixed by H-bentonite. When 1 symmetry unit of K alone was added, 6.4 mg of K were fixed by 2.119 g of H bentonite. When 9 symmetry units of Ca were added to 1 of K, the K fixed was only 2.1 mg. The results showed that K competed successfully with Ca as previously indicated.

8557. JONES, U.S. **Availability of humate potassium.** *Sci. Soc. Am., Proc.* 12, 373-8(1947)—(Pub. 1948).—*C.A.* 43, 2725*a*.

Humic acid, free of mineral contaminants, was prepd. and satd. with a const. amt. of exchangeable K and various amts. of exchangeable Ca and H. At equil., of the total exchangeable K present, 82 to 96% was sol. in carbonated water and 50 to 90% in water. Increasing amts. of K dissolved as the Ca satn. increased from 0 to 80%, but beyond this there was little, if any increase. At equil., H-bentonite held twice as much exchangeable K as did humic acid.

8558. LAMPITT, L.H.; MONEY, R.W.; JUDGE, B.E., AND URIE, A. **Pectin studies. I. Method of**

purification. *J. Soc. Chem. Ind.* **66**, 121-4 (1947).—*C.A.* **41**, 7016*i*.

Purification of pectin was studied by using pptn. by EtOH or Me_2CO, dialysis, ion exchange, and combinations of these methods. The highest pectin content (detd. as Ca pectate) was obtained by dialysis followed by pptn. in 70% EtOH. Ash content was reduced to 2-4% by this method. It was thought that passage through ion-exchange resins, which reduced the ash to 0.25% of the Ca pectate value, cause some splitting off of combined inorg. material.

8559. LEVINE, A.K. AND JOFFE, J.S. **Fixation of potassium in relation to exchange capacity of soils. IV. Evidence of fixation through the exchange complex.** *Soil Sci.* **63**, 329-35(1947).—*C.A.* **41**, 5666*f*.

A simple linear relation existed between the amt. of K entering the exchange complex and that fixed. K must first be in the exchangeable form to be fixed. The similarity of results of the 2 expts. indicated that the phenomenon of fixation was essentially the same for different fixing materials.

8560. LUCAS, E.H. AND HAMNER, C.L. **Inactivation of 2,4-D by adsorption on charcoal.** *Science* **105**, 340 (1947).—*C.A.* **41**, 4268*c*.

Aq. solns. of the Na salt of 2,4-dichlorophenoxyacetic acid in concns. of 1000 to 10,000 p.p.m. were inactivated by 1-10% aq. suspensions of charcoal (Norit A). Oil prepns. of 2,4-dichlorophenoxyacetic acid were less readily inactivated. The discovery was of value in removing small residues of 2,4-dichlorophenoxyacetic acid from equipment which was also used for other agricultural purposes, since even small amts. were injurious to certain plants.

8561. MCAULIFFE, C.D.; HALL, N.S.; DEAN, L.A., AND HENDRICHS, S.B. **Exchange reactions between phosphates and soils: hydroxylic surfaces of soil minerals.** *Soil Sci. Soc. Am., Proc.* **12**, 119-23 (1947).—*C.A.* **43**, 1131*f*.

Kinetics of the exchange between phosphate on the surface of soil minerals with phosphate in soln. was followed by the use of P^{32}. Two reactions were recognizable. The first of these in which the fraction P^{32} solid/P^{32} soln. changed logarithmically with respect to time corresponded to exchange between phosphate in soln. and phosphate on the surface. Phosphate after sorption on the surface underwent a further reaction which remains to be studied. The amt. of rapidly equilibrating surface phosphate paralleled levels of phosphatic fertility measured by anion exchange. Extents of hydroxylic surfaces for kaolinite, halloysite, diaspore, and gibbsite were measured by use of the isotopic-exchange reaction: Surface $OH^- + DOD \rightleftarrows$ Surface $OD^- + HOD$.

8562. MELSTED, S.W. AND BRAY, ROGER H. **Base-exchange equilibrium in soils and other exchange materials.** *Soil Sci.* **63**, 209-25(1947).—*C.A.* **41**, 5665*g*.

The term "symmetry value" was used to express the condition when the no. of milliequivs. of exchangeable cations on a colloid equaled the total milliequivs. of salt in soln. The distribution of ions of the same valence on an exchange surface was affected less by the concn. of the soln. in an equil. system than in a leaching system. The concn. in soln. of ions of different valences had a marked effect on their final distribution on the exchange material in both types of systems. The ratio of the ions in a leaching soln. was a factor in detg. the distribution of those ions on the exchange material. Distribution of the ions on an exchange surface was controlled to a greater degree by the nature of the colloid or exchange material than by any other single factor.

8563. OLSON, R.V. **Iron solubility in soil as affected by pH and free iron oxide content.** *Soil Sci. Soc. Am., Proc.* **12**, 153-7(1947) (Pub. 1948).—*C.A.* **43**, 1133*c*.

Ammonium acetate adjusted to pH 4.8 dissolved Fe from soils that varied from 0.15 p.p.m. in alk. soils to 20 p.p.m. in acid soils. The amt. of Fe dissolved increased rapidly with decreases in soil pH in soils more acid than pH 6.5. This indicated a difference in the amt. or form of Fe in acid soils as compared to neutral or alk. soils. The addn. of Fe_2O_3 to 1 of the soils caused an increased Fe soly. at all pH levels. At pH levels below 4.5, Fe soly. in the soil suspensions did not reach the soly. of Fe in sulfate solns.; this indicated the presence of org. or inorg. Fe compds. which were more sol. than the Fe sulfates.

8564. RUBINS, E.J. AND DEAN, L.A. **Anion exchange in soils. II. Methods of study.** *Soil Sci.* **63**, 389-97(1947).—*C.A.* **41**, 7604*c*.

The methods used for satg. soils with anions and for displacing the adsorbed anions were virtually a counterpart of the common base-exchange methods. Procedures were given for extg. exchangeable anions and for prepg. soils satd. with anions. Analytical methods were outlined for the detn. of phosphates in exts. contg. 0.5 *M* concns. of arsenate, fluoride, citrate, and tartrates in 0.5 *M* phosphate exts.

8565. TOTH, STEPHEN J. **Release of adsorbed potassium, calcium, magnesium, and barium from a soil colloid as influenced by the nature of the acidoid link.** *Soil Sci.* **63**, 141-50 (1947).—*C.A.* **41**, 4264*d*.

The anions adsorbed by samples of Sassafras-loam colloid receiving phosphate, silicate, and humate treatments were, resp., 0.12 milliequiv. per g, 7.00 milliequiv. per g, and 1.12 g per g. The exchange capacity of a cation-satd. colloid receiving a phosphate treatment was Ca, 34.06; Ba, 42.54; Mg, 40.41; and K, 28.32 milliequiv. per 100 g; the percentage increase in the exchange capacity after the treatment was: Ca, 48.3; Ba, 74.8; Mg, 20.9; and K. 20.3%. The amts. of Ca cation released by hydrolysis from a colloid receiving no treatment, phosphate, silicate, and humate treatments were, resp., 16.4, 21.9, 19.8, 16.3%; the corresponding amts. of Mg cation were, in the same order, 26.2, 32.3, 33.6, and 37.6%.

8566. TOTH, STEPHAN J., AND BEAR, FIRMAN E. **Phosphorus-adsorbing capacities of some New Jersey soils.** *Soil Sci.* **64**, 199-211(1947).—*C.A.* **42**, 5146*g*.

The P-adsorbing capacities of the surface horizons of these soils in a standard H state ranged from 0.03 milliequivs. for Norton silt loam.

Liming these H soils to pH 6.5 resulted in marked reduction in P adsorption. The P-adsorbing powers of the H soils of a few profiles were lower than those of the original samples. This was due to loss of Fe and Al by soln. in the 0.05 *N* HCl used to prep. them. Phosphate applications to the max. adsorption value greatly increased the exchange capacities of soils in the field state.

8567. VOLK, GAYLORD M. AND BELL, C.E. **Effect of anion balance on the leaching of ions from sandy soils.** *Soil Sci. Soc. Am. Proc.* 12, 188-90 (1947) (Pub. 1948).—*C.A.* 43, 1509*d*.

The movement of NO_3^- and Cl^- followed a generally similar pattern. The crest of concn. of sol. salts occurred with the passage of approx. 6.6 in. of water. Ca and Mg were similar in their responses to variation in anion concn. and there was only slight difference in their response to the Cl^-, NO_3^- and $SO_4^=$ ions. Na^+ had a concn. crest at the passage of 7.2 in. of water after treatment. Fifty-two % more SO_4 (from sol. carriers) moved from the band placement than from broadcast placement. At pH 6.9, 90% more SO_4 was lost than at pH 6.1. In general, all of the cations responded to all anion crests of concn., but there was a definite differential response in mixts. which might be called a repression of soly. under the equil. set up in the presence of the exchange complex.

8568. WEAVER, ROBERT J. **Reaction of certain plant-growth regulators with ion exchangers.** *Science* 106, 268-70 (1947); *Boton. Gaz.* 109, 72-84 (1947).—*C.A.* 41, 7221*b*; 42, 1012*i*.

The degree of adsorption and elution of 2,4-$Cl_2C_6H_3CH_2COOH$ and its NH_4^+, Cu^{++} and Ca^{++} salts, 2,4,5-$Cl_3C_6H_2CH_2COOH$, and $C_6H_5NHCO_2$-iso-Pr by certain cation and anion exchangers (Amberlite IR-100 H, Zeo-Karb H, Decalso, Zeo-Dur, Amberlite IR-4B and De-Acidite) was studied. Amberlite IR-100 H adsorbed almost equal equiv. amts. of 2,4-$Cl_2C_6H_3CH_2COOH$ and its salts. The amt. of 2,4-$Cl_2C_6H_3CH_2COOH$ adsorbed varied directly with the concn. of the soln. Elution data indicated that much of it adsorbed in soils was not subject to leaching

8569. WHITTAKER, C.W.; COE, D.G.; BARTHOLOMEW, R.P.; VOLK, G.W., AND RADER, L.F., JR. **Influence of placement on response of crops to calcium phosphates.** *J. Am. Soc. Agron.* 39, 859-68(1947)—*C.A.* 42, 706*e*.

Di- and tricalcium phosphates, both found in ammoniated superphosphate, gave greatly reduced yields in the localized placement. Silicocarnotite, the principal phosphatic component of basic slag, was also adversely affected by a localized placement. Mixing with as little as 2.5% of the soil greatly improved crop response to dicalcium phosphate and silicocarnotite and gave some improvement with tricalcium phosphate. Hydroxylapatite and fluorapatite in general gave much lower crop response than the other phosphates, and that response was less affected by varying placement.

8570. WOODRUFF, C.M. **Determination of the exchangeable hydrogen and lime requirement of the soil by means of the glass electrode and a buffered solution.** *Soil Sci. Soc. Am., Proc.* 12, 141-2(1947) (Pub. 1948).—*C.A.* 43, 1131*d*.

A soln. buffered at pH 7 was used of such a character that the pH of the soln. decreased linearly with respect to the quantity of acid that could be added to it. A satisfactory buffered soln. consisted of a mixt. of *p*-nitrophenol and Ca acetate titrated to neutrality with NaOH. If the buffering capacity of such a soln. was large with respect to the buffering capacity of the soil that was added to the soln., and if the depression of the pH of the soln. by the exchangeable H of the soil was restricted to small values, then the depression of the pH of such a soln. approached an abs. measure of the exchangeable H in the soil.

8571. ALEIXANDRE, FERRANDIS, V. AND VICENTE, J. GARCIA. **The variation of the physiochemistry properties of soils with their particle size.** *Anales inst. españ. edafol., ecol. y fisiol. vegetal (Madrid)* 7, 529-604 (1948).—*C.A.* 43, 6347*a*.

The fractions by sedimentation were (1) less than 0.80 μ, (2) between 0.80 and 1.13 μ and (3) between 1.13 and 1.97 μ in diam. The 3 fractions were taken from each of 19 soils from various parts of Spain, and each separately analyzed for SiO_2, Al_2O_3, Fe_2O_3, TiO_2, CaO, MgO, and loss on ignition. The proportions of SiO_2 and TiO_2 increased with the particle size. Loss on ignition decreased with increase in particle size. The ratio Fe_2O_3/Al_2O_3 was unchanged in the various fractions of the same soil. In several cases Mg increased with decreasing particle size. When the clays were converted to acid clays, the gel fraction of the samples increased with decreasing particle size.

8572. ALLAWAY, W.H. **Differential thermal analyses of clays treated with organic cations as an aid in the study of soil colloids.** *Soil Sci. Soc. Am., Proc.* 13, 183-8 (1948).—*C.A.* 44, 4179*d*.

When a piperidine-treated clay was subjected to differential thermal analysis, a stepwise combustion of the adsorbed piperidine often resulted. The temps. at which the combustion was most rapid may be related to the compn. of the clay. The method was sufficiently promising to warrant consideration, but the information gained merely supplemented that from other methods.

8573. ANTIPOV-KARATAEV, I.N.; KADER, G.M., AND FILIPPOVA, V.N. **Nature of the uptake of ions by clays and soils. IV. Uptake of bivalent cations by red-brown clay and some soils.** *Kolloid, Zhur.* 10, 73-82(1948).—*C.A.* 43, 7618*e*.

The uptake was reversible and the "equil. const." k was independent of $K_1:K_2$ for Ca:Mg on a red-brown clay, a red soil, and a podzol soil, k being 1.5, 4.1, and 4.1, resp. The Cl^- was 0.015 *N* in all cases. The uptake was reversible on red-brown clay, but k varied with $K_1:K_2$ for Ca:Pb and Ca:Hg, and the reversibility was poor for Ca:Cu in both aq. and alc. solns. The greater the value of k, the greater was the selectivity of a soil. Bentonite clay was less selective than soils contg. kaolin and sericite. The uptake decreased in the series Pb>Ba>Ca>Mg for chernozem and Pb>Ca>Ba>Mg for montmorillonite clay.

8574. Antipov-Karataev, I.N.; Pasvik-Khlopina, M.A.; Merkulova, M.S., and Grebenshchikova, V.I. **Nature of the uptake of ions by clays and soils. V. Uptake of heavy metal ions by clays and soils in dynamic conditions.** *Kolloid. Zhur.* 10, 401-5(1948).—*C.A.* 43, 7618*g*.
Solns. of $HgCl_2$, $PbCl_2$, and $CuCl_2$ were filtd. through a column 5 cm wide of argillaceous soil satd. with 19 mg equiv. Ca per 100 g at a rate of 1 cm/min. For 0.002 *N* $HgCl_2$ and 0.006 *N* $PbCl_2$, the const. *k* was 277 and 100 liters/cm, resp. $CuCl_2$ behaved like $PbCl_2$. Before the breakthrough, the soil bound 1.1, 1.9, and 2.7 mg equiv. Cu^{++} or Pb^{++} from their 0.0005 *N*, 0.001 *N*, and 0.002 *N* solns., resp.

8575. Arle, Fred H.; Leonard, O.A., and Harris, V.C. **Inactivation of 2,4-D on sweet-potato slips with activated carbon.** *Science* 107, 247-8 (1948).—*C.A.* 42, 5154*g*.
Sweet potato slips, the roots of which were moistened and then dusted with activated carbon (Norit A, about 1 lb/1000 sprouts), were protected against injury from the Na salt of 2,4-D, used immediately before planting. Concns. sprayed on the soil were 1000, 2000, 3000, 4000 p.p.m., resp., calcd. as free acid equiv.

8576. Barbier, Georges and Chabannes, Jean. **Relation between adsorption of anions by clays and their flocculation.** *Compt. rend.* 226, 1036-8(1948).—*C.A.* 42, 6480*d*.
The rapid adsorption of sulfate or phosphate by suspensions of various clays increased markedly on addn. of a salt which caused flocculation, such as $CaCl_2$, and reached a max. when flocculation was complete. Clays deprived of exchangeable bases by acid treatment did not adsorb phosphate, except for those contg. free Fe_2O_3, which were activated for phosphate adsorption by acid treatment. Neg. sols and humic acid were not adsorbed by clays unless flocculating agent was present.

8577. Barbier, Georges and Chabannes, Jean. **The mechanism of the slow fixation of phosphate by clay soils.** *Compt. rend.* 226,2175-78 (1948).
The slow fixation of phosphates in the soil differed essentially in the initial rapid adsorption. The reaction took place first at the external surface of the particle and then penetrated slowly into the interior network of the clay crystallites. The first bonds of the clay with the phosphate ions were broken easily by dilute acid, but the final combination was dissociated easily by dilute alkali.

8578. Bear, Firman E., and Prince, Allen B. **Magnesium needs of New Jersey soils.** *New Jersey Agr. Expt. Sta., Bull.* 739, 4-19(1948).—*C.A.* 43, 3956*e*.
Alfalfa adsorbed Mg, Ca, and K in the ratio of 1:5:6, resp., when the soil ratio was 4:43:6. Heavy application of K increased Mg deficiency in the plant. As MgO applications to the soil were increased, increased yields of potatoes and vines resulted based upon the dry wt of the crops. Upon untreated soil, the Mg content of the tubers, leaves, and stems were, resp., 13, 18, and 11 milliequivs. Sol. sulfate and oxide forms were more effective than dolomitic limestone in overcoming Mg deficiencies. Less than 20% of the soils contained optimum Mg.

8579. Chernov, V.A. **The nature of soil acidity. II. The mechanism of the reaction of acid soils with solutions of neutral and hydrolytically basic salts.** *Pedology* (U.S.S.R.) 1948, No. 1, 14-23.—*C.A.* 42, 7470*c*.
The value of soil acidity, detd. by the interaction with different salts, depended not only on the pH of the soln. and the nature of the cation but also on the anion. In the interaction of red loams and podzolized soils with hydrolytically basic salts of CH_3COONa and NaF, the anions of these salts exchanged with the OH ions and for that reason, the hydrolytic acidity of the soils was near or lower than the exchange acidity.

8580. Coleman, N.T. and Mehlich, A. **Some chemical properties of soils as related to their cation exchange-anion exchange ratios.** *Soil Sci. Soc. Am., Proc.* 13, 175-8 (1948) (Pub. 1949).—*C.A.* 44, 3641*g*.
There was a relationship between the equil. pH of Ca-soil-H_3PO_4 system (pH_e) and the ratio of cation-exchange capacity to anion-exchange capacity (C/A) such that pH_e could be used as an index of C/A ratio. Adsorption of phosphate ions was highest for those soils with low C/A ratios. There were at least 2 types of bonding between phosphate ions and clay; the first seemed to be exchange adsorption, the second counter ion exchange. The greatest increases in cation-exchange capacity were observed for those soils with the lowest C/A ratios. Montmorillontic soils gave high C/A ratios and low pH_e values, kaolinitic soils gave intermediate values, and Gibbsitic soils gave low values of C/A ratio and high values for pH_e.

8581. Ensminger, L.E. **The relation between water lost and the phosphate ion adsorbed on phosphating clay minerals and soil colloids.** *Soil Sci. Soc. Am. Proc.* 13, 170-4 (1948) (Pub. 1949).—*C.A.* 44, 3642*i*.
Clay minerals and soil colloids, as well as chemically pure Al_2O_3 and hydrated Al_2O_3, were treated with 40 ml of *M* $(NH_4)_3PO_4$ per 2 g of material at pH 4.25, 5.7, and 7.0 The molar ratio of water-released to PO_4- adsorbed increased material at pH 4.25, 5.7, and 7.0. The molar ratio this indicating a change in the valence of the phosphate ion adsorbed. The ratio for chemically pure hydrated Al_2O_3 increased from 1.53 at pH 4.25 to 3.01 at pH 7.0. This indicated that P was adsorbed as the PO_4 ion at pH 7.0. The ratio for chemically pure Al_2O_3 varied from 0.57 to 1.35, which indicated the valence of the phosphate ion adsorbed varied with pH.

8582. Fujimoto, Charles K. and Sherman, G. Donald. **Behavior of manganese in the soil and the manganese cycle.** *Soil Sci.* 66, 131-45 (1948).—*C.A.* 42, 9026*a*.
The exchangeable Mn of soils decreased progressively with increasing quantities of lime applied. Dolomite had a smaller depressing effect on exchangeable Mn than did $CaCO_3$. Plant absorption of Mn was decreased by the addn. of either

$CaCO_3$ or dolomite to soil. S, when applied to soils, increased the exchangeable Mn and increased the absorption of Mn in plants. Chem. reducing agents such as hydroquinone, $SnCl_2$, HCHO, hydrazine sulfate, and KI increased the exchangeable Mn of soils; hydroquinone was the most effective of the group studied.

8583. GAPON, E.N. AND CHERNIKOVA, T.N. **Chromatographic exchange adsorption of cations by soil minerals.** *Doklady Vsesoyuz. Akad. Sel'sko-Khoz. Nauk im, V. I. Lenina* (U.S.S.R.) No. 7, 26-8(1948).—*C.A.* 43, 3549*h*.

Columns of kaolinite and bentonite in glass tubes were leached with an equimolar soln. of $Co(NO_3)_2$ and $CuSO_4$ and washed with water. On top of the column of kaolinite appeared pale blue-green spots (the Cu zone) and on the bottom pale pink-colored spots (the Co zone). Passing a 1.0 *N* soln. of $(NH_4)_2CO_3$ gave a ring of colloidally pptd. blue $CuCO_3$. By continuous washing with the $(NH_4)_2CO_3$, all of the Cu could be removed as the carbonate.

8584. GHOLSTON, L.E. AND DALE, C. **The release of exchangeable and none-exchangeable potassium from several Mississippi and Alabama soils upon continuous cropping.** *Sci. Soc. Am., Proc.* 13, 116-21(1948) (Pub. 1949).—*C.A.* 44, 2685*i*.

German millet was grown for 545 days, under greenhouse conditions, on representative soil types from 8 Mississippi and 3 Alabama agricultural soil areas. Eight crops were harvested from each soil and 2 soil samples were taken after alternate harvests. Six of the 11 soils showed a considerable lowering of the exchangeable K content by the 1st and 2nd crops, Whereas the other 5 soils, though showing a similar trend, were decreased more gradually by successive crops. After the 2nd harvest, all of the soils exhibited a rather gradual lowering of their exchangeable K content to the point where the K-supplying power of the soils was largely detd. by the rate at which nonexchangeable K was converted to the exchangeable form.

8585. GOR'KOVA, I.M. **The influence of water on the aggregation of dispersed systems of soil and other materials from the ground.** *Pochvovedenie* 1948, 260-7.—*C.A.* 42, 9022*d*.

Water was contained in soils and materials, such as kaolin, bentonite, and clays, at 3 water levels: (1) hygroscopic moisture or water vapor mols. adsorbed by the surface of the solid phase; (2) water of the diffused double layer of ions on the surface of the solid phase; (3) free water. Quant. data were given on the moisture content of the different zonal soils at the 3 levels and on the relation of these conditions of moisture to the aggregation of the materials tested.

8586. HANNA, W.J. AND REED, J. FIELDING. **A comparison of ammonium acetate and buffered barium chloride methods for determining cation-exchange properties of limed soils.** *Soil Sci.* 66, 447-58 (1948).—*C.A.* 43, 3128*f*.

The $BaCl_2$ method and NH_4OAc method for detg. exchange properties of soil were compared on 3 soils limed to different degrees. In all cases the values obtained with the $BaCl_2$ procedure were highest. At 15% satn., the Bladen, Craven, and Hyde soils gave an exchange capacity of 22.1, 9.5, and 38.2 milliequiv. per 100 g of soil with the $BaCl_2$ procedure. The ammonium acetate procedure gave values of 14.1, 4.3, and 17.2 resp. At 60% satn. the values were 22.3, 10.0, and 39.2 for $BaCl_2$ and 14.2, 5.0, and 18.9 for NH_4OAc. At 90% satn. the corresponding values were 22.1, 10.0. and 35.9 for $BaCl_2$and 14.7, 5.5, and 20.0 for NH_4OAc. Appreciable amts. of $CaCO_3$ were dissolved by the NH_4OAc but not by the $BaCl_2$ soln.

8587. HARDY, F. AND HEWITT, C.W. **Phosphate fixation in British Guiana sugarcane soils.** *Trop. Agr. (Trinidad)* 25, 19-22 (1948).—*C.A.* 43, 8591*i*.

A marked capacity to fix added sol. P was demonstrated for surface samples of representative sugar cane soils. The degree of fixation was about 73% of P absorbed or 65% of P added. After 3 months incubation, limed (with gypsum and calcium bicarbonate) and unlimed samples fixed 67 and 78%, resp. of the added P.

8588. HOSKING, J.S. **The cation-exchange of soils and soil colloids. I. Variation with hydrogen-ion concentration.** *J. Council Sci. Ind. Research* 21, 21-37(1948).—*C.A.* 42, 7469*a*.

A rapid method for detg. cation-exchange capacities was described. Samples as small as 0.1 g were leached with NH_4OAc solns., adjusted to pH values from 5 to 10, and the NH_4^+ adsorbed estd. In all the samples cation-exchange capacities increased from a min. value at pH 5 to a max. value at pH 9, then decreased at higher pH values. The rate of increase in cation-exchange capacities per unit pH varied from 0.5 to 3.0 milliequiv. per 100 g, and this variation was independent of the clay mineral type, the soil type and the magnitude of cation-exchange capacities. The term "cation-exchange capacity of the soil" should be used for the value at the pH of the soil, and the term "max. cation-exchange capacity," for the value at pH 9.

8589. HOSKING, J.S. **The cation-exchange of soils and soil colloids. II. The contribution from the sand, silt, and clay fractions and organic matter.** *J. Council Sci. Ind. Research* 21, 38-50 (1948).—*C.A.* 42, 7469*d*.

Cation-exchange reactions were not confined to the clay or colloid fractions of soils. There was a decrease in cation-exchange capacities in passing from the colloid to the silt fraction, but cation-exchange capacities persisted in all but the most highly siliceous sand fractions. Cation-exchange capacities of the silt and sand fractions were related to the presence of high concns. of clay minerals which distributed generally throughout all the fractions of the soil.

8590. KHACHVANKYAN, M.A. **The cationic complex adsorbed by clays in equilibrium with several types of natural waters.** *Gidrokhim. Materialy* 14, 69-75 (1948).—*C.A.* 45, 5470*f*.

The treated clays were subjected to pressure to remove the excess of equil. soln. This was followed by leaching the clay with a 1.0 *N* soln. NH_4Cl. At the same time the moisture of the pressed clay was detd. by drying at 105-110°C. To obtain the true value of the adsorbed cations it was necessary to det. the vol. of the cations in the equil. soln. between the clay particles. It was possible to calc. the complexes of adsorbed cations on the clay which corresponded to the equil. conditions with the cations of the 4 types of water analyzed. These data may be used in detg. the type of soln. in which the clays formed.

8591. LEENHEER, L. DE. **The adsorptive properties of soils and their mineralogical interpretation.** *Bull. soc. belge géol., paléontol. et hydrol.* 57, 299-320 (1948).—*C.A.* 43, 7618*i*.
Some data on Belgian clay soils were reviewed.

8592. MARSHALL, C.E. **Ionization of calcium from soil colloids and its bearing on soil relations.** *Soil Sci.* 65, 57-68(1948).—*C.A.* 42, 5151*a*.
In the montmorillonite and beidellite clays the active fraction varied abruptly for Na and for Ca at different stages of neutralization. Na showed a narrow zone and Ca a broad zone of very low activity. Kaolinite showed a fairly steady rise in active fraction for both cations as the amt. of base increased. These differences in active fraction reflected large differences in differential heat of adsorption of the cation in different regions of the titration curves. Ionizations of all cations, but especially of Ca, was much greater for kaolinite than for the montmorillonite clays.

8593. MARSHALL, C.E. **Electrochemical properties of mineral membranes. VIII. Theory of selective membrane behavior.** *J. Phys. & Colloid Chem.* 52, 1284-95 (1948).—*C.A.* 43, 2069*g*.
The mobility ratio of cations within the membrane, as well as differences in differential heats of adsorption, were considered.

8594. MATTSON, SANTE. **Laws of ionic exchange. III. Donnan equilibria in plant nutrition.** *Kgl. Lantbruks-Hogskol. Ann.* 15, 308-16(1948). —*C.A.* 42, 6033*f*.
Barley plants were grown in kaolin and in 11 g bentonite plus enough quartz sand so that all weighted 300 g. Each was satd. with one of a series of solns. that contained K and Ca ions in the proportions from 90/10 to 10/90% resp., of the exchange capacity. In the 3-weeks-old plants the K/Ca ratio varied from 3.0 to 19.8 in the plants grown in Kaolin and from 4.9 to 55.4 in the plants grown in bentonite. The difference was explained as a valence effect on the Donnan distribution of ions in a system of 2 colloidal phases of different ionic activities. The relatively large amts. of NH_4^+ and Mg^{++} in the nutrient solns. apparently displaced enough K to satisfy the requirements of the plants in the kaolin as readily as in the bentonite.

8595. MCLEAN, E.O. AND MARSHALL, C.E. **Reciprocal effects of calcium and potassium as shown by their cationic activities in montmorillonite.** *Soil Sci. Soc. Am., Proc.* 13, 179-82 (1948) (Pub. 1949).—*C.A.* 44, 3644*i*.
The Ca in the montmorillonite clay was more firmly held than H. Ca in small proportions had relatively little effect, but as the proportion of Ca increased it greatly enhanced the dissocn. of the K clay. K in relatively small amts. could cause a strong depression in the Ca activities, but by the time a 50:50 mixt. was reached the Ca could no longer be measured. These data were detd. on 0.5% K-H and Ca-H bentonite systems.

8596. MEHLICH, A. **Determination of cation- and anion-exchange properties of soils.** *Soil Sci.* 66, 429-46 (1948).—*C.A.* 43, 3127*i*.
Enough air-dry soil to give 0.5 to 2.5 milliequiv. exchange capacity was weighed into special funnels. $BaCl_2$ was buffered at pH 8.1 with triethanolamine added, the soil washed with unbuffered $BaCl_2$, and finally with water. Exchangeable H, Ca, Mg, K, and Na were detd. in the filtrate. The cation-exchange capacity was obtained by replacement of Ba from the soil with $CaCl_2$, at pH 8, pptg. the Ba as the chromate, and finally detg. $BaCrO_4$ colorimetrically. For the detn. of anion-exchange capacity the Ca-satd. soil was treated with H_3PO_4 in an amt. equiv. to the cation-exchange capacity. After 24 hrs of contact, the pH was measured, and the phosphate ion adsorbed was detd. The exchangeable phosphate was detd. by replacement with acidified NH_4F.

8597. MEHLICH, A. AND REED, J. FIELDING. **Effect of cation-exchange properties of soil on the cation content of plants.** *Soil Sci.* 66, 289-306(1948).—*C.A.* 43, 3128*c*.
The principal effects on plants of the exchangeable cations of soils were: (1) an increase in the exchangeable K, for any given level of Mg and Ca, caused an increase in K, and decreased Ca and Mg in the plants; (2) an increase in the exchangeable Mg, for any given level of Mg and Ca, increased Mg, decreased Ca, and had no significant effect on K in the plants; (3) for approx. the same level of exchangeable K, the K content of the plants increased and the Ca, and Mg contents decreased with decreasing cation-exchange capacity; (4) though the sum of the cations in the plant varied somewhat with the harvest or with the crop, it was relatively const. for each crop; and (5) for any given soil treatment, the K content in oats and turnips was about the same order.

8598. MILLER, R.B. **Chemical properties of two New Zealand bentonities.** *New Zealand J. Sci. Technol.* 30B, 198(1948).—*C.A.* 44, 5049*f*.
Two samples of bentonite had base-exchange capacities of 43.7 and 74.0 milliequiv. %, and contained 11.4 and 0 milliequiv. % exchangeable Na, and 15.6 and 0% free $CaCO_3$, resp. One sample also contained 36.6 milliequiv. % exchangeable Ca and after leaching with 18 and 4 milliequiv. % Mg and K, resp., had 80% base satn. By normal base-exchange methods, e.g., leaching with NaCl, the swelling properties (which det. com. value) of both were improved. Thus, lower-grade bentonites having inadequate swelling properties could be improved by this process.

8599. PERKINS, ALFRED T. **Kaolin and treated kaolins and their reactions.** *Soil Sci.* 65, 185-91(1948).—*C.A.* 42, 6975*f*.
Certain properties of kaolin were drastically changed by heating or by mortar grinding. Heating caused a loss of about 13%, of the wt of the clay in the form of H_2O. This treatment also caused an increase in particle size, an increase in phos-

phate fixation, an increase in alky. of the mineral, and development of a somewhat whiter color. Grinding kaolin markedly increased the base-exchange capacity, phosphate-fixing capacity, and alky.; it slightly darkened the color. The chief differences between the effects of heating and grinding were the changes in base-exchange capacity and in phosphate fixation. This was interpreted to mean that base exchange was a function of surface area, whereas phosphate fixation was a function of the OH radicals as well as of surface area.

8600. Petronici, Clara and Buffa, Aldo. **Determination of exchange capacity of soils.** *Ann chim. applicata* 38, 329-31(1948).—*C.A.* 45, 7733*i*.

Various methods for the detn. of ion-exchange capacity of soils were compared experimentally. Gedroiz' method was the best.

8601. Sarishvili, I.F. **Determining the adsorption of acetic acid in soils.** *Pochvovedenie* 1948, 184-9.—*C.A.* 42, 9022*c*.

The red soils (red loam) adsorbed some AcOH when acetate was used in detg. hydrolytic acidity. Soils showing a hydrolytic acidity lower than exchange acidity adsorbed more AcOH. A method of detg. AcOH and type of app. used were described.

8602. Sauerlandt, Walter. **The exchange capacity of manure.** *Z. Pflanzenernahr., Dungung u. Bodenk.* 41, 53-64(1948).—*C.A.* 43, 3132*a*.

The exchange capacity was detd. for manure mixed with various composting materials (straw, potato tops, sawdust, peat, powd. needles, and leaves) in order to follow changes during rotting. In the alk. region, the exchange capacity, representing carboxyl and phenolic groups, showed no great change during rotting, but the exchange capacity in the acid region representing only carboxyl groups decreased.

8603. Scheffer, F. and Schachtschabel, P. **Structure and sorption of soil colloids.** *Beitr. Agrarwiss*, No. 4, 11-20(1948).—*C.A.* 43, 7171*a*.

The base-exchange capacity of soils is called a "sorption-capacity" as the involved processes in the soil were still unknown. The sorption properties of the inorg. components in the soil was given and the methods to det. the partial sorption of the org. matter were described.

8604. Sequeiros Bores, José M.. **Agricultural characteristics of tobacco-growing areas (Cáceres and A'vila) in Spain. II. Base-exchange capacity of the soil.** *Bol. inst. nacl. invest. agron.* (Madrid) No. 19, 205-19(1948).—*C.A.* 46, 3197*g*.

Climatic influence was weak and the underlying rocks had a great influence on the compn. and character of the soils. They were poor in exchangeable bases, particularly K. Detailed analyses were tabulated.

8605. Sharov. V.S. **The rate of diffusion of adsorbed cations in a suspengel of clay.** *Kolloid. Zhur.* 10, 463-5 (1948).—*C.A.* 43, 7777*h*.

Suspengel was solidified suspension. When two cylinders of bentonite, one satd. with Ca and the other with Cu, were kept in direct contact or were sepd. by a thin paper or cellulose sheet, Cu^{++} migrated into the Ca bentonite at a rate of 0.5 cm in 500 hrs at 20°C.

8606. Sokolov, A.V. and Koritskaya, T.D. **The movement of phosphates in the soil.** *Pedology (U.S.S.R.)* 1948, 636-40.—*C.A.* 43, 5141*g*.

Tests were made on the movement and adsorption of P of different sources (mono-, di-, and tri-Ca phosphate, Ca metaphosphate, and K metaphosphate) as affected by temp. and speed of filtration. Plants were grown in a double pot, the inner one receiving N and K salts and the outer one contg. the P salt. The plants were grown in the inner pot which was sepd. from the outer by a collodion membrane. The phosphates moved through the membrane and supplied the plants with P. The temp decrease did not alter much the adsorption of P. With an increased speed of filtration, more P moved through the soil.

8607. Takahashi, Seikô; Hirota, Kôki, and Inoue, Yoshiyuki. **Agricultural chemicals. VI. Adsorption of nicotine by acid clay and the inhibitor.** *J. Agr. Chem. Soc. Japan* 22, 31 (1948).—*C.A.* 46, 9760*i*.

Nicotine was adsorbed from leaf-tobacco ext. (pH 5.6, nicotine 0.205%) by acid clay at a slightly lower rate at pH 5-6 and at similar max. rates at pH lower than 5 and higher than 6. The optimum amt. of acid clay added was 10%, when 58.3% of the nicotine in the ext. was adsorbed. From a dil. soln. of pure nicotine sulfate 10% acid clay could adsorb 97% of the nicotine. Thus, there must be an inhibitor for this adsorption in the leaf-tobacco ext. NH_4 salts, pectin, and resinous material were found to be responsible for this inhibition.

8608. Troug, Emil. **Lime in relation to availability of plant nutrients.** *Soil Sci.* 65, 1-7 (1948).—*C.A.* 42, 5149b.

Conditions with pH between 6.5 and 7.5 were the most favorable for phosphate availability. Below pH 6.5, the influence on availability rapidly became less favorable. At strong acidity, the conditions for both the accumulation of S in org. matter and its subsequent transformation to sulfate for plant use were not very favorable. With increased acidity, the amts. of K, Ca, and Mg that existed in readily available form usually decreased. Liming decreased the availability of such elements as Mn, Fe, B, Cu, and Zn.

8609. Tryon, E.H. **Effect of charcoal on certain physical, chemical, and biological properties of forest soils.** *Ecol. Monographs* 18, 81-115 (1948).—*C.A.* 44, 9603*d*.

Two types of charcoal, hardwood and conifer, in 2 sizes, less than 1 mm and 2 to 5 mm, were mixed with 3 soils, Merrimac sand, Maltby sandy loam, and Berlin clay loam, so that the charcoal comprised 15, 30, and 45% of the total by vol. Addn. of charcoal reduced the rate of evapn. and thus tended to increase the time required to reach the wilting percentage. Total N was increased by hardwood charcoal and decreased by conifer charcoal. Phosphoric acid, K, Ca, and Mg were increased as were pH values.

8610. VLAMIS, J. AND JENNY, H. **Calcium deficiency in serpentine soils as revealed by absorbent technique.** *Science* **107**, 549(1948).—*C.A.* 42, 5597*c*.

Absorbent techniques, involving amberlites as ion carriers, were used to det. whether or not rosette disease was conditioned by Mg excess or Ca deficiency, either abs. or relative. Ca Amberlite added to Conejo soil overcame the disease and produced normal plants. Water-culture expts. showed that the disease was produced as a result of Ca deficiency, in the absence of significant amts. of Co, Cr, and Ni.

8611. WEAVER, ROBERT J. **Contratoxification of plant growth-regulators in soils and on plants.** *Botan. Gaz.* **109**, 276-300(1948).—*C.A.* 42, 3895*c*.

In field plots 2,4,5-trichlorophenoxyacetic acid was least toxic and the Bu ester of 2,4-D most toxic and persistent as measured by the emergence of beans, soybeans, mustard, and Sudan grass and by the wt of tops. Toxicity was decreased by spading or plowing. Admixt. of ion exchangers Zeo-Karb H or Norit A reduced or completely eliminated the toxic effect of 2,4-D. Super Filtrol and attapulgus clays were ineffective, lampblack and bone char partially so as contratoxicants.

8612. WEAVER, ROBERT J. **Uses of activated carbon in contratoxification of plant-growth regulators.** *Botan, Gaz.* **110**, 300-12(1948).—*C.A.* 43, 2355*h*.

With 2,4-D(NH_4salt) applied at 10 lb/acre, 100-500 lb Norit A, each raked in the top 3 in., were required for complete contratoxification. With a cone consisting of a mixt. of Norit A and soil placed above each seed or with a mixt. covering a row of seeds, protection against a broadcast application of 2,4-D was obtained and weeds were controlled. Norit A in soil, retained its absorption capacity for 2,4-D for 12 days. Coating the seeds with Norit A before planting in soil previously treated with 2,4-D protected red kidney bean but not soybean, pea or wheat. When Norit A was applied following spraying with the Bu ester, it gave little protection unless applied within 15 min.

8613. ZUEV, L.A. AND GAPON, E.N. **The adsorption of water vapor by soils.** *Pedology (U.S.S.R.)* **1948**, No. 2, 113-20.—*C.A.* 42, 7470*f*.

A weakly degraded chernozem and a medium podzolized loam were satd. with Ca, Mg, Na, and H. Mixts. of the cationic soils were made up and subjected to adsorption of water vapor under a vacuum of 4.5×10^{-5} mm Hg at 15°C. The adsorption curves for the different cations and their mixts. took on an S-shaped form. At the start, the adsorbed cations had some influence on the adsorption of vapor. In general, the effect of the cations was indirect, inasmuch as they have affected the structure of the soil. The Freundlich equation was applicable only to the initial portion of the curve.

8614. ADERIKHIN, P.G. **The role of exchangeable cations in the adsorption of phosphorus by chernozem.** *Pochvovedenie (Pedology)* **1949**, No. 5, 302-5.—*C.A.* 43, 7621*c*.

One sod-podzolized and 4 chernozem soils were treated with 0.05 *N* HCl to saturate them with H and then were leached with chlorides of Na, K, NH_4, Mg, Ca, and Fe to replace the H. The prepared soils were treated with $CaH_4(PO_4)_2$, 0.004 molar soln., shaken for 5 min., and allowed to stand for 24 hrs shaken again, and filtered. The quantity of P adsorbed was detd. by "difference" analyzing the filtrate. The highest adsorption of P was gained by the soil satd. with Fe, followed by Ca. The soils varied in the adsorptive capacity for P, depending on the exchange capacity.

8615. AIDINYAN, R. KH. **Material exchange and formation of mineral colloids in the first stages of soil formation on massive crystalline substructures.** *Doklady Akad. Nauk S.S.S.R.* 67, 729-31(1949).—*C.A.* 44, 495*e*.

Examn. of moss and lichen growth on rock showed that the ash of the plants was much higher in P and Ca than was the rock structure; the excess may reach 500-1000%. Similar, but less pronounced accumulation was observed with K, Mg, Fe, and Mn, followed in descending order by Al, Na, and Si, on basalts. Such activity of the plants resulted in formation of humus-enriched "melkozem" soil, capable of cation exchange of 10-50 milliequivs. per 100 g, which was 60-80% sats. with Ca. The ion-exchange capacity of the colloids was 70-100 milliequivs. per 100 g.

8616. ALBAREDA HERRERA, J. MA.; ALVIRA, T., AND GUERRA, A. **The brown soils of Spain.** *Anales edafol. y fisiol. vegetal* (Madrid) **8**, 421-501 (1949).—*C.A.* 45, 1279*f*.

The clays showed the typical ratio SiO_2/R_2O_3 = 2. The exchange capacity had no relation to this ratio in the clay. There was a pos. connection between SiO_2/Al_2O_3 and the amt. of Ca contained in the clay. The exchange capacity increased with the content of slime + clay. There was a well-defined parallelism between content of org. matter and content of gels. The presence of org. matter facilitated soln. of the gels in the Tamm reagent. In all cases, including a single podzol, the amt. of SiO_2 in the form of gel was virtually const. in all horizons, and only the Fe and Al sesquioxides showed variations. The brown soils studied had not undergone degradation.

8617. ASGHAR, A.G.; DHAWAN, C.L., AND BHOLA, K.D. **Preliminary studies on the establishment of color standards in relation to soil constants.** *Indian J. Agr. Sci.* **19**, 21-9(1949).—*C.A.* 45, 4859*e*.

The soils were analyzed for clay, sticky point, exchangeable bases, available phosphate, and $CaCO_3$. A correlation analysis was run between soil color and the other analyses. A significant positive correlation was found between black color and both clay and exchangeable Ca. By partial correlation analysis, black color was found to depend on the amount of exchangeable Ca, and to be independent of the clay content. Red color was significantly correlated with sticky point.

8618. ASKLUND, B. **The problem of the differentiation of the apatite iron ores.** *Geol. Fören. i. Stockholm Förh.* **71**, 127-76 (1949)(English summary).—*C.A.* 43, 8317*a*.

These ores had special chem. characteristics: low SiO_2, as shown by the predominance of syenitic rocks, high Na, V, Ti, and P. These characteristics were best explained on the basis that the ores represented the result of sepn. of magma into 2 immiscible liquid phases.

8619. Asklund, B. **Apatite iron ores and geochemistry.** *Geol. Fören. i Stockholm Förh.* **71**, 333-46 (1949).—*C. A.* **43**, 8317*f*.

From the geochem. viewpoint some rather rare types of apatite Fe ores were observed like those of Ikerberg (Sweden) which were combined with increasing percentages of Cr, Co, Ni as compared with ores which were combined with syenites and quartz-porphyries. The whole series of rocks which were related with apatite-Fe ores all over the world belonged to quite especially Na-rich types.

8620. Ayres, A. S. **Release of nonexchangeable potassium in Hawaiian sugar-cane soils.** *Univ. Hawaiian Agr. Expt. Sta. Tech. Bull.* **9**, 50 pp. (1949).—*C. A.* **44**, 10984*e*.

Moist storage of soils produced no changes in levels of exchangeable K. Partial removal of exchangeable K, followed by moist storage, resulted in the release of small amts. of K. Ca soils liberated 2.5 times as much K on moist storage as acid soils. Liming of acid soil did not release K if exchangeable K were not first displaced. Treatment of soil with H_2O_2 did not result in increased recovery of exchangeable K. Levels of exchangeable K diminished with cropping. Release of nonexchangeable K upon electrodialysis was directly related to the release by soils on moist storage. Rates of release of K decreased with time. Extn. of exchangeable K-free soils with hot *N* HCl produced quantities of K which were directly related to the release of nonexchangeable K upon cropping and also upon moist storage.

8621. Barbier, Georges and Chabannes, Jean. **The mechanism of the adsorption of phosphates by various constituents of the clay of soils.** *Ann. agron.* **19**, 343-79(1949)—*C. A.* **43**, 9315*d*.

The sol. fraction of P_2O_5 in fertilizers was taken up by the clay by a slow process of absorption which included 2 successive phases that differed in the speed of fixation and the nature of the bonding force. In the first phase a band between PO_4^{-3} with exchangeable metallic cations, especially Ca, was quickly established. In the second phase the PO_4^{-3} was bound by the nonexchangeable cations that were an integral part of the clay particles and migrate with them to the anode during electrophoresis. The PO_4^{-3} taken up in the first absorption gradually passed into the second. The second form can subsequently be extd. by dil. alkali. If in this extn. $Ca(OH)_2$ was used instead of NaOH some of the PO_4^{-3} bound in the second manner passed into the first.

8622. Barbier, Georges and Durroux, Marcelle. **Equilibria to which the fixation of potassium in the nonexchangeable state gives rise in the soil.** *Compt. rend.* **228**, 1747-9(1949).—*C. A.* **43**, 7172*g*.

Expts. were carried out on a clay soil to det. whether there was an equil. between the exchangeable and nonexchangeable K. Samples were washed with $CaCl_2$ soln., kept moist for varying lengths of time, and then extd. with $AcONH_4$. The fact that the amt. of exchangeable K was greater for longer periods indicated a change from nonexchangeable to exchangeable K. This transformation was found to be favored by alternate desiccation and humectation of the soil, but the same treatment favored the transformation to nonexchangeable K in other soils. Ca-contg. humates suppressed both transformations.

8623. Birch, H. F. **The estimation of adsorbed and acid-soluble phosphates in East African soils.** *Tech. Commun. No.* **46**, 225-30(1949).—*C. A.* **44**, 4182*a*.

Data on 20 soils showed that below pH 5.5 the ratios of adsorbed P_2O_5 to acid-sol. P_2O_5 ranged from 28 to infinity, between pH 5.5 and 6 from 1.8 to 6.8, while above pH 6 no ratio was greater than 2.7 and most of them were approx. 1. With increasing soil acidity the proportion of P_2O_5 in the adsorbed form increased; with increasing alky. the proportion of acid-sol. P_2O_5 increased. At pH 4.9 and below, 100% of the P_2O_5 was in the adsorbed form, at pH 8.5 and above, none of the soil P_2O_5 was in the adsorbed form. Similarly for the acid-sol. fraction, at pH 8.8 and over, 100% of the P_2O_5 was in this form and none at pH 4.9 and under.

8624. Brown, Bahngrell W. **A fluorescence study of Wyoming bentonite.** *Am. Mineral.* **34**, 98-101(1949).—*C. A.* **43**, 8988*a*.

Wyoming swelling-bentonite and Colorado beidellite, when brought into contact with a water soln. of Zn uranyl acetate, fluoresced under short ultraviolet light; other clays did not respond. Data were given correlating this test to the green compressive strength, viscosity, and shear.

8625. Chernov, V. A. **The nature of soil acidity. III. The mechanism of the reaction of acid soils with an alkaline solution.** *Pochvovedenie (Pedology)* **1949**, No. 5, 256-67.—*C. A.* **43**, 7616*h*.

A water and KCl suspension of Krasnozem (red loam) of the Caucasian subtropics was detd. at a series of points on the titration curve of the KCl suspension. The data showed that the mechanism of the reactions involved was as follows: the OH groups combined with the trivalent Al and the K ions were adsorbed by the soil. This reaction took place in the pH range 5.4-7.2. The pH curve of the H_2O suspension was 2.0-2.5 units lower than that of the KCl suspension. From the quantity of alkali that it took to titrate to the break on the titration curve, the base necessary to eliminate the exchange acidity was calcd.

8626. Coleman, N. T.; Jackson, M. L., and Mehlich, A. **Mineral composition of the clay fraction. II. Several Coastal Plain, Piedmont, and mountain soils of North Carolina.** *Soil Sci. Soc. Am., Proc.* **14**, 81-5 (1949)(Pub. 1950)—*C. A.* **45**, 1713*c*.

The mineral constitution of the fine clay, coarse clay, and the fine silt fractions of the *A*, *B*, and *C* horizons of 7 North Carolina soils were detd. The base-exchange capacities of the colloids were largely correlated with the kind of colloidal minerals present.

8627. D'ANS, JEAN AND ULRICH, ERNST. **Conversion of montmorillonite with neutral salt solutions.** *Naturwissenschaften* 36, 344-5(1949).—*C. A.* 44, 5504*h*.

Hydrogen montmorillonite (HMo) was titrated in 1 to 3% KCl soln. (100 ml) with a glass electrode as indicator. The amt. of H ions liberated was proportional to the HMo used; however, the Mo acted as a dibasic acid, the first H was readily neutralized, whereas it took up to several days for the equil. to become established with the second H. From the data an apparent mol. wt. of HMo of 2000 was calcd.; the mol. wt of the simplest formula $Al_2O_3.4SiO_2.H_2O$ was 360.

8628. EVANS, D. D. AND KIRKHAM, DON. **Measurement of the air permeability of soil in situ.** *Soil Sci. Soc. Am., Proc.* 14, 65-73(1949)(Pub. 1950).—*C. A.* 45, 1710*g*.

A method was developed for measuring the air permeability of soil without disturbing the soil. Measurements of the permeability of some Iowa soils under different cropping systems and treatments demonstrated the usefulness of the method.

8629. EVERSON, JOHN N. AND WEAVER, JAMES B. **Effect of carbon black on properties of soils.** *Ind. Eng. Chem.* 41, 1798-1801 (1949).—*C. A.* 43, 9317*i*.

Carbon black incorporation in soil had an important temp. effect. At the surface and 2 in. deep in the soil, addn. of carbon increased max. and min. temp. attained. This temp. effect increased the time available for plant growth and possibly the biol. activity in the soil.

8630. FERRARI, CARLO. **The adsorption of silicic acid by roots.** *Boll. sci. facoltà chim. ind. univ. Bologna* 7, 23-5 (1949).—*C. A.* 43, 9320*f*.

The colored silicomolybdic ion was formed only if silicic acid reacted with molybdic acid; it did not form if the silicates were previously treated with acids and SiO_2 was free. This reaction was used to det. the condition of silicates existing in soils near the root hairs, which in respiratory activity, develop CO_2. Silicic acid formed by the action of HCl or H_2SO_4 on a sol. silicate in the soil existed in a dialyzable form, able to react with NH_4 molybdate.

8631. FRIED, MAURICE AND MACKENZIE, ARNOLD J. **Rock phosphate studies with neutron-irradiated rock phosphate.** *Soil Sci. Soc. Am., Proc.* 14, 226-31(1949)(Pub. 1950).—*C. A.* 45, 3542*a*.

With rock phosphate, the higher the soil pH, the lower the relative amts. of fertilizer to soil P absorbed by plants. With superphosphate, soil pH did not influence this relative uptake. At pH 5.8, plant removal of P from superphosphate equaled or exceeded removal from rock phosphate even when the latter material was applied at 4 times the P_2O_5 rate. The total uptake of P from the rock phosphate was as much as 16.4 times that of Ca.

8632. GORING, C. A. I. AND BARTHOLOMEW, W. V. **Microbial products and soil organic matter. II. The effect of clay on the decomposition and separation of the phosphorus compounds in microorganisms.** *Soil Sci. Soc. Am., Proc.* 14, 152-6 (1949).—*C. A.* 45, 2123*e*.

Mixed microbial tissue was allowed to decomp. in the presence of varying concns. of kaolinite and bentonite. With the analysis used, clay did not prevent almost complete extn. of the org. P present although it did interfere with the normal distribution among the several org. fractions. Bentonite exerted a more marked effect than did kaolinite.

8633. HARRIS, THOMAS H. **The determination of γ-benzene hexachloride in insecticide products.** *J. Assoc. Offic. Agr. Chemists* 32, 684-90 (1949).—*C. A.* 43, 9330*i*.

Silicic acid (50 g) was employed in the chromatography and 5-ml fractions were collected. The slurry of silicic acid with nitromethane and hexane was prepd in a Waring Blendor. A dye, D & C Violet No. 2 (1-hydroxy-4-p-toluinoanthraquinone), was added to the soln. aliquot to be chromatographed and served as a visible marker for the front of the colorless γ-benzene hexachloride band as it moved down the column. The advantages of the method were fewer fractions collected, simplified app., and more rapid analysis, the chromatography time being reduced from about 3 hrs to about 45 min.

8634. KIEFER, C. **Origin of the charge of suspensions of foliated minerals and its relation to the surface lattice structure of minerals.** *Bull. soc. franc. céram.* **1949**, No. 2, 24-30; *Ceram. Abstracts* **1951**, 147.—*C. A.* 46, 6043*g*.

Electrophoretic studies were conducted to det. whether the charge on the kaolinite micelle could be ascribed to adsorption of ions from the surrounding soln. or to dissocn. of ions from the surface of the mol. It was shown that kaolinite acquired its charge by adsorbing ions, while mica (muscovite) became charged by dissocn. of ions from its surface. This was demonstrated by measuring the electrophoretic velocity of the micelles at varying concns. The velocity of mica increased with increasing diln., while that of kaolinite decreased. Na pyrophosphate was used as the deflocculant. The results were confirmed by the observed changes in the cond. and the pH of the suspension.

8635. KREVELEN, D. W. VAN AND HOFTIJZER, P. J. **Drying of granulated materials. I. Drying of a single granule.** *J. Soc. Chem. Ind.* 68, 59-66(1949).—*C. A.* 43, 4906*a*.

To predict the dimensions of app. needed, a theoretical presentation was followed by the derivation of equations for granules with no sol. salts and granules with sol. salts crystg. during drying. Exptl. verification was obtained by using wet marl and nitro-chalk fertilizer contg. 60% NH_4NO_3 and 40% marl.

8636. LANDERGREN, STURE. **Formation of apatite-iron ores.** *Geol. Fören. i. Stockholm Förh.* 71, 293-302 (1949).—*C. A.* 43, 8317*b*.

The problem of apatite-Fe ore genesis was considered as a link of a metamorphic cycle within the upper lithosphere. The enrichment in Fe, V, P, and F took place mainly in the exogenic phase of development, on the geochemistry of the Fe ores of Grangesberg, and on the general geochemistry of the Swedish Fe ores and assocd.

rocks. The element distribution mentioned was significant for sediments especially those in the English oölitic Fe ores which were of typical marine origin. The V:Fe and P:Fe ratios in these ores were nearly identical with those in the Swedish apatite-Fe ores. Also, the geochem. cycle of F^- was typically exogenic and combined with that of P. Enrichment of both elements was normal in sedimentary ores.

8637. MALQUORI, ALBERTO AND FORTUNIO, MARIA. **The surface activity of argillaceous materials. III. Treatment of different types of clay with hydrochloric acid and potassium hydroxide.** *Ann. chim. applicata* 39, 427-46(1949).—*C.A.* 45, 9785*c*.

The clay was treated for 30 min. with boiling HCl (concn. from 0.1 *N* to 10.5 *N*) and boiling KOH (5%) resp., the soln. filtered, and the amt. of dissolved SiO_2, Al_2O_3, and Fe_2O_3 detd. The ratio of dissolved SiO_2 to Al_2O_3 seemed to be a const. for the same type of clay, the abs. value of the dissolved materials being a measure of the amorphous material contained in the clay. The treatment with HCl decreased the anion-exchange capacity of every clay, whereas the treatment with KOH did not affect it.

8638. MANN, C. A.; CEAGLSKE, N. H., AND OLSON, A. C. **Mechanism of dielectric drying.** *Ind. Eng. Chem.* **41**, 1686-94 (1949).—*C.A.* 43, 8752*i*.

A comparison of 4 drying curves, the movement of liquid H_2O in the sand, crit. moisture contents, and relation between const. drying rate and the unsatn. of the air were independent of the method of drying. The rate of dielec. drying increased linearly with voltage, increased with the frequency when the air temp. increased, and might increase or decrease with an increase in air velocity depending upon the air temp. The rate depended on particle size and, perhaps, shape and bulk d., and upon the elec. properties of the liquid satg. the sand.

8639. MARSHALL, C. E. AND BARBER, S. A. **The calcium-potassium relationships of clay minerals as revealed by activity measurements.** *Soil Sci. Soc. Am., Proc.* **14**, 86-8(1949)(Pub. 1950).—*C.A.* 45, 1713*a*.

The Ca-K relationship was studied on Arizona bentonite, Putnam clay (beidellite), illite from Illinois grundite, illite from Maquoketa shale, kaolinite from Langley, S.C. halloysite, and attapulgite. When the ratio of K/Ca activities was plotted against the ratio of K/Ca concns., it was seen that the montmorillonite group clays gave extremely steep curves as compared with kaolinite. The data emphasized the fact that the ionic environment of the plant root was an extremely sensitive function of the type of clay mineral present in the soil.

8640. MILES, EVAN E. **Report on exchangeable potassium in soils.** *J. Assoc. Offic. Agr. Chemists* 32, 370-2 (1949).—*C.A.* 43, 7172*e*.

A collaborative study of exchangeable K in soils indicated that the volumetric potassium cobaltinitrite-ceric sulfate procedure of Mehlich was more accurate than the flame-photometric method.

8641. MOSCHLER, W. W.; OBENSHAIN, S. S.; COCKE, R. P., AND CAMPER, H. M. **The effect of varying amounts of ground limestone on the pH and base exchange properties of Sassafras fine sandy loam.** *Soil Sci. Soc. Am., Proc.* **14**, 123-5(1949)(Pub. 1950).—*C.A.* 45, 1711*b*.

The data were based on samples taken after 23 yrs of liming at different rates. The 10-18 in. layer contained much less org. matter and dil. acid-sol. P than did the 0-8 in. layer. However, the 2 layers compared favorably in pH, exchangeable H, Ca, Mg, and K. In terms of percentage satn., the exchangeable H decreased from a high of 61% to a low of 28% at the extreme rates of application (0 and 3000 lbs per acre, resp.), while exchangeable Ca increased from a low of 24% to a high of 57%.

8642. NAYAR, M. R. AND SHUKLA, K. P. **Base exchange, adsorption, permeability, and related properties of soils.** *J. Sci. Ind. Research* (India) 8B, No. 8, 137-40 (1949).—*C.A.* 44, 5503*g*.

A series of adsorption expts. with Na_2CO_3 of varied concn. on soils showed that Freundlich's adsorption isotherm was applicable. The const. a in the equation $y=aC^{1/n}$, in which y was Na_2CO_3 adsorbed and C the equil. concn., showed that a varied as the square of the base-exchange capacity, B. The value of n varied from 0.8 to 1.1. Data on the base-exchange reaction showed that the Ca exchanged, x, could be expressed in terms of the initial concn., I, and the base-exchange capacity, B, as follows: $x + (P+IB)/(q+I)$ in which p and q were consts. This equation fitted the data more closely than that of Langmuir or of Vageler.

8643. PATHAK, A. N.; MUKERJI, S. K., AND SHRIKHANDE, J. G. **The cation-exchange capacity of the different mechanical fractions of the soil and its organic matter.** *Current Sci.* **18**, 375-6 (1949).—*C.A.* 45, 293*f*.

Samples were taken at depths of 0 to 15, 15 to 30, and 30 to 60 cm from profiles of the station's permanent wheat plots that have been used without manure and with manure. The samples were sepd. into clay, silt, and sand fractions according to the international method. The base-exchange capacity was detd. for each sample and for the primary particles of all samples of both series it was of the order 30 milli-equivs./100 for the clay, 7.5 for the silt, and 2 for the sand. The exchange capacity of the clay alone was 4.48 milliequivs./100 at 0 to 15 cm, 5.77 at 15 to 30, and 9.09 at 30 to 60 for the unmanured series and 3.91, 6.11, and 8.52 for the manured series.

8644. PERKINS, ALFRED T. **Reactions of muscovite, bentonite, and their treated residues.** *Soil Sci.* 67, 41-6 (1949).—*C.A.* 43, 3957*f*.

Grinding altered the chem. and phys. characteristics of muscovite and bentonite. It greatly increased the base-exchange capacity of muscovite and its reaction with acid and base. It activated bentonite so that aggregation or polymerization occurred when the mineral was suspended in water. Base-exchange capacity was decreased by prolonged grinding, which indicated decompn. of the mineral.

8645. PERKINS, ALFRED T. **Reactions of bentonite as influenced by adsorbed cations and grinding.** *Soil Sci. Soc. Am., Proc.* 14, 93-6(1949).—*C.A.* 45, 2374*b*.

Dry grinding bentonite destroyed the montmorillonite complex. The decompn. products reunited to form other minerals including kaolin. The formation of kaolin was favored by satg. the exchange complex with equal amts. of Ca and H. Ca-satd. bentonite did not form kaolin on grinding, and H-satd. bentonite formed only min. amts.

8646. RANEY, W. A. **Field measurement of oxygen diffusion through soil.** *Soil Sci. Soc. Am., Proc.* 14, 61-5 (1949)(Pub. 1950).—*C.A.* 45, 1709*h*.

A chamber for measuring O_2 diffusion in the soil in *situ* was described. There was little difference between the effects of regular plowing and subsurface tillage, but disked and rotary-tilled plots gave higher values for density and lower values for the diffusion rate and partial pressure of O_2 at 4-, 8-, and 12-in. depths. In the rotations, the partial pressure of O_2 was lower under the rotation with the larger quantity of incorporated org. matter, yet the diffusion rate was higher which indicated better aeration even with the lower partial pressure of O_2.

8647. SHAW, W. M. **Determination of exchangeable hydrogen and lime requirement of soils.** *J. Assoc. Offic. Agr. Chemists* 32, 437-52 (1949).—*C.A.* 43, 7171*d*.

When 13 soils were titrated with $Ca(OH)_2$ in 0.5 *M* $(AcO)_2Ca$ and $Ba(OH)_2$ in 0.5 *M* $(AcO)_2Ba$, little difference in values was obtained, whereas $AcONH_4$ gave much lower results. At the Ca-absorption levels equiv. to the indicated base requirement by the $Ba(OH)_2$-$(AcO)_2Ba$ titration, the incubated soils had a pH about 7.1. The proposed "2-point" titration procedure was believed to be more in line with the base-exchange principle, and gave results nearest to those obtained by soil-$CaCO_3$ equil.

8648. SMITH, H. V.; BUEHRER, T. F., AND WICHKSTROM, G. A. **Effect of exchangeable magnesium on the chemical and physical properties of some Arizona soils.** *Soil Sci.* 68, 451-62 (1949).—*C.A.* 44, 4179*f*.

A study of two poor Arizona soils high in Mg showed that the poor structure of these soils was due to their high montmorillonite content of colloidal clay. Mg acted like Ca and not like Na in its effects upon the structural properties of soil; e.g. when capillary rise was measured on Gila fine sandy loam satd. with different amts. and ratios of Mg to Na, the rate of capillary rise decreased as the percentage of Na satn. increased and the percentage of Mg satn. decreased.

8649. THERON, J. J. AND NAUDE, C. J. **The influence of fertilizers and irrigation on the acidity and the exchangeable bases of the soil.** *Union S. Africa, Dept. Agr. Sci. Bull. No.* 276, 21 pp. (1949).—*C.A.* 44, 9606*g*.

This application of about 200 lb per acre of $(NH_4)_2SO_4$ over a 4-year period reduced the pH of the surface soil of a red loam from 5.5 to 5.0. This treatment also reduced the exchangeable Ca and Mg in the surface soil; some of the ions were absorbed in the subsoil. The pH of the subsoil was not affected. The exchangeable K also was not affected either in the surface or subsoil. The annual application of 7 tons of manure raised the pH of the surface soil by about 0.16 units and materially increased the exchangeable Ca, Mg, and K. The use of irrigation water contg. 200 p.p.m. of Ca and Mg bicarbonates raised the pH of the soil and increased the exchangeable Ca and Mg materially.

8650. VLAMIS, J. **Growth of lettuce and barley as influenced by degree of calcium saturation of soil.** *Soil Sci.* 67, 453-66 (1949).—*C.A.* 43, 7622*h*.

Leaching with 5 tons of gypsum per acre alleviated rosette disease and improved the yield markedly. Various cations were added to the soil on cation-exchange Amberlite. Ca-Amberlite relieved the symptoms and increased the yield to the normal high fertile soil level. Mg-Amberlite decreased the yield and increased the rosette disease. Sr-Amberlite effected a very slight improvement. Various cation Amberlites were added to a fertile soil in an attempt to produce the rosette. Only when the Ca satn. was lowered, irrespective of the method, did the rosette appear.

8651. WIKLANDER, LAMBERT. **Adsorption equilibra between ion exchangers of different nature. I. Release of cations from soil by adsorption on exchange resins.** *Kgl. Lantbruks Högskol. Ann.* 16, 670-82(1949).—*C.A.* 44, 778*g*.

The distribution of a univalent ion in equil. with H ion between two acidoids of different properties mixed in different proportions was calcd. on the basis of theory. By an appropriate choice of proportions of the mixt. the ion could be almost completely adsorbed on the stronger ion. The effect of the time of contact, grain size of the resin, and the proportions of the mixts. was studied with a mineral soil satd. with various cations and a sulfonated ion-exchange resin "Wolfatit K". Equal proportions of the resin and the soil effected a practically complete extn. of the releasable ions. The ions studied were K, Cu, Mn, Fe, and Al.

8652. ALBAREDA HERRERA, J. M.; ALEIXANDRE FERRANDIS, V., AND GARCIA VICENTE, J. **Variation of the physicochemical properties of clays with size of particle.** *Anales edafol. y fisiol. vegetal* (Madrid) 9, 279-337 (1950); *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* 2, 80-2; 4, 74 (1950).—*C.A.* 45, 4858*i*; 46, 4714*a*.

The active surface and the quantity of water adsorbed increased if the fraction was mostly kaolinite, but the influence of particle size was inconspicuous if it was mainly montmorillonitic. The B.E.T. equation was used to calc. y_m (the no. of mol. layers of water adsorbed). Comparison of y_m and the exchange values of the clays showed that, in general, they varied in the same sense. It was immaterial whether the 0.8- or the 1.13-μ fraction was taken, because their phys. properties and mineral compns. were much alike; in less-developed soils it was advisable to sep. the fractions.

8653. Askinazi, D. L. and Ginzburg, K. E. **The role of clay minerals in the soil on the adsorption of phosphate ions.** *Trudy Pochvennogo Inst. im. V. V. Dokuchaeva, Akad. Nauk S.S.S.R.* 33, 20-48(1950).—*C.A.* 47, 240*e*.

Ignited clay minerals and R_2O_3 changed their capacity to adsorb phosphates. $Fe(OH)_3$, iron-contg. minerals, and $Al(OH)_3$ in some cases reduced the quantity of sorbed P; in other cases, freshly prepd. $Al(OH)_3$, gibbsite, and other Al-contg. minerals increased the adsorption of P. Montmorillonite and muscovite were not affected by the ignition; biotite behaved like the Fe-contg. minerals. Pot tests with the different phosphates corroborate the chem. tests on the capacity to adsorb P and make it immobile.

8654. Baird, Guy B. and Mehlich, A. **The effect of soil-exchangeable cations on Swiss chard and cotton.** *Soil Sci. Soc. Am., Proc.* 15, 201-5(1950)(Pub. 1951).—*C.A.* 46, 209*e*.

The effect of exchangeable Ca, Ba, Sr, Mg, K, Na, NH_4^+, and H ions on the growth and mineral content of Swiss chard and cotton was studied in greenhouse pot cultures. The degree of Ca satn. ranged from 10 to 80%, the remainder in each case being made up by one of the other complementary ions. At the highest level of Ca there were no significant differences in growth of Swiss chard, and only slight differences in the case of cotton, irrespective of the complementary ion. At the lowest level of Ca both plants failed to grow where the complementary ion was Ba, H, or Na. In addn. cotton failed at this Ca level when Sr or K was the complementary ion.

8655. Baouman, Alfred. **The enrichment and thermal treatment of natural phosphates.** *Genie civil* 127, 266-70 285-90(1950).—*C.A.* 44, 11044*d*.

The North African phosphates were described and their drying and flotation reviewed. Thermal treatment of these phosphates, the reactions involved, and the properties of the thermophosphates obtained were discussed. They could be used instead of superphosphates in fertilizers.

8656. Barber, Stanley A. **Studies of cationic activities on clay minerals.** *Pub. No.* 1361, 215 pp. *Microfilm abstracts* 9, No. 3, 3-4 (1950).—*C.A.* 44, 5676*h*.

8657. Barbier, Georges and Maroger, Maurice. **Action of humates on pulverized apatite.** *Compt. rend.* 230, 130-2(1950).—*C.A.* 44, 4619*g*.

Humates dissolved in H_2O permitted calcium phosphates slightly sol. in themselves to maintain a stable suspension, and formed a homogeneous colloidal soln. A neutral colloidal soln. of calcium humates was agitated 1 day with 2.5 g pulverized apatite contg. 1% > 2 μ particles, then centrifuged at 1500 gravity 10 min. The liquid floating on the surface contained 6.7 mg P_2O_5/liter compared with 0.32 for the apatite agitated in pure H_2O. If a neutral soln. of calcium phosphate (6 mg P_2O_5/liter of mixt.) was added to the humates, the phosphates remained entirely dissolved in the intermicellar liquid. Suspensions of known amts. were centrifuged and verified the fact that the apatite settled independently of the humates.

8658. Bárta, R.; Satava, V.; Vachtl, J., and Vašiček, J. **Green clay of Vonšov.** *Chem. Listy* 44, 177-84(1950).—*C.A.* 45, 5843*c*.

The green clay of Vonšov (northwestern Bohemia) was subjected to chem. analysis, microscopic, thermal, x-ray investigations, and examn. under the electron microscope. Sorption capacity and ability to eliminate adsorbed electrolytes were detd. Possibilities of tech. use were suggested.

8659. Beavers, Alvin H. and Marshall, C. E. **The cataphoresis of clay minerals and factors affecting their separation.** *Soil Sci. Soc. Am., Proc.* 15, 142-5 (1950); *Univ. Microfilms, Pub. No.* 1772, 143 pp; *Microfilm Abstracts* 10, No. 3, 236-7 (1950).—*C.A.* 46, 206*f*.

Sepn. of complex mixts. of clay minerals by selective coagulation of individual members was discussed. Favorable conditions for sepn. occurred when 1 constituent of the mixt. had zero zeta potential and was coagulated, while the others had a high zeta potential and formed a stable suspension.

8660. Benson, A. A.; Bassham, J. A.; Calvin, M.; Goodale, T. C.; Haas, V. A., and Stepka, W. **The path of carbon in photosynthesis. V. Paper chromatography and radioautography of the products.** *J. Am. Chem. Soc.* 72, 1710-18 (1950).—*C.A.* 44, 5967*g*.

Paper chromatography was employed to sep. the radioactive products formed during photosynthesis in $C^{14}O_2$. The method was used for the sepn. and identification of carboxylic acids and phosphate esters. The first observed product of CO_2 assimilation during photosynthesis was isolated and shown to be phosphoglyceric acid.

8661. Bergna, H. E. **Electrokinetic behavior of clay minerals.** *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* 3, 75-80, 174 (1950).—*C.A.* 46, 5761*a*.

The electrokinetic behavior of clay minerals, kaolinite, halloysite, illite, and montmorillonite was studied and the electrokinetic potential variation with pH established with a microelectrophoretic cell. An explanation of the different electrokinetic behavior of clays, based on cryst. structure, was suggested.

8662. Bidwell, O. W. and Page, J. B. **The effect of weathering on the clay mineral composition of soils in the Miami catena.** *Soil Sci. Soc. Am., Proc.* 15, 314-18(1950)(Pub. 1951).—*C.A.* 46, 1864*c*.

The illitic type of clay mineral was dominant in the horizons of these soils. This type of clay mineral was present in the parent material and it appeared that a large part of this mineral occurring in the solum may have been inherited from the parent material. Differential thermal and x-ray analyses gave little evidence for change in the nature of the clay minerals of these soils with depth. Cation-exchange detns.

indicated differences in chem. properties with depth.

8663. Black, I. A. and Smith, E. **Routine determination of exchangeable bases in soils by the Lundergardh flame spectrographic method.** *J. Sci. Food Agr.* 1, 201-8(1950).—*C.A.* 45, 495*i*.
A modified procedure was given for detg. exchangeable bases which also gave information on the base satn. of the soil. The modifications include an automatic leeching app. for extg. soils with NH_4OAc.

8664. Bloomfield, C. **Observations on gleying.** *J. Soil Sci.* 1, 205-11(1950).—*C.A.* 46, 7265*e*.
Samples of clays were incubated with sugar solns. under anaerobic conditions in glass bottles. Artificial gleying occurred and the reaction decreased to pH 4-5. When $CaCO_3$ was present, a gum often formed on the top. Only a small amt. of the reduced Fe remained in the clay, the majority being in the soln. On oxidation, Fe^{+++} was not always pptd.; some complex org. compds. were formed.

8665. Bodman, G. B. and Fireman, Milton. **Changes in soil permeability and exchangeable cation status during flow of different irrigation waters.** *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* 1, 397-400; 4, 175-6(1950).—*C.A.* 46, 2728*d*.
The effect of long-continued irrigation of soil-columns with NaCl-free H_2O and with H_2O salinized by the addn. of $CaCl_2$ and NaCl was examd. with respect to changes in permeability and exchangeable cation status of Aiken and Yolo clay loams. Similar patterns of permeability changes were observed regardless of salt concn. and cationic ratios, e.g., (a) high initial, (b) min., and (c) max. permeability. Stages (a), (b), and (c) were attributed to gradual air displacement, increased H_2O satn., and better H_2O conduction. Influences of microörganisms were believed negligible. High-Na H_2O (Ca/Na = 0.17) increased the exchangeable Na in the soil and also very greatly reduced its permeability, but the latter occurred only when irrigation with high-Na H_2O was followed by irrigation with H_2O of much lower content of total sol. salts.

8666. Boischot, P.; Durroux, M., and Sylvestre, G. **The fixation of iron and manganese in calcareous soils.** *Ann. inst. natl. recherche agron.*, Ser. A, *Ann. agron.* 1, 307-15(1950). —*C.A.* 45, 6331*c*.
Fe and Mn were fixed by Ca in soil. Fe was pptd. and difficult to redissolve in soil soln. Mn was adsorbed and easily dissolved in soil soln. Mg caused an increase in Mn fixation. Clay also adsorbed Mn and yielded it to soil solns.

8667. Bower, C. A. **Fixation of ammonium in difficultly exchangeable form under moist conditions by some soils of semiarid regions.** *Soil Sci.* 70, 375-83 (1950).—*C.A.* 45, 4387*d*.
Of the 21 samples studied, 15 fixed appreciable amts. of NH_4. The sums of the amts. of NH_4 and K fixed were practically the same regardless of the KCl/NH_4Cl ratio in the treating soln. Both the NH_4 and K ions caused equal reductions in the cation exchange capacity.

8668. Bower, C. A. **Availability of ammonium fixed in difficultly exchangeable form by soils of semiarid regions.** *Soil Sci. Soc. Am., Proc.* 15, 119-22(1950)(Pub. 1951).—*C.A.* 46, 203*c*.
A comparison was made of difficultly exchangeable NH_4^+ and readily exchangeable NH_4^+ in soil. A max. of only 10% of the NH_4^+ supplied in difficultly exchangeable form was recovered by barley after 17 days of growth when cultures were not artificially inoculated with nitrifying bacteria, while as much as 75% of the readily exchangeable NH_4^+ was recovered.

8669. Brown, Donald A. and Albrecht, Wm A. **Complementary ion effects in soils as measured by cation exchange between electrodialyzed hydrogen clay and soils. Cation exchange between electrodialyzed clay and soils as a measure of the suite of cations most available to plants.** *Soil Sci. Soc. Am., Proc.* 15, 133-8(1950) *Univ. Microfilms, Pub. No.* 1775, 166 pp.; *Microfilm Abstracts* 10, No. 3, 239-40 (1950).—*C.A.* 45, 6330*i*; 46, 202*h*.
Increasing the percentage satn. by Na decreased the fraction of Ca and Mg in the suite of cations exchanged under all levels of $CaCO_3$. The fraction of K was both increased and decreased. The fraction of Na in the cations exchanged increased proportionally to the degree of Na satn. at the 65% Ca level. The effects of Na were greatest at the lowest levels of $CaCO_3$, the effects being modified by addns. of 3.0, 6.0, and 9.0% free $CaCO_3$.

8670. Carè, Enrica. **DDT and bentonite in the control of Calandra granaria.** *Boll. zool. agrar. e bachicolt., univ. studi Milano* 16, 37-46(1950).—*C.A.* 46, 4164*d*.
A satisfactory technique of assocg. bentonite as insectifuge and DDT as insecticide against *C. granaria* was described.

8671. Davidson, Donald T. **Exploratory evaluation of some organic cations as soil-stabilizing agents.** *Iowa Eng. Expt. Sta., Eng. Rept.* No. 4, 531-7(1950-51); *Highway Research Board, Proc.* 29, 531-7(1949).—*C.A.* 45, 8176*g*.
Armac T, Armac 18D, Armac 12D, Rosin Amine-D acetate, Amine 220, and Ammonyx T were tested on Edina sub-soil, a highly plastic fine-grained clay in amt. equiv. to 1 to 75% of the base-exchange capacity. Results by ASTM methods for plastic limit, liquid limit, plasticity index, shrinkage limit, and rate of slaking were good.

8672. De Keyser, W. L. and Rijssen, A. van. **Micaceous and clay minerals. I. Alteration of micaceous minerals.** *Trans. Intern. Congr. Soil Sci. 4th Congr., Amsterdam* 1950, I, 99-100; IV, 66.—*C.A.* 46, 1395*f*.
The behavior of micaceous minerals was studied in the presence of a finite vol. of H_2O at 100°C and an infinite vol. of H_2O at 80°C. At 100°C it was found that the rate of exfoliation was different for various minerals, and an equil. condition reached, which was characterized by a grain-

size distribution. The rate of exfoliation and the final grain-size distribution were very sensitive to the presence of other ions or small quantities of other minerals, e.g., feldspars. At 80°C the pH of micaceous minerals showed a marked influence of dissolved CO_2, indicating a rather strong adsorption of the CO_2 on the mineral. The titration curves showed 2 isoelec. points at pH ± 7 and pH ± 3.

8673. EATON, FRANK M. **Significance of carbonates in irrigation waters.** *Soil Sci.* 69, 123-33(1950).—*C. A.* 44, 7467*g*.

The ability of Na to replace adsorbed Ca and Mg in the soils was increased when irrigation water contained sufficient carbonate plus bicarbonate to ppt. most of the Ca and Mg as carbonates. Thus, low Na concn. in irrigation water did not insure against Ca replacement and black alkali formation.

8674. ERIKSSON, ERIK. **The water content-ion activity relationship in bentonite gels and soils.** *Kgl. Lantbruks-Högskol. Ann.* 17, 204-10 (1950)(in English).—*C. A.* 45, 5348*g*.

As long as the water content was below the point of transition from gel to suspension the water content was equal to a const. × (H^+ ion content)$^{-1/2}$ + another const. for bentonite, and approx. valid in a very small range for electrodialyzed ground Mölner humus, a low-moor peat and 5 clayey soils.

8675. EVERSON, JOHN N. AND WEAVER, JAMES B. **Effects of carbon black on the properties of soils. II. Effects on humid soils.** *Soil sci.* 69, 369-76(1950).—*C. A.* 44, 10982*c*.

Carbon black, by darkening soils, increased energy absorption; because of the differences in charges between colloidal clay and carbon, flocculation and an aggregation occurred in some treated soils. Carbon-treated soils were ready for plowing as much as two weeks earlier than untreated soils. Other factors increased by carbon treatment were water-holding capacity, accumulation of salts near soil surfaces, wet and dry flocculation and moisture content.

8676. FUJIWARA, AKIO. **Chemical constitution and availability of iron and aluminum phosphates. I. The constitutions and fertilizer effects of scarcely soluble phosphates.** *Tohoku J. Agr. Research* 1, 129-41, 143-9 (1950).—*C. A.* 45, 7284*e*.

The scarcely sol. phosphates, particularly iron salts, became high in fertilizer effect by the promotion of hydrolysis resulting from high temp., alk. reaction of surface water, and large quantity of water. In winter the degree of hydrolysis was lowered, but Al salts were not reduced and showed an effect superior to iron salts for barley crops. Amorphous ppts. of $FePO_4$, $AlPO_4$, and cryst. $Ca_3P_2O_8$ promoted fertilizer effects in descending order of effectiveness. The method of manufg. fertilizer by dissolving phosphate rock and repptg. after neutralization was important.

8677. GATTA, LUIGI DELLA. **The red soils of Apulia. I. Exchangeable potassium.** *Ann. sper. agrar.* 4, 169-78(1950).—*C. A.* 44, 8034*e*.

The exchangeable K in 92 cretaceous lime soils and 4 eocene soils from Apulia varied from 0.010 to 0.052 (av. 0.029) % or 300-1560 kg/ha. The exchangeable K of 50% of the samples was between 0.0225 and 0.0375%. The Apulian red soil was richer in exchangeable K than that from other provinces and did not need a K top dressing. There was no relation between exchangeable and total K in these soils.

8678. GONZÁLEZ, F. GARCÍA. **Properties of silicates of the montmorillonite group.** *Anales edafol. y fisiol. vegetal* (Madrid) 9, 149-85 (1950).—*C. A.* 45, 3704*e*.

Alk. and alk. earth samples of montmorillonites were heated to const. wt at 100-800°C and rehydrated in a moisture-satd. atm. Montmorillonites contg. cations of large vol. and small electrostatic field had a high rehydration capacity as long as the crystal structure was not destroyed by loss of tightly bound H_2O. The fixation of the layers brought about a condition similar to that of the structure of mica. Both montmorillonite and kaolinite behaved as moderately strong acids and reacted practically neutral at pH 5. On the other hand, clays reacted as very weak acids on account of the presence of gels of Al_2O_3, Fe_2O_3, and SiO_2.

8679. GORING, C. A. I. AND BARTHOLOMEW, W. V. **Microbial products and soil organic matter. III. Adsorption of carbo-hydrate phosphates by clays.** *Soil Sci. Soc. Am., Proc.* 15, 189-94(1950).—*C. A.* 46, 205*i*.

Data were presented to show to what extent some of the carbohydrate phosphates could react with the clay mineral fractions commonly found in soil. The concn. of the adsorbents in suspension was 0.5% and of P 0.025 to 0.075 mg per ml. With coarse bentonite the sequence of decreasing adsorption of the salts of monovalent cations was phytin > phytin derivs. > fructose 1,6-diphosphate > fructose 6-phosphate, orthophosphoric acid > glucose 1-phosphate > glycerophosphoric acid > phosphoglyceric acid. Salts of divalent cations were adsorbed to a greater extent than those of monovalent cations. The carbohydrate phosphates and orthophosphoric acid were fixed to the greatest degree between pH 5 and 6.5. Bentonite adsorbed carbohydrate phosphates to a greater extent than did illite or kaolinite.

8680. GRANDORI, REMO; GRANDORI, L.; DOMENICHINI, G., AND CARÈ, E. **Bentonite as disinfestation agent of stored wheat.** *Boll. zool. agrar. e bachicolt., univ. studi Milano* 16, 51-84(1950). —*C. A.* 46, 4164*c*.

Fine powd. Italian bentonite mixed 0.2-0.5% with wheat was satisfactory to control wheat insects. Bentonite was permitted by the Italian Pharmacopeia.

8681. GRUNER, E. AND VOGEL, R. E. **Swelling properties of bentonites based on adsorption of cations.** *Kolloid-Z.* 116, 89-99(1950).—*C. A.* 44, 6229*h*.

Treating six bentonites with alk. earth (Mg, Ca, Sr, Ba) or alkali (Na, K) hydroxides gave semifluid slips, the consistency of which depended on the concn. of the hydroxide. Two opposing reactions were involved: (1) liquifaction, as a result of OH-ion adsorption, and (2) swelling as a result of the adsorption of H_2O at the Si-O planes of the montmorillonite crystal lattice. The latter depended largely on the cation valence and on the basicity of the hydroxide, i.e., the chemisorption of the bentonite-hydroxide system which took place at the Si-O planes. Hydration of the adsorbed cations resulted in addnl. H_2O at the planes, and thus in increased swelling. Increasing basicity of the hydroxide caused increased chemisorption, blocking of the Si-O planes, and thus reduced swelling.

8682. Gutierrez Rios, E. and Gonzalez, F. Garcia. **Genesis of bentonite from Tidinit (Spanish Morocco).** *Trans. Intern. Congr. Soil Sci. 4th Congr., Amsterdam* **1950**, **I**, 92-6; **IV**, 65.—*C.A.* **46**, 1398*i*.

The high pH values (8.28-8.70) of the suspensions in H_2O showed that the process occurred under alk. conditions. Thermal analysis by the method of dehydration curves at 100-800°C showed a steady increase in hydration H_2O. The cation-exchange capacity showed a steady increase from 5.23 to 104.07 milliequivs./100 g of sample. Silicates of bentonites from Spanish Morocco have been formed by action of H_2O on andesites under alk. conditions, with hydration of the original lattice of feldspar which caused rupture of the lattice bonds and permitted formation of a suitable equil. between the silicate compn. and the soln. producing the transformation.

8683. Gutiérrez Ríos, E. and Martin Vivaldi, J. L. **Hydration of layer-lattice silicates with exchangeable cations.** (Inst. edafol. y fisiol. vegetal, Granada, Spain). *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* **2**, 67-71; **4**, 59 (1950).—*C.A.* **46**, 4319d.

8684. Hardon, H. J. **The bases in the clay fraction of Indonesian soils.** *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* **1**, 310-12(1950).—*C.A.* **46**, 2726*g*.

The lateritic soils contained kaolinite, the marl soils montmorillonite, and the limestone soils metahalloysite. An explanation of this uniform compn. was the rapid weathering under tropical conditions. H_2O adsorption was a function of mineralogical compn. The amt. of adsorbed bases was detd. on the clay fraction of more than 45 samples of Indonesian soils of several soil groups. Ca was mostly in the exchangeable form, but only a small % of Na was exchangeable; Mg and K was intermediate between these two. The bases present in the nonexchangeable form were either a constituent of the clay minerals or were bound to Fe oxides, which amt. to rather high percentages in the clay fractions. Although total Ca was generally higher than Mg, the nonexchangeable Mg showed the highest values of the bases: also there was a high % of nonexchangeable Na in all the soil fractions.

8685. Haseman, J. F.; Brown, Earl H., and Whitt, Carlton D. **Some reactions of phosphate with clays and hydrous oxides of iron and aluminum.** *Soil Sci.* **70**, 257-71(1950).—*C.A.* **45**, 4387*h*.

Phosphate fixation by clay minerals was affected by pH, concn. of the phosphating soln., temp., and the nature of the mineral. The decreasing order in which minerals fixed phosphate generally was: gibbsite, goethite, illite, kaolinite, montmorillonite. Complex Fe and Al phosphates formed upon fixation showed pattern similar to the palmerite pattern.

8686. Hutton, Curtis, E. **Chemical and physical characteristics of a chrono-litho-sequence of loess-derived prairie soils of southwestern Iowa.** *Soil Sci. Soc. Am., Proc.* **15**, 318-24 (1950)(Pub. 1951).—*C.A.* **46**, 1681*g*.

The data indicated clay minerals of a high exchange capacity belonging to the montmorillonite-nontronite and illite groups. The exchange capacity of the clay in the more highly weathered Seymour soil was lower than in comparable horizons of the Monona and Sharpsburg. The data showed that (*a*) cation eluviation, (*b*) formation and movement of clay within the sola, (*c*) differences in parent material, and (*d*) variations in effective time of soil formation were the primary causes of the differences between the profiles studied along this sequence.

8687. Istomina, V. S. **The wedge effect of thin layers of water between the particles of coherent ground.** *Kolloid. Zhur.* **12**, 279-85 (1950).—*C.A.* **44**, 10981*i*.

Soils of a definite moisture content, w_o, were placed in beakers and covered with H_2O. After 1.5-3 months, the moisture content was detd. at different levels, and the depth h was found at which $w = w_o$. From the exptl. relation between h and w_o, the relation between pressure and the thickness a of the H_2O film covering the soil particles was calcd.; $\sigma = h\gamma$ and $a = w\gamma/S(1-n)\Delta$; γ was the d. of the soil, S its specific surface, n its porosity, and Δ was the density of H_2O.

8688. Jenny, H.; Nielsen, T. R.; Coleman, N. T., and Williams, D. E. **The measurement of pH, ion activities, and membrane potentials in colloidal systems.** *Science* **112**, 164-7(1950).—*C.A.* **44**, 9774*e*.

The liquid-junction potential between a KCl bridge and a suspension of highly charged clay or resin particles was not negligible. The transference no. of Cl^- in KCl solns. was lowered by suspended cation exchange particles, the more so the greater the exchange capacity and the less the activity of the KCl. The membrane potential had the effect of lowering the electrometrically detd. pH of suspensions, pastes, and gels.

8689. Khan, D. V. **The absorption of organic substances by soil minerals.** *Pochvovedenie* (Pedology)(U.S.S.R.) **1950**, 673-80.—*C.A.* **45**, 4385*g*.

Humic acid was prepd. by extg. soil with 2% NH_4OH, pptg. with H_2SO_4, dialyzing until free of SO_4, and dissolving with NH_4OH to pH 6.8. This soln. was mixed with montmorillonite and assocd. minerals, kaolinite, orthoclase, and muscovite in the ratio of 1:5. The montmorillonitic group adsorbed 1.2-0.969 g C per 100 g of the mineral; kaolinite 0.20 g; orthoclase 0.25 g; and muscovite 0.44 g. When the minerals were ground to less than 0.2 μ, the kaolinite, orthoclase, and muscovite increased their adsorption capacity, but not the montmorillonite. The minerals were satd. with H, Ca, Fe, and Al and tested for sorptions of humic acid. The Fe- and Al-satd. minerals sorbed most.

8690. KOSHEL'KOV, P. N. **The neutralizing capacity of ground rock phosphate.** *Pochvovedenie* (Pedology)(U.S.S.R.) 1950, 688-97.—*C.A.* 45, 4392*a*.

Ground rock phosphate was not as effective as a neutralizing agent of soil acidity as $CaCO_3$. However, its P availability continued for a long period of years. In using phosphates it is well to keep in mind that it does eliminate sol. Al and partially neutralizes soil acidity.

8691. LOW, PHILIP F. AND BLACK, C. A. **Reactions of phosphate with kaolinite.** *Soil Sci.* 70, 273-90(1950).—*C.A.* 45, 4387*i*.

Phosphate fixation in concd. solns. by kaolinite was in 2 stages: (1) surface replacement of Si tetrahedra by P tetrahedra, (2) phosphate-induced decompn. of the surface phosphate with subsequent pptn. of an Al phosphate compd. Phosphate fixation in dil. solns. differed from phosphate fixation in concd. solns. In dil. solns. phosphate fixation by kaolinite was a chem. reaction which followed the Freundlich adsorption isotherm.

8692. LEENHEER, L. DE; BOODT, M. DE, AND WELVAERT, W. **The determination of the exchange capacity of the mineral fraction and of the organic matter in the Belgian seapolders.** *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* 1, 129-32(1950)(English summary)—*C.A.* 46, 6303*d*.

Schachtschabel's percolation method was used on a rough soil sample and a 2nd test on a sample treated with 100 vol. % H_2O_2. The results were very satisfactory. The difference in exchange capacity of the clay and silt fraction in 2 different sublandscapes of the seapolders was evident, according to their different ages and mineralogical compns., although the granulometric analysis showed no differences.

8693. MAREL, H. W. VAN DER. **The mineralogical composition of the clay (< 2 μ) separate of the Dutch soils and their cationic-exchange capacity.** *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* 2, 92-4(1950).—*C.A.* 46, 4713*h*.

The mineralogical compns. and base-exchange capacities were given for various (< 2 μ) separates of sea, river, and boulder clays, river loams of pre- and postglacial origin, loess, residual clays from soft limestones, and sediments of tertiary and older date.

8694. MAREL, H. W. VAN DER. **The determination of the cationic-exchange capacity of the inorganic soil particles.** *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* 2, 94-7(1950).—*C.A.* 46, 4713*i*.

The < 2 μ separate of the soil was percolated with 0.5 *N* solns. of NaOAc (pH about 8.2)(to remove adsorbed H ions), NH_4Cl (pH about 5.5)(to remove the elec. double layer of amorphous gels), and NaCl, the filtrate-NH_4 detd., and the cation-exchange capacity (C.-E.C.) calcd. The application of this method to various clays of Dutch soils indicated that there was a close relation between the mineralogical compn. of the clay separate free from org. matter of the Dutch sediments and their C.-E.C. in meq./100 g of < 2 μ separate.

8695. McCLELLAND, J. E. **The effect of time, temperature, and particle size on the release of bases from some common soil-forming minerals of different crystal structures.** *Soil Sci. Soc. Am., Proc.* 15, 301-7 (1950)(Pub. 1951).—*C.A.* 46, 1682*f*.

The effect of particle size, degree of Ca and H satn. of the colloid, temp., and time on the rate of release of bases from bentonite-mineral mixts. was investigated. The minerals examd. were olivine, augite, hornblende, albite, labradorite, microcline, anorthoclase, muscovite, phlogopite, and biotite. The rate of release of bases from minerals increased with decreasing particle size, but the extent to which particle size influenced base release varied with different minerals. Increasing the ratio of Ca:H on the colloidal complex decreased the rate of base release. The rate of base release increased with temp., but the effect of increased temp. decreased with time. Fresh minerals released bases at a fast rate and this rate rapidly decreased with time.

8696. McGEORGE, W. T. AND FULLER, W. H. **Relation between the sodium:calcium ratio in the saturation extract and percentage sodium in the exchange complex.** *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* 1, 400-3; 4, 175-6(1950).—*C.A.* 46, 2729*d*.

Studies of the soils in the upper Gila River Valley of Arizona, after irrigation several years with H_2O of high salinity and unfavorable Na:Ca ratio, indicated an increase in percentage exchangeable Na (X) in the soil and a higher Na:Ca ratio (Y) in the satd. ext. Plots indicated a correlation between X and Y, the unit change in Y/unit change in X being greater for the subsoils than for the surface soils.

8697. McILRATH, WAYNE J. **Growth responses of tomato to nutrient ions adsorbed on a pumice substrate.** *Plant Physiol.* 25, 682-701 (1950).—*C.A.* 45, 221*a*.

The pumice substrate on which the various ions were adsorbed consisted of 3900 g of pieces 1 in. or less in diam. The results indicated that sufficient amts. of Mg, K, and P could be adsorbed on pumice to satisfy the plant's requirements for growth to maturity. The quantity of adsorbed Ca was inadequate for normal growth.

8698. MEHLICH, A. **Cation exchange-anion exchange ratios of kaolinitic soil colloids.** *Trans. Intern. Congr. Soil Sci. 4th Congr., Amsterdam 1950*, **I**, 133-5; **IV**, 80-1.—*C.A.* 46, 1199*c*.

Digestion of kaolin and kaolinitic soils 4 hrs with 20% HCl to remove most of the Fe and Al oxides resulted in a slight increase in the cation-exchange capacity (C) and a large decrease in the anion-exchange capacity (A). Consequently, the *C/A* ratio was increased and the equil. pH (pH$_e$) decreased. Also, in most cases, the anion-exchange capacity of the treated samples was nearly the same as the cation-exchange capacity before treatment. The *C/A* ratios and pH$_e$ values of the untreated samples showed some relation to the clay mineral compn. Phosphating increased the cation-exchange capacity of the untreated soils and kaolin and had no effect on the HCl-treated soils; the *C/A* ratio was correspondingly increased, but was not as high as on the HCl-treated soils.

8699. MEHLICH, A. AND REED, J. FIELDING. **Hydrogen in soils in its relation to mineral content of plants.** *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* 1, 251-4(1950).—*C.A.* 46, 2218*b*.

Results showing the effect of H ions from HCl on the release of metal cations as related to degree of satn. indicated that (*a*) with the complementary ions remaining const., the release of Ca increased with increasing degree of Ca satn., (*b*) for a given degree of Ca satn., but increasing amts. of Mg or K, the release of Ca decreased, the decrease being greater the lower the degree of Ca satn., (*c*) with decreasing amts. of HCl supplied, for a given degree of Ca satn. and const. Ca-Mg or Ca-K ratios, releases of Mg and K in proportion to Ca increased. Progressively less H ions were adsorbed by soil colloids from addns. with decreasing degree of base satn. A characterization of soils from the standpoint of cation-exchange capacity, exchangeable cations and their release by varying amts. of HCl indicated the reasons for the variations of cations in different or the same plant species.

8700. MENZEL, R. G. AND JACKSON, M. L. **Sorption of copper from acid systems by kaolinite and montmorillonite.** *Trans. Intern. Congr. Soil Sci. 4th Congr., Amsterdam 1950*, I, 125-8; IV, 80.—*C.A.* 46, 1199*b*.

Exchange reactions of Cu, K, and H ions were studied. The simple exchange of Cu^{++} ions for K ions sorbed on kaolinite or montmorillonite occurred only in acid dil. Cu solns. The sorption of $CuOH^+$ ion, formed by hydrolysis of Cu^{++} ion according to the equation: $Cu^{++} + H_2O = CuOH^+ + H^+$, was indicated by release of less K than Cu sorbed accompanied by a pH decrease. The H^+ ions released in forming $CuOH^+$ ions were buffered to a limited extent by Al dissolved from the clays.

8701. MERWIN, H. D. AND PEECH, MICHAEL. **Exchangeability of soil potassium in the sand, silt, and clay fractions as influenced by the nature of the complementary exchangeable cation.** *Soil Sci. Soc. Am., Proc.* 15, 125-8 (1950)(Pub. 1951).—*C.A.* 46, 203*a*.

Four soils representing the Dunkirk, Mardin, Honeoye, and Gloucester series were leached with successive portions of 0.5 *N* acetate solns. of different cations. The amt. of K exchanged by the different cations decreased in the following order: Na > H > NH_4 > Mg > Ca > Ba. Three of the soils failed to release K to the 0.5 *N* Ba and Ca acetate solns., but effectively removed the trace of K present as an impurity in these salt solns. In contrast to the continued extn. of K by the NaOAc and the AcOH soln., the NH_4OAc soln. gave a very clear-cut sepn. of the exchangeable K.

8702. MUKHERJEE, S. K. AND GANGULY, A. K. **Base-exchange capacity and crystalline structure of silicate minerals related to soils and clays.** *Indian J. Phys.* 24, 233-56(1950).—*C.A.* 45, 6973*i*.

The chem., phys., and elec. nature of crystals of β-cristobalite, β-tridymite, kaolinite, pyrophyllite, talc, montmorillonite, attapulgite, muscovite, and illite were reviewed with the object of correlating these data with the base exchange capacity. The effect of particle size was considered, and it was shown that for some minerals this could be correlated with base exchange capacity while for others it could not.

8703. OLPHEN, H. VAN. **A tentative method for the determination of the base-exchange capacity of clays.** *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* 2, 97-9; 4, 81(1950).—*C.A.* 46, 4712*h*.

A new tentative method for the detn. of the base-exchange capacity of clays with cetyltrimethyl ammonium bromide was discussed. It was based on the exchange of the cations by strongly adsorbed org. cations. Interfering flocculating electrolytes were NaCl and $FeCl_3$, which should be removed previously by washing on a collodion membrane.

8704. PAAUW, F. VAN DER. **Relation between the lime status and the availability of phosphates in a sandy soil.** *Verslag Landbouwkund. Onderzoek.* No. 56.8, 19 pp.(1950).—*C.A.* 45, 2125*b*.

At the beginning of the expt. different amts. of P_2O_5 and Ca were obtained by application of varying amts. of these in 25 combinations. The expt. was continued for 6 yrs. After a few yrs, the pH varied between 4.2 and 6.3, the P-citrate no. (H_3PO_4 sol. in 1% citric acid), between 12 and 50. In sandy soil, the soly. of H_3PO_4 in H_2O diminished the higher its pH. The P-citrate no., however, was rather independent of the pH. In most cases, the effect of a high P content on the yield was most important at a high pH. Deficiency in P_2O_5 produced in this case markedly decreased yields. The absorption of P_2O_5 contained in the plant material was considerably less at a high pH. In general, optimal yields were obtained with a high P_2O_5 and Ca content. A very low pH had a similar effect on the relation between P_2O_5 content and yield, as has a high pH. The absorption of P_2O_5 proved to be optimal at pH 4.8-5.5; if higher, there was need for more P_2O_5.

8705. PARKERT, C. W.; PERKINS, ALFRED T., AND DRAGSDORF, R. D. **Decomposition of minerals by grinding.** *Trans. Kansas Acad. Sci.* 53, 386-97(1950).—*C.A.* 45, 505*f*.

Kaolinite, montmorillonite, and muscovite decompd. on grinding in a ball mill. Samples ground for various periods of time up to 25 weeks were analyzed with reference to av. particle size, soly., pH, base-exchange capacity, thermal curves, and x-ray diffraction. Indications were that grinding permitted the formation of amorphous material differing from the original material in chem. reactions and structure.

8706. Peng, C. Y.; Chang, S. W., and Hou, K. C. **Nutrient adsorption by soils in relation to soil plasticity.** *Trans. Intern. Congr. Soil Sci. 4th Congr., Amsterdam 1950*, I, 136-7.—*C. A.* 46, 1197*c*.

Plasticity curves were made on samples of a series of soils in which increasing doses of $CaCO_3$ and $Fe(OH)_3$ were incorporated. A yellow-colored lateritic soil (Limonized)(designated as Y_1, Y_2, and Y_3 for its 3 calcified forms), which showed the highest adsorption, and the least reliberation of P_2O_5, increased its reliberation power to as much as 100% when it had been enriched with 2.5% of $CaCO_3(Y_1)$; it then decreased this power to below half of its original with Y_2 and Y_3. Neither of the other soils, including a lateritic soil, a neutral purple-brown soil, and a halloysite, showed the corresponding increase in reliberation power. The effect of various exchangeable cations on the nutrient adsorption power and on the form of plasticity curves was detd. by using an acid purple-brown soil, a red earth, and a halloysite.

8707. Perkins, A. T. and Draggsdorf, R. D. **Decomposition of bentonite as influenced by adsorbed hydrogen and calcium plus grinding.** *Soil Sci. Soc. Am., Proc.* 15, 93-7(1950)(Pub. 1951).—*C. A.* 46, 207b.

Dry grinding of bentonite caused its decompn. so that the Al and Si were more reactive and sol. The decompn. of bentonite and other clay minerals might result in the temporary formation of amorphous silicas, aluminas, or their hydrates, which might recombine into the original clay mineral or other clay minerals of similar structure.

8708. Ramírez Romero, Guillermo. **Exchangeable cations extracted from soils of Valle by tenth normal hydrochloric acid and by ammonium acetate.** *Acta Agron.* 1, No. 1, 51-6(1950). —*C. A.* 46, 2729*i*.

Total exchangeable cations, Ca, Mg, and K were detd. upon 55 soils and subsoils from a point in Valle, 5 km north of Palmira by two methods. The direct detn. of Mg by Titan Yellow gave figures much higher than the difference between the total exchangeable bases and the sum of the exchangeable Ca and K.

8709. Ramsauer, B. **The soil-moisture progress curves.** *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* 2, 35-7; 4, 38-9(1950)(English summary).—*C. A.* 46, 5763*b*.

The H_2O in the soil was defined as the total amt. of H_2O actually present in the soil profile characterized by its type. In the climatically normal yr a characteristic curve of soil moisture had to correspond to each natural soil profile.

8710. Rode, A. A. **Nature of the forces retaining "capillarily suspended" moisture in soil.** *Trudy Pochvennogo Inst. im. V. V. Dokuchaeva* 32, 397-406(1950).—*C. A.* 46, 5763*e*.

The term "capillarily suspended" included unrelated phenomena. In sandy soils as well as in the interphases of subsoil-air and fine-grained subsoil-large-grained subsoil, water was held primarily by capillary forces and was thus correctly called "capillarily suspended." In loamy and clayey soils and subsoils water was held by membrane pressure and should therefore be referred to as "membrane suspended." In all cases, part of the water was held by mol. forces and was, therefore, combined water.

8711. Roy, B. B. and Das, S. C. **Electrochemical properties of hydrogen clays from typical Indian soils.** *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* 3, 81-3(1950).—*C. A.* 46, 5759*i*.

H-clays isolated from regurs (black cotton soils) from different localities of India appeared to be montmorillonitic in nature, and H-clays from lateritic soils of Belgaum and Coimbatore and from acid soils of Jorhat were kaolinitic, according to potentiometric titration curves, electroviscous properties, SiO_2/R_2O_3 and SiO_2/Al_2O_3 ratios, and x-ray, thermal dehydration, and optical studies.

8712. Saito, Nobufusa; Kokubu, Nobuhide, and Kakihana, Hidetake. **Alteration of petalite.** *J. Chem. Soc. Japan*, Pure Chem. Sect., 71, 131-3(1950).—*C. A.* 45, 4610*a*.

A general tendency was that during the alteration SiO_2 and Li_2O contents decreased, while those of Al_2O_3 and water increased. In spite of the decrease of Li_2O other rare alkali metals such as Rb and Cs were found to be considerably concd. in altered petalite. These phenomena were explained by the base-exchange reaction of hydrous aluminosilicates such as hydrocastorite or montmorillonite to which petalite changed by alteration.

8713. Sugden, W. **The influence of the film of water absorbed on mineral grains on the hardening of natural sediments and remarks on similar phenomena.** *Geol. Mag.* 87, 26-40(1950); *Chem. Zentr.* 1950, II, 980.—*C. A.* 46, 11060*b*.

A study of the mechanism of the hardening of sediments showed that the water adsorbed on the mineral grains played an important role in the process. This adsorbed water was also of importance in other geol. processes, such as the migration of oils and gases.

8714. Trifonov, I. and Spasov, A. **The effect of high mechanical pressure upon the binding between the water of constitution and the silicate radical in the kaolin molecule.** *Annuaire univ. Sofia*, II, *Fac. sci.*, Livre 2, 37-43 (1950)(German summary).—*C. A.* 46, 11055*a*.

Samples (10 g) of kaolin, previously dried 1 hr at 120°C, were subjected to 20 tons/cm^2 pressure for 6 hrs at ordinary temp., 150°C, and 200°C, the blanks were also heated to the same temps. without application of pressure. Then, both blanks and samples were heated 1 hr at temps. ranging from 200 to 800°C, and the loss of water of constitution was detd. In general, the results indicated that the rate of dehydration was greatest between 400° and 500°C for both. However, at temps. below 500°C more H_2O was lost by samples than by blanks, the difference showing a max. again between 400° and 500°C.

8715. ULRICH, RUDOLPH. **Some chemical changes accompanying profile formation of the nearly level soils developed from Peorian loess in southwestern Iowa.** *Soil Sci. Soc. Am., Proc.* 15, 324-9(1950)(Pub. 1951).—*C.A.* 46, 1682*c*.

The changes in exchangeable cations and pH within similar morphological horizons indicated that H had taken the place of the other cations in the order: Na > K > Ca > Mg with increasing horizon differentiation. The development of a nearly impermeable subsoil was accompanied by a marked increase in exchangeable Na in all horizons. The base-exchange capacity of the eluvial horizons increased to a max. and then decreased with increasing horizon differentiation, whereas the base-exchange capacity of the lower horizons continued to increase. The percentage of base satn. of the solum horizons tended to decrease with increasing horizon differentiation, indicating that cationic eluviation was an important process.

8716. VASSILIADES, C. **Determination of the total exchange capacity of soils.** *Prakt. Akad. Athenon* 25, 427-37(1950).—*C.A.* 47, 3501*i*.

A quick method for detg. the total exchange capacity of soils was developed. The soil was satd. with Ba which was replaced with Cr. From the decrease in strength of the K_2CrO_4 soln. (used to replace Ba by Cr) detd. iodometrically after changing it to K_2CrO_7 with H_2SO_4, the total exchange capacity of the soil was found.

8717. VERHOEVEN, B. **Soil-moisture studies in view of salt-movement control.** *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* 3, 165-9; 4, 177-9(1950).—*C.A.* 46, 5763*c*.

The possibilities were pointed out to calc. capillary rise in different soil types with varying water tables, of the total evapn., and of the passage of H_2O through soil owing to rain or irrigation.

8718. VERVELDE, G. J. **Ion adsorption by soil minerals as a Donnan equilibrium.** *Proc. Koninkl. Nederland Akad. Wetenschap.* 53, 919-30(1950).—*C.A.* 44, 8579*d*.

Adsorption phenomena in the soil were best described by the laws of the Donnan equil. The measurement of the membrane potential of solid materials could be performed by using a glass-electrode type of app., but the difficulties of transforming soil constituents into suitable electrodes remained. The potentials measured with glass electrodes were essentially membrane potentials. A complication of the exchange laws was caused by the fact that in some soil minerals adsorption was not only a two-dimensional surface phenomenon, but also occurred in the interior of the particles.

8719. VRIES, D. A. DE. **Some remarks on gaseous diffusion in soils.** *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* 2, 41-3; 4, 43(1950).—*C.A.* 46, 2728*i*.

The relation between the diffusion rate through a granular material and the porosity of the material was calcd. for materials built up of elementary particles of different shapes, by using a formula derived from the theory of elec. cond. The theory could be applied likewise to the case where the elementary particles formed aggregates; the diffusion rate in the latter case was, at the same porosity, greater than for the same soil with the elementary particles uniformly distributed.

8720. WALKER, G. F. AND MILNE, A. **Hydration of vermiculite saturated with various cations.** *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* 2, 62-7; 4, 58-9(1950).—*C.A.* 46, 4432*e*.

Exchangeable Mg cations normally present in vermiculite can be replaced by other cations, e.g., Li, Na, Be, Mg, Ca, Sr, Ba, or Al, with concomitant alteration in the organization of the structural H_2O layers. Of the ions which entered the structure, only K and NH_4 were not assocd. with layers of H_2O mols. in the vermiculite lattice. The amt. of structural H_2O present was also sensitive to changes in humidity, although less so than in the montmorillonites.

8721. WANDER, I. W. **Effect of calcium phosphate accumulation in sandy soil on the retention of magnesium and manganese and the resultant effect on the growth and production of grapefruit.** *Proc. Am. Soc. Hort. Sci.* 55, 81-91 (1950).—*C.A.* 44, 9602*i*.

Ca phosphate accumulated in large amts. in the sandy soils of central Florida through the use of superphosphate in mixed fertilizers and the const. adjustment of soil reaction to pH 5.5 to 6.0 with ground limestone. The accumulated Ca phosphate was a factor in the retention of Mg and Mn added as sulfates, but did not affect the retention of K added as sulfate or chloride. In sandy soils of low exchange capacity the adsorptive power of Ca phosphate became of importance in citrus nutrition. Growth and production records indicated that conditions which favored the accumulation of Ca phosphate within a pH range of 5.5 to 6.0 resulted in better nutrition of grapefruit.

8722. WAZER, JOHN R. VAN AND BESMERTNUK, EVELYN. **Action of phosphates on kaolin suspensions.** *J. Phys. & Colloid Chem.* 54, 89-106(1950).—*C.A.* 44, 3685*g*.

A rheological study of the effect of adding small amts. of ortho-, pyro-, tripoly-, trimeta-, and long- and short-chain vitreous phosphates to various purified kaolins was described. The reduction in yield value upon addn. of a polyphosphate anion was only slightly more pronounced in the presence of all Na cations than in the presence of all $(Me)_2N^+$ cations, the pH being kept at 7. The chain phosphates formed a lyotropic series in which the ability to soften a Na-kaolin slurry was in the order of increasing ionic wts, with part of this effect attributed to anionic charge and part to complexing ability of the polyphosphates. The phosphates and other deflocculants caused the yield value to remain low until the solids concn. was nearly equal to the plastic limit where the yield value increased suddenly.

8723. WIKLANDER, LAMBERT. **Fixation of potassium by clays saturated with different cations.** *Soil Sci.* 69, 261-8(1950).—*C.A.* 44, 9601*f*.

The nature of the adsorbed ion on soil colloids markedly affected the amt. of K fixation which may occur. Ions of similar size to K prevented much K fixation. Cations of dissimilar size that occupied fixation positions were easily replaced by the K resulting in greater fixation. Fixation was found to be low when the clay was satd. with H, K, or NH_4, but very high when satd. with Ca and, especially, with Na.

8724. WIKLANDER, LAMBERT. **Kinetics of phosphate exchange in soils.** *Kgl. Lantbruks Högskol. Ann.* 17, 407-24(1950)(in English). —*C.A.* 45, 5346*e*.

Tagged P atoms were used to study the equil. between the various forms of P: (a) in the soil soln., (b) micellar, relatively readily displaceably adsorbed at the soil soln.-soil particle interface, (c) less readily displaceably adsorbed, and (d) pptd. insol. some of which is not available. Neutral salts had the expected effect in displacing the equil. according to their ability to react with P_2O_5 or only to affect the tonicity of the soln. Drying a pedalfer soil increased its ability to retain P, decreased the exchangeable P_2O_5, and increased the proportion fixed.

8725. WINTERINGHAM, F. P. W.; HARRISON, A., AND BRIDGES, R. G. **Analysis of DDT derivatives by reversed-phase paper partition chromatography.** *Nature* 166, 999(1950).—*C.A.* 45, 6788*c*.

The paper for reversed-phase chromatography was prepd. by dipping it in an ether soln. of petrolatum. A mixt. of radio-Br analogs of DDT in benzene was spotted on the paper and run (descending) with EtOH:H_2O:concd. ammonia, 80:15:5. $(C_6H_4Br)_2CHCCl_3$, $(C_6H_4Br)_2C{:}CCl_2$, and $(C_6H_4Br)_2CHCOOH$ showed R_f values of 0.44, 0.35, and 0.75, resp.; they were located and detd. by counting the β-radiation from Br^{82}. A test indicated no isotopic exchange.

8726. WYLLIE, M. R. J. AND PATNODE, H. W. **The development of membranes prepared from artificial cation-exchange materials with particular reference to the determination of sodium-ion activities.** *J. Phys. & Colloid Chem.* 54, 204-27(1950).—*C.A.* 44, 4748*i*.

Similarity was noted for artificially prepd. membranes from cation-exchange materials and natural shales, in which clay minerals served as cation-exchange materials and inert constituents as binding agents. Granular Me-polymethacrylate was mixed and molded with bentonite, illite, Fuller's earth, Zeokarb, and Amberlites IR-1 and IR-100. The first and last gave potentials in NaCl solns. of different concns. that were close to those computed by the Nernst equation. Amberlite IR-100 permitted concns. as high as 4 *N*. Polystyrene as a binding agent could contain 50-70% Amberlite, but the membranes were less satisfactory mechanically than with polymethacrylate with 20-30% Amberlite.

8727. YASUE, YASUNOBU. **Zacher's effect of titanium oxide and zirconium oxide against insects.** *Science* (Japan) 20, 184(1950).—*C.A.* 45, 10467*i*.

The insecticidal effect of the powder of TiO_2 or ZrO_2 was proved against *Tribolium ferrugineum*. The insecticidal activities of the IV group elements were in the following order: $ZrO_2 > TiO_2 > SiO_2$.

8728. ZACHER, FRIEDRICH. **Surface-active powders and contact insecticides.** *Proc. 8th Intern. Congr. Entomol., Stockholm* **1948**, 838-41(1950). —*C.A.* 45, 8710*g*.

In the control of grain weevils with DDT dusts, the addn. of SiO_2, MgO, Al_2O_3, or activated charcoal had no appreciable effect.

8729. ZALMAZON, E. S. AND SHISHOVA, E. S. **Method of separation of the colloid fraction from carbonaceous clay and ooze.** *Izvest. Akad. Nauk S.S.S.R., Geol. Ser.* **1950**, No. 2, 145-9.—*C.A.* 45, 509*g*.

Expts. were made with samples of clays, the purities of which were confirmed by chem. and thermal analyses. Data furnished were: (1) soly. of argillaceous minerals in 0.1 *N* HCl and 0.5 *N* AcOH, (2) soly. of clay in filtrates and wash waters, and (3) soly. of carbonates in the filtrates and wash waters.

8730. ADERIKHIN, P. G. **The influence of soil structure on the adsorption of phosphoric acid.** *Pochvovedenie* (Pedology) **1951**, 201-3.— *C.A.* 45, 7734*b*.

Pulverizing chernozem increased the quantity of P adsorbed. The different-particle size fractions of several soils showed that the finer the fraction the higher the P adsorbed.

8731. AKAMINE, ERNEST K. AND SAKEMOTO, HERBERT I. **Brominated charcoal to prevent fading of Vanda orchid flowers.** *Am. Orchid Soc. Bull.* 20, No. 3, 149-52; *N.Y. State Flower Growers Bull.* No. 72, 1 (1951).—*C.A.* 46, 3703*g*.

Premature fading of Vanda orchids in shipment from Hawaii to the U.S. was probably due to C_2H_4 from one or more faded blooms accelerating the fading of the others. Sealing Br-impregnated activated coconut charcoal (23% Br_2) with the flowers prevented the fading flowers from causing the normal ones to fade; the marketable life of normal flowers was also prolonged. The correct amt. of the Br_2 charcoal to use should be detd.

8732. ALBAREDA HERRERA, JOSE M^A; ALEIXANDRE FERRANDIS, VICENTE, AND SANCHEZ CALVO, M^A. DEL CARMEN. **The Silurian rocks of Spain. II.** *Anales edafol. y fisiol. vegetal (Madrid)* 10, 461-506 (1951).—*C.A.* 46, 4970*e*.

An analytical study of the Spanish Silurian rocks was reported. A detn. of total exchange capacity and principal exchange cations in Silurian clays showed that Ca was present in greatest quantity, followed by Mg, suggesting that the Mg absorbed gradually formed more stable complexes than did the Ca.

8733. AOMINE, SHIGENORI. **The fixation of ammonium(ion) in soils. I. Ammonium fixation of some soils in the southeastern provinces of Japan.** *J. Sci. Soil Manure, Japan,* 22, 83-7 (1951).—*C.A.* 46, 3692*f*.

NH_4^+ was found less in surface soils and more in subsoils. There was a correlation coeff. of + 0.69 ± 0.05 between the fixed and adsorbed NH_4^+. Drying before treatment did not affect soils having a strong affinity for fixed NH_4^+. Drying before treatment did increase the percentage of fixed NH_4^+ in the soils.

8734. Babcock, K. L.; Davis, L. E., and Overstreet, Roy. **Ionic activities in ion-exchange systems.** *Soil Sci.* 72, 253-60(1951).—*C.A.* 47, 240*c*.

The activity of an ion in the adsorbed state in a soil system can be detd. by specifying a value of soln. compn. If the infinitely dil. soln. was chosen as the reference state, the activity of an adsorbed ion was the same as its activity in the soln. phase. Therefore, the activity of the adsorbed ion was not uniquely correlated to other values such as degree of satn. or mole fraction. However, activity ratios were involved in exchange reactions and could be correctly estd. from ion-exchange relations. The "ion-exchange const." was an experimentally detd. useful quantity. It was not, however, the same as the thermodynamically defined equil. const. for the exchange process.

8735. Barbier, G.; Maroger, M., and Gachon, L. **Phosphoric acid and humus.** *Ann. inst. natl. recherche agron., Ser. A, Ann. agron.* 2, 317-33(1951).—*C.A.* 47, 809*h*.

Neutral humates showed no measurable solvent action on finely ground, naturally occurring phosphates (apatites). Humic anions sat. the pos. charges of $Fe(OH)_3$ and reduced its power to adsorb the PO_4 ion. It was not established that complex Fe humic compds. can adsorb PO_4 ions in the presence of exchangeable Ca.

8736. Barker, S. A. and Marshall, C. E. **Ionization of soils and soil colloids. II. Potassium-calcium relationships in montmorillonite-group clays and in attapulgite.** *Soil Sci.* 72, 373-85(1951).—*C.A.* 47, 3505*a*.

Ca-K relationships were examd. in detail for Putnam clay (beidellite, Arizona bentonite, and attapulgite). Ca and K mutually affected each other through the bonding-energy relationships of the ionizing surfaces. The ratio of K activity to Ca activity at 10% exchangeable K was 1.2 for Putnam clay, 2.1 for Wyoming bentonite, and 4.1 for Arizona bentonite. These ratios, however, were affected by other colloid-chem. and phys. factors in addn. to the concn. of the clay.

8737. Barshad, Isaac. **Cation exchange in soils. I. Ammonium fixation and its relation to potassium fixation and to determination of ammonium-exchange capacity.** *Soil Sci.* 72, 361-71(1951).—*C.A.* 47, 3502*d*.

A wide variety of soils had the capacity to fix both NH_4 and K. Much of this fixation resided in the coarser fraction of the soils and was assocd. with vermiculite-like minerals. Leaching with a salt soln. did not effectively remove all the adsorbed NH_4^+. Only distn. with NaOH was found effective. The replacement of an adsorbed ion depended upon its accessibility. Ions in an expanded-type layered lattice were replaceable by any kind of a cation; ions in a contracted-type layered lattice were replaceable only by those cations that caused the lattice to expand when they were adsorbed.

8738. Bonnet, J. A.; Lugo-López, M. A., and Abruña, F. **Cation-exchange capacity of some tropical soils of Puerto Rico.** *J. Agr. Univ. Puerto Rico* 35, 49-56(1951).—*C.A.* 46, 11532*h*.

The total exchange capacity for 81 soils and for 4 cations, Ca, Mg, K, and Na, were detd. The highest value obtained for total exchange capacity was about 64 meq. per 100 g of dry soil for a rendzina and the lowest was 2 meq. for a laterite. There was a wide difference between the min. and max. values of total exchange capacity for various soil groups. The highest value for total exchangeable bases was over 60 meq. for an alluvial soil and the lowest was less than 2 meq. for a lateritic soil; these contained 80 and 32%, resp., of exchangeable Ca.

8739. Brasseur, H.; Dallemagne, M. J., and Melon, J. **The constitution of hydroxylapatite and chlorapatite synthesized in a wet way.** *Bull. soc. roy. sci. Liége* 20, 447-52(1951).—*C.A.* 46, 6043*a*.

Synthetic hydroxylapatite and chlorapatite were shown to differ from natural substances by substitution of $1/2\ H_2O$ for $Ca(OH)_2$ and $CaCl_2$, resp., from thermal analyses and x-ray diffraction data. The synthetic compds. were proposed as precursors in natural formation of apatites. Impure chlorapatite was synthesized by adding $CaCl_2$ to a cold H_3PO_4 and heating the mixt. to boiling.

8740. Brown, D. A. and Albrecht, Wm. A. **Plant nutrition and the hydrogen ion. VII. Cation exchange between hydrogen clay and soils.** *Univ. Missouri Agr. Expt. Sta. Research Bull.* No. 477, 3-24(1951).—*C.A.* 46, 11530*f*.

The permeability of different membranes decreased significantly with increasing drying periods between 1.5 and 6 min. The rate of cation exchange increased with increasing ratios of cation/H^+. The suite of cations exchanged was more significant than the fractions of their totals exchanged from the soil. By adjustment of the cation:H^+ ratio and the time interval for exchange, the suite of cations exchanged became more representative of that which can be exchanged from the soil to the plant roots.

8741. Budnikov, P. P. and Al'perovich, I. A. **Plasticity and swelling of deaerated clay.** *Doklady Akad. Nauk U.S.S.R.* 81, 659-62(1951).—*C.A.* 46, 9274*f*.

Readily fusible montmorillonite clays contg. quartz were deaerated in a vacuum chamber, and the air contents detd. Plasticity was detd. by the sphere method. The process of swelling was divided into two stages, one characterized by connection of adsorbed moisture with exothermic heat effects and contraction of the system, and a 2nd stage characterized by osmotic suction of the liquid phase proceeding without heat and contraction effects. Removal of micro-dispersed air destroyed the surface tension at the macro-bubble-water boundary, increased the mobility of the liquid phase, and promoted osmotic infiltration of moisture during the swelling process.

8742. Ciferri, Raffaele and Marcelli, Emanuel. **Toxic effect of mercury zeolites on tobacco**

seedlings. *Notiz. malattie piante* (Italy) No. 14, 11-16(1951).—*C.A.* 46, 1692*i*.

A Hg zeolite, used at the dose of 0.3% for the disinfection of tobacco seeds, caused some toxic effect on the seedlings. Seedlings were able to free the Hg from the zeolites in a form to give a pos. reaction with diphenylcarbazone. The absorption of the poison did not take place through the roots, as these were rather inhibited in their development.

8743. Crivelli, Emanuele. **The production of fluosilicates and of silica gel in the works of phosphate fertilizers.** *Chimica* (Milan) 6, 426-8(1951).—*C.A.* 46, 5273*h*.

About 2 kg of Na fluosilicate (98%) could be theoretically recovered from the washing waters of the gases produced in the manuf. of 100 kg of fertilizers, but actually this production ordinarily reached 0.5-1 kg because the F compds. were difficult to remove from the spongy masses of hyperphosphates. The production of F silicates and of silica gel was described.

8744. Davidson, Doreen I.; Sowden, F. J., and Atkinson, H. J. **Application of paper chromatography to identification and quantitative estimation of amino acids in soil organic-matter fractions.** *Soil Sci.* 71, 347-52(1951). —*C.A.* 46, 3193*a*.

Both qual. and quant. estns. of specific amino acids were made on org. fractions of two soils. One-dimensional and two-dimensional chromatograms were used. The amino acid content of org. matter was much lower in a dark-brown prairie soil than in two fractions of a podzol soil.

8745. Fischer, C. W., Jr. and Keller, J. R. **Prevention of decay of horticultural products by the use of brominated activated charcoal.** *Proc. Am. Soc. Hort. Sci.* 57, 432-8 (1951) *N. Y. State Flower Growers Bull. No.* 65, 2-3 (1951).—*C.A.* 45, 10462*h*; 8179*c*.

Rot in flower shipments in tight enclosures could be prevented by the use of brominated active charcoal suspended over the flowers. Actual contact with the flowers must be avoided as HBr was apparently formed in such cases and injured the flowers. Promising results were also secured with raspberries, strawberries, and tomatoes.

8746. Funabiki, Shigeo and Goto, Kyo. **Soil colloids of middle and western Japan. VI. Adsorption of calcium and ammonium ions by the soils.** *J. Sci. Soil Manure, Japan* 22, 140-2(1951).—*C.A.* 46, 3693*c*.

NH_4^+ and Ca^{++} were adsorbed in almost equal amts. in the noncolloidal fractions of soils. In the colloidal fraction, more Ca^{++} was adsorbed than NH_4^+. This was attributed to the difference in the "form" of H ion; namely, one was exchangeable with NH_4^+ and the other was not.

8747. Gallaway, Bob M. and Buchanan, J. Spencer. **Lime stabilization of clay soil.** *Bull. Agr. Mech. Coll. Texas* 7, No. 1, 57 pp.(1951); *Texas Eng. Expt. Sta. Bull.* No. 124.—*C.A.* 46, 7265*f*.

The load-bearing capacity of soils used in *road-building* was improved by the reaction of certain clays with lime. The stabilization was chem. in nature. The weaker positively charged metallic elements were replaced by the stronger positively charged Ca cations, which in turn influenced the thickness of the adsorbed moisture films on the exterior of the clay grains. The plasticity of clay soils, which was a rough measure of their stability, was a function of the thickness of the water films. Claylike soils of low base-exchange capacity showed no improvement in plasticity properties, and all those of high base-exchange capacity showed large improvement.

8748. Hadaway, A. B. and Barlow, F. **Sorption of solid insecticides by dried mud.** *Nature* 167, 854(1951).—*C.A.* 45, 8700*e*.

Aldrin, γ-$C_6H_6Cl_6$, dieldrin, and DDT (listed in the order of increasing persistence) were sorbed by the surfaces on which they were sprayed. When the crystals of dieldrin and DDT were no longer visible, the insecticidal activity was lost; with aldrin and γ-$C_6H_6Cl_6$, however, activity persisted. The rate of sorption depended on the particle size of the insecticide, the nature of the surface, and (inversely) on the relative humidity. Sorption on absorbent material, such as the dried mud walls in the houses of African natives, was very high, sorption being complete in 24 hrs at 78°F.

8749. Hauth, W. E. Jr. and Davidson, Donald T. **Clay fraction in engineering soils. II. Particle-size distribution and cation-exchange capacity.** *Iowa Eng. Expt. Sta., Engr. Rept. No.* 10, 458-64 (1951-52).—*C.A.* 46, 9756*a*.

The measurement of particle-size distribution in the colloidal range was based on the measurement of the sp. gr. of the suspension by a soil hydrometer (range of 1.010-0.990). The exchange capacity values varied widely depending on the type and particle size of the clay mineral involved.

8750. Klechkovskiĭ, V. M. and Zherdetskaya, G. N. **Sorption of phosphate ions in soils as studied by isotope displacement.** *Doklady Akad. Nauk S.S.S.R.* 76, 717-20(1951).—*C.A.* 45, 5854*h*.

Letting a 1-g soil specimen stand 20 min. with 5 ml soln. of labeled Na phosphate (P^{32} isotope) at pH 6 and concn. 0.001 mg P_2O_5 per ml, filtration, washing with pure H_2O until the washing gave const. impulse count, and passage of 5-ml portions of 0.01 *N*, then 0.1 *N* Na phosphate free of P^{32} through the soil specimen showed definite displacement of the labeled PO_4 ion by a several-fold factor (in terms of impulse count). Peat-podzol and chernozem soils showed such isotope displacement most rapidly and completely; krasnozem was more retentive (results given graphically). Passage of labeled Na phosphate soln. through chromatographic column with soil specimens showed the max. sorption of 0.6 mg per 1 g of soil for the peat-podzol type and over 2.4 mg/g for krasnozem type, as shown by increased max. concn. in the upper layers of the specimen.

8751. Long, M. I. E.; Owen, O., and Winsor, G. W. **The availability of nitrogen in some bone materials used in horticulture.** *J. Sci. Food Agr.* 2, 125-34(1951).—*C. A.* 45, 5857*a*.

Samples of bone meal were added to soil in quantities equiv. to 300 p.p.m. and after a nine-day incubation period at 23.5°C, the fraction of total N readily converted to NH_3 and nitrate was detd. Significant correlations with these fractions were found with the percentage of total N sol. in water, with bulk ds., pH of their aq. suspensions, and the NH_3 liberated on distn. with magnesia.

8752. Manshard, E. **Relation of pH (H_2O) value and base-exchange capacity *(V)* as a basis for determining the sorption capacity *(T)* for soils.** *Z. Pflanzenernähr. Düngung, Bodenk.* 54, 125-34(1951).—*C. A.* 46, 8302*d*.

On the basis of the analyses of 179 soils a formula $pH(H_2O) = 0.0354\ V + 4.0$ was derived. V together with S detd. in various ways may be used to det. T, sorption capacity, from $T = \frac{S}{V}100$, where $S =$ buffer capacity. Classification of soils on basis of calcd. T were made.

8753. McGeorge, W. T. and Breazeale, E. L. **Absorption of gypsum by semiarid soils.** *Arizona Agr. Expt. Sta. Tech. Bull.* No. **122**, 3-48 (1951).—*C. A.* 46, 11531*i*.

A reasonably close approximation of the gypsum-absorbing capacity of the soil could be detd. by a lab. examn. The exchangeable cations did not combine with the clay minerals with equal firmness. There was an initial gypsum reaction with the active colloid mass after which there was a slower and continuing reaction with the less-active mass. Frequent light applications of gypsum in the irrigation water were more effective than single heavy applications of dry gypsum. The gypsum requirement of a soil could not be calcd. on the basis of exchangeable Na or K.

8754. McIlrath, Wayne J. **Nitrate adsorbed on pumice as a nitrogen source for plant growth.** *Proc. Iowa Acad. Sci.* 58, 179-88(1951).—*C. A.* 46, 5764*e*.

Although the nitrate adsorption of pumice was very low, a major portion of the nitrate became available for plant utilization under the conditions of this expt. The mechanism of the release of nitrate from the substrate was unknown. Growth of plants on the pumice substrate was normal until the available supply of N became the limiting factor.

8755. McLean, E. O.; Barber, S. A., and Marshall, C. E. **Ionization of soils and soil colloids. I. Methods for simultaneous determination of two cationic activities.** *Soil Sci.* 72, 315-25(1951).—*C. A.* 47, 807*e*.

The appropriate mobility ratio for the membrane electrode must be detd. The appropriate equations, techniques, and precautions necessary for detn. of the cationic activities were illustrated. The technique was feasible and membranes made for this purpose were reusable.

8756. Mel'nichenko, L. G. **Some colloidal-chemical processes occurring in the system clay-water.** *Ogneupory* **16**, 81-8(1951).—*C. A.* 45, 8323*d*.

In analyzing the surface phenomena of the system clay-water, it was necessary to consider the processes of hydrolysis of kaolinite. Such hydrolysis, in all probability, occurred gradually under ordinary conditions; it started on the surface of the particles with the formation of intermediate protective compds., and the decompn. of the kaolinite into individual hydroxides began only under more favorable conditions. The elec. charges on the kaolinite particles resulted: (1) direct dissocn. of "clay" acid with the sepn. in soln. of H^+ ions, which were in the cryst. cell of the kaolinite, and the formation of macroanion and (2) dissocn. of secondary intermediate compds. resulting from the hydrolysis of the locations with ruptured bonds. Solvation had a greater effect on relative stabilities of colloidal solns. than did the elec. charges.

8757. Mortland, M. M. and Gieseking, J. E. **Influence of the silicate ion on potassium fixation.** *Soil Sci.* 71, 381-5(1951).—*C. A.* 46, 3195*e*.

When K_2SiO_3 was added to clay minerals, K fixation may occur. Kaolinite fixed insignificant amts. of K, montmorillonite clays intermediate amts., and illitic clays intermediate to high amts. When KOH was added to the same clays, very little fixation occurred. Fixed K was that K which could not be removed with boiling N HNO_3.

8758. Mukherjee, S. K. and Marshall, C. E. **Electrochemical properties of mineral membranes. IX. Membrane characteristics of clay pastes.** *J. Phys. & Colloid Chem.* 55, 61-8(1951).—*C. A.* 45, 2796*f*.

By using inverted glass U tubes contg. clay plugs to connect two electrolyte solns., the "membrane potential" of the plug was detd. as the equil. p.d. between two satd. calomel electrodes, one dipping into each soln. The plugs were made from Wyoming bentonite (montmorillonite) and Putnam clay (beidellite), by using the fine (less than 0.2 micron) fraction of electrodialyzed clays satd. with the desired cation (Na^+, K^+, or Ca^{++}). The plugs gave high cond. and came to equil. quickly, though overnight contact was sometimes necessary. With different concns. of the same chloride in the two solns., the range of activities over which the clay plugs showed selective behavior for cations and obeyed the Nernst equation was detd. as follows: 0.001-0.027 for K^+, 0.00097-0.0175 for Na^+, 0.000033-0.0027 for Ca^{++}. Within these ranges, potential detns. on clay plugs exposed to different solns. were used to calc. the differences in differential heat of adsorption for two cations.

8759. Mukherjee, J. N.; Mitra, R. P., and Bagchi, S. N. **Electrochemical character of H-clays in relation to their mineralogical compositions.** *Indian Soc. Soil Sci. Bull.* No. 6A, 1-18(1951).—*C. A.* 47, 6077*c*.

Potentiometric titration curves and suspension viscosities of Indian kaolinites, bentonites, and soils (and especially graded size fractions thereof) in their mineralogical characterization were given. Viscosities were measured for 2% suspensions in an Ostwald viscometer, and titrations were run in 1/4% suspensions. H-kaolinite, H-kaolins, and H-clays from lateritic soils and acid soils were of dibasic character with inflections in the pH curves at about 8 and about 9 representing capacities of from 5 to 20 meq./100 g at the first inflection and near twice as much at the second. Viscosities were about 0.7 or 0.8 centipoise without appreciable changes from pH 6 to 11. H-montmorillonite, H-bentonites, and H-clays from black cotton soils were essentially of monobasic character, and capacities ranged from about 50 to 100 meq./100 g, the inflections ranging from pH values of 7 to 9.

8760. Mukherjee, S. K.; De, R. M., and Rao, Venugopala. **Cation exchange in homoionic clay salts. I. Influence of hydrogen ion concentration on symmetry values and the lyotrope series.** *Indian Soc. Soil Sci. Bull.* No. 6A, 67-88(1951).—*C.A.* 47, 6077*h*.

Clay fractions, a black cotton soil, an acid soil, and a Kashmir bentonite, were selected for prepn. of homoionic clays. Na-, K-, NH_4-, Ca-, and Ba-clays were made by neutralization to equivalence of the respective H-clays, and Mg- and Al-clays by repeated leachings. Each reciprocal system, M-clay + M'A = M'-clay + MA, was prepd. from both directions, and analyzed by analysis of the supernatant liquid both for the chlorides of each metal and for the acetates of those available. Apparent cation exchanges estd. from symmetry values in systems of purposely controlled low pH tended to become equal, but the actual introduction of exchanging cations into the complex in competition with H followed the lyotrope series with good resolution. The homoionic clays actually prepd. still retained some residual exchangeable H. Actual measured pH values at equil. were always lower in the chloride systems than in the acetate.

8761. Mukherjee, S. K. **Cation exchange in homoionic clay salts. II. Symmetry values and the mineralogical composition of the clays. III. Comparative study of the base-exchange equations and of the exchange isotherms in the light of the exchange measurements.** *Indian Soc. Soil Sci. Bull. No.* 6A, 89-95, 96-114 (1951).—*C.A.* 47, 6078*c*.

For three prepd. clays symmetry values for displacements of the univalent ions and of Al from the kaolinite type were higher than those from the montmorillonites, and displacements of the bivalent ions were lower. Exchange isotherms obtained for various clay salts of the acid clay and black cotton soil clay above were used to approx. the relative merits of the base-exchange equations.

8762. Muñoz, V. Cortes. **Spectrophotometric determination of calcium in tobacco.** *Bol. inst. nacl. invest. agron.* (Madrid) 11, 371-401 (1951).—*C.A.* 46, 10551*b*.

Ext. 1 g of ground tobacco with 25 ml HCl, dild. 1:2, filter, wash, treat with active charcoal, make to a vol. of 200 ml; mix 1 to 10 ml, corresponding to 0.18 to 0.6 mg Ca, with 2 ml satd. $C_2O_4(NH_4)_2$ soln. at 90°C, neutralize with dil. NH_4OH, centrifuge after 90 min., wash the ppt. with a mixt. of H_2O 100, EtOH 100, Et_2O 100 and concd. NH_3 soln. 2 ml, dry, dissolve in exactly 1 ml 5% HCl, add 10 ml $Fe(CNS)_3$ soln., and read the absorption in a spectrophotometer at 540 mμ.

8763. Nagasawa, Sumio and Yoshinobu, Midori. **Lethal effect of so-called inert pulverized dusts on insects. IV. Volclay and Panther Creek bentonites on the adult of the azuki bean weevil Callosobruchus chinensis.** *Botyu Kagaku* 16, 35-40(1951).—*C.A.* 45, 10467*g*.

Volclay (Na-rich, readily absorbing H_2O, and swelling and suspendable in H_2O) and Panther Creek (Ca-rich, absorbing H_2O slightly more than Fuller's earth, not much swelling, and pptg. from H_2O) bentonites were sprinked as fine dusts (through a no. 325-sieve) over *Callosobruchus chinesis* held at 30°C and 52, 73, 91, and 100% relative humidity. Both were found lethal, but showed no significant difference in effect. Males were more resistant than were females. The lethal effect seemed primarily due to abrasion inflicted by the dust particles on the insect body and secondarily to a loss of H_2O from the body.

8764. Noda, Masaya and Saio, Kenji. **The phosphate-fixing capacity by iron and aluminum in soils. I. The influence of humus on phosphate fixation by iron and aluminum.** *J. Sci. Soil Manure Japan* 22, 64-8(1951).—*C.A.* 46, 1686*g*.

The power to prevent phosphate fixation was greater in hydroxy acids than in amino acids. The following order of decreasing power to prevent fixation was established: citrate > tartrate > oxalate > glycerine > alanine > succinate.

8765. Rojas-Cruz, Luis A. **Determination of the total base-exchange capacity of soils with a high content of organic matter.** *Rev. colombiana quím.* 4, No. 1, 18-24(1951).—*C.A.* 46, 2730*a*.

Total base-exchange capacity was detd. for 12 soils by 4 methods as well as the pH, total N, org. C, and exchangeable H. For soils contg. more org. matter than 2%, the sum of the bases displaced by NH_4OAc was added to the H displaced by distn. with $Ba(OAc)_2$. The exchange capacity of the soils appeared to be due in large part to org. exchange materials.

8766. Rojas-Cruz, Luis A. **The exchangeable bases of twelve Colombian soils and their effect upon the fertility.** *Rev. colombiana quím.* 4, No. 1, 25-31(1951).—*C.A.* 46, 2730*c*.

The base-exchange capacity of Colombian soils was high in general and in many exceeded 100 meq. /100 g. The detn. of an exchangeable cation was not enough to det. its availability, the proportion of the total base-exchange capacity of the soil it occupied must be considered. The high rainfall in Colombia was considered a major factor of the low degree of satn. of the soils, and Ca and probably Mg were shown to be deficient.

8767. Samuel, Boyd L. **Chromatographic separation and determination of some organic thiocyanates in insecticide products.** *J. Assoc.*

Offic. Agr. Chemists 34, 764-5(1951).—*C. A.* 45, 10469*h*.

The chromatographic detn. of the γ isomer of benzene hexachloride was found to be satisfactory for sepg. 2-thiocyanoethyl esters of aliphatic acids whose av. C content was 10-18 (as a unit), isobornyl thiocyanoacetate, and 2-butoxyethel 2-thiocyanoethyl ether.

8768. SASAKI, SEIICHI. **Japanese acid earth. I. Chemical properties.** *J. Sci. Soil Manure Japan* 21, 193-7(1951)(English summary).—*C. A.* 46, 1195*g*.

The base-exchange capacity and titratable acidity were very low in the *P* layer, but the 1st was high in the G_1-H_2 layers (paralleling the 10% HCl-sol. SiO_2 contents) and the 2nd was likewise high in the G_1, G_2, and H_1 layers especially in the upper layers (agreeing with the degree of unsatn.). This indicated that the acid earth was formed by weathering of both the inner and outer layers accompanied by the mineralization of clay. From the discrepancy of the base-exchange capacity and titratable acidity, the acidity of the acid earth might not agree with the so-called adsorption capacity.

8769. SCHACHTSCHABEL, PAUL. **Determination of *S*-values (exchangeable cations), *T*-values (sorption capacity), and degree of saturation (of soils).** *Z. Pflanzenernähr. Düngung Bodenk.* 53, 7-20 (1951).—*C. A.* 45, 10453*c*.

Best results were obtained from the sum of the exchangeable cations or by the amt. of NH_4^+ sorbed from NH_4Cl soln. Various methods were compared for detn. of the *T*-values. For calcn. of the degree of satn., a soil of pH 7 (KCl) was considered satd.

8770. SHAW, W. M. AND MACINTIRE, W. H. **Exchangeable hydrogen as determined by various procedures in relation to the soil's capacity for calcite decomposition.** *J. Assoc. Offic. Agr. Chemists* 34, 471-92(1951).—*C. A.* 45, 9785*h*.

The calcium acetate procedure was found to be the one best adapted for routine detn. of the lime requirement necessary to raise the pH value of a soil to near neutrality. Procedure: Shake 10 or 20 g of soil with approx. 100 ml of 0.5 *M* Ca acetate previously adjusted to pH 7, and allow to stand overnight. Filter the suspension through a folded filter into a 250-ml volumetric flask. Transfer the soil to the filter and wash with the acetate soln. to a vol. slightly below the 250-ml mark and then add the acetate soln. to the mark. Transfer the 250-ml ext. to a 400-ml beaker and titrate with 0.1 *N* $Ba(OH)_2$ to pH 8.8 using a pH meter. This titration in ml of 0.1 *N* $Ba(OH)_2$ minus the titration value of 250 ml of the Ca acetate blank, divided by the sample wt and multiplied by 10 gives the exchangeable H in meq. per 100 g of soil.

8771. SMITH, DONALD H. AND CLARK, FRANCIS E. **Anion-exchange chromatography of inositol phosphates from soil.** *Soil Sci.* 72, 353-60 (1951).—*C. A.* 47, 3502*b*.

Phytin and its derivs. were extd. from 4 soils by standard techniques. When these were subjected to chromatographic analysis only 10.5, 6.9, 16.2, and 34.0% of the exts. were inositol hexaphosphate. When soils were incubated with inorg. P for 30 days, some of the P was found in the chromatographically sepd. inositol hexaphosphate.

8772. THEMLITZ, R. **Absorption of iron by nontronite.** *Z. Pflanzenernähr., Düngung, Bodenk.* 54, 249-72(1951).—*C. A.* 46, 9024*h*.

The av. cation adsorption capacity olive-green nontronite was 80 milliequiv. per 100 g clay mineral. The base-satd. complex after sepn. had the compn. CaO 80, MgO 19, K_2O 1%. Mineral acids > 0.1 *N* attacked the nontronite; dil. acids dissolved Fe. H_2O was easily and continuously removed below 300-350°C, while above this temp. H_2O of constitution escaped stepwise at intervals. Loss of water of constitution above 350°C reflected the destruction of the lattice brought about by the action of acids. Nontronite energetically adsorbed Fe^{+3}. Fe-nontronite on hydrolysis yielded H-nontronite and ferric oxide hydrate. The ferric oxide hydrate was adsorbed on the surface of the mineral giving it a more or less rust-brown color. The adsorbed phase on the surface aged less rapidly than did Fe_2O_3 sol adsorbed on quartz.

8773. WIKLANDER, LAMBERT. **Saturation of colloids and soils by means of exchange resins.** *Kgl. Lantbruks-Högskol. Ann.* 18, 154-62(1951). —*C. A.* 46, 3193h.

The resin in granular form was satd. with the ion to be transferred to the colloid or soil and filled into a glass column of which the outlet tube was brought up to the filling level and provided with a stopcock. Thus, the hydrostatic head on the column was small. The fine suspension was passed through the column. In this way about as much K was transferred to a soil as by electrodialysis and more than by leaching with KCl soln. When the resin was contained in a Cellophane tube and stirred about in the suspension considerably less was transferred in the same length of time.

8774. AGARWAL, B. R. AND POLLARD, A. G. **Extraction of potassium from soil by electrodialysis and by ammonium acetate leaching. II. Examination of potassium-hydrogen clays.** *J. Sci. Food Agr.* 3, 152-3 (1952).—*C. A.* 46, 7268*e*.

Suspensions of clays were treated with KOH according to their base-exchange capacity and dried. They were then electrodialyzed with water in a Marsden cell at times up to 2 hrs and also leached with NH_4OAc soln. Electrodialysis for 1 hr removed substantially the same amt. of K as leaching. It was suggested that the K removed by the more prolonged dialysis was derived from nonexchangeable or fixed forms.

8775. AĬDINYAN, R. KH. **Minerals of percolloidal soil fractions.** *Doklady Akad. Nauk S.S.S.R.* 83, 291-4(1952).—*C. A.* 46, 8793*a*.

The secondary minerals formed in the soil owing to soil formation and weathering were usually capable of swelling, etc. in the presence of H_2O. Soil specimens fractionated as to particle size, indicated the presence of several fractions (by d.)

in the particle size range 0.2-2.0 μ, with some 90% composed of lighter minerals. This range covered the presence of montmorillonite, quartz and mica, feldspars, kaolinite, and ferrous minerals. The smaller particles were generally more rounded in shape. The amt. of org. matter adsorbed on such specimens showed a progressive increase with decrease of d. After removal of humus by H_2O_2 the adsorbability declined to some extent.

8776. ALBAREDA HERRERA, JOSE M^A.; ALEIXANDRE FERRANDIS, VICENTE, AND SANCHEZ CALVO, M^A. DEL CARMEN. **Soils of Silurian origin in the Spanish humid zone.** *Anales edafol. y fisiol. vegetal* (Madrid) 11, 455-507 (1952).—*C.A.* 47, 3501*a*.

The analytical data were tabulated of chemicomineral and org. analyses, exchange capacity and cation-exchange studies, and mech. analysis, Mech. erosion predominated over chem. erosion in the formation of the profiles, which was in agreement with the climatic conditions of the area, which did not favor chem. erosion. The distribution of exchange cations along the profile agreed with the humid character of the soil. The predominating clay material was illite, at times accompanied by kaolinite, the formation of which agreed with the pH of the profile.

8777. AOMINE, SHIGENORI AND WADA, KOJI. **The fixation of ammonium [ion] in soils. V. Fixation of ammonium [ion] in homoionic soils.** *J. Sci. Soil Manure, Japan* 23, 1-4(1952).—*C.A.* 47, 2411*a*.

Soils from mica schist, granite, and alluvium were studied. After satn. with Li, Na, K, Mg, Ca, Ba, and H by chloride treatment (for H, by HCl or acetic acid), the soils were caused to adsorb NH_4^+ by treatment with neutral *N* NH_4OAc soln. NH_4^+ remaining in soils after leaching with *N* KCl was considered as fixed, that remaining after washing with methanol, as absorbed. Washing with dil. acid decreased the fixation capacity of soil, but not its absorption capacity. Ba or Ca soil, prepd. from H-soil, had the same fixation and absorption to capacities as had H-soil. H-soil from micaceous soil tended to have a high absorption capacity than had the original soil. Soil satd. with Ca, or Na fixed about the same amount of NH_4 as did the original soil; that satd. with Li, Mg, or Ba fixed less; K soil had no fixing power.

8778. AYRES, A.S. AND HAGIHARA, H.H. **Available phosphorous in Hawaiian soil profiles.** *Hawaiian Planters' Record* 54, 81-99(1952).—*C.A.* 46, 9241*d*.

The supply of the available P was found to be related to the degree of weathering of the soil. Fertilization resulted in the accumulation of considerable reserves of available P in surface layers of many of the soils examd., but this was not generally true of the humic and hydrol humic latosols, as in some of these soils the available P was very low and below the crit. level for the optimum growth of sugar cane. Generally the levels of available P diminished with depth.

8779. BEAR, F.E.; PRINCE, A.L., AND TOTH, S.J. **Effect of increasing fertilizer concentration on exchangeable cation status of soils.** *Soil sci. Soc. Am., Proc.* 16, 327-30(1952).—*C.A.* 47, 5599*d*.

The most significant general effects in a 10-yr expt. of adding 1 ton per acre of a 4-8-8 fertilizer annually, or its equiv. in higher grades up to and including a 12-24-24, were the lowering of pH values, increase in exchangeable H and K, and reduction in exchangeable Ca and Mg. There was little evidence to indicate any bad effects that could not readily be overcome by the use of Mg-contg. liming materials as correctives. No relation was apparent between fertilizer concn. and crop content of Ca, Mg, K, and Na.

8780. BOWER, C.A.; REITEMEIER, R.F., AND FIREMAN, M. **Exchangeable cation analysis of saline and alkali soils.** *Soil Sci.* 73, 251-61 (1952).—*C.A.* 47, 5053*f*.

Because of the difficulties inherent in the detn. of exchangeable cations and cation-exchange capacity of saline and alkali soils, modified procedures were adopted. The following scheme was used: (1) ext. soil with NH_4OAc and det. the cations removed; (2) det. the cations in a satn. ext. of the soil; (3) subtract (2) from (1); (4) det. cation-exchange capacity by measuring the amt. of Na absorbed from excess NaOAc. To overcome the problem of poor permeability, samples were shaken in centrifuge tubes with the extg. liquid and centrifuged clear. The process was repeated as necessary.

8781. CHATTERJEE, B. AND BOSE, J. **The electrochemical properties of humic acid.** *J. Colloid Sci.* 7, 414-27(1952).—*C.A.* 46, 10790*c*.

Results of chem. analysis of humic acid sols extd. from acid soil or from Merck's humic acid were: C 50.2-54.3, H 4.3-5.2, N 1.9-3.3, ash 3.4-8.3%. The titration curves corresponded to H-ion activities of the order of 10^{-4} *N*, which was greater than the activity of the ultrafiltrate from the sols. Humic acid sols contained weakly dissocd. acids, part of which were in true soln. and part consisted of insol. colloidal particles. The base-exchange capacity of the sols depended on the nature of the base used for titration.

8782. CHERNOV, V.A. **The nature of soil acidity.** *Pochvovedenie* 1952, 899-908.—*C.A.* 47, 6590*e*.

New exptl. data were presented on the source of Al that appeared in soln. when the cations of different soils were replaced either by 0.05 *N* HCl, 1.0*N* KCl alone, or intermittently with these extg. agents. Al came from nonsilicate sources and was capable of entering the exchange complex more effectively than the H ion.

8783. CHERNOV, V.A.; BELYAEVE, N.L., AND KISLITSYNA, L.P. **A comparison of the energy of adsorption of hydrogen, aluminum, calcium, and ammonium ions by chernozem and red loams.** *Pochvovedenie* 1952, 528-37.—*C.A.* 47, 1897*d*.

The adsorption of the H, Al, Ca, and NH_4 ions by lateritic soils, chernozem, and askangel was studied by using the chlorides of these salts in various combinations, with and without various concns. of HCl and with $(CH_3COO)_2Ca$. The const. of the adsorption exchange was detd. and this const. (which was the same as the ratio of the energy of adsorption of the H ions to that of the adsorption of Ca ions) was not a const. but a variable value. The ratio of the adsorption energy of any two kinds of cations in soils was not a const. The energy of adsorption of Al^{+3} was many times greater than the energy of adsorption of Ca in lateritic loam and askangel. The energy of adsorption of H ions on the objects used was lower than that of the Ca ions. The energy of adsorption of Al^{+3} was many times greater than the energy of adsorption of H ions.

8784. CORNFIELD, A.H. **Rapid copper acetate method for the determination of the base-exchange capacity of soils.** *J. Sci. Food Agr.* 3, 388-90(1952).—*C.A.* 47, 4535*a*.

The method was applicable to unsatd. and calcareous soils. Place 4 g of air-dried soil (passed through a 2-mm sieve) and 0.5 g of $BaSO_4$ in a test tube marked at 11.6 ml. Add 5 ml of 0.5 *N* AcOH and shake 0.5 min. Add a few drops of AmOAc if foaming is severe; if effervescence occurs add another 5 ml of 0.5 *N* AcOH, or as much as is necessary until effervescence ceases. Add 0.07 *N* AcOH almost to the top of the tube, shake 10 sec., allow to settle, remove most of the supernatant, and repeat the washing with 2 more portions of 0.07 *N* AcOH. Add 0.07 *N* AcOH to mark, and then add 10 ml of 0.1 *M* $Cu(OAc)_2$. Heat at 50 °C for 5 min. in a water bath, stirring occasionally. Cool, remove a 10-ml aliquot of the supernatant, add 10 ml of 20% KI, and titrate with standard 0.5 *N* $Na_2S_2O_3$. The 10 ml of soln. withdrawn for titration was equiv. to 2 g of soil, and the base-exchange capacity of the soil equal to the reduction in Cu ion concn. when expressed in appropriate units.

8785. DEMOLON, ALBERT; BOISCHOT, PIERRE, AND LAJON, JACQUELINE. **The ability of soils to fix the H_2PO_4 ion.** *Compt. rend.* 234, 1820-3 (1952).—*C.A.* 46, 9243*c*.

With a muddy soil of pH 6.5 which contained 14% clay, 8.7% free Fe, 0.9% humus, and 0.14% P_2O_5, it was found that free Fe entered into the fixation of P_2O_5 and that the fixation reached a max. when the P/Fe ratio was less than 3%. Hydroxyquinoline, humic acid, tannin, or H_2S was found to block the fixing power of the Fe. The clay in the soil was found to be related to the Fe which it fixed by adsorption. The substitution of K^+ by Ca^{++} at constant pH resulted in the fixation of P_2O_5, but the addn. of CaO had an opposite effect. The fixing capacity for P_2O_5 was given for 7 soils.

8786. DOLE, MARJORIE WELSH. **The Aspergillus niger method for determining copper in soils.** *Soil Sci.* 73, 135-47(1952).—*C.A.* 47, 3499*d*.

The method was found satisfactory for measuring small amts. of available Cu. Spore color was a better criterion of Cu level than either amt. of sporulation or mycelial wt. Both ionic and adsorbed Cu were readily available to *A. niger*, although the rate of color development was slower for adsorbed Cu. A recommended procedure for routine assays for soil Cu was described.

8787. EGGERT, R.; KARDOS, L.T., AND SMITH, R.D. **Relative absorption of phosphorus by apple trees and fruits from foliar sprays, and from soil applications of fertilizer, using radioactive phosphorus as a tracer.** *Proc. Am. Soc. Hort. Sci.* 60, 75-86(1952).—*C.A.* 47, 5601*c*.

Greenhouse and field expts. showed that water-sol. radioactive P salts applied as sprays to foliage and small branches of apple trees could be adsorbed and translocated to other parts of the trees. In the greenhouse tests with trees 1 yr old, $(NH_4)_2HPO_4$ was absorbed in larger amts. than $NH_4H_2PO_4$, Na_2HPO_4, Na_3PO_4, and $Ca(H_2PO_4)_2$. There was a continuing absorption during the 30 days even though the leaves were never remoistened after the initial spray had dried. As terminal growth developed from the area originally sprayed, increasing amts. of P were found in unsprayed leaves that were removed at intervals of 1 week from near the tip of that growth. When P was applied to the soil there was no uptake by the trees when a penetration of only 2 in. was obtained. When the fertilizer penetrated 4 in. deep, 2.68-3.78% of the P in the tissue was obtained from the fertilizer; when penetration was 8 in. deep, up to 5.77% of P came from the fertilizer.

8788. FOX, R.L.; OLSON, R.A., AND MAZURAK, A.P. **Persistence of ammonium ion and its effect upon physical and chemical properties of soil.** *Agron. J.* 44, 509-13(1952).—*C.A.* 47, 2410*h*.

NH_4^+ applied to an eroded Sharpsburg soil in early November was almost completely recovered in the surface one-half in. on April 1. Appreciable amts. of NH_4^+ remained in the surface one-half in. after 2 addnl. months. The persistence of the NH_4^+ caused a deflocculated condition which resulted in a crusting of the surface soil. Soil samples collected on April 1 showed increased pH in proportion to rate of NH_4^+ application in the previous fall. Samples collected on June 15 showed increased exchangeable H^+ and decreased pH and exchangeable Ca^{++} and Na^+ with increasing rate of NH_4^+ application. The influence of applied NH_4^+ on exchangeable K^+ and Mg^{++} was small. A trend of reduced permeability with increasing rate of NH_4^+ application was noted in disturbed samples collected in the early spring.

8789. HSEUNG, Y. AND JACKSON, M.L. **Mineral composition of the clay fraction. III. Some main soil groups of China.** *Soil Sci. Soc. Am., Proc.* 16, 294-7(1952).—*C.A.* 47, 244*i*.

Samples from China were analyzed by fractionation at 5, 2, 0.2, and 0.08μ, and application of x-ray diffraction and elemental analysis procedures. Montmorinic dioctahedral illite was found in the Desert soils and showed a young stage of soil weathering. The content of the montmorin series was low in most of the soils studied, attributed to drier cool climates than in the regions of the U.S. where it commonly occurred. The weathering mean ranged from 2.5 to 11.0 for the soils of China examd.

8790. JACQUET, J. AND LE NIR, Y. **Rapid method for the determination of so-called assimilable phosphates in soils.** *Compt. rend. acad. agr., France* 38, 139-42 (1952).—*C.A.* 47, 245*f*.

A 0.25, 0.5, and 1% soln. of trichloroacetic acid was used, resp., to ext. P from acid, slightly calcareous, and calcareous soils. Three g of finely ground sample was agitated for 1 min. with 18 ml of the proper concn. of trichloroacetic acid in a test tube fitted with a ground-glass stopper and filtered. To 6 ml of the filtrate, 1 ml of molybdate reagent was added and the mixt. shaken. The mixt. was treated with 2 ml of a 2% soln. of hydroquinone and shaken. The contents were allowed to stand 10 min. and 10 ml of Na_2SO_4 added. A blue complex phosphomolybdate formed immediately and the intensity of the color measured by means of an electrophotometer.

8791. KEIL, K. **The densification and strengthening of binding soils (adhering loose rocks).** *Bautechnik* 29, 42-6 (1952).—*C.A.* 46, 5814*c*.

Binding soils could be stabilized (to make them more suitable for building foundations and stronger as building materials) by chem. or electrolytic treatment based on the phys. change which the soil underwent by elimination of the decisive influence of the water. This was made possible by the limitation of the exchangeability of ions and the capacity of water mols. to be adsorbed at the unsatd. border areas of the clay minerals. The action of this chem. strengthening was always limited to the chem. sphere of influence. The mutual actions between chemicals and soils were discussed.

8792. KELLER, W.D. AND FREDERICKSON, A.F. **Role of plants and colloidal acids in the mechanism of weathering.** *Am. J. Sci.* 250, 594-608(1952). —*C.A.* 47, 803*f*.

The decompn. of minerals by H ions resulted from its penetration into the carbonate and silicate crystal lattices to form high-energy bondings with O. The H ions may arise from the ionic double layer surrounding plant roots, humic or carbonic acids in natural waters, or acidic clays. The breakdown of the rock was effected by the polarization of O atoms by H ions or by ion-exchange processes. The replaced metallic cations were transferred in soln. or by contact exchange by networks of colloidal particles. The growing plants utilized some of the cations as nutrients and hence promoted further weathering.

8793. MAMAEVA, L. YA. **A rapid method for determining adsorbed sodium in solonetzic soils.** *Pocȟvóvedenie* 1952, 574-6.—*C.A.* 47, 1881*h*.

The method was based on: (1) adsorbed Na was replaced by Ca^{++} of gypsum with a definite titer; (2) After contact of the soln. of $CaSO_4$with the soil, the residual Ca^{++} in soln. was detd.; (3) The residual Ca^{++} of the gypsum soln. was detd. by pptg. with 0.1 *N* soln. of a mixt of NaOH and Na_2CO_3; (4) The excess alkali mixt. was detd. by titrating with 0.1 *N* HCl.

8794. MCLEAN, E.O. **The effect of humus on cationic interactions in a beidellite clay.** *Soil Sci. Soc. Am., Proc.* 16, 134-7(1952).—*C.A.* 46, 8305*h*.

Expts. with mixts. of 10 parts of beidellite clay and 1 part of crude humic acid showed that the exchange capacity of the clay-humic acid system was 73% of that of the sum of the component parts. Base satn. in the clay-humus systems, relatively higher than the sum of actual exchange capacities of the component parts, resulted in higher activities of the cations in all cases than in the clay alone. In spite of the higher activities in the clay-humic acid systems the interactions of the cations were very similar to those in the clay alone.

8795. MILLER, E.V. AND COLEMAN, N.T. **Colloidal properties of soils from western equatorial South America.** *Soil Sci. Soc. Am., Proc.* 16, 239-44(1952).—*C.A.* 47, 245*d*.

In the humid tropical regions, kaolin clays were common, but there was also evidence of juvenile soils. Immaturity was indicated by high contents of exchangeable bases, presence of clays with high cation-exchange capacities, evident lack of crystallinity of the clays, and pH values which were relatively low for the existing degree of base satn. Dark colored acidic Andean soils possessed high phosphate-retaining capacities and high exchangeable Al. Their cation/anion exchange-capacity ratios were less than 1.

8796. MITCHELL, LLOYD C. **A new indicator for the detection of the chlorinated pesticides on the paper chromatogram.** *J. Assoc. Offic. Agr. Chemists* 35, 1928(1952).—*C.A.* 47, 5063*f*.

Spray with 0.05 *N* $AgNO_3$ in 95% alc. and air-dry for 1/2 hr. Spray with 37% HCHO soln. and air-dry for 1/2 hr. Spray with *N* KOH in MeOH, air-dry for a few min. to remove excess MeOH, and heat in an oven at 130-3° for 1/2 hr. Spray with a mixt. of concd. HNO_3 and 30% H_2O_2 (1 + 1) and air-dry overnight. Expose to the sun or bright daylight until the spots are fully developed. This indicator was suitable for compds. resistant to alk. dehalogenation such as aldrin and dieldrin, as well as compds. not so resistant.

8797. MOTL, O. **The determination of Atabrin by means of an ion-exchange chromatographic method.** *Českoslov. farm.* 1, 630-2(1952).—*C.A.* 47, 5071*d*.

The basic component was detd. on Amberlite IRA-400.

8798. NIKITIN, A.A. AND RAINEY, JOSEPHINE W. **Reactions between trace-element salts and nitrogen-phosphorus-potassium carriers in fertilizers.** *Agron. J.* 44, 541-6(1952).—*C.A.* 47, 2415*f*.

The weak pptg. action of phosphate on trace elements did not interfere with their availability when used with N-P-K carriers in fertilizers. Superphosphate sorbed much smaller amts. of trace elements than did the nonacid-forming N-P-K (6-8-6) fertilizer. A substantially larger amt. of Cu than Zn and Mn was sorbed by N-P-K. Sorption of trace elements by N-P-K was considerably reduced in the presence of $Fe_2(SO_4)_3$. There was less pptn. of trace elements if NH_3 had been completely reacted with N-P-K before the addn. of the trace elements. With NH_3 present, Cu sorption by N-P-K was diminished above pH 6.0 by formation of the cuprammonium complex. When lime was used to adjust the pH, the sorption of Cu was const. above pH 5.0.

8799. O'COLLA, PROINSIAS. **Analysis of chlorinated organic insecticides by partion chromatography on paper and on cellulose columns.** *J. Sci. Food Agr.* 3, 130-5(1952).—*C.A.* 46, 8802*h*.

γ-Hexachlorocyclohexane in insecticidal prepns. was detd. as follows: A sample contg. approx. 40 mg γ-hexachlorocyclohexane was extd. 3 times with petr. ether satd. with Ac_2O, filtered into a flask contg. a trace either of benzeneazo-2-naphthol or of 1-hydroxy-4-*p*-toluidinoanthraquinone and dild. to 5 ml. The soln. contained all the γ- and ζ-isomers present in the sample and some of the α- and β-isomers. The isomers were sepd. chromatographically. Locating γ-hexachlorocyclohexane was aided by viewing the fluorescent benzeneazo-2-naphthol, which moved with the ζ-isomer, under ultraviolet light.

8800. PRATT, P.F. **Release of potassium from nonexchangeable forms from size fractions of several Iowa soils.** *Soil Sci. Soc. Am., Proc.* **16**, 25-9(1952).—*C.A.* 46, 5237*c*.

The K release from nonexchangeable forms to HNO_3 per unit wt was highest in the 0.2-2-μ fraction for 12 of 13 Iowa soils, was highest in the <0.2-μ fraction for 1 soil, and decreased with increase in particle size in the silt fractions. For each of 6 size fractions the release per unit wt was correlated with release from the whole soil. The clay fractions contributed about 60% and the coarser fractions about 40% of the K release from the whole soil. For 8 soils the lowest total K was in the <0.2-μ fraction and the highest total K was in the 2- to 5-μ fraction. The percentage of the total K sol. in HNO_3 was highest in the < 0.2-μ fraction and decreased with increase in particle size.

8801. PYLE, R.E. AND JONES, P.R. **The effects of wetting agents on the physical properties of clay bodies.** *Am. Ceram. Soc. Bull.* **31**, 233-6 (1952).—*C.A.* 46, 9274*e*.

Florida kaolin 50, feldspar 15, flint 35% was used. The wetting agent was dissolved in a small portion of the water of plasticity which was const. at 28% of the dry wt. In general, drying shrinkage and porosity were decreased by the addn. of a wetting agent, while firing shrinkage, dry strength, and fired strength were increased. The nonionic and cationic agents had but little effect. Each wetting agent had its individual optimum concn.

8802. RAMBERG, HANS. **Chemical bonds and distribution of cations in silicates.** *J. Geol.* **60**, 331-55 (1952).—*C.A.* 46, 11055*c*.

The presence of OH did not affect the Fe-Mg distribution in talc and anthophyllite, but appeared to do so in serpentine and chlorites. The capacity to accept Al in the tetrahedral positions also increased from orthosilicate to tectosilicate. Al preferred to enter Si positions with a max. no. of electroneg. bridging oxygen-neighbors. This resulted in a decrease of the electronegativity of the oxygen with a consequent increase in the Fe-Mg ratio and evidence was presented to support this theoretical conclusion in hornblende, anthophyllite, and biotite.

8803. ROTINI, O.T.; DEL CARRATORE, A.; LOTTI, G., AND CARLONI, L. **The absorbant power of agricultural land for metaphosphoric acid.** *Chimica e industria* (Milan) **34**, 711-14(1952).—*C.A.* 47, 4533*e*.

To det. the velocity of metaphosphate fixation of agricultural soil, 300 cc. 0.1 *N* metaphosphate soln. was added to 150 g earth, and the residual Na metaphosphate detd. after 1 min., 30 min., 1 hr, 5 hrs, and 7 hrs. The results showed that metaphosphate absorption was almost instantaneous and the total absorption after 7 hrs was very little more than that after 1 min. To det. the absorption curve of Na metaphosphate as a function of the initial concn., the residual $NaPO_3$ was detd. in a series of measurements in which 50 g earth was treated for 5 min. with 100 cc. $NaPO_3$ solns. of varying concn. The results of fixation velocity and final metaphosphate concn. measurements showed that the process of absorption presents all the characteristics of colloidal absorption phenomena.

8804. SCHOFIELD, R.K. **Soil colloids.** *Chemistry & Industry* **1952**, 76-8.—*C.A.* 46, 7265*b*.

Colloidal particles of the soil usually had a neg. charge. In a soil, well leached with 0.01 *M* $CaCl_2$, the soln. was considered around a neg. particle. The Ca-ion concn. in the Stern layer and in the Gouy layer against it were controlled by the neg. charge in the solid surface. Diln. of the outer $CaCl_2$ concn. did not greatly affect the inner concn. The inner Ca-ion concn. was controlled by the neg. charge on the solid. An equation for the neg. adsorption in the Gouy layer was obtained which involved only slight approximation. The Smoluchowski equation was inapplicable in some cases because the elec. cond. varied so much within the diffuse double layer. Calcn. of the proportion of the Ca and of the Na ions in both the Gouy and Stern layers was described.

8805. SHAW, W.M. **Report on exchangeable hydrogen in soils. Interrelationship between calcium sorption, exchangeable hydrogen, and pH values of certain soils and subsoils.** *J. Assoc. Offic. Agr. Chemists.* **35**, 597-620(1952). —*C.A.* 47, 2917*b*.

The Ca acetate procedure for the detn. of exchangeable H in soils afforded satisfactory indications of the $CaCO_3$ required to raise the soil to pH 7, and this procedure could be utilized jointly with the pH detn. and one other soil const. (Metal cation content, exchange capacity, or pK value) for the detn. of $CaCO_3$ required to raise the pH to values other than 7. To obtain concordant results with the Ca acetate procedure, the directions concerning the size of sample, duration of contact, and vol. of leaching should be adhered to.

8806. SMITH, DONALD H. **Chromatographic separations of soil organic compounds.** *Iowa State Coll. J. Sci.* **26**, 287-8(1952).—*C.A.* 47, 1881*c*.

The acidic nature of phytin suggested that its presence in soil could be investigated by base-exchange methods. A 1.25 × 24-cm bed of a base anion exchanger in the sulfate form wassatd. to 0.25 of its length with inositol phosphates. The bed was washed at the rate of 32 ml per hr by HCl whose concn. was increased from 0.1 *N* to 1.0 *N*. The effluent for each hr was collected separately. From a mixt. of Na phytate and derivs., 9 org. compds. were collected in quantities sufficient to det. their inositol to P ratios. To a sample of each soil, inositol phosphates were added and a second sample was left untreated. All samples were extd. by a method thought to be specific for phytin. Only 25 to 50% of the extd. org. P was eluted concurrently with known inositol phosphates. To 2 soils, radioactive P, dextrose, and NH_4NO_3 were added. After 30 days' moist incubation at room temp., a mixt. of inositol phosphates was added and the phytin was extd. immediately. The ext. was sepd. chromatographically. Activity was found in part of the eluate known to contain inositol penta- and hexaphosphates.

8807. Smith, Donald H. and Clark, Francis E. **Chromatographic separations of inositol phosphorus compounds.** *Soil Sci. Soc. Am., Proc.* 16, 170-2(1952).—*C.A.* 46, 8574*g*.

A chromatographic method was described for the resolution of inositol phosphates. Na phytate, considered sufficiently pure to use as a standard of comparison, was found to contain some 30% of compds. other than the hexaphosphate. The pentaphosphate constituted the bulk of the admixed material. From a mixt. of Na phytate and derivs., 9 org. P compds. were sepd. in sufficient quantities to permit detn. of their inositol/P ratios.

8808. Smolík, Ladislav. **The influence of the exchangeable bases on the height of the capillary rise of water in soil.** *Sborník Českoslov. Akad. Zemědělské* 25, 473-8(1952).—*C.A.* 47, 4533*g*.

A H soil (pH 4.06) was prepd. by electrodialysis of the sandy loam. By action of hydroxides on this soil Ca soil (pH 7.53), Mg soil (pH 8.44), and Na soil (pH 9.93) were prepd. and used to det. the heights of the capillary rise (soils connected with H_2O by cotton). The highest rise were in the H soil, the lowest in the soils with the highest amt. of the exchangeable Na. The rise of H_2O in soils satd. with $Mg^{2+} + Ca^{2+}$ was between the rise of the H and Na soil.

8809. Williams, D.E. and Jenny, H. **The replacement of nonexchangeable potassium by various acids and salts.** *Soil Sci. Soc. Am., Proc.* 16, 216-21(1952).—*C.A.* 46, 8302*e*.

A large proportion of the K absorbed by plants growing on Ramona loam was obtained from the nonexchangeable form. The soil contained 20,000 p.p.m. of K of which 78 p.p.m. was exchangeable to neutral, normal NH_4OAc. Rye plants grown by the Neubauer technique removed, in addn., 112 p.p.m. of nonexchangeable K from the soil. Water satd. with CO_2 at pH 4.0 leached through the soil for 50 days removed only 39 p.p.m. of nonexchangeable K. Equal vols. of CO_2- satd. water which passed through the soil removed the same amt. of K regardless of the rate of leaching or thickness of the soil column. The final concn. of K in the CO_2-satd. water leachates was 0.1 p.p.m. A correlation was found in extn. and leaching expts. between pH and the amt. of K replaced from the soil.

8810. Evans, Daniel D. **Effect of combined pressure and concentration gradients on gaseous flow through soils.** *Iowa State Coll. J. Sci.* 27, 165-6(1953).—*C.A.* 47, 5592*i*.

Darcy's law was found to be valid down to pressure gradients as low as 0.00018 mm of H_2O per mm of porous medium and probably down to 0. Slip flow and free mol. flow in ordinary moist soil were negligible. Five problems were solved by use of the combined laws of Darcy and Fick and two auxiliary equations: (1) Flow through a tube of porous medium with an absorber at one end which removed one component, in a specific case, could be calcd. with only 13% error by considering diffusion flow only. (2) Flow through a tube of porous medium with a volatile liquid at one end, when CS_2 was the liquid, was calcd. from diffusion only and the error was 43%. (3) The inclusion of a viscosity factor in expt. 2 was negligible. (4) A respiration problem in which O_2 and CO_2 were diffusing in opposite directions showed a slight build up of pressure due to differences in the two rates of diffusion, the change produced a max. error of 6% in the calcd. rates. (5) Studying the importance of mass flow of gas, as during a linear change of barometric pressure with time, showed that normal changes of barometric pressure had little influence on transference of gases in soil.

8811. Flegg, P.B. **The effect of aggregation on diffusion of gases and vapors through soils.** *J. Sci. Food Agr.* 4, 104-8 (1953).—*C.A.* 47, 5591*i*.

The diffusion coeff. of Et_2O and Me_2CO through soils did not vary over the range of aggregate sizes tested. The diffusion coeff. decreased as the moisture present in the soil increased regardless of aggregate size. It was calcd. that the decrease in diffusion coeff. produced by the water in the soil was approx. proportional to the reduction in porosity due to the vol. of water present.

8812. Kamoshita, Yutaka and Iwasa, Yasushi. **Effect of heating soil upon the absorption of dyes by the soils. I.** *J. Sci. Soil Manure, Japan* 23, 141-2(1953).—*C.A.* 47, 5595*a*.

When soils were heated from 300 to 600°C, their absorptive power for methylene blue was changed in accordance with their natures. The power increased in volcanic ash soil, but decreased in acid soil and also kaolinitic soil.

8813. Tamura, T. and Jackson, M.L. **Structural and energy relationships in the formation of iron and aluminum oxides, hydroxide, and silicates.** *Science* 117, 381-3(1953).—*C.A.* 47, 7142*f*.

A particular difference between the Al and Fe series was the absence of cryst. $Fe(OH)_3$, resulting in the formation of lepidocrocite, FeOOH, by oxidation and dehydration of cryst. $Fe(OH)_2$. The formation of Mg and Fe silicates of Al (montmorins) took place only where soil leaching was slow, being replaced by kaolin as leaching progresses, while iron-rich soils decomp. to goethite ($HFeO_2$) and Fe_2O_3.

V-9. Applications to Foods, Wines, and Liquors

8814. LYMAN, J.F.; BROWNE, E.H., AND OTTING, H.E. **Readjustment of salts in milk by base-exchange treatment.** *Ind. Eng. Chem.* 25, 1297-8(1933).—*C.A.* 28, 834⁸.

Passage of raw milk through zeolite removed more Ca and P when the milk had been acidified. Milk of artificially increased acidity (0.3% as lactic) lost 22% each of its Ca and P. After this treatment, rennin failed to produce a curd unless the milk was first boiled. On boiling, the tendency to coagulate was greater when HCl had been used previously to acidify the milk than when citric acid had been used. The Na:K ratio or content need not be disturbed if the zeolite was revived with the proper salt combination. Revival with NaOH was necessary to affect P removal. Previous treatment with HCl lowered the alky. of the ash obtained from zeolite-treated milk, but treatment with lactic or citric acid raised it. Butter fat did not interfere with base-exchange and the milk was not appreciably changed in taste.

8815. CONNOLLY, G.C. **A new purification tool. Activated carbon.** *Mida's Criterion* (Whiskey & Wine Ind.) 41, 53-6 (March)(1936)

The use of activated carbon just previous to the cistern-room was suggested for the purification of alcohol or the treatment of young whiskey in order to eliminate the traces of "slop" or "hog-track" odor and taste. The presence of grain oils and certain fatty matter, possibly coming from the germ of the grain, was largely responsible for these particular impurities. Usually 0.5 to 1.0 lb of "Nuchar Wa" was sufficient for treating 50 gallons of most young whiskies, although as much as 2 to 5 lbs were required for very heavy bodied whiskies. The treated raw liquor was about 103 to 110 proof. After contact of about 1/2 to 1 hr, the mixture was filtered through a completely enclosed filter press. The filter cake was blown with air, removed, and destroyed by burning on the distillery premises.

8816. CONNER, R.T. AND STRAUB, G.J. **Combined determination of riboflavin and thiamin in food products.** *Ind. Eng. Chem., Anal. Ed.*, 13, 385 (1941)

No appreciable adsorption of riboflavin from solns. containing 3-10 micrograms occurred on a column of Decalso. Riboflavin was quantitatively adsorbed on Floridin and Supersorb, but appeared to be completely eluted from the latter only. The necessary remaining details of the analysis were critically discussed.

8817. GENTILINI, LUIGI. **Chromatographic analysis applied to the detection of the most common adulterants of the color of red wines.** *Annuar. staz. sper. viticolt. enol. Conegliano* 10, 59-72(1941).—*C.A.* 40, 3222⁹.

Chromatographic analysis with an adsorbing column of activated MgO and with Et_2CO as a washing liquid permitted the detection of the presence of the following colors added to red wines: hematin, basic and acid fuchsin, scarlet red, and Bordeaux B and R.

8818. DÉRIBÉRÉ, MAURICE. **Bentonite and hygiene.** *Ann. hyg. publ., ind. sociale* 20, 1-8 (1942).—*C.A.* 37, 3863⁸.

The use of bentonite for the clarification of water, wine and AcOH and for cosmetics was discussed.

8819. GENTILINI, LUIGI. **The effect of charcoal on the alcoholic and glycerol fermentation of grape must.** *Ann. tech. agrar.* 14, 94-8(1942).—*C.A.* 38, 4749⁶.

Sterilized must dild. to 12% of sugar was fermented at 31°C by beer yeast in the presence of wood or animal charcoal (0.5 and 2.5%). Addn. of charcoal increased considerably the content of CO_2 and decreased the yield of alc., favoring the formation of glycerol. Addn. of sulfite had an unfavorable effect on the formation of glycerol.

8820. HAMILL, GEO. K. AND SIMONDS, PAUL W. **Detection of grape wine in blackberry wine.** *J. Assoc. Official Agr. Chem.* 25, 220-6 (1942).—*C.A.* 36, 2371¹.

The method consisted essentially in dilg. 10 ml of wine with 50 ml of acidified water (either with or without preliminary reduction with 0.5 g granulated Zn and 4 drops concd. HCl), filtering through a 2:1 mixt. of Grade A activated Al_2O_3 and filtercel, washing with H_2O or dil. CH_2O, and observing under ultraviolet light. The presence of grapes was indicated by yellow colors ranging from pastel tones to russet; blackberries and other berries imparted mauve to purple shades, some contained "off" shades, others approached the clear purples of control tubes adsorbed from water only.

8821. LECOQ, H. **New technique in qualitative and quantitative microchemical analysis-chromatographic reactions.** *Bull. soc. roy. sci. Liége* 11, 679-94(1942).—*C.A.* 38, 3921³.

The absorbent (Al_2O_3,SiO_2, etc.), was contained in a capillary tube which was attached to a large tube. The liquid to be tested was sucked into the capillary tube through a plug of cotton. The mode of operation and the advantages of the method were fully discussed.

8822. MATCHETT, J.R. **Tartrates from still slops.** *Wines and Vines.* 24, 18 (1943).

Tartrate in brandy still-slops was removed in high purity and satisfactory yield through the use of synthetic anion exchangers placed in beds. When still-slop was passed through these exchangers under controlled conditions, the tartrate remained affixed to them while most of the unwanted material passed through. When the exchanger bed had attained a capacity load, a solution of NaCl was passed through it to remove the tartar as sodium tartrate soln. of about 5% concn. The process yielded calcium tartrate of excellent purity, and recovery will amount to 85% or more. Chemical reagent costs at present prices amounted to about 4 cents per pound of tartrate recovered.

8823. ROUSSELOT, ALBERT. **New method for the demineralization of gelatins.** *Compt. rend.* 216, 54-6(1943).—*C.A.* 38, 5428⁹.

The usual procedures for the demineralization of gelatin increased the protein content of the gelatin. By the use of synthetic ion exchangers, it was possible to demineralize gelatins and glues without increasing the protein content. Gelatins contg. 1 g / liter of Al, Mg, Ca, Ba and SO_4 ions were completely dimineralized by passing over a 15-cm column of a resorcinol-HCHO resin, kept at the temp. of boiling acetone. Demineralization proceeded readily for 8, 10 and 15% gelatin solns. but was poor with 1 or 2% solns. The exchange was a true stoichiometric reaction and the power to exchange did not depend on the surface of the exchanger.

8824. TOLBERT, N.E. AND AMERINE, M.A. **Charcoal treatment of brandy.** *Ind. Eng. Chem.* 35, 1078-82 (1943).—*C.A.* 37, 6814^6.

The phys. properties and effectiveness of 27 charcoals in adsorbing the constituents of brandy from pure soln. in 50% alc. of each major constituent of brandy or from com. brandy were tested. The charcoals (0.5 g per 100 ml) removed acidity, furfural and tannin; but the esters, acetaldehyde and higher alcs. were unaffected. Many charcoals also adsorbed Cu, Fe, coloring matter or ext. material from brandy. The charcoals varied markedly in adsorption ability. Fusel oils up to about 25% could be removed by using larger amts. of charcoal (3 or 4 g per 100 ml); but at 94% alc. and 70°C the adsorption of higher alcs. was reduced. Increasing the period of contact did not improve adsorption. Charcoals failed to remove from the brandy an appreciable amt. of the major chem. constituents; but they improved the organoleptic character as to obnoxious odors, tastes and color.

8825. WILLIAMS, G.C. AND FALLIN, E.A. **Activated carbon treatment of raw whisky.** *Ind. Eng. Chem.* 35, 251-4 (1943).—*C.A.* 37, 1559^4.

The chem. changes and taste changes were reported that took place when a distillate from an alc. fermentation process was treated with each of several activated carbons. The effect of one carbon was investigated between 20° to 80°C. At room temp., the change in acids, esters, aldehydes and fusel oil was slight, but not consistently in one direction. However, the treatment at elevated temps. definitely produced an increase in acids and permanganate time, while it indicated decreases in ester, aldehydes and fusel oil.

8826. GARCÍA HERNÁNDEZ, MANUEL. **Differentiation of ethyl alcohol produced by the fermentation of sugar-cane juices from that produced by the fermentation of grains.** *Anales acad. cienc. med., fis. y nat. Habana* 83, 166-7(1944-45).—*C.A.* 46, 679g.

To 5 ml of EtOH add $FeSO_4.7H_2O$ crystals (free of $Fe_2(SO_4)_3$) and 2 ml of 2% KSCN. Development of a red color was attributed to the presence of peroxides, and was considered to indicate that the EtOH was obtained by the fermentation of sugar-cane juices. EtOH from grains did not give the red color.

8827. KOMINEK, E.G. **The use of ion exchangers in brewing-water treatment.** *Brewers Digest* 19, No. 8, 35-7(T104-T106) (1944).—*C.A.* 38, 6043^9.

The effect of various salts in H_2O on the flavor and appearance of beer was discussed. The presence of high concns. of Na_2CO_3 and $NaHCO_3$ in H_2O in certain localities had required blending with distd. water, an expensive procedure. The cation exchanger made possible the removal of such salts and the 2-stage treatment using a cation and an anion exchanger also removed sulfates and chlorides. The mechanics of ion exchangers were explained and the method of regenerating an exhausted exchanger outlined.

8828. KURSANOV, A.L. AND ISAEVA, E. **Adsorption of enzymes by yeast cells.** *Biokhimiya* 9, 273-83(1944).—*C.A.* 39, 3115^6.

In studying the fermentation processes of champagne wine, it was observed that after the introduction of the champagne yeast, the activity of the enzymes found in the original wine decreased during the first several days; some of the enzymes, like β-glucosidase, had completely disappeared. After 3-4 weeks the enzyme activity again increased. The enzymes initially adsorbed by the yeast cells had been liberated when the latter began to disintegrate. The following enzymes were adsorbed from an aq. soln. by yeasts of the strain *Saccharom. steinberg:* sucrose, peroxidase, trypsin, and β-glucosidase.

8829. MATCHETT, J.R.; LEGAULT, R.R.; NIMMO, C.C., AND NOTTER, G.K. **Tartrates from grape wastes.** *Ind. Eng. Chem.* 36, 851-7(1944).—*C.A.* 38, 5637^1.

A substantial part of the approx. 15 million lb of tartaric acid annually required was potentially available in the wastes of the grape processing industry. Lab.-scale expts. indicated the com. feasibility of using synthetic ion-exchange materials for recovery of this and possibly other valuable constituents of the wastes.

8830. NISSEN, B.H. AND LAUFER, STEPHEN. **Filter mass and filter aids. Outline of methods of analysis.** *Brewers Digest* 19, No. 12, 52-3, 56 (160T-1T, 164T)(1944).—*C.A.* 39, 1113^9.

Filter-mass detns. included moisture, ash, total Fe, distribution, sol. material, ether soly., sol. Fe, I_2 test, taste test and microsopic examn. Semiplant practical tests described prepn. of filter pad on a small filter press. Analyses of filter aids, such, as diatomaceous earths, were much the same as those for filter mass. Tests included: color, pH, H_2O soly., taste, speed of filtration and settling time.

8831. SOL'TS, L.M. **A simplified method for refining raw spirit.** *Farmatsiya* 1944, No. 2, 33-5.—*C.A.* 39, 3392^1.

Samples of raw spirit contg. 0.006, 0.01, and 0.02% aldehydes were dild. to 80, 70, 50, 40, and 20 vol.-%, then shaken with 1-5% of a solid adsorbent. Filtration followed at once, or after standing 8 hrs. Adsorption with clay, activated carbon, whiting, and wood ash gave no significant result with raw (88%) spirit and none after diln. to 80 or 70%. In 50% spirit (initial aldehyde content 0.02%) there was some removal of aldehydes: in 40% spirit the completeness of aldehyde removal ranged up to 60%. Activated carbon was most effective as a deodorant, with the added advantage of low spirit loss (3-5% as against 15-25% with clay).

8832. COOLEY, MAXWELL L.; CHRISTIANSEN, JAMES B., AND SCHROEDER, CARL H. **Chromatographic estimation of vitamin A in mixed feeds.** *Ind. Eng. Chem., Anal. Ed.* 17, 689-92 (1945).—*C.A.* 40, 652⁵.

High-purity Na_2CO_3 was used as the adsorbent in the chromatographic procedure. This facilitated the simultaneous sepn. of vitamin A and carotene from most common noncarotene pigments and other substances occurring in livestock feed which interfered with the $SbCl_3$ detn of vitamin A. Neither vitamin A nor carotene was retained appreciably by the adsorbent. A combination of sapon. with the chromatographic procedure may result in a loss of as much as 9% of the original vitamin A, but recoveries were good when sapon. was omitted.

8833. DIETZ, CARL. **Wort filtration with diatomaceous silica filter aids.** *Brewer's J. (Chicago)* 92, No. 5, 22-3, 52 (1945).—*C.A.* 39, 3391⁴.

Chem. changes occurring during wort cooling, theories on the effect of wort cooling, and wort filtration were discussed. Even with comparatively large amts. of coarse filter aids, the flocculent suspended material rapidly provided a compact cake and brilliant wort. Advantages of wort filtration were: (1) a cleaner yeast, (2) increased capacity, (3) increased yield, and (4) greater uniformity of wort at pitching time.

8834. TOMOTA, NORITAKA AND FUJIKI, KAXUYA. **Application of activated carbon in the butanol fermentation of concentrated "unrefined sake."** *J. Soc. Chem. Ind. Japan* 48, 17(1945).—*C.A.* 42, 6053*b*.

The presence of a small amt. of activated carbon promoted BuOH fermentation of corn. The carbon was added 10 hrs after the fermentation was initiated, with the pH held at 5.6 and the incubation at 35°C for 72 hrs.

8835. CARRE. **The use of activated carbons in agricultural industries.** *Bull. assoc. chim.* 63, 108-10 (1946).—*C.A.* 41, 1126*a*.

The phys. and chem. properties of activated carbons were described. In the sugar industry the best results were obtained by prepg. a slurry in sirup, mixing with 2nd carbonation juice, filtering, adding the filter cake to 1st carbonation juice, evapg., sulfuring, and filtering again. Activated carbon could be used to advantage for removing undesirable impurities from alc., wine, cider, perry, vinegar, and vegetable oils.

8836. CLERCK, J. DE AND DUGAUQUIER, CH. **The specific action of certain ions in water on the quality of beer.** *Bull. assoc. anciens etud. brass. univ. Louvain* 42, No. 2, 64-79 (1946).—*C.A.* 41, 4273*g*.

The effect of water with addn. of certain salts on the quality of beer was studied. Sixty exptl. mashes were prepd. with tap water and distd. H_2O to which the following salts were added: NaCl, Na_2SO_4, $NaNO_3$, $CaCl_2$, $CaSO_4$, $Ca(NO_3)_2$, $MgCl_2$, and $MgSO_4$. The effect of the time of addn. was studied by adding the salts before boiling, after boiling, and during moistening of the malt. The Na ion, especially under the form of chloride, produced a very disagreeable taste, while Na_2SO_4 gave a bitter taste to the resulting beer. Nitrates, besides being harmful to the fermentation, were distinctly injurious to the taste of the beer.

8837. CRANSTON, H.A. AND THOMPSON, JOHN B. **Use of an ion-exchange resin in determination of traces of copper. With special reference to powdered and fluid milk.** *Ind. Eng. Chem., Anal. Ed.* 18, 323-6(1946).—*C.A.* 40, 4314⁴.

The Cu was made available by reducing the pH with $HClO_4$. It was then concd. on an ion exchanger in the H-cycle, stripped from the ion exchanger with dil. HCl, and detd. polarographically by means of an additive standard technique.

8838. DUARTE, CORDELIA NOBREGA AND BARBOSA, MARIA DE LOURDES. **The problem of decolorizing beverages.** *Rev. inst., Adolfo Lutz* 6, 122-31 (1946).—*C.A.* 41, 3919*d*.

Liquids wherein sugars were to be detd. should not be decolorized with vegetable carbon, which adsorbs glucose. Lightly colored vinegars, dry wines, fermented cane juice, gin, rum, kirsch, vodka, etc., which contain less than 1% of sugars, could be decolorized with alumina cream. Where the natural coloring was intense, Pb subnitrate gave excellent results. To a quantity of beverage selected in view of the probable sugar content, add 10-20 vol. % of the 50% reagent (avoiding an excess); after a few min. add the calcd. equiv. amt. of a 20% NaOH soln. and filter off the clear soln. This method succeeded well with bitters, apertifs, etc., which were strongly colored with vegetable exts. that resisted carbon and Pb subacetate (exception: dark beers).

8839. HADORN, H. **The removal of acids and salts from fruit juices and concentrates by ion-exchange resins.** *Mitt. Lebensm. Hyg.* 37, 114-23 (1946).—*C.A.* 40, 5503⁸.

All free acid could be removed from fruit juices by passage through an ion-exchange resin, and by combining this passage with another through a cation-exchange resin, all dissociable salts could be taken out. Juice could be passed through 1 vol. of the ion exchange resin at the rate of 10 vols. per hour, but when 6 to 8 vols. have passed through, the resin must be regenerated. All the odor and taste except sweetness due to the sugars disappeared from the juice during the process.

8840. ISHERWOOD, F.A. **Determination and isolation of the organic acids in fruit.** *Biochem. J.* 40, 688-95(1946).—*C.A.* 41, 2505*f*.

Acidified fruit juice adsorbed into silica gel was extd. in the form of a column with 50% (v/v) butanol-$CHCl_3$. The fruit acids were concd. and dissolved in 50% (v/v) *tert*-amyl alc.-$CHCl_3$ for analysis. The acid mixt. was sepd. by means of a partition chromatogram with 0.5 N H_2SO_4 as the non-mobile and the butanol-$CHCl_3$ mixt. as the mobile phase.

8841. NISSEN, B.H.; BLUST, F.A.; EHRENFELD, L.; KAZANJAN, W.; MILLER, M.C.; PINKERTON, K.E., AND SALETAN, L.T. **Filter mass and filter aids.**

Brewers Digest 21, No. 1, 43-5(7T-9T)(1946).—*C.A.* 40, 2083^4.

Samples were sent to 4 collaborators for analysis based on methods reported in 1944. Data were presented on two filter-mass samples for color, % moisture, H_2O-and EtO-sol. material, I_2 test, ash, distribution, microscopic examination, and taste tests. Filter aids were tested similarly and in addn. pH, settling time, speed of filtration, turbidity, and taste were reported. Adjunct to filter mass was tested also. In general the values reported were in good agreement. Variation was shown in results for loss on ignition and speed of filtration. Further study is necessary.

8842. Ribeiro, Manuel Bessa. **Elimination of reducing agents of nonsugar nature from port wine.** *Anais inst. vinho Porto* 1946, No. 7, 51-68.—*C.A.* 42, 3131*i*.

The advantages and disadvantages of the existing methods for the detn. of the reducing sugars in rich wines were discussed. Tests were carried out to solve the problem of the reducing substances, which were not sugars, by elimination with Pb subacetate, Na_2SO_4, and lactic acid. A pH of 3-4 obtained by incorporation of lactic acid into the wine prevented the combination of the Pb subacetate with levulose and glucose.

8843. Roey, G. van. **The filtering mass and its main adjuvant, "asbestos."** *Bull. assoc. anciens étud. brasserie, Univ. Louvain* 42, 1-12 (1946).—*C.A.* 41, 2281*i*.

The prepn. of the filter pads and how to judge good ones were taken up. The pad should be examd. microscopically for structure and fineness of fiber, and a chem. detn. of the amt. of ash should be made. If the insol. ash was 0.25% or more, it showed that the filter contained at least 1% asbestos fibers.

8844. Tanabe, Osamu. **Manufacture of synthetic saké from the waste liquor of ethyl alcohol distillation.** *Shokuryô no Kagaku* (Sci. of Foods) 1, 298-9(1946-47).—*C.A.* 46, 11572*a*.

The waste liquor left behind after distg. EtOH from the fermented liquor from sweet potatoes by the amylo process was filtered and concd. to 1/30 at 40-50°C. To 1 part of this sirupy liquid 1.5 parts of EtOH was added, the ppt. formed was removed by filtration, EtOH was recovered by distn., and then a comparatively palatable liquid (contg.: total acid (as succinic) 6.72, ethersol. acid (as succinic) 6.60, amino acids 0.42, glycerol 13.74, total N 1.22, glucose 8.40%) was obtained. This liquid was treated with a small amt. of active carbon, neutralized partly with Na_2CO_3, dild. suitably, and incorporated with suitable amts. of glucose and EtOH to form synthetic saké.

8845. Gore, Herbert C. **Use of an anion-exchange resin in the preparation of sirups from orange and grapefruit juices.** *Fruit Products J.* 27, 75-6(1947).—*C.A.* 42, 6469*g*.

By use of an anion-exchange resin it was possible to remove 79% of the titratable acids from orange and grapefruit juice with a loss of 19.8% of the ascorbic acid. The process consisted of stirring the fruit juices with about 5% of the resin for 75 min. at room temp., allowing the resin to settle, and decanting the juice. While the sirups produced by filtering and boiling these juices were clear and of good color, the grapefruit sirup possessed a bitter taste.

8846. Jacobs, Morris B. **Oxidative aging of whisky.** *Am. Perfumer* 49, 263-5 (1947).—*C.A.* 41, 3582*h*.

A review describing methods using oxidizing gases and electrolytic treatment.

8847. Jacobs, Morris B. **Catalytic aging of whisky.** *Am. Perfumer* 49, 391,393 (1947).—*C.A.* 41, 4609*g*.

Review of catalytic oxidative methods, and miscellaneous methods such as those using distn. and oxidation sepn. and oxidation extn., and charcoal treatment for the aging of whisky.

8848. Popov, Asen D. **Detection of elderberry pigments and some other foreign natural and synthetic coal-tar dyes in red wine.** *Annuaire univ. Sofia, Faculté sci.* 44, Livre 2, 31-110 (1947-1948).—*C.A.* 43, 8091*f*.

The Fuller's earth used (Tonsil) could be heated to 500°C without visibly diminishing its adsorption efficiency. The coloring matters of wines and elderberry pigments could be sepd. chromatographically in acid, neutral, and alk. soln. in relation to many adsorption media. The coloring matters of the fruit of *Sambucus nigra* and *S. ebulus* possessed the same chromatographic behavior. The pigments of wine and whortleberry were chromatographically identical. There was no difference between the coloring matter of kermes berries and beets. In the coloring matter of beets a supplementary red-violet component was obtained, which under the conditions of chromatography would not be adsorbed by the new method, but went into the filtrate. The method could be used to det. if a wine was colored with elderberry juice.

8849. Robereau-Gayon, J. **The treatment of wines with bentonite.** *Rév. viticult.* 93, 203-7, 237-43 (1947).—*C.A.* 42, 717*h*.

Wines were stabilized against Cu and Fe pptn. by removing colloidal protein by means of bentonite. Unless protein was removed, wine proteins flocculated gradually and carried the Fe and Cu with them. The unnatural flavor conferred by bentonite was removed by addn. of charcoal. The phys. character of bentonite necessary to give satisfactory results was described.

8850. Valaer, Peter. **Chromatographic adsorption of wines.** *J. Assoc. Offic. Agr. Chemists* 30, 225-6(1947).—*C.A.* 41, 6666*d*.

The adsorption mixt. could consist of equal quantities of filter-cel and Al_2O_3 or of 2 parts by wt of Al_2O_3 to 1 part by wt of filter-cel. The simplified procedure consisted in wetting the adsorption tube with water, dilg. 10 ml of the wine to 50 ml, pouring through the adsorption tubes (an 18-20-in. vacuum expedited the operation), passing 25 ml of water through the adsorption tube, continuing suction of air for 10 min., and proceeding as in the original method. It had been found that: (a) all berry wines exhibited a blue fluorescence; (b) apple, peach, raisin, pear, grape, prune, plum, and cherry wines exhibited bright yellow fluorescence; (c) certain wines like elderberry exhibited unusually deep blue colors; (d) the prohibited pokeberry wine, which was sometimes incorporated into wines, exhibited fluorescence that seems characteristic.

8851. KIELHÖFER, E. **The thermal turbidity of 1947 wines.** *Deut. Wein-Ztg.* 84, 293-4(1948) *Chem. Zentr.* 1949, 1012.—*C.A.* 46, 9247*b*.

The 1947 young wines were far more sensitive to heat than other young wines. Almost all of these wines became turbid at 40-45°C; many of them did even upon standing 3-5 days at 25-6°C. The substances responsible for the turbidity could be removed with gelatin or with isinglass, but a 10% SiO_2 sol gave the best results (500-1000 ml per 1000 liter). Partial clarification was obtained by the use of large amts. of wine carbon (600 g per 1000 liter) or of fluid wine yeast (90-100 liter). Filtration through kieselguhr, cellulose mass, etc., had little effect on the turbidity. The most effective method of clarification was warming the wine to 25-6°C for 3-5 days.

8852. LOZA, V.M. AND VECHER, A.S. **Clarifying wine with bentonites.** *Vinodelie i Vinogradarstvo S.S.S.R.* 8, No. 3, 8-11(1948).—*C.A.* 43, 353*e*.

Bentonite suspensions neutralized (to phenolphthalein) by H_2SO_4 retained their clarifying powers without affecting the titratable acidity of the wine; such suspensions were recommended for treating wines of low acidity. Further neutralization gave a denser ppt. However, neutralization was not a requisite for bentonite suspensions in most cases, since at ordinary dosages acidity was not lowered more than 0.2%.

8853. ODA, MAKOTO. **Butanol fermentation with sugar as the raw material. IV. The effect of adding active carbon.** *J. Agr. Chem. Soc. Japan* 22, 67(1948).—*C.A.* 46, 1705*a*.

Beneficial results were obtained by adding com. active carbon to the mash. Treatment of active carbon with acid or alkali was not effective in improving its effect.

8854. RANKOV, G. AND POPOV, A. **A method for detection of the coloring substance from elderberry in red vinegar.** *Annuaire univ. Sofia, Faculte sci.*, Livre 2, 45, 145-53, German summary, 154-6 (1948-49).—*C.A.* 45, 813*i*.

A chromatographic method, with PbO and Al_2O_3 as adsorbants, was developed to detect artificial coloring of vinegar with elderberry juice. The sample of vinegar (100 ml) was dild. by twice evapg. to 15-20 ml and diln. with H_2O to 100 ml; a 30 ml aliquot was then neutralized with $CaCO_3$, filtered, and passed through a glass tube contg. a 1 cm thick layer of PbO over Al_2O_3 (2-4 cm); a blue-violet coloration of the Al_2O_3 layer indicated presence of elderberry juice.

8855. RUBIA PACHECO, J. DE LA AND BLASCO LÓPEZ-RUBIO, F. **Practical method of clarifying and aging wines.** *Ion* 8, 303-4(1948).—*C.A.* 42, 9068*i*.

Finely dispersed O_2 was bubbled through turbid wine of excessive Fe content (40-60 mg Fe/liter.) On storage and filtration a clear wine of aged flavor was obtained. Residual Fe was 1.6-5 mg/liter.

8856. SKŘIVÁNEK, M. **A new procedure for filtering solutions particularly fermented substrates.** *Chemie* (Prague) 4, 227-8(1948).—*C.A.* 46, 2747*a*.

Freshly pptd. $CaHPO_4$ in the substrate formed a sediment which permitted easy and satisfactory filtration. For monosaccharides and their oxidation products add 1-5 ml of 70% H_3PO_4 to a liter of substrate, keep at 50°C for 10 min., neutralize with freshly pptd. $CaCO_3$, and filter with any accepted filtration. For polysaccharides which were hydrolyzed by acids, add 1 g of slacked lime or the milk of lime to a liter of the substrate, keep at 50°C for 10 min., and neutralize with H_3PO_4 dild. 1:1. The method worked well for fruit juices.

8857. SOMMER, HERMANN; MONNIER, ROBERT P.; RIEGEL, BYRON; STANGER, D. WARREN; MOLD, JAMES D.; WIKHOLM, DONALD M., AND KIRALIS, ELIZABETH S. **Paralytic shellfish poison. I. Occurrence and concentration by ion exchange.** *J. Am. Chem. Soc.* 70, 1015-18(1948).—*C.A.* 42, 6878*i*.

The digestive glands of 4360 kg of mussels contg. a min. poison content of 4000 mouse units (M.U.)/100 g mussel were worked up during a 3-year period. The glands were preserved in acid alc., ground and the pH of the defatted brei was adjusted to 4.5. The solid was centrifuged off, the supernatant liquid decolorized with active carbon and concd. Increase in pH and temp. decreased the activity. Further concn. was effected by passing the ext. through Na-Decalso and elution with 20% $BaCl_2$. Concn. of the eluate and extn. with alc. gave a 50-70% yield of the poison with a toxicity of 70-140 M.U./mg constituting an 18-fold concn.

8858. SOMMER, HERMANN; RIEGEL, BYRON; STANGER, D. WARREN; MOLD, JAMES D.; WIKHOLM, DONALD M., AND MCCAUGHEY, MARGARET B. **Paralytic shellfish poison. II. Purification by chromatography.** *J. Am. Chem. Soc.* 70, 1019-21(1948).—*C.A.* 42, 6879*b*.

Since the poison concentrates prepd. by ion exchange on Decalso contained salts of other org. bases and inorg. salts, further purification was carried out by chromatography on Norit A from 1.0 *N* HCl solns. and elution with distd. H_2O. Exts. with activity greater than 1 M.U./γ were obtained. The details were described.

8859. STADTMAN, FLOYD H. **Deterioration of dried fruits. III. Chromatographic separation of carbonyl compounds as 2,4-dinitrophenylhydrazones.** *J. Am. Chem. Soc.* 70, 3583-6(1948).—*C.A.* 43, 1120*i*.

Apricot concentrates, continuously extd. during storage with Et acetate and the extd. material in H_2O treated with 2,4-dinitrophenylhydrazone, gave a mixt. of 2,4-dinitrophenylhydrazones which, chromatographed on $MgSO_4$ and eluted with C_6H_6-petr. ether, C_6H_6, Et acetate, and EtOH, were shown to contain furfural and hydroxymethylfurfural (by spectroscopic examn.), as well as 13 other CO compds.

8860. WAHHAB, A. **Deterioration of dried fruits. II. Identification of furfurals.** *J. Am. Chem. Soc.* 70, 3580-2(1948).—*C.A.* 43, 1120*h*.

The formation of hydroxymethylfurfural during the darkening of dried apricots was established by the prepn. of the Bz deriv., the phenylhydrazone, and the 2,4-dinitrophenylhydrazone. The evidence for the formation of furfural was based on its steam volatility, spectroscopic analysis, partition between ether and H_2O, and the behavior of its 2,4-dinitrophenylhydrazone on a Tswett column.

8861. BÄSSLER, K. **American bentonite and its suitability for the treatment of wine.** *Weinblatt* 43, 448-50(1949); *Chem. Zentr.* 1950, I, 1040.—*C.A.* 46, 8807*h*.

American bentonite was superior for the removal of protein from wine. Its swelling and adsorption capacities were essentially higher than those of German bentonite. A high tannin content acted as a stabilizer for the bentonite. The addn. of gelatin (e.g., to tannin-contg. fruit wines) therefore accelerated pptn. and filtration. Bentonite also removed undesirable tastes.

8862. BOURNE, E.J.; DONNISON, G.H.; PEAT, S., AND WHELAN, W.J. **Fractionation of potato starch by means of aluminum hydroxide.** *J.Chem. Soc.* 1949, 1-5.—*C.A.* 43, 6447*a*.

To a 3% aq. dispersion of starch contg. 3.5 g $Al_2(SO_4)_3 \cdot 18H_2O$/3.5g starch, an excess NH_4OH was added, and the mixt. centrifuged. The acidified supernatant liquid failed to give the starch-iodide test indicating that Al_2O_3 had adsorbed starch completely. When this ppt. was boiled with H_2O, most of the amylose passed into soln., whereas practically none of the amylopectin dissolved. When less $Al(OH)_3$ was used, amylopectin was preferentially adsorbed.

8863. BUHRER, NILTON E. **Detection of caramel in brandy.** *Chemist Analyst* 38, 86 (1949).—*C.A.* 44, 2171*e*.

Evap. 50 ml to nearly 10 ml, filter if necessary, and to a part of the concentrate add 2 ml of $Pb(OAc)_2$ reagent. Shake and then centrifuge for 5 min. If the supernatant liquid is colorless, caramel is absent. If it is colored, either caramel or a dye may be present. Take another 5 ml of the concentrate and treat with HCl + powd. Zn. If, after this treatment, the liquid is yellow, caramel is present.

8864. CARPENTER, D.C. AND SMITH, W.C. **Separation of a crystalline globulin from tomato juice and determination of its isoelectric point.** *Arch. Biochem.* 23, 45-8 (1949).—*C.A.* 43, 9167*i*.

A cryst. globulin, isolated from tomato juice serum, proved to be anionic at pH 4.2. It could be removed by an anion exchange resin without going through tedious dialysis prior to removal of the food accessory by a cation exchange resin.

8865. CUNHA, RAMOS, MÁRIO DA AND TEIXEIRA DE OLIVEIRA, HERNÂNI. **Chromatographic study of the coloring materials of port wine.** *Anais inst. vinho Porto* 1, No. 10, 11-24 (1949).—*C.A.* 45, 7745*g*.

Colored plates of chromatograms obtained from variously treated wines were exhibited. The adsorbents were Al_2O_3 and a local clay.

8866. GARRETT, O.F. **Application of ionic exchangers to the processing of milk products.** *Proc. 12th Intern. Dairy Congr.* 3, 49-56 (1949).—*C.A.* 44, 6982*c*.

A study was made of the effect of anionic and cationic exchangers on milk, whey, and ice cream mix. Evapd. milk was stabilized against sterilization. Dried cream was more sol. and did not oil off on reconstitution when properly treated before drying. The Ca-ratio must be reduced from 1.2 to below 0.75 in the cream for best results.

8867. GEHRKE, C.W. AND ALMY, E.F. **The action of mineral-ion exchange resins on certain milk constituents.** *Science* 110, 556-8 (1949).—*C.A.* 44, 5488*b*.

The removal of Ca, Na, K, and Mg ions from soln. was studied by the cation exchanger, Zeo-Karb-H. The increasing order of removal was from Na to K to Mg to Ca in individual ion solns. In mixts. Ca was more completely removed if the anion present was citrate, than if it was Cl^-. Single, binary, and ternary solns.of HCl, citric acid, and H_3PO_4 were passed through an anion exchanger, De-Acidite.

8868. KIELHÖFER, E. **Experiences in the treatment of wines which tend to develop protein turbidities.** *Weinblatt* 43, 540-2(1949).—*C.A.* 46, 9247*e*.

Expts. with German and American bentonites, fibrous Al_2O_3, Brockmann Al_2O_3, and celite showed that only bentonite effectively prevented the development of turbidity in wine. The use of 2 g bentonite per liter removed 49-59 mg of N per liter. This was several times the amt. of N removed by the other prepns. The use of as much as 3 g/liter of bentonite had no effect on the taste of the wine. However, the mineral content of the wine was increased by 240 mg/liter, probably due to the adsorption of exchangeable Na, Ca, K, and Mg by the wine. The amt. of N pptd. by thermal treatment (25-30°C) was essentially less than that removed by bentonite. Therefore, the thermally treated wine was less stable but the organoleptic properties were probably less affected.

8869. LEGAULT, R.R.; NIMMO, C.C.; HENDEL, C.E., AND NOTTER, G.K. **Tartrates from grape wastes - use of anion exchangers in a chloride-tartrate cycle.** *Ind. Eng. Chem.* 41, 466-71 (1949).—*C.A.* 43, 3969*i*.

Tartaric acid, as calcium tartrate, was recovered effectively by the exchange of tartrate for Cl^- on an anion exchange resin. Recovery data indicated a useful life of 500 cycles for the materials with a recovery of 1800-2000 lb of tartaric acid/ft^3, by purging every 30 cycles and with a makeup of exchange material of about 10% each 50 cycles. Hot NaOH was most effective in reactivating the exchanger, fouled by cloudy still slop.

8870. MATHERS, ALEX P. **Detection of tartaric acid and tartrates in wine.** *J. Assoc. Offic. Agr. Chemists* 32, 417-21(1949).—*C.A.* 43, 7189*a*.

Activated carbon (0.5g) was added to 10 ml wine dild. with 50 ml distd. H_2O, the mixt. warmed on a steam bath for 10 min., and filtered into a centrifuge bottle. Addn. of 5 ml of 5% neutral AcOPb soln. yielded a ppt. which, after centrifuging, washing with 40 ml distd. H_2O and recentrifuging, was dissolved in 5 ml $AcONH_4$ soln. (20% in glacial AcOH). The ppt. which formed on the addn. of a mixt. of 5 ml of 3% AcOPb soln. in glacial AcOH and 25 ml anhyd. EtOH was collected by centrifugation and treated for 20 min. with a mixt. of 4 ml 10% Na bisulfate soln., 10 ml 1% HIO_4, and 10 ml H_2O. After addn. of powd. $NaHSO_3$, 4 ml of *p*-nitrophenylhydrazine reagent was added and the centrifuge tube placed in boiling H_2O for 10 min., the soln. filtered into a separatory funnel, and the aq. layer extd. with 50 ml Et_2O. After washing the Et_2O ext. with 5 ml distd. H_2O, it was passed through an adsorption column packed with glass powder, the column washed with 30 ml Et_2O, and eluted with 20 ml anhyd. EtOH.

8871. Otting, H.E. **Ion-exchange application in milk products.** *Ind. Eng. Chem.* 41, 457-9 (1949).—*C.A.* 43, 3942*g*.

The cation-exchange removal of Ca from milk to produce a soft or non-curding milk was described. The problems were associated with taste, color, appearance, cream-line, bacterial count, etc., and with maintaining a favorable balance of Ca to P. Ion exchange treatment retarded lactose crystallization in ice cream and prevented coagulation of milk proteins in the preparation of evaporated milk.

8872. Sisakyan, N.M. and Bezinger, E.N. **Separation and determination of amino acids in wine by the methods of (partition) distribution chromatography on paper.** *Doklady Akad. Nauk S.S.S.R.* 69, 573-6 (1949).—*C.A.* 45, 7745*b*.

Examn. of Georgian Kakhetin wines by means of partition paper chromatography showed the presence of: glutamic acid, alanine, valine, and proline; very small amts. of aspartic acid, serine, and threonine were detected, and phenylalanine might be possibly present.

8873. Spaeth, Earl C. and Rosenblatt, David H. **Partition chromatography of anthocyanidins.** *Science* 110, 258(1949).—*C.A.* 43, 9359*d*.

In the course of work on the coloring matter in wine and grapes, a method was developed for sepg. malvidin and petunidin by partition chromatography on a column of pptd. metasilicic acid. A mixt. of malvidin and petunidin in 1:3 BuOH-Et_2O was placed on a column prepd. from 2.38 g metasilicic acid, 1.32 ml 10% H_3PO_4, and 1:3 BuOH-Et_2O and washed through with the latter. Malvidin formed a lower and petunidin an upper band.

8874. Asô, Kiyoshi; Shibaski, Kazuo, and Nakayama, Teizo. **The utilization of apples. I. Effects of ion exchanger on juice and cider.** *J. Fermentation Technol.* (Japan) 28, 454-9(1950).—*C.A.* 47, 1306*c*.

By passing 2 cation and anion exchangers alternately for several times the last anion exchanger (1 kg) adsorbed 106 g malic acid from crude malic acid soln., 69.5 g from purified apple juice, 55.5 g from apple wine, and 36.5 g from turbid juice. The turbid apple juice with high viscosity had to be clarified before treating; otherwise the efficiencies of the exchangers greatly decreased. 63.65% malic acid was released from the exchanger. Excess acids and inorg. substances were excluded by this treatment of the juice and wine, and it also served to prevent their deterioration.

8875. Bosticco, A. and Ramello, Luigi. **Treating acid milk by ion exchangers.** *Ann. facoltà. med vet. Torino* 1, 152-7(1950).—*C.A.* 47, 1303*d*.

Milk treated by anion exchangers got a substantial reduction of total acids, some oscillatio of the pH, slight changes of the rH, d., and reductase time, a slight decrease of the fat and P, and no change of protein, lactose and Cl.

8876. Etienne, A.D. and Beyer, G.F. **Determinatio of alcohol in wines and liqueurs.** *J. Assoc. Offic. Agr. Chemists* 33, 1016-20(1950).—*C.A.* 45 2625*f*.

The William's method was modified for wines and liqueurs. The principal modifications were: (1) an improved extg. reagent; (2) an increase in the vol. of extg. reagent and in the vol. of sample; (3) a redesigned app.; and (4) treatment of sample with activated carbon to prevent emulsions. The method was rapid and accurate, ±0.5%.

8877. Golovatyǐ, R.N. **Determination of copper and iron in wines by cationites.** *Vinodelie i Vinogradarstvo S.S.S.R.* 10, No. 5, 27-8 (1950). —*C.A.* 44, 9620*g*.

The prepn. of a sulfo-resorcin cation exchange resin was described. Both Cu and Fe could be quantitatively adsorbed even from satd. solns. of tartaric acid. In the presence of EtOH, tartaric acid, glycerol, or glucose, however, the activity of the resin was reduced. For Fe detns. 300 ml wine was filtered through the resin; for Cu, 2-3 liter was necessary. Fe was eluted from the H-form of the exchanger by a 20-25% KCl soln. Cu was similarly eluted from the K-form of the resin.

8878. Guntz, A.A. **Ion-exchangers, and their possible application in wine technology.** *Chim. anal.* 32, 246-8(1950).—*C.A.* 46, 7280*e*.

Exchange of cations for H ion should make possible the detn. of total anions by a simple measurement of acid content. Suitable anion-exchange reactions ought to make possible the removal of acetates from wines.

8879. Haller, H. S. and Bell, R. W. **Ion exchange as a means of improving the keeping quality of frozen homogenized milk.** *U.S. Dept. Agr. Annual Conference*, Cornell Univ. (June 20-22, 1950).

Removal of about one-fourth of Ca and lesser amts. of other cations with no removal of the citrates, phosphates, or chlorides resulted in definite improvement in physical stability. The most satisfactory treatment involved the use of an org. cation exchanger regenerated to a 99:1, Na:H ratio. This treatment, by removal of as little as 10 to 15% of the Ca and lesser amts. of the other cations, with no removal of the anions, produced a milk of normal flavor with improved physical stability and deferment of an oxidized flavor.

8880. Haller, H. S. and Morin, A. C. **Ion exchange as a means of varying the salt constituents of milk.** *U.S. Dept. Agr. Annual Conference,* Cornell Univ. (June 20-22, 1950).

An org. cation exchanger regenerated to a 99:1, Na:H ratio produced a soft curd milk of normal pH with one treatment. The milk retained all its citrates, phosphates, and chlorides. Treatment with a cation exchanger regenerated to a 93:7, Na:H ratio, followed by treatment with an anion exchanger, removed up to approx. 20% of the citrates, phosphates, and chlorides in addn. to Ca and other cations. Treatment with a strong anion exchanger, followed by treatment with a small amt. of cation exchanger in the H-form removed citrates and chlorides and small amts. of Ca and other cations, but no phosphates.

8881. Hozumi, Tadahiko and Satô, Makoto. **Studies on alcoholic beverages by paper partition chromatography. I. Detection of reducing sugars of saké and wine.** *Nippon Jôzô Kyôkai Zasshi* (J. Soc. Brewing Japan) 45, 322-5(1950).—*C. A.* 46, 1706*a*.

The R_f values of reducing sugars by the ascending method with (1) PhOH satd. with H_2O or a (2) $BuOH$-Me_2CO-H_2O mixt. (4:1:1) were, resp., D-maltose 0.36-0.38, 0.18-0.19; D-glucose 0.41-0.45, 0.31-0.32; D-lactose 0.46-0.47, 0.15-0.16; D-galactose 0.52-0.54, 0.31-0.39; D-mannose 0.51-0.54, 0.38-0.39; D-xylose 0.54-0.55, 0.43-0.45; D-arabinose 0.53-0.57, 0.38-0.42; D-fructose 0.56-0.57, 0.43-0.45; and D-rhamnose 0.67-0.69, 0.57-0.58. The coloring reagent used was $PhNH_2$ acid phthalate. Japanese saké contained D-glucose and D-maltose, while white wine contained D-fructose, D-glucose, and D-maltose.

8882. Ichikawa, Osamu and Hôjô, Susumu. **The paper partition chromatogram in the course of beef putrefaction. I.** *Igaku to Seibutsugaku* (Med. and Biol.) 17, 49-52(1950).—*C. A.* 45, 1266*g*.

Beef was putrefied at room temp. in summer and, at intervals, samples were withdrawn and hydrolyzed. The amino acids and amines thus obtained were examd. by the paper partition chromatography. The beef after putrefaction for 48 hrs still contained all the essential amino acids, and significant changes were not observed in the number of amino acids detected. Unidentifiable spots increased suddenly after 48 hrs, and most of them were suggested to be amines, owing to their colors with ninhydrin and positions on the paper chromatogram.

8883. Itô, Kyôgorô and Kawanishi, Junsaku. **Synthetic ion-exchange resins in the brewing industry.** *Nippon Jôzô Kyôkai Zasshi* (J. Soc. Brewing Japan) 45, 385-91(1950).—*C. A.* 46, 1706*h*.

In purifying raw alc. an ion-exchange resin was used instead of active carbon for treatment after oxidation of impurities. Electrolytes could be removed successfully. Aldehydes and fusel oil could be partly removed. The pH before oxidation and before ion exchange should be controlled. The resin, especially anion-exchange "Dia-ion A" (Nippon Kasei Co. Ltd.), had the disadvantage of being slightly unstable and sol. in EtOH.

8884. Itô, Kyôgorô; Kawanishi, Junsaku; Kasai, Keisaku, and Yamazaki, Takeshi. **General characteristics of commercial active carbon in the recent (Japanese) market.** *Nippon Jôzô Kyôkai Zasshi* (J. Soc. Brewing, Japan) 45, J. 48-52, 59-62(1950).—*C. A.* 46, 7281*i*.

Thirty-six samples were analyzed and examd. as the purifying agent of saké. The intense black active carbon with low d. was generally best.

8885. Kubo, Shoji and Tsutsumi, Chuichi. **Application of cation-exchange resin in the determination of phosphorus in cereal foods.** *Rept. Food Research Inst.* (Japan) 3, 75-85(1950); 5, 163-9(1951).—*C. A.* 47, 7127*a*.

A detailed report of the method.

8886. Kubo, Shoji and Tsutsumi, Chuichi. **Application of cation-exchange resins to the determination of phosphorus in foods.** *Bull. Chem. Soc. Japan* 23, 187-9(1950)(in English).—*C. A.* 46, 4133*i*.

Ash a 5 g sample at 550-600°C. Dissolve in HCl and evap. to dryness. Dissolve in dil. HCl, filter, and pass through a cation exchanger column (100-200 mesh) in Na form. Adjust the eluate to pH 4.63 (methyl red) and titrate with 0.05 *N* alkali to pH 8.98 (phenolphthalein-thymol blue mixt.). Large amts. of Fe interfered.

8887. Loza, V. M. and Vecher, A. S. **Effectiveness of various bentonites in the clarification of wine.** *Vinodelie i Vinogradarstvo S.S.S.R.* 10, No. 7, 35-9(1950).—*C. A.* 45, 4876*c*.

Since it was known that the capacity for intracryst. expansion was an important factor on the effectiveness of the clarification of wines with bentonite, this property of various bentonites was studied. The colorimetric reaction of benzidine with montmorillonite was used as an indication of the amt. of it present. For effective clarification of wines, bentonite must be at least 99% colloid. The Crimean bentonite although having a satisfactory swelling capacity, especially after treatment with alkali, had only 18% colloid and was therefore unsuitable. The cation-exchange values for the various bentonite samples varied from 92 to 100 equiv. per 100 g. The various samples of bentonite were compared in their speed and completeness of wine clarification and these values were correlated with phys. and chem. properties of the sample.

8888. Ongaro, Dante. **Behavior of wine with organic ion exchangers.** *Riv. viticolt. e enol. (Conegliano)* 3, 277-83 (1950).—*C. A.* 44, 11016*d*.

Percolation through a cation exchanger freed wine from both inorg. and org. cations; the resulting liquid was completely deacidified by an anion exchanger. Treating wine with the anion exchanger alone eliminated the free acids and caused some changes of the salt compn.

8889. Ôtaka, Yôichi. **Constituents of saké. I. Identification of amino acids by paper chromatography.** *J. Agr. Chem. Soc. Japan* 24, 366-8(1950-51).—*C. A.* 46, 10528*f*.

Cystine, aspartic acid, glutamic acid, serine, glycine, valine, leucine, phenylalanine, tyrosine, tryptophan, proline, histidine, arginine, and lysine were detected in saké with paper chromatography. Their contents were roughly estd. by comparing chromatograms obtained with samples and pure amino acids. Contents of glutamic acid, glycine, alanine, valine, leucine, and arginine accounted for the majority of amino acids in saké.

8890. Pavlov-Grishin, S. I. **Use of "Oglanlinskovo" bentonite in the clarification of wine.** *Vinadelie i Vinogradarstvo S.S.S.R.* 10, No. 7, 40(1950).—*C.A.* 45, 4876*f*.

Twelve wines were subjected to clarification with "Oglanlinskovo" bentonite. The rate of treatment was 4-30 g of air-dry bentonite per decaliter of wine, applied as a 10% aq. suspension; 3 wines were completely clarified, darkened to a slight turbidity, and the remaining 5 were not clarified at all. The completely clarified wines required 2 hrs treatment with bentonite. The titratable acidity (calcd. as tartaric acid) dropped 0.22% after treatment with 1-10% suspensions of bentonite and the pH dropped 0.05 units.

8891. Procopio, Mario and Spanò, Nello. **Ion exchange in wine treatments.** *Riv. viticolt. e enol.* (Conegliano) 3, 381-6, 412-18(1950).—*C.A.* 45, 3989*i*.

The results of some batch expts. with both cation exchanger and anion exchangers on wine were reported. High doses 5-20% of cation exchanger (H form) changed wine compn. too much, while doses of 1-2.5% were effective in removing Fe and Cu without affecting wine ashes too much (decrease from 0.220-0.236 to 0.103-0.117%) and acids (increase from 5.6-7.5 to 6.7-9.4 per thousand; pH from 3.1 to 2.1). Doses from 1 to 10% free anion exchanger decreased acids from 0.74 to 0.18%, changed the pH from 3.1 to 5.2 and also removed Fe.

8892. Scandura, Camillo and Grasso, Sebastiano G. B. **Acid removal from wines by anion exchangers.** *Riv. viticolt. e enol.* 3, 17-24 (1950).—*C.A.* 44, 4193*e*.

The batch method of acid removal was discussed, as fixed acids were better adsorbed than volatile acids. By the column method total acids were removed; the addn. of fixed org. acids after the treatment was suggested.

8893. Scandura, Camillo and Grasso, Sebastiano G. B. **Acid removal from wines by anion-exchange resins.** *Riv. viticolt. e enol.* 3, 177-80(1950).—*C.A.* 44, 7022*a*.

Some practical expts. with an industrial app. were reported.

8894. Spaeth, Earl C. and Rosenblatt, David H. **Partition chromatography of synthetic anthocyanidin mixtures.** *Anal. Chem.* 22, 1321-6 (1950).—*C.A.* 45, 7744*i*.

Preliminary to a study of the colored substances in wine and grapes, a chromatographic method for the sepn. of mixt. of synthetic malvidin chloride, petunidin chloride and delphinidin chloride was developed with a 10 cm silicic acid column with 10% H_3PO_4 as the immobile aq. phase and a soln. of 2 parts phenol and 1 part toluene as the nonaq. phase. Three sep. colored portions of the eluate were collected, and the anthocyanidins were detd. spectrophotometrically.

8895. Tarantola, Clemente. **Invertase in wines.** *Riv. viticolt. e enol.* 3, 229-32, 247-53(1950).—*C.A.* 44, 9113*i*.

Wines were not to be subjected to ultrafiltration or decolorization with charcoal, or tannin-gelatin treatment, as some losses of invertase may occur by such treatments. Only the addn. of 500 p.p.m. SO_2 or 200 p.p.m. NaF could be used to stop wine fermentation without invertase injury.

8896. Torii, Hideichi and Furuya, Kôzô. **Separation of tea tannin by means of paper chromatography.** *J. Agr. Chem. Soc. Japan* 24, 178-81(1950-51).—*C.A.* 46, 10483*a*.

BuOH satd. with H_2O was the most favorable developing solvent for sepg. tea tannin with paper chromatography. Six spots of the following R_f values were observed after spraying $Fe_2(SO_4)_3$ soln. on the chromatogram: 0.05-6, 0.22-7, 0.33-7, 0.37-41, 0.41-4, 0.67-9; the colors of these spots were: blue, blue, green, blue, green, blue, in this order. Tannin compn. of tea leaves tested with this method was different with varieties of the plant.

8897. Valaer, Peter Jr. **Chromatographic adsorption of wines.** *J. Assoc. Offic. Agr. Chemists* 33, 319-20(1950).—*C.A.* 46, 7280*f*.

Fluorescent colors shown by the Al_2O_3 in ultraviolet light may afford evidence of adulteration of berry wines with grape, peach, apple, and cherry.

8898. West, D. B.; Evans, R. F., and Becker, Kurt. **Chromatographic analysis in the brewing laboratory.** *Proc. Am. Soc. Brewing Chemists* **1950**, 107-17(1951).—*C.A.* 45, 8716*i*.

Columnar, paper, and ion-exchange techniques were discussed. Investigations were discussed of the sepn., concn., and chromatography on columns of Sn, Cu, and Fe sometimes found in beer. Further work was necessary for quant. chromatographic methods to det. these metals. Research possibilities were suggested by reviewing the literature of allied industries.

8899. Becker, Kurt. **Ion-exchange treatment for brewing water.** *Brewers Digest* 26, No. 7, 43-9(1951).—*C.A.* 46, 3709*h*.

Ion-exchange methods in relation to the treatment of natural waters for brewery uses were described. Water was demineralized more economically by means of ion exchange than by distn. Exchange treatment of waters contg. more than 175 p.p.m. of carbonate hardness, $MgSO_4$ and Na_2SO_4 combined, or $MgCl_2$ and NaCl combined was shown to be as feasible as boiling, lime softening, etc. In order properly to approach the problem of water purification for brewery purposes an individual study should be made of the particular type of water to det. proper treatment. It was suggested that waters contg. under 175 p.p.m. of carbonate hardness and without freakish properties otherwise will not generally warrant demineralizing.

8900. Capt, Emile. **Attempts to prevent iron casse by the use of special carbons.** *Stas.*

fédérales essais viticol., arboricol. chim. agr., Lausanne et Pully, Pub. No. **408**, 883-6 (1951).—*C.A.* **46**, 3711*a*.

Owing to changes in appearance and flavor of wine, the treatment of iron casse with decolorizing carbon did not give satisfactory results.

8901. FÁBREGUES Y SOLAR, JOSE MARIA DE AND MESTRES JANÉ, ANTONIO. **Treatment of grape must with ion-exchange resins.** *Bol. inst. nacl. invest. agron.* (Madrid) **11**, 429-43(1951). —*C.A.* **46**, 10527*e*.

Minerals, colloidal materials, and color which were present in concd. grape limited its use as a source of sugar. The removal of these substances with ion-exchange resins was undertaken with 2-liter samples, which were passed through columns of 100 g anion- or 200 g cation-exchange resin, 500-ml fractions were collected. Detns. of total acids, total SO_2, free SO_2, and reducing sugars were tabulated for individual fractions. The density of the must was 1.0628 and its sugar concn. 15.6%. After an addnl. passage through the anion column the must was completely free from acid and free and combined SO_2. Musts freed from anions and having a pH of about 7 were very difficult to ferment.

8902. GENIN, G. **The recovery and purification of lactose by means of ion-exchange resins.** *Lait* **31**, 511-18(1951).—*C.A.* **47**, 228*i*.

The mechanism of the action of ion-exchange resins was reviewed, and 2 methods of recovering lactose from cheddar-cheese whey were discussed.

8903. GRASSO, SEBASTIANO. **New aspects of the decoloration with resins.** *Olearia* **5**, 24-7 (1951).—*C.A.* **45**, 6350*i*.

Data were given on exptl. tests of the decoloration of raw concd. glycerol, wine, and molasses with a synthetic ion-exchange resin. These inconclusive tests showed that Duolite S-30 did not lose much of its decolorizing power on regeneration.

8904. HARRIS, G.; BARTON-WRIGHT, E. C., AND CURTIS, N. S. **Carbohydrate composition of wort and some aspects of the biochemistry of fermentation.** *J. Inst. Brewing* **57**, 264-80 (1951).—*C.A.* **46**, 9775*e*.

The presence of fructose, glucose, sucrose, maltose, maltotriose, and maltotetraose in wort was confirmed by use of paper chromatography. The presence of maltopentaose was suggested. No free pentoses or isomaltose was found. On subjecting the wort to fermentation by a top-fermenting yeast, glucose was completely removed in 13 hrs, fructose was first excreted then assimilated, all sucrose was absorbed within 25 hrs. Maltose was fermented at a slower rate than either hexose or sucrose.

8905. LÜERS, HEINRICH. **Improvement of brewing water by ion exchangers.** *Brauwelt* **1951**, 407-11.—*C.A.* **45**, 10481*c*.

A discussion of ion exchangers and their applications to brewing operations. $CaCl_2$ was suggested as an additive to demineralized water because of the favorable organoleptic properties of Cl^- and the increase in acidity of wort caused by Ca^{++}.

8906. MALYOTH, ELEANORE. **Paper chromatography of honey.** *Naturwissenschaften* **38**, 478(1951). —*C.A.* **46**, 10482*g*.

With BuOH-AcOH-H_2O as solvent, well-sepd. bands of fructose, glucose, sucrose, maltose, melezitose, and dextrins were obtained on one strip. To develop, the strip was sprayed 1st with aniline oxalate; fructose, glucose, and maltose appeared brown. It was then sprayed with $KMnO_4$ soln. contg. 3% H_2SO_4. During drying at 90-100°C the paper lost color and fructose, sucrose, and melezitose appeared gray-black, glucose and maltose remaining brown. This was a typical behavior for ketoses *vs.* aldoses. Amino sugars could be found by spraying with ninhydrin; they appeared as red spots.

8907. PROCOPIO, MARIO AND ZANIN, SECONDO. **Carbons for iron removal (from wines).** *Riv. viticolt. e enol.* (Conegliano) **4**, 351-8(1951). —*C.A.* **46**, 3711*b*.

Fe removal from both artificial solns. and wines was tried with an active HCl-washed charcoal, 2 ion exchangers (Cecation and Cecanion), and a French carbon called PCH 8. Only PCH 8 seemed to give satisfactory results (30-50% removal) although its action was never const., but was influenced by the liquid to be treated. In any case, the efficiency of $Fe(CN)_6^{4-}$ was not reached.

8908. SCANDURA, CAMILLO. **Acid removal from wine by anion exchangers.** *Riv. viticolt. e enol.* (Conegliano) **4**, 323-8(1951).—*C.A.* **46**, 2234*g*.

In order to avoid losses of particularly important substances, it was suggested adding to the wine, after the exchange treatment, a calcd. quantity of H_2SO_4 and repeating the passage through the exhausted column so that the lost substances could be recovered.

8909. STRINGER, J. E. C. **Chromatograph test for the presence of moisture in alcohol.** *Nature* **167**, 1071-2(1951).—*C.A.* **46**, 1921*g*.

Paper-strip ascending chromatography was used for detecting H_2O (0.1-5%) in alc. The alc. was allowed to ascend a calibrated paper strip contg. 2 zones, the lower impregnated with $FeSO_4$ and the upper with $K_3Fe(CN)_6$. The $FeSO_4$ eluted by the H_2O carried to the upper zone to give a blue band of $Fe_4[Fe(CN)_6]_3$, the extent and intensity of which depended on the amt. of H_2O present.

8910. SULSER, H. AND HÖGL, O. **Application of paper chromatography in food chemistry. I. Principles and methodics. II. Differentiation between fruit wine and grape wine. III. Examination of different vinegars.** *Mitt. Gebiete Lebensm. Hyg.* **42**, 376-94, 395-402, 403-408(1951).—*C.A.* **46**, 651*e*.

The presence of tartaric acid, sorbitol, fructose, glucose, and glycerol was shown by using paper chromatograms. The results thus obtained were checked by chem. analysis. Tartaric and citric acids, sorbitol, fructose, glucose, glycerol, and hydroxymethylfurfural were detected in vinegars by paper chromatography.

8911. UNO, HYOJIRO AND KOYAMA, AKIRA. **Identification of aldehyde by paper chromatography.**

J. Fermentation Technol. (Japan) 29, 219-21 (1951).—*C. A.* 47, 1008*c*.

A mixt. of benzenesulfohydroxamic acid and an aldehyde in abs. alc. was added with NaOH to make it basic, and the hydroxamic acid of the aldehyde thereby prepd. was chromatographed on paper with iso-AmOH:AcOH:H_2O = 5:1:1 or with BuOH:-AcOH:H_2O = 5:1:1 to give R_f values. The aliphatic aldehydes C_1-C_5 could be sepd., but C_6 or more as well as normal and iso-compds. could not. Three aromatic aldehydes, vanillin, veratrum aldehyde, and benzaldehyde as well as two furan aldehydes, furfural and methylfurfural, could be sepd.

8912. WEISS, LOUIS C. **Chromatographic properties of oil-soluble coal-tar colors.** *J. Assoc. Offic. Agr. Chemists* 34, 453-9(1951).—*C. A.* 45, 9865*c*.

The behavior was described of 22 oil-sol. colors, 17 certifiable and 5 nonpermitted, on various chromatographic adsorbents with various solvent systems. With the appropriate adsorbents and solvents, many of these colors could be sepd. from each other chromatographically.

8913. YOSHINO, HIROSHI. **Studies on soy sauce by paper partition chromatography. I. Sugars and amino acids in the cooking juice of soybeans.** *Nippon Jôzô Kyôkai Zasshi* (J. Soc. Brewing, Japan) 46, K. 7-13(1951).—*C. A.* 46, 7282*a*.

The descending method with phenol (with 10% of 0.1% aq. NH_3), collidine, or BuOH-AcOH-H_2O (4:1:1) as the solvent and aniline acid phthalate, benzidine reagent, or resorcinol reagent as the coloring reagent showed the existence of glucose and sucrose in the alc. ext. of the defatted soybean meal and the existence of fructose, glucose, sucrose, and stachyose in the aq. ext. obtained by treating the residue from alc. extn. with H_2O at 40-50°C. The juice obtained by cooking defatted soybean meal under 10 lb pressure contained fructose, galactose, glucose, sucrose, manninotriose, and stachyose; the existence of arabinose and mannose was not evident. The amino acids were examd. with ninhydrin, K iodoplatinate, Pauly reagent, or Ehrlich reagent as the coloring reagent.

8914. YOSHINO, HIROSHI. **Studies on soy sauce by paper partition chromatography. II. Sugars in soy sauce.** *Nippon Jôzô Kyôkai Zasshi* 46, K, 44-51(1951).—*C. A.* 46, 7282*c*.

The influences of NaCl, amino acids, EtOH, and org. acids on the detection of sugars were examd. With soy sauce (which contained about 18.5% NaCl) the effect of NaCl was the greatest; in general NaCl decreased R_f values of sugars. Ketose or ketose-contg. oligosaccharide could not be detected in soy sauce. Owing to the presence of NaCl the detection of oligosaccharides was difficult. Soy sauce contained as monosaccharides glucose, galactose, arabinose, and xylose. Two-dimensional chromatography showed the nonexistence of mannose.

8915. ARRARAS, ENRIQUETA G. **Ion-exchange resins in the separation of caffeine from maté.** *Rev. fac. cienc. quím. Univ. nacl. La Plata* 24, 53-61(1952).—*C. A.* 47, 1865*h*.

Powd. maté *(Ilex paraguarensis)* contg. 1.05% caffeine was extd. by boiling 0.1, 0.2, or 0.5% H_2SO_4 or by cold maceration (similar results). On account of the presence of the cations competing with the caffeine on the resin the yields were reduced. Therefore, org. extg. agents were tried and 5 *N* NH_4OH in 60% alc. was satisfactory, and by this method 98% of the caffeine was extd. by repeating the process several times. To save time $CHCl_3$ was used as solvent, after alkalization of the column with ammoniacal alc., obtaining a yield of 92% of the caffeine present in maté.

8916. BARILE, G.; STEIN, A. M., AND PASCUCCI, E. **Chromatographic investigation of the organic synthetic coloring matters in food products.** *Ind. ital. conserve* 27, 152-4(1952).—*C. A.* 47, 5038*d*.

The dye was extd. from 50 g of a fruit conserve and fixed on wool, the wool was discharged, and the soln. of the dye concd. to a few cc. The chromatographic investigation was made with Whatman No. 4 paper with the following solvents: (1) EtOH (80%) 70, BuOH 20, NH_4OH (d. 0.925) 10; (2) EtOH (80%) 70, BuOH 20, 2*N* AcOH 10 cc. The values of R_f with the 2 solvents for 19 most common org. dyes were tabulated.

8917. CAPT, EMILE. **The application of ion exchanger to sour wines.** *Annuaire agr. Suisse* (N.S.) 1, 1113-27(1952); *Stas. féderales essais agr., Mont-Calme et Montagibert, Lausanne et Pully Publ.* No. 412.—*C. A.* 47, 5623*c*.

The ion exchanger was utilized in the treatment of sour wines with unsatisfactory results.

8918. DELINDATI, G. AND PELIZZIARI, A. **Deacidification of tomato juices with ion exchangers. Preliminary note.** *Ind. ital. conserve* 27, 50-4(1952).—*C. A.* 47, 1305*g*.

The method employed in the expts. was described. With the anionic resin Amberlite IRA-4B, the acid content of the juices decreased from 0.42-0.50 to 0.12-0.15%, and with Activit IMAC it decreased from 0.47-0.53 to 0.17-0.21% (calcd. as citric acid).

8919. FAGEN, HAROLD J.; STINE, J. B., AND HUSSONG, R. V. **The identification of reducing sugars in cheddar cheese during the early stages of ripening.** *J. Dairy Sci.* 35, 779-82 (1952).—*C. A.* 47, 228*g*.

A one-dimensional filter-paper chromatographic method was described for studying the fate of sugars in cheddar cheese. Typical sugar patterns for cheddar cheese made from raw and pasteurized milks were presented. Cheddar cheese made from pasteurized milk contained traces of sugar (galactose) for approx. twice as long as cheddar cheese made from raw milk. Results indicated that pasteurization destroyed or inhibited microörganisms capable of utilizing galactose.

8920. GJERTSEN, POUL. **Chromatography and its application in brewing chemistry.** *Brewers Digest* 27, No. 11, 47-52, 57(137T-142T, 147T) (1952).—*C.A.* 47, 7156*d*.

A review of column and paper chromatography and applications to detection or detn. of amino acids, hop resins, and sugars in brewery materials and products.

8921. HARRIS, JOHN P. **Active carbon, its application in brewing.** *Brewers Digest* 27, No. 2, 50-2(21T-2T)(1952).—*C.A.* 46, 6320*a*.

A review of the use of active carbon for the following purposes in breweries: water purification to remove color, odor, Cl_2, and impurities; sterilization and purification of air; deodorizing of CO_2; removal of color or off-odor or off-flavor from the product.

8922. HASHIZUME, TAKESHI; IRIE, YU, AND MITSUI, TETSUO. **Chemical constituents of beer. I. Identification of amino acids of beer by paper partition chromatography.** *Mem. Research Inst. Food Sci., Kyoto Univ.* No. 4, 12-18(1952)(in English).—*C.A.* 47, 2425*h*.

Amino acids in various beers were pptd. as their Hg salts, filtered, and liberated by H_2S. The chromatograms were prepd. with $PhOH$-NH_3 and BuOH-MeOH (both contg. 35% water) as developing solvents. In the beers of 3 main Japanese makers were found glycine, alanine, valine, leucine, aspartic acid, glutamic acid, asparagine, ornithine, lysine, arginine, histidine, proline, possibly α-aminoisobutyric acid, and an unknown amino acid, and in Tuborg beer (German product) serine in addn. to the above 14 amino acids.

8923. HASHIZUME, TAKESHI AND MITSUI, TETSUO. **Chemical constituents of beer. II. Identification of organic acids of beer by paper partition chromatography.** *Mem. Research Inst. Food Sci., Kyoto Univ.* No. 4, 19-24(1952).—*C.A.* 47, 2426*a*.

As detd. by paper chromatography of the hydroxamic derivs., beer contained acetic, lactic, malic (or citric), oxalic, and succinic acids, the last of which in a considerable amt. The fraction of aldehydes and ketones appeared to have close relation to the flavor of beer.

8924. HELM, E. **Induced gushing in beer.** *Brewers Digest* 27, No. 1, 49-50(5T-6T)(1952).—*C.A.* 46, 6320*f*.

Addn. of aq. $NaNO_2$ to lager beer produced a reddish tint and induced gushing of the pasteurized, bottled product. Gushing was induced also by addn. of an aq. suspension of active carbon but not when the carbon was first held 24 hrs under several changes of EtOH and then suspended in air-free distd. water. Use of 1% aq. NaCN instead of the EtOH did not inhibit promotion of gushing by active carbon.

8925. HÖGL, O. **Investigating sweet wines and "Mistellen" with paper chromatographic methods.** *Z. Lebensm.-Untersuch. u. -Forsch.* 95, 177-9(1952).—*C.A.* 46, 11571*e*.

Mistellen was a grape must product which had been "silenced" (inhibition of fermentation) by adding alc. Genuine dessert wine could be distinguished from Mistellen by the presence of glycerol. Because glycerol was difficultly sepd. from sugar by common methods of analysis, a paper chromatographic method was recommended. A 1.1:4.0:1.9 EtOH:BuOH:H_2O mixt. was used as the solvent and the glycerol was detected with $AgNO_3$ reagent in the procedure. A quant. method was based on comparison of result with those from wines contg. a definite amt. of glycerol.

8926. INSKEEP, GORDON C.; TAYLOR, G. G., AND BREITZKE, W. C. **Lactic acid from corn starch.** *Ind. Eng. Chem.* 44, 1955-1966(1952); *Intern. Sugar J.* 55, 131(1953).

American Maize Products Co., which produced lactic acid from corn syrup in its plant at Hammond, Ind., used a relatively high temperature bacterial fermentation with the micro-organism *Lactobacillus delbruckii*. As the acid was formed in the fermenters, it was continuously neutralized by $CaCO_3$ present in the medium to form Ca lactate, which was later converted to lactic acid. Purification was by repeated carbon bleaches. Its market in the food industry was apparently close to being saturated. However, lactic acid derivatives offered potentially an almost unlimited industrial outlet, depending primarily on the cost for which they could be prepared.

8927. JAKOVLIV, G. **Determination of chromatographic characteristics of fruits in sweet foods and drinks.** *Inds. agr. et aliment.* (Paris) 69, 223-5(1952).—*C.A.* 47, 6570*b*.

Warm conserves, preserves, pastes, candy, and bonbons and dil. with an equal vol. of Fe-free tap H_2O (grind foods contg. whole or chopped fruits and eliminate pits and cores) dil. the drinks with an equal wt of sugar sirup, and evap. any alc. present. Weigh a 50-g sample, add 10 ml of H_2SO_4 (20 vol. 66° Bé acid/100 vol.) and 40 ml of tap H_2O, heat to 50°C mix, let settle, and decant the supernatant. Add 25 ml of pure *sec*-BuOH, and mix well but avoid emulsifying strongly. Transfer 5 ml of the ext. of yellow fruit or 3 ml of red or highly colored ext. to a column packed with chromatographic Al_2O_3 (0.5 × 10 cm packing in a 35-cm tube). Allow 2 hrs per ml for absorption (atm. pressure). Typical chromatograms were described for apricots, bananas, black and red currants, cherries (4 kinds), quince, strawberries, raspberries, gooseberries, bilberries, oranges, peaches, apples, red plums, green gages, red and white grapes, and red tomato concentrate.

8928. JAKOVLIV, G. AND COLPÉ, G. **Column chromatography to identify coloring matter added to foodstuffs.** *Ann. fals. et fraudes* 45, 354-68(1952).—*C.A.* 47, 1301*g*.

Foodstuffs were extd. with an equal wt of H_2O. Beverages contg. EtOH were first freed of the latter by evapn. An ext. prepd. with iso-AmOH was given on a column of Al_2O_3 of 0.5 cm diam. at 20-25 cm height. As eluents (24 hrs, 10 ml each) were used: H_2O, 5% NH_3, *N* NaOH, 0.1 *N* HCl, followed by 3 ml *N* NaOH, MeOH, 5% $BaCl_2$, $NaHSO_3$. The chromatograms of a large no. of permitted and prohibited colorants were described.

8929. JAKOVLIV, G.; GX, A. I., AND COLPÉ, G. **Column chromatographic method in the identification of coloring matter added to foods.** *Ann. fals. et fraudes* 45, 435-6(1952).—*C.A.* 47, 4001*e*.

8930. MARSH, G. AND KEAN, C. **Applications of chromatographic methods to organic acids in wines.** *Wines & Vines* 33, 17-20(March 1952).

The presence of tartrates in berry wines made them liable to rectification tax. Because established methods of analysis were unable to cope with very low tartrate concentrations, it was not known whether fruits other than grapes contained the compound in more than trace quantities. A new procedure involving paper chromatography preceded by treatment of the wine with weakly basic and acidic cation and anion exchangers was developed. The org. acids adsorbed from the wine by the anion exchanger was eluted from the column with dil. NH_4OH. This solution was then passed through the hydrogen form of the cation exchanger, converting the NH_4^+ salts to free acid. Chromatographic analysis of the concentrated effuent permitted determination of as little as 50 p.p.m. of tartaric acid.

8931. MARSHALL, C. AND WALKIN, A. **Preparation of full-flavored apple juice with increase resistance to fermentation.** *Food Technol.* 6, 229-234(June 1952).

Ion exchange resins were employed to decrease the tendency of apple juice toward fermentation. A single pass of the juice through a strongly acidic cation exchanger greatly improved resistance to fermentation, although considerable loss of volatile flavor occurred. A full-flavored juice of high fermentation resistance was prepared by removing the volatile flavor before deionization and then reconstituting the juice after treatment.

8932. MILLER, JOHN M. AND ROCKLAND, LOUIS B. **Determination of cysteine and glutathione in citrus juices by filter paper chromatography.** *Arch. Biochem. Biophys.* 40, 416-23(1952).—*C.A.* 47, 1305*e*.

Filter-paper chromatography demonstrated the presence of cysteine and glutathionine in concentrates of the sulfhydryl constituents of orange, grapefruit, lemon, and lime. Heating the fresh juices decreased the amt. of both compds.

8933. NAUMANN, CARL W. **The removal of cations from wort and beer.** *Brauwissenschaften* **1952**, 105-6.—*C.A.* 47, 2932*e*.

By passing dild. wort and beer through a cation exchanger acidic solns. were obtained from which phosphate could be quantitatively pptd. with magnesia reagent. The phosphate in both was found to be the same while the total acids in beer was higher due to org. acids formed during fermentation by yeast. Org. acids in ion-exchanged beer seemed to inhibit the growth of organisms which may include sarcina, bacilli, acetobacteria, and wild yeast. The cation exchanger may be helpful in chem. analysis, study of the metabolism of PO_4^{3-}, phosphoprotein, and phytic acid by yeast, and brewing operations.

8934. PEREIRA, A. **A paper chromatography method for quantitative determination of cystine in wheat gliadin hydrolyzates.** *Cereal Chem.* 29, 478-81(1952).—*C.A.* 47, 1866*g*.

The detn. of cystine-cysteine in hydrolyzates of wheat gliadin by the described method gave a mean of 2.83%, somewhat greater than the literature values of 2.74, 2.6, and 2.4.

8935. RUF, W. **Paper chromatograph for detection of foreign coloring materials in wine.** *Z. Lebensm-Untersuch. u. -Forsch.* 94, 190-4(1952). —*C.A.* 46, 6318*i*.

Chromatographs of the coloring material of blackberry, bilberry, elderberry, beets, vegetable Bordeaux, synthetic Bordeaux, each of these mixed with red wine were compared with red wine. The chromatographs were made from water, alc.-water mixt., and phenol-water mixt. The distinguishing features were illustrated and discussed.

8936. SCHILD, E. AND RIEDL, W. **Chromatographic analysis of the bitter substances of hops.** *Brauwissenschaften* **1952**, 81-7.—*C.A.* 47, 819*d*.

The bitter substances of hops were extd. quantitatively with MeOH in a homogenizer and the ext dild. with 2% H_2SO_4 was extd. then with hexane or petr. ether. Concn. *in vacuo* at 40°C in an atm. of CO_2 or N_2 gave a residue of total hop resins. Chromatography of the latter dissolved in benzene on silica gel gave an eluate from which the α- and β-hop acids were recovered by concn. The soft resins were detd. by difference while resoln. in MeOH and addn. of $Pb(OAc)_2$ gave a quant. value for humulone, lupulone could be detd. by difference. In view of the availability of suitable silica gel, chromatography was suggested for a rapid assay of hops.

8937. SIMONDS, PAUL W. AND PRO, M. J. **Chromatographic detection of grape wines in the presence of other wines.** *J. Assoc. Offic. Agr. Chemists* 35, 796-9(1952).—*C.A.* 47, 2931*b*.

Paper chromatography was employed to isolate a fluorescent material from grape wine for the purpose of detecting grape wine in the presence of other wines. A paper strip was suspended in a mixt. of the wine with water and butanol. After the initial development of the chromatogram, the paper was dried and suspended in a mixt. of satd. aq. K Al sulfate and abs. alc. After development with this solvent, the paper strip was dried and suspended in an atm. of NH_3 for 3 min. and then examd. under ultraviolet light. With grape wine a strong chrome to cadmium yellow fluorescent band was obtained; with peach, cherry, and apple wine, a weak brown-yellow fluorescent band; and with a no. of other wines tested no fluorescent band was obtained.

8938. STEUART, DAN W. **Redox potentials in cider making.** *Chemistry & Industry* **1952**, 830-1.—*C.A.* 47, 2900*a*.

Attempts were made to study changes in cider by detn. of the oxidation-reduction potentials; however, the Indicator Time Test (ITT) was found more convenient. For these tests 5 ml of a 0.005 *M* soln. of 2,6-dichlorobenzenoneindophenol was mixed with 200 ml of cider, and the time required for 50% decolorization of the dye was measured.

This was detd. by sighting through the bottle of the mixt. and a similar bottle of water and comparing with a similar bottle of cider without dye viewed in line with a 50% decolorization standard comprised of 2.5 ml of the dye soln. in 200 ml of phthalate buffer of pH 3.5. For apple juices from the press, ITT ranged from 5 to over 60 (all values in min. for 50% decolorization). Bubbling air through several juices for 1 hr had no effect on ITT in some, but increased the values by as much as 2 times in others.

8939. UNDERWOOD, G. E. AND DEATHERAGE, F. E. **Amino acids of green and roasted coffee, including a new method of protein hydrolysis.** *Food Research*, 17, 425-432(1952).—*C.A.* 46, 11498*d*.

Fourteen amino acids were identified in hydrolyzates of green Santos coffee beans. By use of ion-exchange chromatography, 9 of these amino acids were estd. quantitatively in hydrolyzates prepd. from the green and roasted coffee beans. A new method of protein hydrolysis, with an ion-exchange resin, gave almost complete hydrolysis of casein and of water-sol. coffee proteins. The resin used was Dowex 50, a sulfonated polystyrene resin; the hydrolysis was accomplished by mixing the protein, water, and the H-form of the resin, and then refluxing the mixt.

8940. ZABRODSKIĬ, A. G. AND MOVCHAN, A. A. **Action of adsorbents on alcoholic fermentation.** *Biokhimiya* 17, 513-20(1952).—*C.A.* 47, 3513*i*.

The adsorption and desorption occurring on the surface of solids improved the gas metabolism of the yeast cells in the liquid, and thereby increased the rate and extent of alc. fermentation. The adsorbents tested were wood-spruce shavings, oat husks, dry-mash pellets, peat, glass rods, clay, and activated carbon. An unfiltered soln. of sugar, yeast, and nutrient materials caused 90% sugar fermentation. When 5 g sawdust was added to 400 ml of the mixt. the fermentation increased to 99%. The solid adsorbent assisted in the liberation of CO_2 from the liquid. In the absence of solids, the liquid became supersatd. with CO_2 and the yeast activity was thereby inhibited. The use of adsorbents might find practical application in the fermentation of pure molasses and filtered hydrolyzates from wood. Unfiltered corn wort contained so much suspended material that the addn. of adsorbents did not affect the fermentation.

8941. KEENEY, MARK. **Chromatographic determination of butyric acid and the detection of milk-fat adulteration.** *Ice Cream Trade J.* 49, 30-6, 106-8(1953).—*C.A.* 47, 6567*a*.

The variation in the butyric acid content of fat from mixed herd milk was narrow enough to permit the easy detection of more than 10% adulteration of milk fat with nonmilk fat. When data have been accumulated on the butyric acid content of milk fat from various sources, detection of as little as 5% adulteration should be possible.

8942. SULSER, H. AND HÖGL, O. **Application of paper chromatography in food chemistry. IV. Quantitative paper chromatography with the spectrophotometer.** *Mitt. Lebensm. Hyg.* 44, 79-123(1953).—*C.A.* 47, 7125*d*.

A method particularly suitable for series detns. was developed by prepg. small-size diapositives of the photographs of paper chromatograms and measuring their intensity with a spectrophotometer. From 1.5 to 100 γ of alanine, glycerol, hydroxymethylfurfurol, colamine, and choline could be detd. within 5-10%.

8943. TURK, AMOS AND VAN DOREN, A. **Fruit storage. Saturation of activated carbon used for air purification.** *J. Agr. Food Chem.* 1, 145-51(1953).—*C.A.* 47, 6064*g*.

This study presented qual. and quant. analyses of the sorbates of several carbons and their variations through a fruit-storage season. Infrared spectra illustrated changes in relative prominence of several org. functionalities in the carbon sorbates as the season progresses. Analyses of brominated carbon were given. Based on these results, hypotheses were made concerning functioning of activated carbon in fruit storage.

8944. WILLIAMS, A. F. **Determination of glycerol in fermentation solutions. A rapid chromatographic procedure.** *Nature* 171, 655(1953).—*C.A.* 47, 6597*c*.

The method involved the prepn. of a column of coarse cellulose powder which supported a column of chromatographic Al_2O_3. Sufficient sample was taken to give approx. 0.5 g glycerol and contg. approx. 3 ml H_2O. After addn. of 0.5 g Na_2SO_3, 1 g NaOAc, and 0.1 ml AcOH, the resulting soln. was mixed with 15 g Al_2O_3 and the mixt. transferred to the column. The glycerol was eluted with 250 ml of solvent (acetone contg. 5% vol./vol. H_2O and 0.5% vol./vol. glacial AcOH). A volumetric procedure, involving titration with 0.1 *N* NaOH, was used for the final detn. of the glycerol.

V-10. Applications to Soaps, Fats, and Edible Oils

8945. CIUSA, W. **Susceptibility of olive oil to autoxidation. I.** *Ann. chim. applicata* 30, 141-6(1940).—*C.A.* 34, 7638^2.

The antioxidants naturally present in cod-liver oil and olive oil were removed by adsorption on carbon or activated silica. Curves were given for the O_2 uptake (Barcroft-Warburg technique) of olive oil at 40°, 60°, 70° and 90°C; only that at 90°C indicated the occurrence of an induction period.

8946. LIESEGANG, M. C. **A method for estimating the carbon black-removing power of washing agents.** *Fette u. Seifen* 47, 458-60(1940).—*C.A.* 36, 1402^7.

Increasing amts. of washing agent were stirred with 200 mg of carbon black. Drops of this mixt. were placed on baryta paper and rinsed with H_2O. The amt. of washing agent required so that the paper was no longer darkened was called the "carbon black no." This varied between 2 and 70; 2 signified the greatest carbon black-removing power.

8947. STELLING, OTTO. **The so-called activated bleaching earths.** *Tekn. Samfund. Handl.* 1940, 109-30.—*C. A.* 38, 2797[3].

A com. product equiv. to bleaching earth was obtained by activating a Swedish clay contg. montmorillonite as a basic substance. The activation process could not be considered to be just an exchange of bases by substitution of metal ions with H ions, because the activity was still maintained after the replacement of the H ions by treatment with various salt solns., even if the replaceability of the base was decreased about 75%, as when treated with a $CaCl_2$ soln. The bleaching action attained a max. with the increase of the time for treatment with acid. The higher the concn. of the acid, the more readily was the max. attained. The bleaching action decreased with increased moisture content and grain size.

8948. PALENI, ANDREA. **The action of the active earths and carbons on oils, and its evaluation.** *Chimica e industria* 23, 87-90(1941) (Italy).—*C. A.* 36, 7337[1].

The usual methods of detg. the activity of decolorizing adsorbents by color measurement did not permit the detn. of the "non-oil" substances sepd. from the oil. By shaking the adsorbent (after the adsorption process) in the cold with petr. ether, the adsorbed substances remained on the adsorbent and could then be extd. and detd. The decolorizing value was given by the ratio adsorbed substance/adsorbent.

8949. ROSSI, GUIDO. **The refining of vegetable oils.** *Riv. catasto servizi tec. erariali* 8, 320-8(1941).—*C. A.* 37, 3961[3].

Industrial refining processes, including preparatory operations, neutralization and distn., esterification, decolorization, deodorization and hydrogenation were reviewed, as well as a discussion of properties and yields of refined oils.

8950. SARIN, J. L. AND KUKERAJA, I. S. **Some northern India bleaching earths.** *J. Indian Chem. Soc., Ind. & News Ed.* 4, 184-8(1941).—*C. A.* 36, 4676[4].

Eight clays were tested: (1) the dehydration curve between 100° and 600°C, (2) measuring the rise in temp. upon mixing 5 g of the dried (115°C) clay with 10 ml of turpentine and (3) detg. the % soly. of Al_2O_3 and Fe_2O_3 by heating the clay with 0.5 *N* HCl for 3 hrs. Each sample was dried at 90-5°C, screened through a 200-mesh sieve and dried at 110°C for about 4 hrs, after which the bleaching action was detd. by mixing 4% of the clay with rape oil at 90°C and agitating for 10 min., filtering the mixt. and measuring the color of the oil in a Duboscq colorimeter.

8951. BAILEY, A. E.; FENGE, R. O., AND SMITH, B. A. **Variables affecting the yield of normal oleic acid produced by the catalytic hydrogenation of cottonseed and peanut oils.** *Oil & Soap* 19, 169-76(1942).—*C. A.* 37, 275[9].

The nature of the Ni catalyst as influenced by its method of prepn. may have a large effect on the compn. of the hydrogenated product. One of the Ni catalysts formed excessive amts. of isoöleic acid without being correspondingly selective. In the hydrogenation of cottonseed oil, within a wide range of conditions, the production of total solid acids with a given catalyst was relatively const. Peanut oil was a more suitable raw material than cottonseed oil for the production of normal oleic acid because of its initially greater content of this acid and its lesser content of linoleic acid.

8952. BOEKENOOGEN, H. A. **Adsorption methods in the chemistry and technology of the fatty oils.** *Chem. Weekblad* 39, 289-92(1942).—*C. A.* 39, 1769[4].

The bleaching of oils and especially the sepn. of glycerides from other lipoids and from fatty acids were discussed, as well as the sepn. of the fatty acids from one another.

8953. KAUFMANN, H. P. AND KIRSCH, P. **The increase in the molecular size of unsaturated acids and of their esters as the basis for the drying process and the manufacture of surface-coating materials. III. The fractionation of glycerides.** *Fette u. Seifen* 49, 841-54(1942).—*C. A.* 37, 6481[2].

Sepn. by adsorption method with Al_2O_3 and silica gel were reported for blown and oxidized linseed, rapeseed and China wood oils. In general, Al_2O_3 adsorbed the constituents of high mol. wt while the reverse was true of silica gel. A blown linseed oil with a viscosity of 113 centipoises was sepd. with Al_2O_3 into a filtrate of 62 centipoises and an adsorbed portion of 928 centipoises. With silica gel as the adsorbent, the corresponding viscosities were 154 and 106.

8954. LOEW, GUILLERMO AND GOETZ, ARTURO B. **Comparative tests on active earths and charcoals.** *Rev. farm. (Buenos Aires)* 84, 359-64 (1942).—*C. A.* 37, 1232[5].

Adsorbing earth and active charcoal, both of Argentine and foreign origin, were compared by measuring the decolorizing effect on soy-bean oil. In every test, 100 g of oil was heated with increasing quantities of decolorant, from 0.5 to 3% beginning at 70°C, and increasing to 110°C during 15 minutes. The filtered, refined oil was compared with the original sample and a linear effect was observed. Argentine earth was more efficacious than imported earth, but the domestic charcoal was inferior.

8955. SATÔ, MITSURU. **The energy states of the valency electrons in some metals. I, 12. The mechanism of the catalytic action of zinc in the preparation of unsaturated higher alcohol by hydrogenation of vegetable oil.** *Science Repts. Tôhoku Imp. Univ.* 30, 137-53(1942).—*C. A.* 44, 4220*a*.

Hydrogenation of oil extd. from the seeds of Perilla frutescens was studied. At room temp. and above, the electronic energy was insufficient to dissoc. the adsorbed H_2 and to initiate hydrogenation; at 200°C, despite a decrease of the electronic energy, the addnl. thermal energy caused dissocn. and catalytic reaction. At 320°C the energy supplied by the Zn dropped suddenly to such a value that both adsorption and catalytic action became very weak.

8956. Uyeno, Seiichi and Anzai, Rinnosuke. **The life of nickel cataysts and the recovery of spent catalysts.** *J. Soc. Chem. Ind. Japan* 45, 648-9(1942).—*C. A.* 43, 5210*i*.

The life of Ni catalysts for the hardening of fatty oils depended mostly on the purity and kind of oils to be hardened as well as on the refining process with which they had been previously treated. In general, the catalyst could be reused in several batches only with vegetable oils. Catalysts used in hardening marine-animal oils usually deteriorated more rapidly, since some catalyst poisons usually remained in the refined oil. In general, previous refining greatly increased the no. of batches that could be hardened with one charge of catalyst.

8957. Uyeno, Seiichi. **The carrier of the nickel catalyzer used in the hardening of fatty oil.** *J. Chem. Soc. Japan* 63, 976-7(1942).—*C. A.* 41, 3308*i*.

In the hardening of fatty oil under a pressure higher than 100 atm., diatomaceous earth, Kibushi clay, active white earth, kaolin, talc, yellow ocher, and Kurama clay as carriers showed nearly the same activity. Active white earth had the greatest action. The action of bauxite was inferior to that of diatomaceous earth. When bentonite was used as carrier, the formation of higher alc. was presumed from the smell of the reaction product. The use of bentonite shortened the time required to filter the reaction product.

8958. Cavier, Raymond. **The hemolytic action of alkali soaps and their adsorption by charcoal.** *Compt. rend.* 216, 255-6(1943).—*C. A.* 39, 713^7.

The relation between the hemolytic activity of alkali soaps and their adsorption by animal charcoal was investigated. Fifty ml of soap soln. buffered to pH 9.0 was shaken at 20°C with 0.25 g of purified charcoal. Isotherms of adsorption were established for Na dibromoricinoleate, dibromostearate, linolenate, linoleate, oleate, hydrocarpate, bromolaurate, ricinoleate, laurate and hydroxystearolate. A parallelism was established between the hemolytic activity and the intensity of the adsorption.

8959. Duuren, A. J. van. **Bleaching earths of the Netherlands East Indies.** *Koloniaal Inst. Amsterdam, Mededeel No.* 61, *Afdeel. Handelsmuseum No.* 27, 81 pp.(1943).—*C. A.* 40, 7535^2.

Bleaching earths from different localities in Java were studied. These earths consisted partly of montmorillonite and partly of mica-clay minerals. Activation was carried out by boiling 20 g of material with 50 ml of 10% HCl, followed by heating in an autoclave for 30 min. at 138-140°C. The samples were then cooled, filtered, washed, and dried at 105°C. Decolorization tests on mineral and other oils proved to be unsatisfactory for a correct evaluation of the other earths.

8960. Fischer, Earl K. **Surface-active agents.** *Soap, Sanit. Chemicals* 19, No. 12, 25-9, 53 (1943).—*C. A.* 38, 596^9.

The term, surface-active agent, referred to compds. which were adsorbed at an interface, changing the phys. properties of the system. Chemically these compds. ranged from definite entities to unknown mixts. They were characterized by a relatively large mol. which had 2 mol. components of different affinities. They were usually of low volatility. In aq. soln. they were of 3 types in terms of electrolytic dissocn.: anionic, cationic and nonionic.

8961. Graff, Morris M. and Skau, Evald L. **Colored chromatograms with higher fat acids.** *Ind. Eng. Chem., Anal. Ed.* 15, 340-1(1943).—*C. A.* 37, 3961^1.

A mixt. of MgO impregnated with phenol red and petr. ether was poured into a 60-70-cm glass tube 11 mm in diam. and the solvent allowed to percolate out. Fat acid mixts. dissolved in 50 ml of petr. ether were added to the column and the solvent allowed to percolate through. When the mixt. came in contact with the adsorbent, a yellow band was formed which sepd. into zones. After these were clearly developed, the column was allowed to run dry, forced from the tube and cut into sections defined by the change in color of the adsorbent. The fat acids were removed from the latter by dissolving in HCl and extg. with diethyl ether. It was possible to demonstrate a sepn. of an unsatd. fat acid from a satd. one of the same no. of C atoms, and of two satd. fat acids differing in chain length by 4 C atoms.

8962. Joshel, Lloyd M. **An apparatus for quantitative catalytic hydrogenation.** *Ind. Eng. Chem., Anal. Ed.* 15, 590-1(1943).—*C. A.* 37, 6162^4.

An all-glass app. which filled the entire gap between a strictly microapp. and the standard Adams (Burgess-Parr) machine was described. Flasks of several sizes fitted with a magnetic stirrer and 50-ml and 500-ml burets gave the required flexibility.

8963. Kaufmann, H. P. and Wolf, W. **Adsorption separation in the field of fats. V. The separation of cis-trans isomers.** *Fette u. Seifen* 50, 519-21(1943).—*C. A.* 39, 205^7.

Al_2O_3, silica gel and charcoal were compared as adsorbents in the sepn. of an equimol. mixt. of tributyrin and tristearin. Tributyrin was more strongly adsorbed by Al_2O_3 and by silica gel and could be quantitatively sepd. Al_2O_3 or silica gel adsorbed mono-, di-, and tristearin in that order. A mixt. of 1 g each of the Me esters of fumaric and maleic acids in 35 ml Et_2O was poured through a column of 25 g C; 0.3 g of the maleic acid ester was found in the filtrate. The "percolate" obtained with 35 ml ice-cold Et_2O contained a mixt. of the 2 esters; 0.7 g of the fumaric acid ester was obtained from the $CHCl_3$ eluate. A mixt. of 90% oleic, 10% elaidic acid was found in the eluate of the upper part of a silica gel column through which had been poured a C_6H_6 or petr. ether soln. of a mixt. of equal parts of the 2 acids.

8964. Kufferath, A. **Filtration of oils and fats.** *Fette u. Seifen* 50, 370-2(1943).—*C.A.* 38, 3498^8.

Various filter presses used in the fat and oil industry were described. The use of filter aids was discussed.

8965. Uyeno, Seiichi; Tokunaga, Toshikadzu, and Nishio, Minako. **Separation of fatty acids by means of adsorption by bentonite.** *J. Chem. Soc. Japan* 64, 135-8(1943).—*C.A.* 41, 3308*h*.

8966. Uyeno, Seiichi; Tokunaga, Toshikazu, and Nakamori, Gi-ichi. **Separation of oil by adsorption with bentonite. II. Separation of unsaponifiable constituents.** *J. Chem. Soc. Japan* 64, 312-14(1943).—*C.A.* 41, 3309*f*.

The adsorptive power of bentonite for the satd. unsaponifiable portion of fatty oil was larger than for the unsatd. fraction.

8967. Walker, F. T. and Mills, M. R. **Component glycerides of linseed oil—segregation by chromatography. II. Thiocyanogen value of linolenic acid.** *J. Soc. Chem. Ind.* 62, No. 7, 106-9(1943).—*C.A.* 37, 6913^1.

By subjecting a large amt. (70 g) of linseed oil to chromatographic fractionation it was possible to isolate linoleodilinolenin (8 double linkages), and a mixt. of trilinolenin (9 double linkages) and linoleodilinolenin.

8968. Cummins, A. B.; Weymouth, L. E., and Johnson, L. L. **Filter aid and carbon treatment of prime steam lard.** *Oil & Soap* 21, 215-23 (1944).—*C.A.* 38, 5424^2.

With the use of filter aid alone without carbon, each successively coarser filter-aid grade gave a higher filtration rate with corresponding measurable decrease in degree of clarification. Hyflo or at most Celite 503 were the coarsest grades to be recommended for this use. Selection of the most suitable grade depended on the sp. flow-rate or clarity requirements. With the use of filter aid plus carbon of the type tested, Hyflo Super-Cel was the coarsest grade which would satisfactorily retain this carbon. Celite 512 appeared well-suited for this use.

8969. Harris, John P. **Oil decolorizing.** *Soap* 20, No. 5, 31-2, 70(1944).—*C.A.* 38, 3498^8.

The process of decolorizing various fats and oils by treatment with active carbon was described.

8970. Heinz, H. J. **Adsorbents and their use in the fat industry.** *Fette u. Seifen* 51, 448-54 (1944).—*C.A.* 44, 6657*g*.

8971. Kufferath, A. **New compounds for decolorizing and clearing in the fat industry.** *Fette u. Seifen* 51, 280-2(1944)—*C.A.* 44, 6657*i*.

8972. Paleni, Andrea. **Coloring matters of vegetable oils, and the mechanism of decolorization. IV. Refining the oils.** *Chimica e industria* 26, 138-45(1944)(Italy).—*C.A.* 40, 3281^5.

The preliminary treatment of the oils with H_2SO_4 to remove chlorophyll, neutralization with alkali, decolorization, deodorization, sepn. of solid glycerides, filtration, neutralizing by distilling off the free acid, and esterification were all described.

8973. Daniel, David; Lederer, Edgar, and Velluz, Léon. **Constituents of wool fat. II. Chromatographic study of the unsaponifiable fraction.** *Bull. soc. chim. biol.* 27, 218-25 (1945).—*C.A.* 40, 4897^9

The unsaponifiable fraction was dissolved in petr. ether and passed through a column of Al_2O_3. The first filtrate contained a very small amt. of a mixt. of paraffin hydrocarbons. Successive fractions obtained by adsorption and elution contained: (1) a very small amt. of unidentified unsatd. d-rotatory steroid ketones; (2) cholesta-3, 5-dien-7-one, strongly l-rotatory, about 0.6% of the original lanolin; (3) "isocholesterol" (a mixt. of lanosterol, dihydrolanosterol, γ-lanosterol, and agnosterol), 20-26% of the lanolin; (4) cholesterol, 20-30% of the lanolin; and (5) a mixt. of dextrorotatory substances amounting to 5% of the lanolin.

8974. Hassler, John W. **Influence of pH of the adsorbent on the properties of edible oils and fats.** *Oil & Soap* 22, 60-2(1945).—*C.A.* 39, 1998^9.

The effect of active carbon and active clays was discussed. Bee[illegible] and cottonseed oil were used with the clays and menhaden, peanut and coconut oil with the active carbon. The pH of the adsorbent was detd. on the aq. ext. and that of Fuller's earth ranged from 7 to 10 and that of the carbons from 8 to 11. Peroxide bodies in an oil were adsorbed by active clays and carbons; and this work confirmed previous studies that lowering the pH of an adsorbent resulted in increased removal of peroxide bodies.

8975. Prakash, Brahma and Ram, Atma. **Replacement of glycerol by bentonite, a cheap substitute in R.-M. saponification.** *Proc. Ann. Convention Oil Technol. Assoc. India* 2, 36-8 (1945).—*C.A.* 45, 7805*e*.

Because of the scarcity of glycerol, bentonite was tried as a substitute to aid sapon. in the procedure for detn. of the Reichert-Meissl no. Tests showed that 0.3-0.4 g of 100-mesh or 0.4-0.5 g of 60-mesh bentonite was suitable.

8976. Ramsey, L. L. and Patterson, W. I. **Separation and identification of the volatile saturated fatty acids (C_1 to C_4).** *J. Assoc. Official Agr. Chem.* 28, 644-56(1945).—*C.A.* 40, 811^9.

The volatile acids were sepd. on a chromatographic partition column of silicic acid, satd. with an aq. soln. of a suitable indicator, with $BuOH\text{-}CHCl_3$ as the second solvent. Formic, acetic, and propionic acids were sepd. completely from one another, but butyric and isobutyric acids were obtained together, free from their homologs. Pos. identification of all the acids except isobutyric was based on the microscopic examn. of a characteristic cryst. salt (cerous formation, mercurous acetate, mercurous propionate, mercurous butyrate, photomicrographs of which were reproduced).

8977. Sylvester, N. D.; Ainsworth, A. N., and Hughes, E. B. **Determination of fat in mixtures containing fatty acids and the determination of unsaponifiable matter in oils and fat.** *Analyst* 70, 295-301(1945).—*C.A.* 39, 5099[9].

A soln. contg. fat and fatty acids was passed through a column of Al_2O_3 slurry which was tinted with bromothymol blue. The position of the fatty acid band was clearly defined. $CHCl_3$ or Et_2O was convenient as washing solvent. This absorption method for the removal of fatty acids could be applied to the detn. of unsaponifiable matter in oils and fats after acidification of the sapond. product, but the relatively large quantity of fatty acid to be removed made another procedure more advantageous. After the soap soln. had been extd. with ether to remove unsaponifiable matter, wash the ext. with dil. acid to decomp. any dissolved soap and remove the resulting fatty acids by passing the ether soln. through an adsorption column.

8978. Ziels, N. W. and Schmidt, W. H. **Catalytic effect of metals and light on fats and oils.** *Oil & Soap* 22, 327-30(1945).—*C.A.* 40, 1049[9].

The effects of various metals and alloys present during deodorization of hydrogenated cottonseed oil were tabulated, also the effect of deodorizing temp. on the proöxidant effect of boiler plate steel and 18-8 and 18-3-3 stainless steel. The metals tested were: Al, Ni, Ta, Sn, Cr, Fe, Co, Cu, Mn, Pb, and the alloys Inconel, Rezistal, and monel. All metals tested with the exception of Al and Ni exerted some proöxidative effect on various fats and oils of a consistency and purity suitable for shortenings. The metal effect became more noticeable with increasing temps. As a mechanism, the formation of metallic soap was suggested by the inter-action of the metal and the free fatty acid. Inconel and Rezistal were the best of the alloys tested, with monel the poorest.

8979. Hinners, Herbert F.; McCarthy, Justin J., and Bass, Raymond E. **The evaluation of bleaching earths. The adsorptive capacity of some bleaching earths of various pH for chlorophyll in soybean oil.** *Oil & Soap* 23, 22-5(1946).—*C.A.* 40, 2326[4].

Refined extd. soybean oil was bleached in vacuo for 30 min. at 110°C under controlled conditions with various concns. of com. bleaching earths. The bleached oil was analyzed spectrophotometrically and the Lovibond color detd. and the chlorophyll density calcd. by Beer's law. The Lovibond color was not indicative of the chlorophyll concn. in the oil and could not be used to det. the adsorptive capacity of an earth for this pigment. The removal of chlorophyll from the oil by these earths followed Freundlich's adsorption equation. Although the trend was toward better decolorization at the lower pH values, this efficiency was not a function of pH. The adsorption capacity of a bleaching earth for chlorophyll in soybean oil apparently was proportional to the amt. of H or OH ions capable of being adsorbed by the earth.

8980. Kirchner, J. G.; Prater, Arthur N., and Haagen-Smit, A. J. **Separation of acids by chromatographic adsorption of their p-phenylphenacyl esters.** *Ind. Eng. Chem., Anal. Ed.* 18, 31-2(1946).—*C.A.* 40, 1448[3].

Highly purified *p*-phenylphenacyl esters showed a blue fluorescence in ultraviolet light. The derivs. of the lower fatty acids could be used for a chromatographic sepn. on silicic acid columns. A 1:1 mixt. of benzene-petr. ether (b. 80-90°) was used for both adsorption and development, and pressure was used to develop the chromatograms. The derivs. of higher mol. wt were less strongly absorbed than the lower ones. Each member from acetic to capric could be sepd. from the one preceding or following it, and the isoacids with 4, 5, and 6 C atoms could be similarly sepd.

8981. Langston, R. B. and Rich, A. D. **Nomographs for determining relative bleaching costs of adsorbents.** *Oil & Soap* 23, 182-4(1946).—*C.A.* 40, 4540[4].

Nomographs were given for a rapid method for evaluating the differences between bleaching adsorbents. Two operations were involved: (1) the detn. of cost of adsorbent plus adsorbent handling cost and (2) the detn. of value of oil lost in the press cake. The sum of these 2 items offered a basis for comparing adsorbents and was taken as the bleaching cost. When the adsorbent dosage was greater than that covered by the scale of the nomograph, the adsorbent dosage was divided by 2 and the resulting adsorbent purchase and handling costs were doubled.

8982. Oda, Makoto. **Butanol fermentation with sugar as the raw material. III. Increasing the concentration of the mash.** *J. Agr. Chem. Soc. Japan* 21, 16-17(1946).—*C.A.* 46, 1704*i*.

To avoid the toxicity of BuOH some oils and carbons were tested on their power to absorb BuOH; the most effective was com. carbon, supernorite; among the oils tested, emulsified coconut oil, emulsified soybean oil, emulsified peanut oil were high in BuOH absorption. The concn. of sucrose in the mash was varied from 7 to 10%, but 10% was too high. For the 8% mash with peanut cake 1.2%, intermittent addn. of supernorite was effective.

8983. Puri, Amar Nath; Rai, Balwant, and Ratti, T. R. **Studies in the bleaching properties of clays.** *J. Indian Chem. Soc., Ind. & News Ed.* 9, 22-33(1946).—*C.A.* 41, 4660*d*.

The properties of some typical bleaching earths were studied and attempts were made to find some single characteristic property or const. of earth to distinguish a bleaching from a nonbleaching clay. Thirty typical earths were activated by treatment with HCl. The bleaching action of the activated earths was tested by mixing 0.5-g portions with 10-ml portions of a crude oil, heating the mixt. at 90°C for 10 min. and detg. the bleaching effect with the Duboscq colorimeter.

The oils used in these expts. were crude rape seed, crude cottonseed and cottonseed oil treated with NaOH to neutralize free fatty acids. Five earths showed a comparatively good bleaching action, but no single characteristic was found which detd. their suitability for activation. The earths should be free or almost free of humus, with a base-exchange capacity of 20-30 milliequivs. per 100 g of earth, and a neutralization value of about 20 milliequivs.

8984. WILLIAMS, K. A. **Chromatography in the analysis of fatty oils.** *Analyst* 71, 259-63 (1946).—*C. A.* 40, 4980[1].

The application of chromatography to the analysis of fatty oils was reviewed, and methods described for detg. free fatty acids, carotene, xanthophylls and vitamin A, hydrocarbons, oxidized acids and certain impurities of olive oil.

8985. ARCURI, JOSÉ. **Study of the activity and ability of activation of Argentine bentonite.** *Rev. facultad cienc. quim.* 22, 217-24(1947).—*C. A.* 44, 11049*i*.

Seven samples of 200-mesh bentonite from various Argentine deposits were evaluated for their ability to decolorize raw rapeseed oil (Lovibond 90Y/6.0R). One, 2, 3, 4, and 5% of the bentonites were added to the oil at 105°C, agitated for 5 min., filtered off on a Buchner funnel, and the color of the filtered oil was detd. An English Fullers' earth was used for comparison, 3% of which reduced the color to 40Y/5.2R. Not nearly as good an effect was obtained with any of the Argentine materials. Bentonites were activated by treating them with 0.3, 0.6, 1.2, 3, and 6 *N* HCl under reflux at 100°C for 0.5, 1, 2, 3, 4, and 5 hrs, filtration, washing out the excess acid, drying, and powdering them to 200 mesh. Natural bentonites retained between 13.95 and 18.85% of oil, while activated bentonites retained 38.40 to 54.50% (g per 100 g bentonite).

8986. LIN, I. AND WU, SU-MING. **Decolorization of vegetable oil by acid clay.** *Research Bull. Fukien Acad. No.* 2, C 4-8(1947)(in English).—*C. A.* 42, 2118*i*.

Acid clay from Kien-Yang and from Lien-Cheng removed by adsorption the coloring matter from peanut oil less than from darker teaseed oil, the 1st clay being a better decolorizer than the 2nd. Higher temp. and treatment with 5% HCl improved the decolorization. The acid treatment increased adsorption 5-10% and the decolorizing effect was equiv. to the addn. of 70-100% more clay.

8987. MATHUR, KRISHNA G. **Studies in activated silicates.** I. *J. Indian Chem. Soc., Ind. & News Ed.* 10, 47-52(1947).—*C. A.* 42, 6497*a*.

SiO_2 and silicates of Fe, Al, Cr, Cu, Mg, Mn, Ni, and Co were pptd. by adding metallic salt solns., 1-20% concn., to Na_2SiO_3 soln., washing, drying at 60-70°, grinding, and activating at 100-400°C. For the bleaching of linseed, groundnut, cottonseed, rapeseed, and mineral oils, silicates of Mn, Mg, and Cu showed low activity. The bleaching efficiencies were best for silicates pptd. at low concns., about 2%, by slow pptn., and activation at 350°. For the adsorption of benzoic acid, the silicates outside the concn. range of 5-15% showed a loss in adsorptive capacity.

8988. MAZUMDAR, BHUPENDRA KRISHMA AND GOSWAMI, M. N. **Chromatographic separation of stearic acid and oleic acid.** *Indian Soap J.* 12, 227-33(1947).—*C. A.* 42, 3973*i*.

The purpose of the investigation was to develop a method for sepg. stearic acid from oleic acid which was invariably an impurity in stearic acid. The prepn. of Al_2O_3, MgO, silica gel, and activated carbon adsorbents and their use as column materials were described in detail. The Al_2O_3 and MgO columns gave the best results, with carbon the third choice.

8989. MCINTOSH, R.; JOHNSON, H. S.; HOLLIES, N., AND MCLEOD, L. **Preliminary observations of the dielectric constants of vapors adsorbed on activated silica.** *Can. J. Research* 25B, 566-74(1947).—*C. A.* 42, 1466a.

The dielec. consts. of EtCl, butane, and $(CH_2)_2O$ adsorbed on silica gel were detd. by measuring the change in the capacity of an elec. condenser when such gel contg. the adsorbate was placed between the plates of the condenser. The dielec. const. calcd. for adsorbed butane was close to that calcd. for the bulk liquid, whereas the value calcd. for adsorbed EtCl was significantly lower than the value calcd. for the liquid.

8990. PALENI, V. ANDREA. **Decolorization of vegetable oils by active earths.** V. *Olii minerali, grassi e saponi, colori e vernici* 24, 56-8, 77-8(1947).—*C. A.* 46, 279*g*.

The example of sulfured olive oil bleached with Tonsil Optimum 1939 and with Prolit V46, was used to show that carotenes (λ 435) were adsorbed with up to 3-4% earth, while the adsorption of chlorophyll (λ 660) continued up to 7-8% clay.

8991. PAREKH, N. N. AND VAIDYA, B. K. **Activation of clays and earths.** *J. Indian Chem. Soc., Ind. & News Ed.* 10, 29-39(1947).—*C. A.* 42, 6499*a*.

The acid activation of a moderately plastic china clay from Junagadh state, a low plastic yellow clay from Madras Province, and a Central Indian Fuller's earth were studied. The acid concn. was varied from 0.5 to 6 *N*, residual acidity from 1 to 0.003 *N*, and activation from 100° to 600°C. HCl soln. was only 1/2 to 1/3 as effective as H_2SO_4 soln. Bleaching tests were made with groundnut and sesame oils. Fuller's earth was the most active, while little improvement was shown by the yellow clay through activation.

8992. PRITCHETT, W. C.; TAYLOR, W. G., AND CARROLL, D. M. **Chlorophyll removal during earth bleaching of soybean oil.** *J. Am. Oil Chemists' Soc.* 24, 225-7(1947).—*C. A.* 41, 5735*d*.

Approx. 25% of the chlorophyll in crude soybean oil was removed by refining with alkali. Hydrogenation of the oil to a shortening consistency with ordinary catalyst at moderate temp. reduced the chlorophyll by about 2/3; and complete hardening reduced about 95% of the chlorophyll. Deodorization of hardened soybean oil had little influence on the chlorophyll content.

8993. UKIL, SUDHIR CH. AND GOSWAMI, M. N. **Decolorization and deodorization of mustard oil.** *Indian Soap J.* **12**, 258-65(1947).—*C.A.* 42, 3974*g*.

Allyl isothiocyanate was removed from mustard-seed oil by passing steam at 100°C through the oil for 1.5 hrs. The S compd. was not removed by treatment with silica gel, CuO, or cuprammonium compd. For decolorizing the oil, the best results were obtained by treatment with a mixt. of 9 parts of acid-treated Fuller's earth and 1.5 parts of Carbonit (vegetable carbon) for 45 min. at 75°C. Carbonit could be replaced by rice-husk charcoal, made by heating rice husks slowly up to 800-900° and then holding at that temp. for 1 hr, followed by cooling, boiling with 10% NaOH soln. for 2 hrs, filtering, washing to remove NaOH, and drying in a steam oven.

8994. APPELL, FRANCINE. **Chromatography and its application to the study of fatty oils.** *Chimie & industrie* **60**, 36-40(1948).—*C.A.* 42, 7999*a*.

The application to the sepn. of unsaponifiable, fatty acids, glycerol, and oxidation and polymerization products of oils were discussed.

8995. ATKINSON, D. I. W. **The displacement of liquids from porous solids.** *J. Imp. Coll. Chem. Eng. Soc.* **4**, 78-92(1948).—*C.A.* 44, 4291*f*.

The results were applied to filtration, such as the sepn. of vegetable oils from Fuller's earth, or to petroleum production. Expts. were made with 2-layer beds of glass and steel spheres 1/16 to 1/4 in. in diam. to det. the fraction of liquid vol. that would drain from an initially satd. bed. For C_6H_6, heptane, ether, EtOAc, $CHCl_3$, H_2O, liquid paraffin, and lubricating oil, the percentage of drainage was nearly const., varying from 90.75 to 93.4% as the sphere diam. was increased. The contact angle of each of the above organic liquids with H_2O and steel was found to be zero, except the angle for C_6H_6 which was 13°.

8996. DUTTON, HERBERT. J. AND REINHOLD, CATHERINE L. **Adsorption analysis of lipides. III. Synthetic mixtures of ethyl stearate, oleate, linoleate, and linolenate.** *J. Am. Oil Chemists' Soc.* **25**, 120-4(1948).—*C.A.* 42, 3973*f*.

The adsorption analysis of 6 binary mixts. composed of ethyl stearate oleate, linoleate, and linolenate was studied on alumina columns. This technique resulted in fractionation of all 6 systems, including the oleate-linoleate mixt., the latter not fractionating by distn. methods. Measures of the performance of the columns were obtained by dividing the eluate into 2 portions at the point in the fractionation at which the starting compn. was reached. The efficiency of sepn. of pairs appeared to depend on the difference in degree of unsatn. of the components. Over-all recoveries of esters from the columns ranged from 71.8 to 87.5%.

8997. GRACE, N. H. **Canadian erucic acid oils. I. Refining and bleaching.** *Can. J. Research* **26F**, 349-59(1948).—*C.A.* 43, 2000*e*.

The erucic acid oils of Canada (from rapeseed and from mustard seed varieties screened from western Canadian wheat) were dark and unsuitable for edible oils. Clay bleaching tests in CO_2 atm. were made on these oils with or without treatment by conventional alkali refining. Super-filtrol was better than Neutrol, and much better than unactivated Manitoba bentonite; it was used in the following tests: Results of treating and bleaching were expressed in terms of free fat acid and relative transmission in % at 440 and 660 mμ compared to Stanolax (white mineral oil) as standard. With 4% clay increasing treating time from 20 to 80 min. at 100°C had little effect on transmission of rapeseed oil, either crude or partial alkali treatment treated, but did increase free acids of the crude oil from 0.38 to 0.62%, with no change for the other.

8998. HIRSBRUNNER, HANS RUDOLF. **Scouring mineral oil-lubricated wool.** *Textil-Rundshau* 3, 343-52, 382-91, 423-29(1948).—*C.A.* 43, 2780*b*.

Wool lubricants contg. mineral oils were more difficult to remove than those based on vegetable oils. Soaps emulsified best. The colloidal-chem. effects of scouring agents were compared. Mineral oils contg. nonsatd. compds. showed yellowing in storage and light. Non-scoured or insufficiently scoured wool showed inferior dyeing results after insulation, caused by oil residues. Adsorption of scouring and emulsifying agents also counteracted dye adsorption.

8999. KING, R. R. **A.O.C.S. official bleaching earths.** *J. Am. Oil Chemists' Soc.* 26, 12-13 (1948).—*C.A.* 42, 2119*f*.

Natural bleaching earth should be made from English Earth of the XL000 brand and Activated Bleaching Earth should be made from Special Filtrol brand activated clay.

9000. KIRSANOV, N. V. **Properties of upper-Pliocene montmorillonite clays of Sakami.** *Doklady Akad. Nauk S.S.S.R.* 60, 1037-9(1948). —*C.A.* 43, 977*b*.

These were dense, greasy clays of typical origin from swamps or small lakes. The clay minerals belonged to the Mg type of montmorillonite; Ca was bound only to accessory calcite and gypsum; a little was adsorbed on the montmorillonite. The adsorption and bleaching properties of these clays were interesting from the standpoint of technology, e.g. for mineral-oil raffination, soap industry, as a filling or washing agent in textile and fur industry, for oil boring and prospecting slurries, etc.

9001. LAHUERTA CASAUS, PASCUAL AND SANCHEZ MARCO, GODOFREDO. **The regeneration of catalysts used for hydrogenating fats.** *Rev. acad. cienc. exact. fís.-quím. y nat. Zaragoza, Ser. 2A*, 3, No. 2, 65-72(1948).—*C.A.* 44, 6657*h*.

The patent literature was reviewed and the prepn. of catalysts by the decompn. of Ni formate described. The analysis of catalyst residues for Ni (by the dimethylglyoxime method) and for fatty materials by means of the consts. of the Et esters was outlined, including the question of Ni soaps that were sol. in the fat.

9002. MATHEW, P. K.; NAIR, P. V.; RAMAKRISHNAN, T. A., AND SREEMULANATHAN, H. **Deodorization of shark-liver oil.** *Nature* 162, 494(1948).—*C. A.* 43, 1531*b*.

Shark-liver oil could be deodorized by steam treatment, agitation with fermenting milk or toddy, or by catalytic hydrogenation with Ni catalyst. Hydrogenation with 0.25% Ni catalyst for 20-45 min. at 120°C improved the keeping quality with loss of only 7% of vitamin activity. One % catalyst was insufficient to effect complete deodorization, while 0.4% catalyst or operation at higher temps. caused vitamin destruction.

9003. MIYAKE, ROICHI. **Hydrogenation of fatty oils. I. Finback whale oil under atmospheric pressure.** *J. Pharm. Soc. Japan* 68, 1-4(1948)(English summary).—*C. A.* 44, 352*b*.

When finback whale oil was catalytically hydrogenated with Ni-silica gel till the product gave an I_2 no. 83, only those having 2 or more double bonds were satd., and those with 1 double bond originally existed in the oil, or formed by this partial hydrogenation remained unsatd. The reaction was the same at 180° or 210°C; however, it proceeded 1.44 times faster.

9004. MIYAKE, ROICHI. **Hydrogenation of fatty oils. II. Finback whale oil and soybean oil with H. Akins' catalyst.** *J. Pharm. Soc. Japan* 68, 8-10(1948)(English summary).—*C. A.* 44, 352*c*.

With Akins' Cu-Cr oxide catalyst, unsatd. fatty acids above linoleic acid series in both oils underwent selective partial hydrogenation at 180°C or 210°C under atm. pressure. If the reaction started with an initial pressure of 40 atms. H_2 at 140°C, the same results were obtained, but at 180°C, not only oleic acid series, but also the acid radicals were reduced too.

9005. MIYAKE, ROICHI. **Hydrogenation of fatty oils. III. Quantitative analysis of constituents of the seed oil of Xanthium strumarium by selective hydrogenation method.** *J. Pharm., Soc. Japan* 68, 12-13(1948)(English summary).—*C. A.* 44, 352*d*.

From exhaustive hydrogenation by Cu-Cr oxide catalyst and detn. of I_2 no. of the product, the amt. of satd. acid in the oil could be calcd. The decrease of I_2 no. by this hydrogenation also gave the basis for calcn. of linoleic acid, since linoleic was the only highly unsatd. acid in this oil.

9006. MIYAKE, ROICHI. **Hydrogenation of fatty oils. IV. Adkins' catalyst (A) Relation between the decomposition temperature of copper ammonium chromate and activity of copper-chromium oxide catalyst.** *J. Pharm. Soc. Japan* 68, 14-17(1948)(English summary).—*C. A.* 44, 352*e*.

$CuNH_4CrO_4$ decompd. in the air under atm. pressure at 280°C. An addn. of $BaCrO_4$ or kieselguhr or change in the reaction of the pptg. medium did not alter this decompn. temp. Heating the product up to 280°C was sufficient to produce an active catalyst. Under 7 mm Hg pressure, the decompn. temp. was lowered to 260°C, but the product showed no superior catalytic power.

9007. MIYAKE, ROICHI. **Hydrogenation of fatty oils. V. Adkins' catalyst. (B) Reduction of the catalyst and its catalytic action.** *J. Pharm. Soc. Japan* 68, 18-21(1948)(English summary).—*C. A.* 44, 352*f*.

The reduction of Cu oxide in Adkins' catalyst by H_2 began at 128°C under atm. pressure. The reduction of highly oxidized Cr to Cr_2O_3 began at 140°C, but proceeded slowly. In the presence of the Cu oxide, the reduction was very rapid. In Adkins' catalyst, it was reduced to Cu which actually catalysed the hydrogenation of fatty oil.

9008. MIYAKE, ROICHI. **Hydrogenation of fatty oils. VI. Adkins' catalyst (C) Promoter action of chromium oxide.** *J. Pharm. Soc. Japan* 68, 22-5(1948)(English summary).—*C. A.* 44, 352*g*.

In order to hydrogenate highly unsatd. fatty oil at atm. pressure, Cr oxide, a promoter, was necessary to aid the action of the reduced Cu.

9009. MIYAKE, ROICHI. **Hydrogenation of fatty oils. VII. Adkins' catalyst. (D) Chromium oxide as catalyst for the hydrogenation of carbonyl group.** *J. Pharm. Soc. Japan,* 68, 26-8(1948)(English summary).—*C. A.* 44, 352*g*.

Chromium oxide in Adkins' Cu-Cr oxide catalyst had a catalytic action of its own in the hydrogenation of the carbonyl group.

9010. MIYAKE, ROICHI. **Hydrogenation of fatty oils. VIII. Adkins' catalyst (E) Significance of activation of catalyst by washing with acetic acid.** *J. Pharm. Soc. Japan* 68, 29-31(1948)(English summary).—*C. A.* 44, 352*h*.

The function of washing Cu-Cr oxide with AcOH was to remove H_2O-sol. poison, and H_2O could be substituted for the acid without lowering its catalytic power.

9011. MIYAKE, ROICHI. **Hydrogenation of fatty oils. IX. Catalytic action of copper supported on kieselguhr.** *J. Pharm. Soc. Japan,* 68, 32(1948)(English summary).—*C. A.* 44, 352h.

Cu catalyst supported on kieselguhr also could selectively hydrogenate highly unsatd. acids in the oil to oleic acid series under atm. pressure, similar to Adkins' Cu-Cr oxide catalyst.

9012. MIYAKE, ROICHI. **Hydrogenation of fatty oils. X. Relationships between degree of dispersion of copper and carrier and surface area; and between degree of the dispersion and activity of copper catalyst.** *J. Pharm. Soc. Japan,* 68, 33-7(1948)(English summary).—*C. A.* 44, 352i.

The degree of dispersion and surface area of catalyst on kieselguhr, which went through sintering, held a hyperbolic relationship. The high activity of Cu catalyst after sintering in hydrogenation of finback whale oil occurred at a definite degree of dispersion. A method of prepg. a Cu catalyst on kieselguhr relatively uniform was given. Sintering occurred when copper catalyst was repeatedly subjected to reduction and oxidation.

9013. Miyake, Roichi. **Hydrogenation of fatty oils. XI. Adkins' catalyst (F) Characteristic of the catalyst and significance of addition of barium chromate.** *J. Pharm. Soc. Japan* 68, 38-9(1948)(English summary).—*C. A.* 44, 353*a*.

Adkins' catalyst and Cu-kieselguhr catalyst were similar in many respects, except superior uniformity of dispersion of Cu in the former. The fact that high activity of Adkins' catalyst was confined to the short period of time before sintering must be due to this fact. $BaCrO_4$ did not hamper the reduction of copper oxide, and might act as an increased carrier.

9014. Reinbold, Catherine L. and Dutton, Herbert J. **Adsorption analysis of lipides. II. The fractionation of soybean oil and derived ethyl esters.** *J. Am. Oil Chemists' Soc.* 25, 117-20(1948).—*C. A.* 42, 3973*d*.

A rapid method of fractionating soybean glycerides and their ethyl esters by adsorption analysis on an Al_2O_3 column was described. It compared favorably with other fractionation methods. In the adsorption analysis of crude soybean oil the I_2 nos. of fractions ranged from 104 to 173; but under other conditions of adsorption I_2 nos. as high as 200 were obtained. The I_2 nos. of soybean ethyl esters ranged from 61 to 185. Recoveries from the columns were 82.4% for glycerides and 90.0% for the esters.

9015. Salvi, G. **Selective adsorption. Theory, methods, and applications for the separation of hydrocarbons.** *Riv. combustibili* 2, 79-102(1948).—*C. A.* 43, 2839*i*.

Sepn. of hydrocarbon mixts. and analyses of oils and fats by selective adsorption were reviewed. The advantages of the Hopf chromatograph were pointed out for semi-industrial operation.

9016. Swain, Lyle A. **Chromatographic analysis of the unsaponifiable matter of marine animal oils.** *Can. Chem. Process Inds.* 32, 553-4 (1948).—*C. A.* 42, 7069*g*.

A glass tube 1 cm inside diam. was packed with Al_2O_3(-80 + 150 mesh) and heated to 200°C for several hrs. The unsaponifiable matter from 2.5 g of dogfish-liver oil (about 0.5 g) was dissolved in a small vol. of light petroleum, which was caught in 150-ml portions. Evapn. of the 1st portion left a colorless liquid amounting to less than 3% of unsaponifiable matter. In the column a yellow band of pigment was visible approx. 2/3 down the column. Examn. of the column by ultraviolet showed the greenish yellow fluorescence characteristic of vitamin A in a band immediately above the band visible in daylight. Passage of CH_2Cl_2 through the column immediately moved both the visible band of pigment and the fluorescent band of vitamin A down and out of the column.

9017. Tsuchiya, Tomotaro. **Decolorization of rice oil.** *J. Nippon Oil Technol. Soc.* 1, No. 3, 24-9(1948).—*C. A.* 43, 5611*a*.

Addn. of AcOH (0.1-1.0%) to acid clay decreased yellow and green colors, but the red increased; addn. of H_2SO_4 was effective only when the amt. was not more than 0.1% at 50-80°C. Addn. of H_3PO_4 (0.1-0.5%) gave the product of best color. Treatment with activated Fe powder gave good results, although a large amt. was necessary to decolorize to the extent of refined soybean oil.

9018. Zaǐtsev, Mikola. **A new catalyst for the hydrogenation of fats and its use in industry.** *Ukraïn. Tekh.-Hospodars'k. Inst. (Regensburg), Nauk. Zapiski (Ukrain. Tech. Husbandry Inst., Sci. Repts.)* **1948**, No. 1 (Whole No. 4), 123-32(in German, 132-5; in English, 135-8)—*C. A.* 43, 7607*h*.

To 70 parts of $NiSO_4.7H_2O$ and 18 parts of $CuSO_4.5H_2O$ in 4000 parts of H_2O in a vessel with a protective rubber coating was added 50 parts of Na_2CO_3 in 200 parts of H_2O carrying suspended colloidal silica. The ppt. was filtered and the solid was washed with 2000 parts of water at 40°C. Drying of the solid in an oven at 90-100°C yielded a product contg. 5-8% H_2O. It was suspended in a recently distd. fatty oil and the mixt. was hydrogenated, first at 250°C and finally at 275°C. The catalyst was isolated by filtration. The performance of the catalyst compared favorably with other com. catalysts. Its main advantage was the low over-all consumption of Ni.

9019. Doscher, Todd M. **Characteristics of detergent suspended drilling fluids.** *Oil Gas J.* 48, No. 8, 75-80(1949).—*C. A.* 44, 1249*b*.

The effects of soaps and sulfonates added to bentonite drilling fluids were studied. Concn. of 2 to 3% detergent was economically more feasible, but the com. advantage of the fluids described has yet to be proved. Detergents and other colloids acted by coating the clay particles or aggregates.

9020. Grasso, Sebastiano. **New method for the chemical purification of glycerol.** *Olearia* 3, 885-7(1949).—*C. A.* 44, 4201*e*.

To 100 ml glycerol (concn. 85%) add 3 ml concd. H_2SO_4, heat to 140°C for 40 min., passing a strong current of steam through to carry off acrolein and HCOOH. Add 18 g baryta dissolved in little H_2O, completing the operation at 110°C. Add 1 ml concd. H_2SO_4 to bring the pH of the soln. to 3, filter, pass the soln. through a cation- and an anion-exchange resin (Zeokarb HI and DeAcidite E), and decolorize with active carbon.

9021. Gruntfest, I. J. and Young, E. M. **The chemistry of detergency.** *J. Am. Oil Chemists' Soc.* 26, 236-8(1949).—*C. A.* 43, 5213*a*.

A single fiber was placed in a drop of H_2O suspension of a finely divided carbon and observed microscopically. The carbon particles adhered to the fiber; when a proper amt. of soap was added, the carbon particles did not stick to the fiber. Similar expts. with fabric simulated laundry practice. The amt. of dirt picked up by the fabric and held in such tests was estd. by reflectance measurements. There was a critical concn. of soap above which the cloth was recovered white and below which it was black. This concn. depended on the amt. of dirt. When the critical concn. of soap was plotted against the amt. of dirt, a linear relationship was observed.

9022. JENSEN, WALDEMAR. **Chromatographic analysis of tall oil.** *Finnish Paper Timber J.* 31, 293-4(1949)(in English).—*C. A.* 45, 2205*b*.

The filtrate from the detn. of the petr. ether-insol. matter in a 5-g sample of tall oil was dild. to 250 ml. A 50-ml aliquot was evapd. and the neutral matter detd. in the residue by the previous method. The rest of the soln. was transferred to a flask with a reflux condenser, the petr. ether was distd., the residue esterified with MeOH, dissolved in ether, and washed with NaCl soln. The ether soln. thus obtained was dild. to 200 ml. A 50-ml aliquot of this soln. was evapd. to 5-10 ml and the neutral matter (now including the ester) detd. chromatographically; 300-ml ether was used for elution and the substance obtained dried 30 min. before weighing. The difference between the 2 amts. of neutral matter thus detd. comprised the fatty acids in 1-g sample (as ester).

9023. KAWAI, JUNICHI. **Decolorization of rice oil by hydrogen peroxide.** *J. Nippon Oil Technol Soc.* 2, No. 1. 1,30-2(1949).—*C. A.* 43, 5611*b*.

Treatment of rice oil with 2% of 35% H_2O_2 removed 69% of color; this was a much better performance than that of activated carbon or acid clay.

9024. KING, R. R. AND WHARTON, F. W. **Oxidation effects in adsorption bleaching of vegetable oils.** *J. Am. Oil Chemists' Soc.* 26, 201-7 (1949).—*C. A.* 43, 5207*i*.

Adsorption of color and oxidative decrease in color were favorable reactions which resulted during bleaching operations, while oxidative increase in color and oxidative stabilization against adsorption were unfavorable reactions. Adsorbents were shown to catalyze these oxidative reactions. Under any comparable set of conditions significantly lower colors resulted when bleaching was carried out under vacuum or in an inert atm. Multiple-stage bleaching under atm. conditions showed no advantage because of the adverse oxidative effect but might be advantageous under vacuum conditions. Low-pH earths responded better than high-pH earths to vacuum bleaching with respect to improved color removal and oil stability.

9025. KING, R. R. AND WHARTON, F. W. **Continuous vacuum bleaching of vegetable oils.** *J. Am. Oil Chemists' Soc.* 26, 389-92(1949).—*C. A.* 43, 9489*a*.

The advantages of a com. continuous vacuum bleaching method were: deaeration and dehydration of the oil-adsorbent mixt. in the cold by flashing the slurry into a vacuum to remove H_2O and O_2 prior to bleaching; further dehydration and degasification after heating to bleaching temp. by continuous flashing into a vacuum to remove bound H_2O and gaseous products of decompn.; maintaining a closed system to avoid atm. contact from the time the cold refined oil entered to the time the cooled bleached oil left the system.

9026. OTERO-AENLLE, E.; CADORNIGA, CARRO R., AND POMARES, BOIX S. **Some properties of alkali salts of fatty acids. I. Wetting capacity and capillary activity.** *Anales real soc. españ. fís. y quím.* 45B, 1337-60(1949).—*C. A.* 45, 4467*b*.

The wetting capacities of Na and K salts of capronic, caprylic, butyric, stearic, palmitic, and oleic acids were studied in 0.1% solns. The values obtained were compared with surface tension measurements. It was detd. that the capillary activity was not the only factor affecting wetting capacity. The effects of cation, addn. of NaOH, electrolytes, and alc. on wetting activity and surface tension were studied. There was no correlation between wetting capacity and surface tension.

9027. SATO, MITSURU AND MARUYAMA, KENJI. **Energy state of the valence electrons in some metals. I, 17. Catalytic action of Zn in the hydrogenation of the oil extracted from the seed of Perilla frutescens.** *Science Repts. Research Insts. Tohoku Univ. Ser. A,* 1, No. 1, 51-2 (1949).—*C. A.* 44, 9786*c*.

Zn was particularly active as a catalyst in this reaction in the range 200-320°C. Its decrease in activity at 320°C was not as sharp as the increase in activity at 200°C and further investigation at the higher temp. was suggested.

9028. STOUT, LAWRENCE E.; CHAMBERLAIN, DONALD F., AND MCKELVEY, JAMES M. **Factors influencing vegetable-oil bleaching by adsorption.** *J. Am. Oil Chemists' Soc.* 26, 120-6(1949).—*C. A.* 43, 3635*c*.

On the basis of adsorbent activity the acid-activated clays were generally 1.5 to 2 times more effective as bleaching agents than the natural earths. The activity of an adsorbent in bleaching a vegetable oil was at a max. at some particular temp. The acid-activated clays tested had a temp. of max. activity in the range of 100-106°C. The natural earths had max. activity at 118° to 132°. The 3 materials tested that were high in silica had a max. activity at 180° to 250°C, which was high for use in the edible-oil industry.

9029. TSUCHIYA, TOMOTARO. **Effect of added acids on the decolorization of oil by acid clay.** *J. Nippon Oil Technol. Soc.* 2, Nos. 2/3, 1-9 (1949).—*C. A.* 43, 8709*b*.

With crude soybean, rapeseed, and Showyou oil decolorization by acid clay was increased more effectively by addn. of oxalic acid than by addn. of H_2SO_4, AcOH, or H_3PO_4. When AcOH and acid clay were used, green and yellow colors were decreased, but red was increased. H_2SO_4 (0.1%

of oil) was effective at 50°C; at 80°C the green and yellow colors decreased while the red increased. Addn. of H_3PO_4 was effective without exception when the amt. was 0.1-1.0% of the oil.

9030. Ueno, Seiichi; Yoshizaki, Tokuzo, and Ito, Shigeru. **Hardening of fatty oil with use of multiple-component catalysis. I. Catalytic activity of unreduced catalyst consisting mainly of nickel and copper.** *J. Chem. Soc. Japan,* Ind. Chem. Sect., 52, 194-6(1949).—*C.A.* 45, 4063*i*.

A Ni-Cu-kieselguhr (1:1:7) catalyst was prepd. by mixing kieselguhr with $NiCO_3$ and $CuCO_3$ which were pptd. from a $NiSO_4$-$CuSO_4$ soln. The ppt. was washed, filtered, and dried at 100°-105°C. This catalyst was used without being subjected to reduction in H_2. Expts. were done at 180°-200°C with soybean oil in an autoclave under varying H_2 pressures, amts. of catalyst, durations, and water contents. Hardening occurred at low pressures. Above 200°C hardening occurred even at 1 atm. pressure within 2 hrs with 1% catalyst; addn. of free fatty acid showed small effect. H_2O added to oils worked as a neg. catalyst in some cases, but accelerated the reaction in others. Addn. of Na, K, Mg, Ca, Al, Pb, Cr, and Mn salts to the catalyst showed neg. results.

9031. Weil, Herbert. **Industrial oil and fat chromatography.** *Paint Technol.* 14, 391-9, 439-53(1949).—*C.A.* 44, 1267*h*.

9032. Williams, K. A. **The analysis of mixtures of fatty oils with hydrocarbons.** *J. Assoc. Offic. Agr. Chemists* 32, 668-72(1949).—*C.A.* 43, 9489*c*.

The method, especially suitable for the detn. of small percentages of mineral oil in admixt. with fatty oils, consisted of 3 steps: (a) sapon. of oil, (b) sepn. of unsaponifiable matter, and (c) chromatography of the latter on a column of Al_2O_3 with light petroleum (b.p. 40°-60°C) or petroleum benzine (b.p. 30°-75°C) as the solvent. The technique of Newburger could be employed in the chromatography step; an alternative technique (somewhat similar) was described in detail. The hydrocarbons passed through the column and could be quantitatively recovered from the percolate, while the rest of the unsaponifiable matter remained adsorbed.

9033. Williams, K. A. **Chromatographic analysis of fatty oils.** *Discussions Faraday Soc.* 1949, No. 7, 264-7.—*C.A.* 45, 1788*h*.

Advances of the last few years in the application of chromatography to the analysis of fatty oils were briefly reviewed. In particular, reference was made to the sepn. of fatty acids from triglycerides and hydrocarbons from the unsaponifiable matter of natural oils. The sepn. of the constituent mols. of natural oils was described.

9034. Wustefeld, H. **Adsorption and absorption of surface films, especially phosphate coatings, and their plasticity.** *Arch. Metallkunde* 3, 223-4(1949).—*C.A.* 44, 403*g*.

The mechanism of adhesion of soap and complex solns. was discussed.

9035. Zimov'ev, A. A. **Kinetics of reactions proceeding with absorption or evolution of gas. I. Kinetics of the hydrogenation of fats.** *Zhur. Priklad. Khim.* 22, 1253-62(1949). —*C.A.* 44, 3778*d*.

Rates of hydrogenation of vegetable oils consisting mainly of oleic acid triglycerides, in a stream of H_2 [reduced from $(HCOO)_2Ni$ with H_2, in the oil, at not over 260°-5°C], were followed either by detns. of the I_2 no. i, expressing the amt. of double bonds, or of the vol. h. (ml S.T.P.) absorbed. For a 1st-order reaction, $-di/dt = ki$, and $dh/dt = k(h_o - h)$, where h_o corresponded to the amt. of H_2 absorbed at complete satn. The activity of a given Ni catalyst, expressed by k, increased during the reaction but, on repeated use, it tended to become const. At that stage, k was approx. proportional to the amt. of catalyst, in % of the amt. of the oil.

9036. Alexander, A. E. and Gray, V. R. **Aluminum soaps, their nature and gelling properties.** *Proc. Roy. Soc.* (London) A200, 162-8(1950).—*C.A.* 45, 10622*d*.

The chem. nature of Al soaps could be studied by the reaction between Al alkoxides and fatty acids in org. solvents. The product of aq. metathesis between an alkali metal soap and an Al salt appeared to be an adsorption complex of the fatty acid upon hydrated alumina; combination occurred during drying. A polymeric formula for Al soaps was suggested, based upon sixfold coördination Al-O octahedra. When these octahedra joined through an apex, a di-soap resulted, when through an edge, a mono-soap; a combination of these resulted in intermediate values. Some preliminary infrared measurements of Al mono- and di-soaps were consistent with these conclusions.

9037. Fairbairn, D. and Harpur, R. P. **Chromatographic separation of the saturated C_2-C_8 fatty acids from a single small sample.** *Nature* 166, 789-90(1950).—*C.A.* 45, 4061*i*.

Sepn. of mixts. of C_2-C_8 fatty acids was accomplished by adsorption on prepd. silica columns. Silica was obtained by acidifying com. Na_2SiO_3 soln. to pH 8.5 (thymol blue) at 22°C. After aging the ppt. was washed and dried at 110°C for 48 hrs. Two silica columns were prepd., each contg. 0.2 g of silica. In one column (*A*) the silica was impregnated with 1 ml of 0.2% Alphamine Red R indicator, 0.8 ml of 0.1 *N* NaOH, and 1 ml H_2O. In the other column (*B*) the silica was treated with 0.5 ml of 0.2% bromocresol green indicator, 2.1 ml BuOH (199:1), and packed in 14-mm glass tubes. The 2 columns were joined vertically with column A above. The following procedure was used: The fatty acid mixt. in $CHCl_3$-BuOH (99:1 by vol.) soln. was washed into the A column and the chromatogram developed with addns. of $CHCl_3$-BuOH (199:1). Octanoic and hexanoic acids passed rapidly through the *A* column and were fractionated in the *B* column below, eluted, and titrated separately. When the butyric acid band was about to leave column *A*, the columns were sepd. and each fraction obtained by elution with appropriate solvents.

9038. JENSEN, WALDEMAR. **Chromatographic analysis of tall oil. III. Location of acidic matter in column.** *Paper and Timber* (Finland) 32, 142-4(1950)(in English).—*C.A.* 45, 5404*g*.

In the analysis for neutral matter in tall oil by chromatography, the fatty acids were retained on the upper part of the column of Al_2O_3 and the resin acids on the lower. The lowest 10% of the column contained only 1% of the total acids, from which the amt. of adsorbent was concluded to be adequate. Attempts to sep. resin from fatty acids by chromatography were unsuccessful.

9039. KAHLER, F. H. **Purifying crude glycerol by ion exchange.** *Chem. Eng.* 57, No. 7, 109 (1950).—*C.A.* 44, 9170*c*.

Ion exchange could eliminate distn., but not evapn., in the purification of crude glycerol solns. The new method gave a uniform product, stable to light, and the purified solution could be concd. without loss.

9040. KAUFMANN, H. P. **Refining of edible oils.** *Olearia* 4, 101-7(1950).—*C.A.* 44, 7073*g*.

The methods of refining crude vegetable oils, which did not lead to losses of their valuable components, were reviewed, and a plant-scale expt. with colza-seed oil was cited. Chromatography and mol. distn. were critically examd. as possible methods for the tech. sepn. of the valuable accessory substances in vegetable oils.

9041. KAUFMANN, H. P. **Adsorption separations in the fat field. VI. Paper chromatography.** *Fette u. Seifen* 52, 331-42(1950).—*C.A.* 44, 10351*e*.

Paper chromatography was applied to the identification of colors in fats and to the sepn. and identification of fatty acids or mixts. of fatty acids and glycerides. Carotene was detd. by capillarizing a 1-g sample in 100 ml petr. ether or C_6H_{14}, developing with iso-PrOH, and testing for B-carotene by the Carr-Price reaction. Under the same conditions, Ceresin Orange yielded a redish orange zone, dimethylaminoazobenzene an intense reddish violet, Annato (bixin) green, and Ceresin Red red.

9042. KAUFMANN, H. P. AND BUDWIG, J. **The foam test in paper chromatography.** *Fette u. Seifen* 52, 555-6(1950).—*C.A.* 45, 2236*d*.

The foam test for the detection of fatty acids and soaps was adapted to paper chromatography. A soln. of 0.2 mg fatty acid (in petr. ether) or 0.2 mg soap (in water) was placed on a Schleicher and Schüll No. 598G filter paper previously impregnated with Cu acetate soln. and dried. A reagent consisting of equal parts of 30% H_2O_2 and 30% NH_4OH was then added drop by drop. The O_2 liberated caused the ammonia soap to foam. As little as 10 γ oleic acid could be detected.

9043. KOBASHI, TOKUO AND NOBORI, HIROSO. **Studies on the manufacture of higher fatty alcohols by catalytic reduction of fatty oils.** *J. Chem. Soc. Japan,* Ind. Chem. Sect. 53, 363-5 (1950).—*C.A.* 46, 11714*h*.

The activity of the catalyst consisting of cupric zinc oxides and diatomaceous earth was enormously promoted by immersing it in dil. solns. of dichromates or $KMnO_4$ soln. The reduction of fatty acids of coconut oil could advantageously be carried out in the presence of the catalyst giving a product of hydroxyl value 205.6.

9044. LÖW, IRMENTRAUT AND ARGOUD, SIMONE. **Chromatography of carotene from palm oil.** *Oléagineux* 5, 629-33(1950).—*C.A.* 45, 4467*g*.

Concd. carotene exts. of palm oil were prepd. by distn. and by sapon. procedures. When the exts. were dissolved in petr. ether and passed through a column of MgO, 3 carotene isomers (α, β, and γ) and lycopene were found, β-carotene predominating. During the course of treatment, stereoisomers were formed, particularly di-*cis*-β-carotene, which is often misnamed pseudo-α-carotene. Isomerization was reversible, the trans form being the more stable.

9045. MOKRUSHIN, S. G. **Experimental studies of laminar systems. XIX. Ultrathin films as stabilizers of foam.** *Kolloid. Zhur.* 12, 448-51(1950).—*C.A.* 45, 1840*i*.

Colloidal solns. of $Fe(OH)_3$, $Cr(OH)_3$, and $Al(OH)_3$, and thin films of these hydroxides, produced by passing NH_3 over the surface of salt solns., increased the time of collapse of 0.1% gelatin foams. Sols. of CuS, PbS, and ZnS also increased the time, if used in minute amts., but thin films of these sulfides lowered it.

9046. MUKHERJEE, S. **The mechanism of autoxidation of fats. I. Kinetics of catalytic oxidation of oleic and linoleic acids. II. Oxidation of methyl oleate and methyl linoleate.** *J. Indian Chem. Soc.* 27, 230-7, 238-44(1950).—*C.A.* 45, 2233*i*.

Kinetic studies were made of the hematin-catalyzed oxidation of oleic and linoleic acids, and the uncatalyzed oxidation of their methyl esters. O_2 absorption, peroxide formation, and double-bond content were measured. The initial stage of the reaction in each case was cyclic peroxide formation at the double bond, only one bond being attacked in linoleic acid. Subsequently more O_2 was used up than could be accounted for in this way, probably by the formation of hydroperoxide, the energy liberated in peroxide formation being able to remove H from active methylene groups. A chromatographic method for linoleic acid purification was described.

9047. PARDUN, H. AND KUCHINKA, R. **The influence of catalysts on the fatty acid formation during paraffin oxidation.** *Erdol u. Kohle* 3, 109-19(1950).—*C.A.* 44, 6109*g*.

Metal stearates were prepd. and a "Fischer-Tropsch-Gatsch" was oxidized at 120°C to an acid no. 50 with catalyst concns. from 0.05 to 2%. Ca, Th, Mn, Co, and Ni increased the speed of oxidation in proportion to the catalyst concn. The stearates of Na, Ce, Pb, and Fe accelerated the reaction at low, but retarded it at higher concns. Ti, Zr, and Sn gave no definite relation between speed of oxidation and catalyst concn. This was explained on the basis that it was not possible to reproduce the soly. of the accelerator in the substrate.

9048. SATAKE, KAZUO AND SEKI, TOKUICHIRO. **Paper chromatography of hydrazides of fatty acids.** *Kagaku no Ryôiki* (J. Japan. Chem.) 4, 557-61 (1950).—*C.A.* 45, 4604*f*.

Among the solvents examd. mixts. of iso-AmOH, lutidine, and water (10:1.5:1 vol), and especially of iso-AmOH, collidine, and water (10:2:1)(the R_f values given below are for this solvent-mixt.) were found suitable. The one-dimensional ascending method was found preferable to the descending method. It was necessary to heat at 100°-130°C to prep. fatty acid hydrazides, but it was only necessary to mix an excess of $NH_2NH_2.H_2O$ with the Et ester of fatty acids at room temp. to produce fatty acid hydrazides detectable by paper chromatography. The hydrazides on paper were detected by spraying BuOH soln. satd. with 10% ammoniacal $AgNO_3$. The R_f values at 10° were for each hydrazide: formic acid hydrazide 0.11, acetic 0.18, propionic 0.37, *n*-butyric 0.54, isobutyric 0.58, *n*-valeric 0.70, isovaleric 0.70, and *n*-caproic 0.77. The min. amt. detectable was 10 γ in the case of acetic acid hydrazide.

9049. UENO, SEIICHI AND ITO, SHIGERU. **Practical hardening of fatty oil by unreduced catalyst. III.** *J. Chem. Soc. Japan*, Ind. Chem. Sect. 53, 252-4(1950).—*C.A.* 46, 11714*i*.

To get reference data for small industries, the hardening of soybean oil was carried out in the presence of the catalysts consisting of the metal salts or hydroxides (Ni-Cu-Ca, Ni-Cu-Mn, Ni-Cu-Zn, Ni-Cu) at atm. pressure.

9050. UENO, SEIICHI; SAKURAI, HIROSHI, AND KAWANAKA, TATSUICHI. **Hardening of rice oil with nonreduced nickel-copper-diatomaceous earth catalyst.** *J. Chem. Soc. Japan.*, Ind. Chem. Sect., 53, 43-4(1950).—*C.A.* 46, 8395*d*.

Rice oil was autoclaved at 180°C for 1 hr in the presence of Ni-Cu-diatomaceous earth catalyst: Ni and Cu were pptd. by adding Na_2CO_3 to the soln. of $NiSO_4$ and $CuSO_4$, and the resulting ppt. washed and dried at 110°C. Diatomaceous earth was ignited and mixed with the ppt. The catalyst was useful for the hardening of rice oil from which wax had been eliminated.

9051. UENO, SEIICHI; SHIGENO, YOSHIHIRO, AND ISHIWATARI, YOSHIRO. **Practical hardening of fatty oil by the unreduced catalyst.** *J. Chem. Soc. Japan*, Ind. Chem. Sect. 53, 218-19(1950). —*C.A.* 46, 9869*f*.

Catalyst copptd. by Na_2CO_3 from the soln. contg. $NiSO_4$, $CuSO_4$, and $Co(NO_3)_2$, and having the, resp., proportions, Cu:Ni:Co of 7:3:2, was active. Preliminary reduction in the hydrogen stream at 350°C improved the activity of the catalyst.

9052. YAMAKITA, ITSURO AND FUJII, YUJIRO. **The decolorization of rice oil.** *Bull. Inst. Chem. Research, Kyoto Univ.* 20, 64(1950).—*C.A.* 45, 5949*d*.

Pretreating crude rice oil with a dil. soln. of acid or salt promoted the decolorizing effect of activated acid clay. The color of the oil of higher acid value caused by contact with iron was also easily decolorized by the same treating.

9053. ANSELMI, SCHIPIONE AND CESARI, ADRIANA. **Sesame oil in margarine and in similar fats, additions of coloring matters.** *Ann. chim.* (Rome) 41, 573-86(1951); *Rend. ist. super sanitá* (Rome) 14, 624-38(1951).—*C.A.* 46, 6852*h*.

The colored material in sesame oil was extd. with EtOH, decolorized with activated carbon, and evapd. to dryness over a water bath. The oily residue gave a characteristic red color with a furfural-HCl mixt. Rancid samples gave a slightly less intense color than fresh samples but never neg. Reaction of sesame oil with $SnCl_2$ was generally reliable but was not specific. The furfural test with one sample of refined peanut oil gave initially an orange then a rose color on standing; one sample of soybean oil gave a rose color but the color decreased on standing; and one hydrogenated peanut oil and one hydrogenated coconut oil gave a transitory rosy color.

9054. BORBOLLA Y ALCALÁ, JOSE M^A. R. DE LA; CASTRO RAMOS, ROSALINO DE, AND VÁZQUEZ LADRÓN, RICARDA. **Studies of Spanish decolorizing earths. I. Preliminary tests of activation and decolorization.** *Ion* 11, 135-41(1951).—*C.A.* 46, 1273*i*.

Earths from Lebrija were studied to det. the usefulness of native earths for refining olive oil. The influence of concn. of HCl and time of attack on the activation of the earths was detd. The most suitable period of contact between oil and earth was 15 min. and satisfactory results were obtained by using 1% earth. The apparent d. of the earth, the cond. of its aq. ext., the dehydration curve, and the capacity for activation were correlated. The difference between the pH of an earth detd. with H_2O and that detd. with a soln. of KCl was a measure of potential activity.

9055. HERB, S.F.; WITNAUER, LEE P., AND RIEMENSCHNEIDER, R.W. **Isolation of eicosapentaenoic and docosapentaenoic acids from natural sources as their methyl esters by adsorption and distillation techniques.** *J. Am. Oil Chemists' Soc.* 28, 505-7(1951).—*C.A.* 46, 1271*d*.

Me eicosapentaenoate (arachidonate) and docosapentaenoate were isolated by adsorption and distn. techniques from the highly unsatd. esters of beef adrenal lipides. Specific extinction coefficients detd. under alkali isomerization in 11% NaOH-glycerol at 180°C for 45 min. and in 21% KOH-glycerol at 180°C for 15 min. were graphically presented.

9056. HOLMAN, RALPH T. **Displacement analysis of lipides. VII. Carrier separation of unsaturated fatty acids.** *J. Am. Chem. Soc.* 73, 5289-92(1951).—*C.A.* 46, 9326*e*.

The positions of a series of single unsatd. fatty acids in a carrier-displacement chromatogram were detd. by use of Me esters of even-satd. acids in 1 series, and Me esters of odd-satd. in another with "Darco G 60" as adsorbent and EtOH as solvent. Increasing the no. of isolated double bonds decreased the adsorption. The change satd. → unsatd. → acetylenic acid decreased adsorption. Differences in adsorbability of cis and trans isomers were slight. One isolated double bond in the mol. decreased adsorption roughly equiv. to 2 fewer C atoms. Sepns. of stearic and linoleic acids, and of linoleic acid and its conjugated isomer by carrier displacement were demonstrated.

9057. Inoue, Yoshiyuki and Noda, Manjiro. **Separation and identification of fatty acids. X. Simplified methods of the preparation of hydroxamic acid solutions for paper partition chromatography.** *J. Agr. Chem. Soc. Japan.* **24**, 291-5 (1951).—*C.A.* **46**, 6408*a*.

Since only the solns. of cryst. hydroxamic acids were necessary for chromatographic sepn., 4 simplified methods for prepg. such solns. were devised. Paper chromatography with hydroxamic acid solns. was applied to butter, coconut oil, and K salts of free fatty acids extd. from fruits of *Ginkgo biloba*. These substances contained, resp., butyric, caproic, and caprylic acids; caproic and caprylic acids; and formic, propionic, butyric, caprylic, ginkgolic, and some di- or tribasic acids.

9058. Inoue, Yoshiyuki and Noda, Manjiro. **Separation and identification of fatty acids. XI. Paper partition chromatography of aliphatic carboxylic acids by means of hydroxamic acid method.** *J. Agr. Chem. Soc. Japan* **24**, 295-8 (1951).—*C.A.* **46**, 6408*b*.

The method for satd. fatty acids was made applicable for unsatd., hydroxy, and polybasic acids. The solvents used were BuOH, AcOEt, and butyrone. R_f values with BuOH and color for hydroxamic acids derived from various acids were reported.

9059. Inoue, Yoshiyuki and Noda, Manjiro. **Separation and identification of fatty acids. XII. Application of paper chromatography to the analysis of fats.** *J. Agr. Chem. Soc. Japan* **25**, 161-5(1951).—*C.A.* **46**, 6408*c*.

A new method for the detection of fats consisted of the oxidative decompn. of the glyceride mixt. by $KMnO_4$ in Me_2CO soln., esterification of the acidic oxidation products, prepn. of their hydroxamic acid derivs., and paper chromatographic sepn. of these acids. Paper chromatograms of hydroxamic acid derivs. thus prepd. from linseed, rape, soybean, olive, and herring oils, Japan wax, and beef tallow were shown (descending method at 30°C with BuOH-H_2O or AcOEt-H_2O as solvents).

9060. Kaufmann, H.P. and Budwig, J. **Paper chromatography in the fat field. IV. Radiometry of oleic acid.** *Fette u. Seifen* **53**, 69-73(1951). —*C.A.* **45**, 9893*e*.

Oleic acid could be detd. by placing microdrops of a soln. contg. 24-72γ oleic acid per drop on a sheet of Schleicher and Schüll No. 2040b filter paper, exposing the paper to NH_3 fumes in a closed vessel for 30 min., adding several drops of a reagent consisting of a 2.5% aq. $Cu(OAc)_2$ soln. contg. 1% of a $Co^{60}Cl_2$ soln. having a radiation of 1 mc. per ml, washing the paper with H_2O, drying, cutting out the spots contg. the Co oleate, and measuring the radiation with a Geiger-Müller counter.

9061. Kaufmann, H.P. and Budwig, J. **Paper chromatography in the fat field. V. Radiometric determination of the iodine number.** *Fette u. Seifen* **53**, 253-9 (1951).—*C.A.* **45**, 7801*i*.

The Hanus method for the detn. of the I_2 no. was adapted to paper chromatography. The reagent was I^{139} Br in MeOH satd. with NaBr. Samples of the order of 20γ were used. The sample (in heptane) was deposited on the paper, the solvent allowed to evap., reagent added until there was no further fading of the color, the paper washed, and the radiation measured.

9062. Kaufmann, H.P.; Budwig, J., and Duddek, E. **Paper chromatography in the fat field. VI. Application to soaps.** *Fette u. Seifen* **53**, 285-8(1951).—*C.A.* **45**, 9893*e*.

Soaps were best hydrolyzed with HCl vapors after applying them to the paper. The inorg. salts were then removed with H_2O. Information was given for sepg. the fat acids.

9063. Kaufmann, H.P. and Budwig, J. **Fats. CXXIX. Paper chromatography in the field of fats. 7. Identification and separation of fatty acids.** *Fette u. Seifen* **53**, 390-9(1951). —*C.A.* **46**, 6851*b*.

The paper chromatography of propionic, butyric, valeric, caproic, enanthic, caprylic, octenoic, pelargonic, decanoic, undecylenic, stearic, oleic, elaidic, linoleic, and erucic acids were investigated. Basic dyes, particularly Rhodamine B and Nile Blue, gave characteristic reactions with these acids, particularly under ultraviolet light. Metallic soaps were investigated by using $Cu(OAc)_2$, $Co(OAc)_2$, $MnSO_4.(NH_4)_2SO_4$, $FeSO_4(NH_4)_2SO_4$, $Ni(HCO_2)_2$, $Cr_2(OAc)_6$, $AgNO_3$, $Hg(OAc)_2$, $Tl_2(SO_4)_3$, LiOAc, $MgSO_4$, $CaCl_2$, $ZnSO_4$, $Al(OAc)_3$, basic Bi acetate, and basic Pb acetate and treating the resulting spots with eriochromecyanine, Na alizarinsulfonate, $K_4Fe(CN)_6$, brucine, Rhodamine B, and dimethylglyoxime.

9064. Kaufmann, H.P.; Szakall, A., and Budwig, J. **Fats. CXXX. 8. Lipide replacement in the human skin and its measurement by paper chromatography.** *Fette u. Seifen* **53**, 406-8(1951)—*C.A.* **46**, 6851*b*.

The lipides present in the epidermis after defatting consisted mainly of fatty acids, particularly oleic acid. An ext. of the skin (not defatted) contained glycerides.

9065. Morel, Charles. **Fuller's earth.** *Soap, Perfumery & Cosmetics* **24**, 889-92(1951).—*C.A.* **45**, 10436*g*.

The types and application of Fuller's earth in soap, cosmetics, and allied industries were reviewed; its composition and properties and its use in oil bleaching were included.

9066. Mukherjee, S. and Roy, Jagadish Chandra. **Bleaching of vegetable oils by clays.** *Indian Soap J.* **16**, 281-7(1951).—*C.A.* **45**, 10619*h*.

Four clays were investigated: Gangetic, silt, kaolin, Bihar bentonite, and Kashmir bentonite. HCl and H_2SO_4 were used as activating agents. Higher temp. of drying following acid treatment, and baking at high temp. prior to acid treatment lowered the bleaching power. H_2SO_4 was as good, and in some cases even better, than HCl for activation. In was more difficult to bleach mowrah oil than peanut oil. The former could not be bleached much above 50% with the most active bentonite samples. The effect of residual acidity of the activated clays on their bleaching power was found to be very remarkable; even small changes in acidity gave wide variations in activity.

9067. Nanavati, D.D. **Catalyst in Vanaspati production.** *Proc. Symposium Indian Oils Fats Natl. Chem. Lab. India, Poona* **1951**, 169-74.—*C.A.* 47, 6676*f*.
The degree of hydrogenation and characteristics of texture and grains in Vanaspati depended upon the quality of the Ni catalyst used. Expts.were described to produce the best catalyst. The reduction was done in oil with 40 lb Ni formate, 4 lb Hyflo, and 160 lb of peanut oil in a cylindrical jacketed vessel 2 ft in diam. and 5 ft high. The final temp. was 475°F for 1 hr. Total time required to complete the batch was 8 hrs. Total H_2 used was 3000 ft^3. The Ni obtained was jet black in color and granular in texture.

9068. Nijkamp, H.J. **Chromatographic determination of the volatile fatty acids C_4 to C_{10}.** *Anal. Chim. Acta* 5, 325-31(1951).—*C.A.* 46, 850*h*.
A semimicro method was described and the prepn. of a suitable silica gel absorbent also discussed.

9069. Ohashi, Ken and Nobori, Hiroso. **The treatment of discarded nickel catalyst.** *J. Chem. Soc. Japan*, Ind. Chem. Sect. 54, 287-9(1951).—*C.A.* 47, 2910*b*.
Three different methods of regenerating discarded nickel catalysts from oil hardening were compared. The catalyst was: (A) washed with caustic soda and then with water, roasted, and reduced in H_2, (B) Washed with CHCl:CCl_2 or C_6H_6 and continue as in A; (C), from the prepn. of sorbit, washed with hot water, dried, and reduced as above. Catalysts A and C were as active as the fresh ones. Catalyst (B) was a little less active, but it could be used for the prepn. of semihardened oil.

9070. Pereira, A. and Serra, J.A. **Quantitative microdetermination of amino acids after paper chromatography.** *Science* 113, 387-8 (1951).—*C.A.* 45, 5750*c*.
A paper chromatographic techique for the qual. and quant. analysis of certain amino acids was described.

9071. Ray, Leonard N. Jr. and Hutchinson, A. Witt. **Electrophoretic mobilities of carbon in dilute soap solutions.** *J. Phys. & Colloid Chem.* 55, 1334-40(1951).—*C.A.* 46, 2427*h*.
Suspensions of 0.2 g carbon (largely 2-10 μ diam.) in 100 ml of soap soln. (from a crude oleic acid) were studied at 16-30°C in a vertical microelectrophoresis cell. The carbon particles always moved toward the anode. The mobility (μ/sec. v. cm) increased rapidly from 1.65 in distd. water to 4.2 in 0.02% soap soln., rose more gradually to a max. of 5.5 at 0.50%, and decreased slightly to 5.1 at 1.00%. The ability of these solns. to suspend carbon (detd. by photoelec. turbidimeter) varied with soap concn. in nearly exactly the same way.

9072. Schuette, H.A. and Dal Nogare, Stephen. **An oxidation-adsorption method for the analysis of methyl ester fractions.** *J. Am. Oil Chemists' Soc.* 28, 229-31(1951).—*C.A.* 45, 6402*g*.
The method was based on conversion of the unsatd. components of the fractions obtained in analytical distn. of fatty oil Me esters to short-chain fragments by $KMnO_4$ oxidation according to Hilditch and Lea and their subsequent adsorption on Al_2O_3 tinted with bromothymol blue. Tests showed (*a*) that the removal of these fragments was practically quant., provided acids lower than lauric were not present in appreiable amts., (*b*) that duplicate samples agreed within 1% of the satd. ester content, and (*c*) that reproducibility of results was about 0.6%.

9073. Sen, Nirmal Kumar and Chakravarti, Jiban Kumar. **Sterols of jute-seed oil (Corchorus capsularis). 1.** *J. Indian Chem. Soc.* 28, 727-31(1951).—*C.A.* 47, 889*e*.
Chromatography with concd. soln. of the sterols in petr. ether through Brochmann alumina (10 cm × 1.5 cm) gave in the filtrate a sterol fraction which on recrystn. m.p. 116°C, $[\alpha]_D^{30} = -57.9°$ ($CHCl_3$) and having a pos. Liebermann-Burchard. A major fraction of the sterol obtained by the elution of the column gave a fraction m.p. 125-7°C, $[\alpha]_D^{30} = -69.5°$ (in $CHCl_3$), pptd. with digitonin, and showed a pos. Liebermann-Burchard. Tests on a recrystd. and further purified portion of this fraction indicated presence of one double bond.

9074. Sen Gupta, Manick Lal and Basu, U.P. **Indian clays: adsorptive and bleaching properties.** *J. Proc. Inst. Chemists* (India) 23, 80-9(1951).—*C.A.* 46, 5803*h*.
Bleaching earths, important to the vegetable-oil industry of India, were largely imported. Native clays (mainly kaolin and bentonite) had little adsorptive power though activation by boiling 200-mesh clay for 1/2 hr with 20% H_2SO_4, filtering, washing out the sulfate, and drying at 110°C offered promise. Indian clays (activated as well as untreated), a Fuller's earth, and a Canadian bentonite were studied. Higher base-exchange and adsorptive power, and a rather high soly. (mainly Al_2O_3) in 0.5 *N* HCl were also characteristic of bentonites. In general, an adsorptive clay had a high SiO_2/Al_2O_3 ratio, a high adsorptive power for methylene blue, a high acid-sol. fraction, and a dehydration curve that approached linearity. Activation with H_2SO_4 had little effect on methylene blue adsorption, but might increase considerably the ability of a clay to decolorize vegetable oil.

9075. Stromquist, D.M. and Reents, A.C. **C. p. glycerol by ion exchange.** *Ind. Eng. Chem.* 43, 1065-70 (1951).—*C.A.* 45, 7803*d*.
Soap lye crude glycerol, sapond. crude glycerol and glycerol sweet waters were deionized by passage through ion exchangers. The concd. glycerol produced by ion exchange followed by evapn. was equal to and in most cases superior to that produced by distn. and contained less color, ash, and fatty acids and esters, and was more stable toward sunlight.

9076. TAKAYASU, KÔICHI. **Oil refining by colloidal clay.** *Eiyô to Shokuryô* (J. Japan Soc. Food Nutrition) 3, 133-7 (1951).—*C.A.* 46, 11714*f*.

A yellow colloidal clay (loss on ignition 12.05, SiO_2 40.21, $Al_2O_3$41.15, $Fe_2O_3$1.95(lowest), CaO 2.20, MgO 1.35%) produced in the Tochigi Prefecture was the most suitable among 4 clays tested. It was efficient for rapeseed oil and naphtha of low acid no., but not for herring oil of high acid no. (146). The most suitable method of activating the clay was: add 3 parts of 40% H_2SO_4 to 1 part of the clay, heat at 105°C for 2 hrs while stirring, filter, wash with water, dry at 110°C and pulverize. This activated silica gel product had: loss on ignition 5.25, SiO_2 92.45, Al_2O_3 2.35, and Fe_2O_3 0.12%. A sufficient amt. of H_2SO_4 or NaOH could be adsorbed on the gel to give convenient products in powd. form.

9077. TSUTSUMI, SHIGERU; YOSHIJIMA, TADASHI; NAGAO, SHIRO; KAYAMORI, HAJIME, AND KAWAMURA, TARO. **Catalytic hydrogenation in the presence of water. III. Effects of promotors on nickel oxide catalyst. IV. Hydrogenation of polar compounds.** *J. Chem. Soc. Japan*, Ind. Chem. Sect. 54, 25-7,27-8(1951).—*C.A.* 47, 956*g*.

The effect of a promoter for the nickel oxide catalyst was studied in the hydrogenation of oils of high acid value. Active carbon was the best; silica gel and acidic clay come next. Even a small amt. of water was harmful to the catalytic action. The hydrogenation of the oils of high acid value took place more easily than did that of neutral ones. The effect of water was studied for the catalytic action of Raney Ni and NiO in the hydrogenation of nitrobenzene, acetone, benzaldehyde, Et cinnamate, benzyl nitrile and crotonaldehyde.

9078. VENKATASUBRAHAMANIAN, T.A. AND DE, S.S. **Ion-exchange resins for removing the free fatty acidity of oils.** *Science and Culture* 17, 180-1 (1951).—*C.A.* 46, 4251*i*.

Oils deacidified with acid-adsorbing resin had better keeping qualities (judged by the induction period in an O_2 atm.) than those deacidified by other methods.

9079. WANG, SU, MING AND BANG, HAAKON. **Chromatographic analysis of Kennewick, Washington peppermint oil.** *J. Am.Pharm. Assoc.* 40, 113-15(1951).—*C.A.* 45, 4000*h*.

The unpleasant odor of Kennewick peppermint oil could be removed by chromatographic adsorption using activated alumina, $MgCO_3$, or Norit. The best eluents were petr. ether and Et_2O. The use of the adsorption column indicated that the various constituents of the oil could be sepd. and also suggested a method of obtaining menthol from peppermint oil.

9080. YAMAKITA, ITSURÔ. **Rice oil. I. Decolorization of dewaxed rice oil.** *Bull. Inst. Chem. Research, Kyoto Univ.* 24, 24-31(1951).—*C.A.* 46, 3775*e*.

Some physicochem. studies were made on the purification of rice oil whose color was difficult to remove. Activated acid clay up to 12% at 20-100°C had some decolorizing action for the highly acid (acid no. 30-96.6) rice oils tested. Pretreatment of the oil with solns. of HCl, $ZnCl_2$, HCOOH, Na_2SO_4, $MgCl_2$ improved decolorizing by the clay; solns. of $CaCl_2$, $BaCl_2$, and $CuCl_2$ were ineffective; $FeCl_3$, $FeSO_4$, phenolic reducing agents (hydroquinone, resorcinol) were detrimental.

9081. YAMAKITA, ITSURÔ AND AIDA, HIROSHI. **Chromatography of fatty acids. (Preliminary report).** *Bull. Inst. Chem. Research, Kyoto Univ.* 27, 72-3(1951).—*C.A.* 46, 3905*d*.

A new method with I_2 as an indicator and alumina as an adsorbent was employed for chromatographic sepn. of stearic and oleic acids. I_2(1 mg) was dissolved in 10 ml petr. ether and adsorbed on Al_2O_3 activated at 500°C. A mixt. of the two acids in petr. ether-benzene-EtOH was added to the top of the column at the rate of 35 min. per ml to produce two yellow lines. From the m.p. and I_2 value, the first layer was found to contain pure stearic acid, the third layer pure oleic acid, and the second layer a mixt. of these.

9082. YOSHIJIMA, TADASHI AND TSUTSUMI, SHIGERU. **Alloy catalysts for hydrogenation. III. Simultaneous hydrogenation and hydrolysis of fatty oils.** *J. Chem. Soc. Japan.* Ind. Chem. Sect. 54, 554-5(1951).—*C.A.* 47, 6679*f*.

Ni-Al alloy and dil. NaOH together could be utilized for the simultaneous hydrogenation and hydrolysis of fatty oils. Fatty oil of a high acid value, such as rice-bran oil, could easily be hydrogenated and hydrolyzed in 3 hrs at 180°C and at a H_2 pressure of 20 atm. in the presence of Ni-Al (1:1) alloy. With decreasing acid values, the necessary amt. of NaOH increased.

9083. ZAGER, S.E. AND DOODY, T.C. **Glycerol removal from aqueous solutions by anion exchange.** *Ind. Eng. Chem.* 43, 1070-3 (1951).—*C.A.* 45, 7803*b*.

Columns of Amberlite IR-400 and Permutit S were treated with $Na_2B_4O_7$ soln. and dil. aq. solns. of glycerol (1 to 10%) percolated through the resins. From 93 to 98% of the glycerol was removed; the Amberlite IR-400 seemed to have a slightly higher capacity than the Permutit S. The greater the concn., the greater the amt. of glycerol removed; the resins removed more glycerol when in previous contact with $Na_2B_4O_7$ than when in contact with H_3BO_3. The pH had little effect on the reaction.

9084. ANON. **Bleaching earths and adsorptive bleaching of oils and fats.** *Seifen-Öle-Fette-Wachse* 78, 23-6(1952).—*C.A.* 47, 6675*a*.

The use of Fuller's earth and active carbon for bleaching fats and oils was used.

9085. BAILEY, A.E. **Nickel catalysts in hydrogenation of fats and oils.** *Ind. Eng. Chem.* 44, 990-4(1952).—*C.A.* 46, 10644*g*.

The amt. of Ni used as a catalyst for oil and fat hydrogenation was relatively small—in the U.S. it was estd. as 500,000-1,000,000 lb. annually. Each lb of Ni accounted for the hydrogenation of 2500 to 5000 lb of oil, and as a catalyst, Ni has no present substitute. A review was presented of the history and technology of hydrogenation and catalyst manufg. and utilization.

9086. Belekar, G.K.; Kane, J.G., and Shahani, H.S. **Utilization of by-products and waste products of the fatty-oil industry. I. Recovery of nickel from spent nickel catalyst.** *J. Sci. Ind. Research* (India) **11B**, 28-30(1952). —*C.A.* **46**, 6852*b*.

Five spent catalyst samples were digested with 10-50% H_2SO_4 and with various H_2SO_4-HNO_3 mixts. of 15-70% and 20-70% proportions. Higher Ni recoveries (93.2 to 98.3%) in the combined mother liquor and washings occurred from mixed acid treatment.

9087. Benfield, D.A. and Young, R.S. **Separation of sub-sieve powders from olive oil.** *Chemist Analyst* **41**, 94-5 (1952).—*C.A.* **47**, 2571*h*.

Diatomaceous earth in a Büchner funnel was efficient for the removal of particles less than 2 μ in diam. from oil that had been used for classification of powders by sedimentation.

9088. Busby, G.W. and Grosvenor, D.E. **The purification of glycerol by ion exchange.** *J. Am. Oil Chemists' Soc.* **29**, 318-20(1952).—*C.A.* **46**, 9869*e*.

Operation of the Lever Bros. Co., Los Angeles, Calif., plant with a purification capacity of 26,500 lb of crude glycerol per day was described. The ion-exchange purified glycerol analysis was: glycerol 99.30, residue 0.0070, ash 0.0006, MaCl 0.0005, and fatty acids and esters 4.90%.

9089. Castro y Ramos, Rosalino de and Vega, Manuel Nosti. **Spanish decolorizing earths. II. Earths from Lebrija and El Cuervo.** *Anales real soc. españ. fíz-y quím.* **48B**, 247-54(1952). —*C.A.* **46**, 8395*h*.

Samples of earth with small natural decolorizing power became excellent decolorants of olive oil when treated with a leach of H_2SO_4, followed by treatment with HCl: Slowly add 100 g pulverized earth with stirring to 15 ml concd. H_2SO_4 (66° Bé.) in 250 ml distd. water and heat the mixt. with stirring 2 hrs at 130°C on a paraffin bath. Dilute, cool, and wash the mixt. until the pH is 6.5. Add sufficient concd. HCl dropwise or NaCl soln. (4 g/25 ml H_2O) to remove the alk. earth metal content (detd. by previous analysis), stir about 10 min., then wash to pH 6.5. Samples of earth treated as above, obtained at Lebrija and El Cuervo showed a decolorant power equal to the earth from Gador and almost as great as that of German Tonsil earth.

9090. Inoue, Yoshiyuki; Noda, Manjirô, and Hamuro, Yasumasa. **Separation and identification of fatty acids. XIII. Investigation of the constitution of unsaturated fatty acids by paper chromatography.** *J. Agr. Chem. Soc. Japan* **25**, 491-5 (1952).—*C.A.* **46**, 6408*e*.

When an unsatd. fatty acid was subjected to ozonolysis, the products of ozonolysis treated with alk. AgO suspension to oxidize the CO of the aldehydes and semialdehydes to COOH, the salts of mono- and dicarboxylic acids thus obtained were esterified and then coverted to their hydroxamic acid derivs. Paper chromatography could be applied to sep. and identify the derivs. This method of investigating the chem. structure of unsatd. acids was tried on oleic, erucic, linoleic, and linolenic acids with success.

9091. Inoue, Yoshiyuki and Noda, Manjirô. **Separation and identification of fatty acids. XIV. Paper chromatography of fatty acids using the filter paper impregnated with silicic acid.** *J. Agr. Chem. Soc. Japan* **25**, 496-9(1952). —*C.A.* **46**, 6408*f*.

Filter paper was immersed in Na silicate soln. (d. 1.36) for 20 min. and then the treated filter paper was immersed in 6 *N* HCl; silica gel could be fixed on filter paper. This was washed with water and air dried for a day or two; it was pressed and preserved in a desiccator. These were used to sep. the higher fatty acids inseparable on ordinary filter paper. BuOH-C_6H_6(1:1) was suitable as the solvent. Satd. fatty acids themselves were chromatographed with MeOH as the fixing liquid phase and naphtha, b. 70-90°C, as the migrating liquid phase on ordinary or silica-impregnated filter paper, but with inferior result to the paper chromatography of hydroxamic acids.

9092. Kaufmann, H.P. and Budwig, J. **Paper chromatography in the field of fats. X. Fluorescent dyes as indicators in the paper chromatographic analysis of fat acids and fats.** *Fette u. Seifen* **54**, 7-10(1952).—*C.A.* **46**, 7793*d*.

In sepg. and identifying linoleic, oleic, elaidic, erucic, stearic, caproic, caprylic, heptanoic, pelargonic, decanoic, octenoic, and undecylenic acids, the following florescent indicators were of value: quinine, Acridine Orange, Rhodamine B, Fluorol G, chlorophyll, anthracene, anthranol, and various combinations.

9093. Kaufmann, H.P.; Budwig, J., and Schmidt, C.W. **Paper chromatography in the field of fats. XI. Identification and separation of conjugated unsaturated fat acids.** *Fete u. Seifen* **54**, 10-12 (1952).—*C.A.* **46**, 7793*g*.

The paper chromatography of 9,11-linoleic acid, 9,12-linoleic acid, β-eleostearic acid, and β-licanic acid was investigated by using reactions with inorg. salts and dyeing with org. dyes on No. 214 filter paper (Macherey, Nagel & Co.) or No. 2043b (Schleicher and Schüll). The following colors were obtained with metallic soaps of these acids (metal, color, and the above acids, resp.): Cu, light bluish green, satd. green, pale green, yellowish green; Fe, yellowish brown, reddish brown, yellow, pale yellow; Ni, very pale green, pale green turning yellow, pale pink, with green border, pale green; Pb, white, white turning yellow, white, white; Cr, grayish green, grayish green turning grayish violet, grayish green, grayish green; Mn, pale pink, pale pink turning brown, white, white; Co, pink slowly turning pale brown, pink turning dirty green, pink, pink.

9094. Kaufmann, H.P. and Budwig, J. **Paper chromatography in the field of fats. XIV. Examination of polymerized oils.** *Fette u. Seifen* **54**, 340-56(1952).—*C.A.* **47**, 885*i*.

Paper chromatography was applied to polymerized and nonpolymerized fish oils. The former can be identified by treating the developed spots with Rhodamine B-Nile Blue sulfate, $Ca(OAc)_2$, or Rhodamine B alone and examg. in ultraviolet light. The thermal polymerization of fish oils resulted in a decrease of highly unsatd. fat acids. The vitamin A content of the oils was lost during polymerization.

9095. KINOMURA, SHIGERU. **Decolorization of rice-bran oil with Filtrol.** *Yushi Kagaku Kyôkaishi* (J. Oil Chemists' Soc., Japan) 1, 81-4(1952).—*C.A.* 46, 9871*a*.

The efficiency of decolorization was detd. of 4 rice bran oils with Filtrol LX-466, Filtrol Special, and Filtrol Super (U.S.A.) and Active White Clay N of Japan. Oil of low acidity was decolorized best with Filtrol LX-466, while oil with high acid values was most suitably decolorized with the Active White Clay N.

9096. MONTES, ADOLFO L. **Application of chromatography in a study of essential oils.** *Anales asoc. quim. argentina* 40, 273-81 (1952).—*C.A.* 47, 5631*i*.

Chromatographic adsorption was applied to the analysis of essential oils with columns of silicic acid and bentonite. The results were given of the sepn. of binary and tertiary mixts. of 2,4-dinitrophenylhydrazones of 12 aldehydes and ketones of essential oils. For a column 2.5 × 25 cm, sample quantities of 0.1-0.2 g in 1% soln. could be used. When the quantity of one component was very small with reference to the other, a taller column was recommended; this permitted the use of a larger quantity of sample.

9097. PHATAK, S.S.; NAHADEVAN, A.P., AND PATWARDHAN, V.N. **Identification of isoöleic acids present in hydrogenated fats by paper chromatography.** *Current Sci.* (India) 21, 162-3(1952).—*C.A.* 47, 2509*f*.

Et esters of the fatty acids from hydrogenated fat were oxidized in $(CH_3)_2CO$ soln. and the dibasic acids sepd. from the mónobasic acids by distn. in vacuum. The dibasic acids were applied as a dil. aq. ammonia soln. to filter paper and chromatogrammed with a BuOH-water solvent.

9098. RAMASWAMI, S. **Recovery of nickel from spent nickel catalysts in vanaspati (butter substitute) plants.** *Indian Soap J.* 18, 20-4(1952).—*C.A.* 47, 2517*a*.

A discussion was given under the following headings: recovery of the assocd. oil, conversion of Ni into NiS, conversion of NiS to NiO, and conversion of NiO into active Ni for use in hydrogenation.

9099. SEN, NIRMAL KUMAR AND CHAKRAVARTI, JIBAN KUMAR. **Utilization of jute seeds with particular reference to the seed fat.** *Indian Soap J.* 18, 164-70(1952).—*C.A.* 47, 4107*b*.

Jute-seed extn. with petr. ether (b. 40-60°) yields 15% oil, while successive expressions in a hydraulic press yield 10%. The oil was satisfactorily refined by treatment with MgO. The product was bright and of a light yellow color and had a characteristic odor. Bleaching with Fuller's earth or animal charcoal was not very successful. Besides some coloring matter and phosphatides, the jute-seed oils were found to contain a mixt. of sterols and higher hydrocarbons.

9100. CATRAVAS, GEORGES N. **Isomerization produced during catalytic hydrogenation of drying oils.** *Compt. rend.* 236, 716-18(1953).—*C.A.* 47, 5696*g*.

The migration of ethylenic bonds during the partial hydrogenation of linseed oil was studied. In operating under amt. pressure and 175-180°C, and by using pure Ni(0.2% based on the wt of oil) supported on diatomaceous earth as catalyst, a max. of 3.8% isomerization was attained in 20 min. Addn. of $NiSO_4$ (corresponding to 1% S) to the catalyst before its reduction gave a max. of 9.8% in 30 min.

9101. DAVISON, B.K. AND WIGGINS, L.F. **The refining of sugar-cane wax.** *Intern. Sugar J.* 55, 10-12(1953).—*C.A.* 47, 3015*a*.

Crude wax (400 parts) was melted with 40 parts bentonite and 10 parts active charcoal. The required alc. (4000-7000 parts) was added and the mixt. refluxed 1 hr. The wax soln. and suspended bentonite and charcoal were decanted from the resin and filtered at 70°C. The hard wax crystallized from the cooled filtrate and soft fatty material was obtained by evapg. the solvent.

9102. SCHLENK, HERMAN AND HOLMAN, RALPH T. **Methanolysis of triglycerides by an anion-exchange resin.** *J. Am. Oil Chemists' Soc.* 30, 103-4(1953).—*C.A.* 47, 4631*h*.

Interesterification by anion-exchange resin was reported. When Amberlite IRA-400-OH-AG resin 20 g was added to a soln. of cottonseed oil 55 g, ether 250 ml, and EtOH 250 mil, 2 liquid layers formed, which became homogeneous as the reaction proceeded. Such reaction with cottonseed, corn, cod liver, and coconut oils gave 61-73% interesterification at 48-72 hrs reaction time.

9103. TYUTYUNNIKOV, B.N. AND FRAĬER, B. **Studies in the field of hydrogenation of fats.** *Masloboĭno Zhirovaya Prom.* 18, No. 1, 7-10 (1953).—*C.A.* 47, 5699*d*.

A test for evaluation of the activity of a hydrogenation catalyst was proposed. The activity of a catalyst was recorded as the av. vol. of H_2 uptake per hr by a standard fat when it was hydrogenated under standard conditions to the same degree as was conventional in practice.

V-11. Applications to Mining and Metallurgy

9104. NARDIN, ERNEST WILLOUGHBY. **The chlorination of gold ores at Mount Morgan, Queensland.** *Eng. and Mining J.* 71, 85-6 (1901).

The ore, crushed dry to pass a 400-mesh screen, was leached with an aq. soln. of Cl_2 and the soln. subsequently pptd. by passing the Au-liquor through charcoal. The installation described treated 100,000 tons of low-grade ore annually.

9105. WARK, IAN W. AND SUTHERLAND, KEITH L. **Principles of flotation. IX. Influence of the anion on air-mineral contact in presence of collectors of xanthate type and its consequent influence on differential flotation.** *Am. Inst. Mining Met. Engrs., Tech. Pub. No.* 1130, 23 pp. (1939).—*C.A.* 34, 2749⁵.

The influence of certain anions, viz., carbonate, chloride, nitrate, formate, acetate, propionate, tartrate, phosphate, silicate and ferricyanide, on flotation by K Et xanthate was studied. Except for carbonate, phosphate, silicate and ferricyanide, all were added as Cu salts replacing the usual $CuSO_4$ addns. Differential flotation was often based upon the more-ready formation of islands of noncontact with some minerals than others, and on the differentiation that persisted as the islands expanded into alk. regions.

9106. HELBIG, W.A. **Physical removal of impurities from plating solutions.** *Proc. Am. Electroplaters' Soc.* 1941, 68-76.—*C.A.* 36, 1549^1.

For calcg. solids capacity of a filter, an approx. rule was one lb/ft^2 of either filter aid or activated carbon will give a 0.5-in. cake. If a filter aid precoat was necessary, a 0.06-in. cake was usually satisfactory. The usual dosage for periodic activated carbon treatment was 3 to 10 lb/100 gal. The suspension should be agitated 30-45 min. before filtration. Activated carbon must be added in an auxiliary tank and should not come into contact with the plating tank. For continuous filtration with activated carbon, 0.5 lb/100 gal was used. Since brighteners and wetting agents were partially removed by activated carbon, their concn. must initally be higher than normal, so that the normal concn. was obtained after the adsorption equal was reached.

9107. HÜTTIG, GUSTAV F.; BITTNER, CHRISTIAN; FEHSER, ROLF; HANNAWALD, HUGO; HEINZ, WILHELM; HENNIG, WALTER; HERRMANN, ERICH; HNEVKOVSKY, OTTO, AND PECHER, JOSEF. **The reactions of solids. CXXIV. The course of the sintering processes in copper powder.** *Z. anorg. allgem. Chem.* 247, 221-48 (1941).—*C.A.* 36, 6060^4.

Very pure, finely divided Cu powder was heated in H_2 under const. conditions for 2 hrs at 100°, 200°, 300°, 400°, 500°, 700°, and 800°C. After cooling, the photomicrograph, x-ray diagram, pycnometric d., vol.(shaken down), soly. in dil. HNO_3, e.m.f., reactivity toward $AgNO_3$ soln., MeOH adsorption isotherms, and catalytic action on the decompn. of H_2O_2 were detd. The most important characteristic of the sintering process was the contraction at approx. 400°C. Before the skin contraction occurred, there was a distinct period of expansion; this was shown by an increase in the capillary vol.

9108. MOORE, GEORGE E. **Reduction of magnesium oxide by tungsten in vacuum.** *J. Chem. Phys.* 9, 427-31(1941).—*C.A.* 35, 3917^5.

The rate *in vacuo* of the reaction $2MgO + W \rightarrow 2Mg + WO_2$ was calcd. The calcns. were found to be in substantial agreement with expt. The calcns. covered the range 1000-1900°K; the min. reaction temp. was about 1135°K.

9109. PERRUCHE, LUCIEN. **Flotation of nonmetallic minerals and various substances.** *La Nature* 1941, 411-15.—*C.A.* 37, 2965^2.

The flotation process was used for: coal, phosphates, chromates, fluorspar, limestone, S, baryta, kaolin, bituminous earths, talc; sepn. or pptn. of individual constituents of mixts., C, Al and cryolite in Al smelting in the elec. furnace, NH_4Cl and alkali nitrates in fertilizer production, NaF, SiO_2 and Na_2CO_3 in the working up of fluorspar and NH_4Cl and $NaHCO_3$ in the production of soda by the Solvay process, and for the purification of sugarcane juice, drinking water, etc.

9110. PHILIPPOT, E. **Arresting power of active carbon for arsine.** *Rev. Universelle Mines* 17, 212-23(1941).—*C.A.* 37, 5159^8.

Air-contg. 1 g/m^3 of AsH_3 was passed at a rate of 1500 liters/hr through boxes contg. active carbon, and a filter, and the times before breakthrough of AsH_3 was observed were measured. Ordinary active carbon was effective for 5-10 min., but anhyd. active carbon was about 5 times as effective. The provision of a silica gel container for preventing access of H_2O to the active carbon was recommended in the case of masks worn by workers in atm. likely to contain AsH_3.

9111. PHILLIPS, ARTHUR AND SKINNER, E.N. **Solubility of oxygen in high-purity copper.** *Trans. Am. Inst. Mining Met. Engrs., Inst. Metals Div., Tech. Paper No.* 1280, 8 pp. (1941).—*C.A.* 35, 3205^8.

Solid soly. of O_2 in high-purity Cu was found to increase from 0.0018% at 550°C to 0.0070% at 1040°C. Failure of the soln. to behave ideally suggested a possible change in the mechanism of adsorption at high temp.

9112. SOKOLOV, I.A. **Use of charcoal for the production of high-quality pig iron.** *Stal* 1941, No. 5, 3-6.—*C.A.* 38, 44^5.

Because FeO was more nearly completely reduced at 800-1200°C by charcoal than by coke and because the soly. of FeO in Fe increased with the temp., the amt. of FeO dissolved in a charcoal blast furnace was smaller. This in turn resulted in decreased quantities of SiO_2, MnO and Al_2O_3 in the pig-Fe, since they were pptd. by FeO. This explained why charcoal pig-Fe with the same analysis (except for nonmetallic inclusions) as coke pig-Fe was superior in quality.

9113. CANGUILHEM CONTRUCCI, H. **Flotation of minerals, especially nonmetallic ones, and its relation to the chemical industry.** *Anales I° congr. panamer. ing. minas y geol., Santiago, Chile* 4, 1796-1801(1942).—*C.A.* 45, 9773^g.

Different applications of the flotation process in the chem. industry was discussed.

9114. FLOE, CARL F. AND CHIPMAN, JOHN. **Effect of impurities on the solubility of sulfur dioxide in molten copper.** *Trans. Am. Inst. Mining Met. Engrs., Inst. Metals Div., Tech. Pub. No.* 1435, 9 pp (1942).—*C.A.* 36, 1576^5.

The effects of C, O and S on the soly. of SO_2 in molten Cu at 1100°, 1200° and 1300°C were studied. The results indicated that for pure Cu and for Cu contg. an excess of either O or S, the reaction of soln. might be expressed by either of the simple equations: $6Cu(\lambda) + SO_2(g) = Cu_2S$ (in Cu) + $2Cu_2O$ (in Cu) or $SO_2(g) = S$ (in Cu) + 2O (in Cu). The equil. const. for this reaction was detd. at 1100°, 1200° and 1300°C.

9115. GLAZUNOV, A.; JENICEK, L., AND VONDRACEK, V. **The influence of sugars on the cathode precipitate.** *Chem. Listy* 36, 318-23 (1942).—*C.A.* 44, 1345*b*.

The presence of glucose or sucrose in a $ZnSO_4$ electrolyte favored the formation of a glossy surface. Similarly, the deposition of black amorphous metal required lower c. ds. with increasing amt. of sugars in the soln. With the same concn. of sugar, the deposition of a glossy surface required higher c.d. at higher temps.

9116. MILLER, E.K. **Air conditioning for blast furnaces.** *Heating & Ventilating*, 39, 48-51 (January), 1942.

The air conditioning unit to dry the blast at a blast furnace of the Jones & Laughlin Steel Corp. resulted in a 16% increase in pig iron production and a 4% reduction in coke consumption. The saving in electric energy offset air conditioning operating cost. Air was conditioned by drawing it through chilled water (38.5°F) sprays and eliminating excess moisture.

9117. SUTHERLAND, KEITH L. **Principles of flotation. X. Influence of cations on air-mineral contact in presence of collectors of the xanthate type.** *Am. Inst. Mining Met. Engrs., Tech. Pub. No.* 1494, 8 pp. (1942).—*C.A.* 37, 1355[5].

The effects of cyanide and alkali upon adsorption of K Et xanthate at activated mineral surfaces were investigated. $ZnSO_4$ had only a small effect on adsorption in the presence of cyanide and a considerable depressant action on chalcopyrite in the absence of cyanide. For $CuSO_4$, the relative insoly. of Cu Am xanthate compared with Cu Et xanthate induced greater island formation (second region of nonadsorption). The formation of the second region of noncontact was more marked with Ag salts, which was in accordance with the greater insoly. of Ag Et xanthate compared with Cu Et xanthate. The order of response of various minerals to xanthate differed according to the cation present.

9118. WEFRING, C. **Wood charcoal as a protection for steel against oxidation (during heat-treatment).** *Tids. Kjemi, Bergvesen Met.* 2, No. 2, 11-14 (1942).—*C.A.* 38, 6257[4].

Heat-treatment of a steel with 0.89% C packed in wood charcoal showed considerable decarburization of the surface. Analysis of the gaseous products from the charcoal showed high H-values and considerable water. Drying at 1000°C or grinding the charcoal to extreme fineness did little good.

9119. WOLOCHOW, DAVID. **Dry blast for blast furnaces.** *Metal Progress* 42, 546, 552, 554, 556 (1942).

Published results indicated that removal of moisture from the furnace blast was a practical and economical means of increasing production and general efficiency. Despite the failure of early dry-blast plants erected early in the century, improved design and lower cost of erection of present-day systems warrent their application today.

9120. CANGUILHEM CONTRUCCI, H. **Some results obtained in the flotation of nonmetallic minerals.** *Rev. ing. quím., Univ. Concepción (Chile)* 2, No. 2, 78-28 (1943).—*C.A.* 39, 1968[3].

Preliminary tests on flotation of limestone and of apatite were described.

9121. ERLENMEYER, H.; KAM, HAZIM, AND THEILHEIMER, W. **Flotation experiments with 8-hydroxyquinoline as collector. V. Flotation experiments on oxide compounds in the presence of metal salts.** *Helv. Chem. Acta* 26, 1129-31 (1943).—*C.A.* 38, 1152[2].

Flotation expts. were performed with ferric oxide, ferric oxide hydrate, chromic oxide, chromic oxide hydrate, hematite and chromite. The added salts included compds. of Cu, Mg, Zn, Fe, Ni, Mn, Ca, Co, Cr and Hg.

9122. JONES, G.W. AND KENNEDY, R.E. **A simple device for detecting small concentrations of organic halide gases in the atmosphere.** *U.S. Bur. Mines, Rept. Investigations* 3697, 10 pp. (1943).—*C.A.* 37, 4599[2].

A simple tester was described for detecting low concns. of halide gases in the atm. Based on the principle of the halide lamp, halide-contg. gases were adsorbed and concd. by adsorbent charcoal; thus, the sensitivity of the test was greatly increased. The tester was so constructed that tests could be made by aspirating the atm. through it, by suspending it in the atm., or by swinging it in the atm. to be tested. Expts. on 25 different halide gases showed that concn. of < 1 p.p.m. could be detected.

9123. MORRISON, W.S. **Synthetic cation and anion exchange resins as new research tools in the field of electrodeposition and related arts.** *Monthly Rev. Am. Electroplaters' Soc.* 30, 702-18 (1943).—*C.A.* 37, 6195[5].

Suggested uses in electroplating were: (1) recovery of Ag from spent Ag plating solns. and rinse water; (2) control of the pH of plating solns.; (3) removal of harmful contaminants in waste water as a means of over-coming sewage-disposal problems; (4) removal of Na_2CO_3 (from CN^- type plating solns.); (5) purification of water used to replace that lost by evapn. By passing a portion of a Ni plating soln. through an anionic resin exchanger, the pH of the soln. could be raised in a few min. from 4 to 6.

9124. BEVER, MICHAEL B. AND FLOE, CARL F. **Solubility of hydrogen in molten copper-tin alloys.** *Trans. Am. Inst. Mining Met. Engrs., Inst. Metals Div., Tech. Pub. No.* 1703, 11 pp. (1944).—*C.A.* 38, 2916[5].

The soly. of H_2 in different liquid Cu-Sn alloys was a regular function of compn. It decreased rapidly with addns. of Sn up to approx. 40% by wt or 25 atomic % and quite slowly with further addns. The intersection of these lines at about 25 atomic % of Sn was interpreted as an indication that Cu_3Sn existed in the liquid state. The soly. of H_2 in pure Cu and in Cu-Sn alloys measured at 1200°C was proportional to the square root of the pressure.

9125. ERLENMEYER, H. AND THEILHEIMER, W. **Flotation experiments with 8-hydroxyquinoline as collector. VII. Fractional flotation as a method for classification of solid substances.** *Helv. Chim. Acta.* 27, 1315-19 (1944).—*C.A.* 39, 2471[8].

The expts. were conducted with hydrated $Fe(OH)_3$, obtained by pptn. from $FeCl_3$ with NH_4OH, 8-hydroxyquinoline as collector, with and without addn. of $Co(NO_3)_2$. The floated part was always lighter in color and of smaller grain size than the residue. No direct relationship between grain size and yield was observed. Expts. were also conducted with Fe_2O_3 prepd. by ignition of $Fe(OH)_3$, by heating $FeSO_4$, in an elec. furnace at 600°C, and by heating FeC_2O_4 at 200°C. When the concn. of the collector was sufficiently great (20 mg of collector to 2 g of sample) there was no marked difference in yield with the different prepns.

9126. Sekine, Hideo. **Mechanism of enamel adherence to steel. I.** *J. Japan. Ceram. Assoc.* 52, 263-7(1944).—*C.A.* 45, 7329*f*.

At higher temps. the viscosity and surface tension of enamel glaze decreased, and it covered the surface of steel. At this stage an oxidized layer formed along the crystal boundaries of the steel surface and bound the glaze and the steel; this layer formed below the γ-to-α transition temp. of the steel. Co oxide acted as the absorbent of heat rays.

9127. Theilheimer, W. and Erlenmeyer, H. **Flotation experiments with 8-hydroxyquinoline as collector. VI.** *Helv. Chim. Acta.* 27, 1313-15 (1944).—*C.A.* 39, 2471[6].

The distribution of hydrate Fe_2O_3 between the foam and sediment with 8-hydroxyquinoline as collector was strongly influenced by addn. of metallic salts. By the addn. of Ni^{+2}, the yield of poorly floating hydrated Fe oxide prepns. was increased from 26.8 to 92%, but the addn. of Cu^{+2} reduced this to 11.2% and with a good floating Fe oxide prepn. yielding 93.4%, this was depressed to 23.0%. Expts. showed that the effect of Cu^{+2} varied with the conditions. In the presence of 0.1 *N* HCl, addn. of $CuSO_4$ depressed the yield of floated material from 26.8% to 11.2%, but when the collector was dissolved in 95% alc. the yield was raised from 9.6% to 45.8% by addn. of $CuSO_4$.

9128. Theilheimer, W. and Erlenmeyer, H. **Flotation experiments with fluorspar.** *Helv. Chim. Acta* 27, 1319-21(1944).—*C.A.* 39, 2470[9].

In flotation expts. with fluorspar with 8-hydroxyquinoline as collector, the yield was greatly affected by conditions. Fluorspar was particularly sensitive to CO_2. A freshly ground sample of fluorspar with 10 mg of collector and 1 ml of 2 *N* NH_3 gave a yield of 90.7%, but after standing a few weeks (both fluorspar and solns.) the same prepn. gave a yield of only 59%. If fresh NH_3 soln. was used, the aged fluorspar gave a yield of 82.5%. Addn. of $Ba(OH)_2$ to bind the CO_2 also raised the yield of 75%.

9129. Theilheimer, W. and Erlenmeyer, H. **Flotation experiments with pegmatite.** *Helv. Chim. Acta* 27, 1428-9(1944).—*C.A.* 39, 2471[2].

In order to use pegmatite as a ceramic raw material, its dark Fe-bearing constituent (mica) must be removed. The purity of the product could be detd. by alk. fusion in which material of the desired purity yielded a white melt, whereas the Fe-bearing constituent produced a bluish green melt. Tests were conducted with various collectors to det. their suitability for purification of pegmatite.

9130. Vernon, W.H.J.; Wormwell, F., and Nurse, T.J. **Surface film on chromium-nickel (18/8) stainless steel.** *J. Iron and Steel Inst.* (London), Advance copy, October (1944)12 pp.—*C.A.* 39, 5234[2].

Surface films removed from polished Cr-Ni (18/8) austenitic steel were analyzed. The Cr content of the film was greater than that of the under-lying steel, and increased with the degree of polish. The thickness of the film as measured by the total oxides present (Cr_2O_3, Fe_2O_3, NiO) increased also with the degree of polish. Surfaces from which the film had been removed were less passive than when polished.

9131. Wada, Masayoshi. **Flotation method. I. Determination of wetness of solid by the plank-slanting method.** *Bull. Research Ins. Mineral Dressing Metall.* 3, 30-45(1944).—*C.A.* 45, 4*e*.

To det. wetness of solid with H_2O the following wet-isothermal equation was derived: $F' = \gamma \cos \theta - \gamma_0 \cos \theta_0 = BRT \log [(c/a) + 1]$, where F' = wet boundary pressure of a boundary-active solid of c concn.; γ_0 = surface tension of pure H_2O; θ_0 = angle of contact between the solid and H_2O; R = gas const.; T = abs. temp.; a and B = arbitrary consts. From $BRT/(a + c)$ ($-A'$, wet activity) differentiated from the above with respect to c, and $(B/a)RT$, the same when c was zero, a and B could be evaluated, and $B/a = k$ was defined as wet activity coeff.

9132. Dietzel, A. **Theory of the adherence of enamel to iron.** *Keramik* 78, 5/8, 19-20; 9/12, 34-36(1945); *Ceram. Abstracts* 1950, 138.—*C.A.* 45, 7329*c*.

When the enamel was fired for the proper time, there was no oxide layer, and there must be another reason for the adherence. Tests showed that the Fe_3O_4 which was dissolved in the enamel reacted with metallic Fe and formed FeO, not the reverse. A 3rd theory on adherence dealt with the roughness of the Fe surface as an indispensable condition. The oxides CoO and NiO were reduced to Co and Ni by the Fe. These Co and Ni deposits formed local galvanic couples and the resulting corrosion caused the roughness.

9133. Gay, R. **Diffusion method of studying precipitation phenomena. Mineralogical applications.** *Bull. soc. franc. mineral.* 68, 60-152 (1945).—*C.A.* 43, 7296*h*.

A layer of gelatin on a glass surface was prepd. If one edge of the gelatin was immersed in a soln. of a salt, the salt diffused into the gelatin and the concn. of the salt increased from one edge of the gelatin to the other. Two such gelatin layers were prepd. with salts that reacted to form a ppt. The two layers were placed together so that the axis of the concn. gradient of one salt was perpendicular to the axis of the concn. gradient of the other salt. The points of contact of the two gelatin surfaces embraced a wide range of concn. differences, and the effect of these differences on the diffusion of ions from one gelatin layer to the other was shown by the progress of a pptn. front. The nature of the pptn. process was discussed with reference to certain concretions, e.g., cone-in-cone, met with in petrography.

9134. Herzog, Eugène. **Formation of calcium carbonate and silica deposits during corrosion of iron in soft water.** *Métaux, corrosion, usure* 20, No. 5, 57-60(1945).—*C.A.* 45, 5599*e*.

Results were given of tests made to examine the conditions in which $CaCO_3$ and SiO_2 deposits formed on mild steel immersed in soft H_2O. Particular attention was paid to the influence of the surface condition of the sample and of the rate of H_2O circulation.

9135. SUSSMAN, SIDNEY; NACHOD, FREDERICK C., AND WOOD, W. **Metal recovery by anion exchange.** *Ind. Eng. Chem.* 37, 618-24(1945).—*C.A.* 39, 3502[9].

Cation exchange-materials had been employed in the recovery of metals, but the use of anion exchangers to recover metals in the form of anionic complexes from dil. solns. was new. Cr recovery was studied most entensively. The chromate removal by the chloride and sulfate salts of the anion exchanger was about the same, i.e., 3.09 and 3.05 milliequiv. per g of exchanger resin. Recovery of the Cr with alk. regenerants, such as NH_4OH, averaged 80-90%. The concn. increase over the dil. feed solns. thus obtained ranged from 10- to 25-fold. Since the anion-exchange resins contained but little inorg. ash, recovery of the higher-priced precious metals by ashing of the resin was economically feasible.

9136. THOMPSON, J.G. **Determinations of hydrogen in iron and steel by vacuum extraction at 800°C.** *Trans. Am. Inst. Mining Met. Engrs.* 162, 369-74 (1945).—*C.A.* 40, 7064[3].

Specimens of plain carbon and low-alloy steels retained approx. 0.00035% H after annealing in H_2 at 1100°C. Remelted electrolytic Fe retained about 0.0005%, and 14-18% Cr steels quenched from 1100°C in H_2 retained more than 0.0007% H.

9137. VOSBURGH, F.J. **Carbon and graphite for mechanical and electrical parts.** *Metals & Alloys* 22, 721-6(1945).—*C.A.* 40, 3[2].

Mech. and phys. properties and uses of carbon, graphite, impervious carbon, impervious graphite, porous carbon, and porous graphite in cylinders, slabs, tubes and brick forms were summarized.

9138. BERGER, P. **Defects in plating solutions and their remedies.** *J. Electrodepositors' Tech. Soc.* 21, 195-209 (1946).—*C.A.* 41, 1563*b*.

Defects of electrodeposits resulting from impurities in the plating soln., from incorrect soln. compn., or from improper cleaning before or after plating were described and remedies were discussed. Methods of purification of the common plating solns were given.

9139. GLAUCH, E.S. **Use of graphite in iron powder compacts.** *Proc. Ann. Spring Meeting, Metal Powders Assoc.* 2, 2-7, discussion. 7-12 (1946).—*C.A.* 45, 4185*e*.

The compacts were made of electrolytic Fe powder with 0.85% by wt of various grades of graphite added. A pressure of 50 tons/in² was used. Sintering took place at 1100°C for 1 hr in dissocd. NH_3. Reduction of the Fe powder in H_2 before mixing and pressing improved the resulting tensile strength and hardness. Residual oxide films tend to decarburize the compact throughout and thus reduce the amt. of the effective graphite. The improvement is not the same for all grades of graphite. Sintering in a graphite tube instead of an open boat improved the mech. properties which were still higher if the powder was freshly reduced. The use of closed-end tubes inside the furnace muffle did not usually result in carburization. For the test conditions described a 1% graphite addn. yields a total C content of 0.9% with 0.75% in form of combined C and 0.15% as graphite.

9140. KARUNAKARAN, C. AND NARASINGARAO, M. **Concentration of graphites by froth flotation.** *Current Sci.* 15, 285-6 (1946).—*C.A.* 41, 2213*g*.

Unoxidized graphite ore contg. as little as 14% C was appreciably enriched even with an unconditioned, coarse pulp in a single stage froth flotation. The ore was ground to pass 50 mesh, 30 g was pulped with 150 ml water, treated with 0.2 ml pine oil, and aerated for 12 min. on a sintered glass funnel. Both froth and gang were sepd., dried, weighed, and analyzed. In every case the froth was enriched in C by more than 15%, but the total graphite recovery was low, in most cases being of the order of 20%.

9141. KURTZ, JACK. **Sintered high-density tungsten and tungsten alloys.** *Proc. Ann. Spring Meeting Metal Powder Assoc.* 2, 40-9, discussion, 49-52(1946).—*C.A.* 45, 4619*d*.

Densities up to 99 1/2% of theoretical were obtained in W alloys contg. 10% Cu-Ni or 10% Co-Ag. Such high densities were more difficult to achieve when the alloy contents were lower which was very desirable for some applications. In this case, purity and particle-size distribution must be carefully controlled. The alloying addns. were mixed in by means of a ball mill. This was done preferably wet with either CCl_4 or alc. for a period of 10 hrs. A small amt. of paraffin may be added to the mixt. to facilitate pressing at 15-20 tons per in.² Sintering for the 10% alloy contg. compn. took place between 1350 and 1400°C and for the 99.5% W material between 1500 and 1650°C.

9142. MOKRUSHIN, S.G. **Experimental investigations of laminar systems. XVI. Formation of uni-and multimicellar films of colloidal ferric and aluminum hydroxides.** *J. Gen. Chem.* (U.S.S.R.) 16, 11-16 (1946)(English summary).—*C.A.* 40, 6935*g*.

Colloidal solns. of hydroxides of Fe, Cr, and Al on long standing formed an invisible film on the surface. Observations on multi-laminar films deposited in the usual manner indicated that for $Fe(OH)_3$ the thickness of the unimicellar film was about 40 A., whereas the size of the micelle as detd. by ultrafiltration was 20mμ.

9143. SCHOUTEN, C. **Synthetic replacements as an aid to ore-genetic studies.** *Econ. Geol.* 41, 659-67(1946).—*C.A.* 42, 8718*e*.

Pyrite in ore bodies exhibited a great variety of forms but in each single deposit the forms were characteristic. The occurrence of metallic sulfides pseudomorphous after FeS_2 but with preservation of internal structures indicated that synthetic replacement might give a clue to the natural process. If natural ore structures were considered due to metasomatism, it was possible to produce similar structure synthetically, using host material from the same locality.

9144. Tomashov, N.D. **Anodic oxidation of aluminum alloys and the possibilities of its application in machine building.** *Vestnik Inzhenerov i Tekh.* 1946, No. 2, 59-65.—*C.A.* 40, 6005^4.

Anodically oxidized Al had properties which made it desirable in the construction of internal-combustion motors. Films 50-500 μ thick were required. The films were porous to an extent variable within certain limits. They could also be filled with pigments to color the surface, with Ag salt to photosensitize it, or with oil or colloidal graphite to impart antifriction properties to the surface. The oxidized film adhered very strongly to the Al base.

9145. Volkova, Z.V. **The bubble mineralization process in flotation.** *Compt. rend. acad. sci. U.R.S.S.* 51, 449-52 (1946).—*C.A.* 40, 7105^4.

A theory of froth flotation was developed which permitted calcn. of the min. quantity of air used in flotation, the coeff. of air utilization, and the coeff. of sepn. of minerals of different flotabilities such as quartz and barite.

9146. Volkova, Z.V. **Flotability of solids.** *J. Phys. Chem. (U.S.S.R.)* 20, 1213-24 (1946) (in Russian).—*C.A.* 41, 2614*f*.

The effects of contact angle, of the size of bubbles and mineral grains, of the induction time of a bubble, and of the ratio (R) of mineral to gang on the result of flotation were calcd. Flotation resulted in sepn. if the grains were 20-400 μ. Smaller grains adhered to bubbles even if wetted, and bigger grains did not adhere whatever the contact angle. The probability of adhesion between a given grain and a given bubble could be calcd. if the surface properties of the grain, the induction time, the size distribution of the powder, and the ratio R were known.

9147. Webber, H.M. and Hotchkiss, A.G. **Furnace atmospheres for sintering.** *Proc. Ann. Spring Meeting Metal Powder Assoc.* 2, 13-38 discussion, 38-9(1946).—*C.A.* 45, 4184*f*.

At high temps. H_2 was reducing in contact with Fe with relatively high amts. of moisture, while at low temps. less moisture was permissible to maintain the reducing condition. For alloy steels and many nonferrous metals H_2 had to be purified. Removal of O_2 was accomplished by passing the H_2 over Cu at 1100-1200°F, or through a Pd catalyst purifier at room temp. Drying was done in activated Al_2O_3 driers up to 1000 ft^3/hr. For greater flow rates refrigeration prior to drying was frequently employed. Compacts made from Cu and especially Ni alloys were sintered in a S-free atm. Coke oven gas usually contains S. In this case the amt. was passed through a water-spray and then through an Fe oxide plus wood shavings tower. The former removed SO_2, the latter H_2S. If the atm. was to be strictly nondecarburizing, CO_2 was removed by absorption in a monoethanolamine soln.

9148. Bloodgood, Don E. and Losson, Felix J. Jr. **Removal of toxic substances from metal-plating wastes by ion exchange.** *Proc. 3rd Ind. Waste Conf., Purdue Univ. Eng. Bull., Extension Ser. No.* 64, 196-208 (1947).—*C.A.* 43, 4797*a*.

Plating wastes contg. 315-335 p.p.m. total hardness, 360-376 p.p.m. alky., 27.7-53.1 p.p.m. CrO_4, 17.3-51 p.p.m. KCN, and pH 7.5-7.95 were passed through a lab. 2-stage ion-exchange unit with cation- and anion-removing resins in series. KCN was reduced to 0 to 5 p.p.m. and CrO_4 almost completely removed. The cation resin was regenerated with 4% NaOH.

9149. Bochmann, Gerhard and Fiddecke, Liselotte. **Influence of adsorbed liquid layers upon crack resistance.** *Metallforschung* 2, 239-43(1947).—*C.A.* 42, 5391*i*.

The influence of adsorbed liquids upon the magnitude of crack resistance of various metals was investigated. In the cracking process the dispersion as well as the cold deformation was influenced by the surface activity of the surrounding medium. This was previously only known for brittle nonmetallic materials. If in cracking, dispersion was of greater significance than the cold deformation occurring simultaneously, crack resistance decreased with increasing surface activity of the surrounding medium. This applied to the investigated metals, Sb and cast Fe.

9150. Brenner, Abner and Riddell, Grace. **Deposition of nickel and cobalt by chemical reduction.** *J. Research Natl. Bur. Standards* 39, 385-95(1947) (Research Paper 1835).—*C.A.* 42, 1857*g*.

Data were presented on the deposition of Ni, Co, and Ni-Co alloys from hot hypophosphite solns. without the use of electric current. The alk, Ni soln. (pH 8-10) contained $NiCl_2.6H_2O$ 30, $NaH_2PO_2.H_2O$ 10, NH_4Cl 50, and sodium citrate 100 g per liter. A typical acid Ni soln. (pH 4-6) contained $NiCl_2.6H_2O$ 30, NaH_2PO_2 10, $NaC_2H_3O_3$ 50 g per liter. Deposition could be obtained on noncatalytic surfaces by changing the compn. of the bath, making contact with a more electronegative metal, or depositing a thin layer of a catalytic metal on the surface of the noncatalytic surface.

9151. Eigeles, M.A. **Effect of variable hydrogen-ion concentration on flotation.** *Gornyi Zhur.* 121, No. 6, 31-5(1947).—*C.A.* 43, 1227*i*.

The effect of alkali and acid on the distribution of the collector (Na oleate) between the soln. and minerals was studied to elucidate the effect of pH on flotation. The effect of H^+ and OH^- on flotation of minerals was due to the adsorption of these ions on the surfaces of the minerals. As the concn. of H^+ increased, they were adsorbed on the mineral surface where their action was two-fold: the amt. of collector adsorbed on the mineral surface was reduced and a strong hydration envelope formed around the surface. The combined effect prevented the mineral particle from adhering to an air bubble. A decrease in the concn. of H^+ in the pulp reduced their no. on the mineral particle, thereby weakening the hydration envelope and also increasing the quantity of collector on the mineral surface.

9152. Eigeles, M.A. **The influence of the size of mineral particles on their depression and activation in the flotation process.** *Doklady Akad. Nauk S.S.S.R.* 57, 919-22 (1947).—*C.A.* 45, 7489*d*.

The effectiveness of the flotation process in the presence of a collector (oleic acid) and a depressor-activator (Na silicate) was studied. The concn. of the oleic acid was so chosen that the av. extn. of the exptl. material (fluorite) was 71.5%. The addn. of 100 g/ton of Na silicate increased the flotation of the fluorite to 95.8%. In general, the higher concns. of Na silicate withdrew the larger particles from the flotation and thus had a depressing action, while the smaller particles were still further activated. For particles of mesh size -14 + 20, concns. of 5-10 and 200-400 g/ton of Na silicate had an activating action, while concns. of 20-100 and 500-1000 g/ton had a depressing action.

9153. HERGT, H.F.A.; ROGERS, J., AND SUTHERLAND, K.L. **Principles of flotation—flotation of cassiterite and associated minerals.** *Am. Inst. Mining Met. Engrs., Mining Technol.* 11, No. 1, *Tech. Pub. No.* 2081, 18 pp. (1947).—*C.A.* 41, 1579*d*.

The use of sulfated and sulfonated paraffin chain compds. for the flotation of cassiterite was studied. With Na cetyl sulfate as collector the conditions recommended for the selective flotation of cassiterite from ore contg. more than 0.2% Sn and Fe sulfides and quartz were: grind in an alk. circuit (pH more than 10); reduce the sulfide content to less than 1.0% by flotation with xanthate; condition the pulp at 25°C for 10 min. with Na cetyl sulfate in the pH range 3.0-5.0 before flotation in this range; leaching with 1% HCl is effective for deactivating quartz prior to cleaner floats, for which no further addns. of collector are made. Sepn. of cassiterite from muscovite and wolframite appeared feasible at pH values below 2. Flotation tests indicated a good sepn. from mica but no sepn. from wolframite.

9154. LEIDHEISER, HENRY, JR. AND GWATHMEY, ALLAN T. **The influence of crystal face on the electrochemical properties of a single crystal of copper.** *Trans. Electrochem. Soc.* 91, 12 pp. (1947)(Prepring).—*C.A.* 41, 2339*b*.

The importance of crystal face in several electrolytic processes in a $CuSO_4$-H_2SO_4 soln. was investigated with the aid of electrolytically polished single crystals of Cu. The processes studied consisted of simple chem. etching, electroetching, electrodeposition, action of an a.c., action of an a.c. superimposed on a d.c., and electrolytic replacement. It was found that all of these processes were influenced greatly by the crystal face exposed at the surface.

9155. LYUTIN, L.V. **Stabilization of mineral suspensions.** *Trudy Vsesoyuz, Nauch.-Issledovatel. Inst. Mineral. Syr'ya, Ministerstvo Geol. S.S.S.R.* No. 178, 151 pp.(1947)(English summary).—*C.A.* 46, 5932*d*.

Sedimentometric and viscometric methods of evaluation of the adhesion intensity of particles were discussed. The effect was discussed of proteins, sulfite liquor, tannins, high-polymer carbohydrates, cetrarinic acid, soaps, and inorg. colloids on suspensions of graphite, kaolin, corundum, and $BaSO_4$.

9156. MOKRUSHIN, S.G. AND SHEINA, Z.G. **Experimental study of laminar systems. XV. Thin films of metal sulfides as emulsifiers.** *Kolloid. Zhur.* 9, 285-8 (1947).—*C.A.* 47, 943*i*.

Films of CuS and PbS, produced by passing H_2S over $Cu^{++}$and Pb^{++}solns., were ground to a powder, x g of which were mixed with 8 ml C_6H_6 and then with 2 ml H_2O. When x varied between 0.02 and 0.1, the most stable emulsions (water-in-oil) formed at $x = 0.08$; the particle diam., d, of the emulsions was smaller, the greater was x, 0.008 cm at $x = 0.08$. When, by mixing 8 ml C_6H_6 with 2 ml 0.25 *N* NaOH and PbS, oil-in-water emulsions were prepd., their stability also was max. at $x =$ 0.08 g and $d = 0.008$ cm.

9157. MOKRUSHIN, S.G. **Experimental study of laminar systems. XVII. Thixotropy of suspensions of crushed films of metal sulfides and hydroxides.** *Kolloid Zhur.* 9, 185-9(1947).—*C.A.* 47, 944*a*.

CuS films, produced at the boundary of 0.5 *M* $CuSO_4$ soln. and H_2S gas, were ground until 72% of the particles were 10-25 μ in size; 25% suspension of this powder was thixotropic. PbS suspensions, prepd. analogously, were thixotropic at 15% concn. $Fe(OH)_3$ and $Cr(OH)_3$ powders, prepd. by passing NH_3 over solns. of $FeCl_3$ and $Cr_2(SO_4)_3$, resp., and grinding to 5-15 μ and 2-6 μ, resp., gave thixotropic suspensions at 36% and 30%, resp.

9158. PETUKHOVA, V.P. **Recovery of silver with the aid of cationite.** *Zavodskaya Lab.* 13, 767-8(1947).—*C.A.* 43, 3306*b*.

The ammoniacal soln. of AgCl was poured over a column of ash-free org. cationite previously purified with HNO_3 and then with 5% NH_4OH. After adsorption, the column was washed with H_2O until removal of Cl^- ions was complete; then, the Ag was eluted with 10% HNO_3. The recovery was 98.5%.

9159. P'YANKOV, V. AND DRUZHININ, F. **Velocity of the reaction between hydrogen sulfide and some metal oxides.** *J. Applied Chem. (U.S.S.R.)* 20, 693-6 (1947)(in Russian).—*C.A.* 42, 1483*d*.

The rate of absorption of H_2S (20% in air) by 0.05-0.15-g samples (grain size 1.5-2 mm) of MnO_2, PbO_2, and yellow HgO was detd. statically at 20°C. The amts. absorbed (moles H_2S per mole oxide) after 1, 5, 25, 50 min. were: MnO_2 1.06, 1.2, 1.45, 1.51; PbO_2 0.64, 0.90, 1.12, 1.29; HgO 0.52, 0.61, 0.72, 0.76. In dynamic absorption, in a stream of air, contg. 0.35-4.0 mg H_2S per liter, flowing at the rate of 500 ml/cm² of sorbent section, the protective effect of layers 10, 20, 30, and 40 mm deep, lasted: MnO_2, 10, 32, 76, and 135 min.; PbO_2, 24, 76, 120, and 184 min., resp.

9160. ROGERS, J. AND SUTHERLAND, K.L. **Principles of flotation—activation of minerals and adsorption of collectors.** *Am. Inst. Mining Met. Engrs., Mining Technol.* 11, No. 1, *Tech. Pub. No.* 2082, 17 pp. (1947).—*C.A.* 41, 1579*f*.

The response of minerals to activator and collector was detd. by captive-bubble tests and confirmed by flotation tests in glass-stoppered cylinders. Five principles were available for detg. the value of a reagent as an activator or depressant: All minerals adsorbed H^+ and (or) OH^- so that the pH value of the soln. largely detd. the adsorptive properties of the mineral. Depressants were chosen from compds. of which the active ion had the same polarity as the collector. Activators were chosen from compds. of which the active ion had the opposite polarity to the collector.

9161. SAPIRO, S.I. **Surface phenomena in metallurgical processes.** *Stal* 7, 395-9(1947).—*C.A.* 43, 2553*f*.

Knowledge of the surface phenomena taking place at the interface melt-gas, melt-solid, melt-melt was important for understanding the processes in a metallurgical furnace. The surface phenomena were classified into: (1) inception of new phases; (2) growth of new phases; (3) adsorption and wetting; (4) dispersion and soln., e.g., dispersion of air in metal within a converter, and (5) sundry contact processes, e.g., $2CO \rightarrow CO_2 + C$ in the presence of Fe_2O_3.

9162. TOLEDO PIZA, FERNANDO ALVARES DE. **Direct reduction of iron ore with charcoal.** *Third Congr. an assoc. brasil. metais, Bol. assoc. brasil. metais* 3, 490-5 (1947) *(Inst. pesquisas tecnol. Div. met., Separata No.* 180*)*.—*C.A.* 42, 2899*g*.

Tests indicated that, when pig Fe was expensive and scrap was scarce, direct reduction of pure iron ores with wood charcoal may be economical, and pilot-plant study for Brazil was recommended. Ceramic or high-temp. alloy pots were practical. Two hrs at 1000°C was insufficient and 12 hrs sufficient to completely reduce 16-kg charges.

9163. WINKELMANN. **Requirements for foundry graphite powder.** *Werkstatt u. Betrieb* 80, 117 (1947).—*C.A.* 42, 2901*f*.

To obtain smooth castings of exact dimensions and without surface defects the graphite powder used for dusting the pattern should be very high in C, and as low as possible in ash and S or pyrite; the cryst. form was preferred to the amorphous, as it is more refractory. The crude graphite was heated in an elec. furnace to 2500-3000°C, and artificially further graphitized by addns. of coke, charcoal, anthracite, or bituminous coal. These addns. were to bind the oxygen of the graphite and to burn almost completely all impurities without attacking the graphite C.

9164. ZAPADANSKIĬ, M.B. **The use of dyes as flotation reagents.** *T͡svetnye Met.* 20, No. 2, 28-31(1947).—*C.A.* 42, 4005*e*.

Acid (anionic), basic (cationic), and mordant dyes were tested as collectors. The acid dyes (predominantly acid azo dyes and primulin) were poor collectors except for metanil yellow. A 1% aq. coln. of metanil yellow was acidified with HCl (0.5 parts of acid to 1 part of dye coln.). As the total quantity of dye soln. was increased from 90 to 510 g per ton, the recovery of 170-mesh fluorite rose from 76 to 85%. With 540 g per ton of collector added in aliquots of 180 g per ton, the total recovery increased to 90-92%. Of the basic dyes methyl violet, crystal violet, and malachite green in the form of free bases acted as collectors. The quartz floated in these tests was of various results. The recovery was 90-95%. To sep. quartz from fluorite, very pure kerosene or white spirit should be used. Carnotite, too, was floated by these reagents. Alizarin, alizarin yellow, and alizarin blue were not suitable for floating quartz or fluorite.

9165. BARGONE, A. AND RINALDI, F. **Mechanism of decarbonization in the treatment of steel.** *Tec. ital.* 3, 319-26(1948).—*C.A.* 43, 3759*g*.

The physicochem. conditions of the decarburization process in liquid steel in elec. and Martin furnaces were investigated. Present hypotheses were examd. to establish the slowest rate-detg. step of the process, the overall equation for which was given as: $FeO + C \rightarrow Fe + CO - \Delta H$. In homogeneous phase, formation of liquid Fe and of gaseous CO took place with rates of the same order of magnitude, depending on general variables such as furnace conditions, or dross.

9166. DASTUR, MINU N. AND CHIPMAN, JOHN. **Elimination of the thermal-diffusion error in studies of gas-metal equilibrium.** *Discussions Faraday Soc.* 1948, No. 4, 100-8.—*C.A.* 43, 4932*i*.

Errors could be minimized by adequate preheating of the incoming gases. Expts. were described at 1535-1563°C, with preheating at low, intermediate, and high levels, i.e., 800°, 1200°, and 1563°C. The primary feed gas was H_2, the admixed gases A, He, and Hg vapor. In the absence of sufficient preheating, addn. of a heavy inert gas tended to diminish the errors.

9167. ERISTAVI, D.I. **Adsorption of nickel and cobalt from aqueous solutions by manganese dioxide and manganese ore of Chiatur.** *Kolloid. Zhur.* 10, 322-8 (1948).—*C.A.* 43, 7774*i*.

MnO_2 adsorbed approx. equal amts. of Co and Ni from solns. of their chlorides and nitrates; at the highest concn. used (1.7 *M*) approx. 6 milliatoms of Ni or Co were adsorbed by 1 g MnO_2 independently of the method of prepn. of MnO_2 (6 methods were used). The adsorption was cationic (i.e., the anion was not adsorbed) and reversible. Various MnO_2 and $MnCO_3$ ores adsorbed more Ni than Co. This may explain the greater percentage of NiO (0.04-0.09%) than of CoO (less than 0.003%) in the ores.

9168. FORNANDER, S. **Behavior of oxygen in liquid steel during the refining period in the basic open-hearth furnace.** *Discussions Faraday Soc.* 1948, No. 4, 296-307.—*C.A.* 43, 4989*a*.

A ladle made from graphite or mild steel was provided with a wooden cover, secured by a thin Fe wire. It could be dipped through the slag layer, and after the wire melted and released the cover, fill itself without contamination with the melt. Reliable detns. of O were carried out this way. The C content of the bath had the greatest influence on the O-content during the refining period. At high C, concn. products [C] × [O] were scattered, but approached equil. values at lower C levels. Mn contents from 0.15 to 2.3% had no influence on O content of bath or on rate of C decrease.

9169. GAUDIN, A.M.; BRUYN, P.L. DE; BLOECHER, W., AND CHANG, C.S. **Radioactive tracers in flotation.** *Mining and Met.* 29, 432-5(1948).—*C.A.* 42, 7210*i*.

Because carbon was an essential ingredient in all collecting and frothing agents, C^{14} could be used as a tracer. Tracer technique may be used to measure surface area of mineral particles and to throw more light on the dynamic properties of the mineral-agent bond formed after addn. of a suitable collector. It may be possible to explain the preferential attachment of collector ions to a particular mineral surface in the presence of other minerals.

9170. GERLACH, WALTER; RENNENKAMPFF, JAKOBA, VON AND BRILL, ALEXANDER. **Magnetic and electrical studies of sintered carbonyl nickel specimens.** *Z. Metallkunde* 39, 130-9(1948).—*C.A.* 42, 7214*d*.

From Ni carbonyl powder (contg. C, 0.05; Fe, 0.04; S, 0.0003%; and Ni balance) small specimens were made by sintering without pressure at 400-1000°C in air, H_2 and vacuum. Sintering in air produced oxidation of powder particles below 1000°C. At 1000°C when d. was highest, equiv. mech., magnetic, and elec. properties were obtained when tested at -300 to +350°C regardless of amt. of sintering; slow cooling in air after sintering caused oxidation only when d. was below max.

9171. GLEMBOTSKIĬ, V.A. **Chemistry of flotation processes.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* 1948, 385-90.—*C.A.* 42, 6171*i*.

Depression of the flotation of a mineral could be attained by reducing the concn. of the ions of the mineral in soln. through introduction of a common ion. Pure quartz was not floatable with any anionic collector (oleic acid, Na oleate, peat resins, high-mol. xanthates, etc.). Smithsonite, $ZnCO_3$, which was nonfloatable owing to its high soly., could be rendered floatable by the process of "two-stage activation" consisting in successive treatment with $BaCl_2$ and Na_2SO_4 and resulting in the formation of an insol. film of $BaSO_4$.

9172. GOODEVE, CHARLES AND JACK, K.H. **Kinetics of nitrogen evolution from an iron-nitrogen interstitial alloy.** *Discussions Faraday Soc.* 1948, No. 4, 82-91.—*C.A.* 43, 4933*d*.

The rate of N_2 evolution from ϵ-Fe nitride at 350 to 500°C was given by a 2nd order equation with respect to interstitial N-concn. and was assocd. with an activation energy of 42,100±1400 cal/g mol. The velocity of diffusion of N atoms to the surface was at least 10^4 times as rapid as the rate-detg. process. The rate-detg. stage of the reaction was considered the combination of N atom pairs at the solid surface.

9173. KATO, ETSUZO. **Removal of pyrite from Amakusa china stone by flotation. I. II.** *Bull. Govt. Research Inst. Ceramics* (Kyoto) 2, No. 1, 5-7; No. 2, 50-53 (1948).—*C.A.* 46, 6349*i*.

Flotation in an alk. medium of china stone from Amakusa Island was studied. Mixts. of K ethyl xanthate with white camphor oil gave good results, while the addn. of NaOH, Na silicate, or Na pyrophosphate to get high pH values (8-10) yielded poor results. No definite relation was found between the degree of removal of pyrite (42-57%) and the particle size of the raw china stone.

9174. KLASSEN, V.I. **Effect of gases liberated from a solution of the flotation of minerals.** *Zhur. Fiz. Khim. (J. Phys. Chem.)* 22, 991-8 (1948).—*C.A.* 43, 3*g*.

Fluorite was flotated when (a) the air bubbles were introduced from outside, (b) the air bubbles were produced by satg. the liquid with air at 0.5-0.75 atm. and releasing the pressure, and (c) both these methods were used simultaneously.

9175. KLASSEN, V.I. **Effect of gas adsorption on the flotability of minerals.** *Gornyl Zhur.* 122, No. 9, 32-4 (1948).—*C.A.* 43, 3325*c*.

The effect of phys. adsorption of a gas (H_2, air, CO_2) on the floatability of fluorite and arsenopyrite was studied by passing the purified gas through a partition and then through the mineral (-100 + 200 mesh) at a rate of 160-8 bubbles/min. The mineral powder raised to the surface was collected and weighed. In the flotation of fluorite (200 g NaOH/ton and varying amts. of oleic acid), air was more active than H_2. The adsorption of gases by the mineral particles was subsequent to the attachment of the collector to the particles. In the absence of a collector, the hydration envelope on the mineral particle was complete and the bound H_2O, devoid of its capacity to dissolve gas, hampered the penetration of the gas to the mineral surface.

9176. KOEBEL, NORBERT K. **Sintering atmospheres used in powder metallurgy.** *Proc. Ann. Spring Meeting, Metal Powder Assoc.* 4, 6-14, discussion, 14-18(1948).—*C.A.* 45, 4185*b*.

In sintering, a reducing atm. was usually required; vacuum sintering was used in special cases where the conventional reducing atms. react with the work. Pure dry H_2 had great reducing power, but was expensive. An atm. produced by heating anhyd. NH_3 to 1700°F over a catalyst may contain up to 0.5% undissocd. NH_3; thus, its application was restricted to nonferrous and low-alloy ferrous materials. The most widely used sintering atm. was produced by exothermal cracking of city or natural gas; this atm. was used chiefly for low-C steel and bronze. The high CO_2 content and the presence of H_2 in conjunction with H_2O was strongly decarburizing. CO_2 could be removed by passing the gas over incandescent charcoal, or by scrubbing the gas with ethanolamine.

9177. KROLL, J. AND SCHELECHTEN, A.W. **Reactions of carbon and metal oxides in vacuum.** *J. Electrochem. Soc.* 93, 247-58(1948).—*C.A.* 42, 5365*e*.

The reduction of several metal oxides by carbon in a vacuum was studied. None of the refractory oxides studied was stable in contact with carbon in a vacuum above 1380°C. Oxides of multivalent metals reacted at 700°C or less. As a method for producing pure metals, best results were obtained with Cr, V, Cb, and Ta. A Cr metal analyzing 97% Cr and a V metal analyzing 93% V were obtained. The vacuum reduction method would be practical only for the production of the more expensive and rarer metals.

9178. Miller, H.C. **Sintering of brass compacts.** *Proc. Ann. Spring Meeting Metal Powder Assoc.* **4**, 70-4, discussion, 74-9(1948).—*C.A.* 45, 4618*h*.

Sintering expts. were carried out with pre-alloyed brass powder pressed at 30 tons per in². Various mixts. of H_2 and N_2 were used as atm. for sintering at 850 °C for 30 min. Flow rates of approx. 2 ft³/hr for each 100-g sample were maintained. Very poor strength resulted from sintering in plain N_2 with gradual improvement as the H_2 content was increased. Loss of Zn increased with greater H_2 content in the atm. Dezincification could be controlled by letting the Zn vapor pressure build up in the atm. The appearance of sintered brass was not impaired by considerable amts. of H_2O. Dezincification was avoided by sintering in closed containers which contained small amts. of zinc stearate not in contact with the work.

9179. Pamart, Charles. **Carbonization conditions for Lorraine coals. Relation between conditioning of the charge and cohesion of the coke.** *Compt. rend. congr. ind. gaz Paris* (Assoc. tech. ind. gaz France) **65**, 156-70(1948).—*C.A.* **46**, 10580*f*.

A min. "porosity" of the charge was important. Rather than attain this by compression of the charge, proper size distribution of the pulverized coal and of low moisture content was important, both of which contributed to low porosity. A series of tests in an 80-mm test oven, 30-kg charge, 600 °C, 60-20-20 mixt. of Lorraine, Saar, and semicoke, showed that the resultant coke increased in Micum tumbler test from 9.4 to 24.4% of 0-10 fraction for moisture content of mixt. from 1.38 to 5.57%.

9180. Peretti, E.A. **New method for studying the mechanism of roasting reactions.** *Discussions Faraday Soc.* **1948**, No. 4, 174-9.—*C.A.* **43**, 4988*g*.

The roasting reaction was followed in the case of CuS, by prepg. cylindrical briquets from -100 mesh C.P. CuS (2.86 cm diam., 2.86 cm long) under 3500 lb/in² pressure, placing them in a muffle furnace at 430-965 °C, and following the reaction by cutting the cylinders transversely and measuring the diams. of the visible phase boundaries. Visual and x-ray examns. showed $CuS \rightarrow Cu_2S \rightarrow Cu_2O \rightarrow CuO$.

9181. Plaksin, I.N. and Bessonov, S.V. **Effect of adsorption and chemical action of oxygen on the flotation properties of gold, silver, and copper.** *Doklady Akad. Nauk S.S.S.R.* **60**, 637-9 (1948).—*C.A.* 43, 7875*f*.

A study was made of the effect of O_2 on the interaction between metal and collector. The contact-angle method was used for detg. the floatability of a given metal surface. For Au the influence of oxide film formation was not observed. For Ag all stages of the oxidation could be observed, whereas for Cu the first stage of oxidation proceeded so rapidly that only the effect of oxide film formation could be observed. Times required to establish contact of metal with collector were studied.

9182. Plaksin, I.N. and Bessonov, S.V. **Role of oxygen and other gases in the flotation phenomena.** *Izvest. Akad. Nauk U.S.S.R., Otdel. Tekh. Nauk* **1948**, 1773-88.—*C.A.* 45, 8417*c*.

The contact angle was measured by projecting the image of a drop resting on a mineral surface, and measuring the angle directly. The metal surfaces were electrolytic Au and Ag which were formed into cylindrical tablets of 8 mm diam. and 0.5 mm thick. The minerals, pyrite, galena, and arsenopyrite were also studied. For exposure of the mineral surface, the method of polishing (under a layer of dist. water) was adopted. O_2 (from the air or dissolved in water) was adsorbed on metal surfaces in the following steps: (1) phys. adsorption of gas, (2) activation of adsorption, and (3) fixation of O_2 on the surface with formation of O_2 film (chemisorption), and then (4) considerable oxidation of the surface with formation of an oxide film. Other gases used in the expts. were N_2 and CO_2.

9183. Plaksin, I.N.; Khazhinskaya, G.N., and Brovkina, T.F. **The problem of the floatability of zinc blende.** *Izvest. Akad. Nauk U.S.S.R., Otdel. Tekh. Nauk* **1948**, 681-90.—*C.A.* 45, 7932*c*.

There was an increase in floatability of zinc blende not activated by $CuSO_4$ when air or O_2 was blown through the pulps for a short time. Floatability of zinc blende was increased by small amts. of $CuSO_4$ (1 kg/ton) but decreased by increasing concns. of $CuSO_4$ to 5 kg/ton. The particle size had a very important influence on the stability of the activating film. Increasing the concn. of lime in the pulp to 0.112% decreased the recovery of zinc blende by 30% during flotation of the slime fraction. By oxidizing the surfaces of the zinc blende particles, their activity toward the collecting reagent was enhanced.

9184. Preller, G.S. **Surface areas of materials.** *S. African Mining Eng. J.* 59, 111-13 (1948).—*C.A.* 42, 4029*d*.

The importance of surface area and condition, particularly in processes of chem. reactions, was discussed at length and the structural properties of some natural minerals were described explaining the reasons for more or less readiness to react with liquids.

9185. Seiberlich, J. **Absorption studies with waste pickle liquor.** *Steel* **122**, No. 2, 90-8 (1948); *Univ. New Hampshire, Eng. Expt. Sta., Eng. Pub. No.* 6.—*C.A.* 42, 8143*e*.

Wood charcoal, animal charcoal, petroleum coke, peat, activated carbon, activated silica, coal dust, and colloidal $Fe(OH)_2$ were used to study the absorption of $FeSO_4$ from com. steel pickle liquors contg. an excess of H_2SO_4. Activated carbon gave best results in neutral and acid solns.; 90% of the soln. was absorbed by the equiv. of carbon. Activated silica and colloidal $Fe(OH)_2$ absorbed approx. 50%. A large part of H_2SO_4 remained in soln. $FeSO_4$ was removed from the activated material by extractions with hot water. Methods for activating the materials were described.

9186. Sutherland, K.L. **Physical chemistry of flotation. XI. Kinetics of the flotation process.** *J. Phys. & Colloid Chem.* 52, 394-425 (1948).—*C.A.* 42, 2836*h*.

A math. analysis was given of the adhesion of mineral to bubble. The "collision area" of a bubble of radius R was proportional to $R\gamma$, where γ was the radius of the mineral particle. Calcd. induction periods were probably about as accurate as the exptl. values. When there was a distribution of mineral particle sizes, the rate of flotation was the sum of a no. of exponential functions of time. When there was a distribution of bubble sizes, the av. rate of flotation was equal to the rate of flotation with suitably defined mean size of bubble. An exptl. method of detg. the bubble-size distribution was described.

9187. Weingraber, H. v. **Standardization of surfaces.** *Die Technik* 3, 417-23(1948).—*C.A.* 45, 8430*g*.

It was necessary to consider alterations in the material caused by machining or other working, the requirements which the material must fulfil, appropriate tests, and means of ensuring reproducibility. The surface structure varied according to pretreatment and state of the raw material, e.g., cast, rolled, or wrought, bonderized, pressed, drawn, or coated protectively. Twenty examples of classes based on static or dynamic strain were described and appropriate mech., optical, and elec. tests suggested.

9188. Aleĭnikov, N.A. **Formation and properties of flotation disperse systems.** *Zhur. Priklad. Khim.* (J. Applied Chem.) 22, 812-22 (1949).—*C.A.* 45, 8850*b*.

The mineralized froth formed by dispersion of air in coarse aq. suspensions of coal were classified on the basis of 2 types: (1) film structure and (2) aggregate structure. The aggregate froths were easily formed in the presence of emulsions of air and hydrocarbons or as a result of disruption of the fine structure of film froth or as a result of processes of flocculation. The phys. condition of the air bubble in the dispersed medium should be considered as the condition of the system, including bubbles, adsorption layers, and their surrounding solvated films. The following relations detg. the depth of the film and the size of the gas bubble were proposed: $h = (a - 1)r$; $\Delta P = 2\sigma/3(a - 1)r$, where h was thickness of film, r radius of froth cell, a max. vol. of froth formed, P pressure of gas inside the froth cell, and σ surface tension of the medium.

9189. Andrade, E.N. da C. and Randall, R.F.Y. **The Rehbinder effect.** *Nature* 164, 1127 (1949). —*C.A.* 44, 3324*f*.

Work on single Cd crystals indicated that the diminution of mech. strength of metals by surface-active liquids was due to a disintegrating action on the metal oxide film.

9190. Burstall, F.H.; Davies, G.R., and Wells, R.A. **Inorganic chromatography on cellulose. III The use of columns of cellulose for the separation of metals.** *Discussions Faraday Soc.* 1949, No. 7, 179-83.—*C.A.* 45, 60*d*.

Ni, Co, Cu, Fe, Hg, Bi, Cd, as chlorides, could be sepd. by elution with appropriate org. solvents on a column of cellulose prepd. from paper pulp. The solvents contained Me Pr CO, acetone, water, HCl, Me acetate, Na phosphate, Et ether, and HNO_3. The sepns. depended on the selectivity of the solvent, the partition of the salts between the org. solvent and the water in the cellulose and the adsorbability of the metal ions.

9191. Church, T.G. **Formation of radioactive surface films on minerals.** *Natl. Research Council Can., Rept.* CRC-407, 8 pp.; *Nuclear Sci. Abstracts.* 3, 83(1949).—*C.A.* 44, 2417*h*.

It was found that specific minerals in an ore could assume a surface radioactivity by undergoing reactions with radioactive ions in soln. It was essential that the mineral have a suitably tarnished or coated surface, for, in general, no exchange occurred on a fresh surface. It was suggested that the radioactivity so induced could be used in conjunction with a mech. device to separate and concentrate valuable minerals or to control plant processes.

9192. Cooke, Strathmore R.B. **The flotation of quartz with calcium as activator.** *Tech. Pub. No.* 2607-B (1949). —*C.A.* 43, 6953*i*.

The activation and flotation of quartz with Ca^{++} could be explained on the basis of exchange of H^+ on the quartz and Ca^{++} in soln. At high Na^+ concns., Na depressed Ca-activated quartz by removing the Ca. At high Ca^{++} concns., hydroxyl ions could replace collector ions and depress the quartz. Fine quartz particles adsorbed Ca ions under conditions which prohibited large particles from doing the same.

9193. Doughty, F.T.C. **Flotability of minerals.** *Mining Mag.* 81, 268-71 (1949).—*C.A.* 44, 878*h*.

Minerals were divided, according to their flotability, into 4 classes: (1) those easily floatable; (2) those floatable, with probable recoveries of the order of 80%; (3) those difficult to float (certain gang minerals make satisfactory results impossible); (4) those not yet floated on a com. basis, though many of them could be floated in the lab. Metallic minerals and industrial minerals were considered separately.

9194. Faddis, S.C. **Effect of nitrogen in improving physical properties of low-carbon steel.** *Open Hearth Steel Proc. Conf., Am. Inst. Mining Met. Engrs.* 32, 260-3(1949).—*C.A.* 46, 4451*c*.

N_2 could be used advantageously in low-C rimmed, semikilled, and capped steels to obtain greater hardness and higher-tensile strength. The hardness of steels contg. 0.007 and 0.1% of N_2 was compared.

9195. Fast, J.D. **Influence of oxygen, nitrogen, and carbon on the impact strength of iron and steel.** *Intern. Gieterij-Congr., Amsterdam* 1949; *Metalen, Congresboek* 1949, 171-83.—*C.A.* 45, 95*h*.

Mild steel was melted in a glass vessel in vacuum to expel CO and N_2 and remelted in the presence of O_2 and N_2. The impact strength of the resulting alloys was measured. N_2 up to 0.030% had no effect at 20°C; O_2, even in large amts., had no effect on mild steel or pure Fe if more than 0.002% C was present. By the ignition of thin-walled cylinders of metal, O_2 was detd. below 0.01% with a precision of 0.0005%. The intergranular cleavage strength was reduced by oxide, but not by carbide, along the crystal boundaries to make the metal brittle. O_2 and N_2 adversely influenced the mech. properties with increasing temp. by shifting the transition range; O_2 and carbon did not cause a min. in the curve of pure Fe, but O_2 + N_2 or C + N_2 did.

9196. Fuks, G.I.; Klychnikov, V.M., and Tsyganova, E.V. **Adhesion of microscopic particles to solid surfaces in liquids.** *Doklady Akad. Nauk S.S.S.R.* **65**, 307-10 (1949).—*C.A.* **44**, 9772*h*.

With suspensions of 0.8-15-μ particles of quartz, glass, graphite, clay, resin, and surfaces of quartz, glass, metal, or paraffin, plots of the fraction θ of particles still adhering to the surface after the action of a force F gave distribution curves with a max. If adhesion was characterized by the min. F/G, and by nos. of adhesions on a vertical (γ_1) and on a horizontal surface (γ_2), it was noted that in H_2O the ratio γ_1/γ_2 increased with the concn. of electrolyte. The values of γ varied with the medium, the nature and size of the particles and of the solid surface, and the length of the time of contact between the particles and the surface. The adhesion no. γ_1 of quartz was an exponential function of the concn. c of electrolyte, $\gamma_1 = k_1 + k_2 \log c$; the coeff. k_2 was approx. const. (8.75-10.0) for chlorides of Li, Na, K, Rb, Mg, Ca, and Ba, whereas k_1 increased with decreasing hydration of equiv. ions.

9197. Gaudin, A.M. and Bruyn, P.L. de. **Radioactive tracers in mineral engineering problems and particularly in flotation.** *Trans. Can. Inst. Mining Met. Engrs.* 52, *(in Can. Mining Met. Bull. No.* 447*)*, 331-7 (1949).—*C.A.* 43, 8321*i*.

Flotation expts. were made relating to the absorption of dodecylamine on quartz. The amine acetate abstracted by quartz amounted to 0.008 mg per g of quartz. Since it was found that the surface of the quartz was such that about 0.21 mg of agent would be required to form a complete monoionic film, the coating in the expt. was only 3.8% complete.

9198. Glembotskiĭ, V.A. **Chemosorptive activity of the mineral in connection with its flotation properties.** *Izvest. Akad. Nauk U.S.S.R., Otdel. Tekh. Nauk* **1949**, 1701-9.—*C.A.* 45, 9311*g*.

In expts. on flotation of galena with K Et xanthate as collector, only part of the mineral surface was covered with a layer of collector. This film was unimol. and the finer the mineral particles, the higher the chemosorptive activity.

9199. Gyorki, József, and Preisich, Miklós. **Removal of sulfur from coal gases.** *Magyar Kém. Lapja* 4, 147-50(1949).—*C.A.* 45, 844*i*.

For the treatment of gases from Hungarian brown coals rich in S, the dry iron hydroxide absorbing method was proposed. The yield of this method was independent of Fe content or eventual alkalinity of the mass. Parallel expts. at the plant of Pét with desulfurizing app. with active carbon or iron hydroxide showed that the first method had lower costs and was available for the production of S at more reasonable prices.

9200. Hussey, S.J. **Application of ion-exchange resins in the cyanidation of a gold and silver ore.** *U.S. Bur. Mines Rept. Invest. No.* 4374, 33 pp (1949).—*C.A.* 43, 3753*e*.

The ore was not amenable to treatment by usual cyanidation techniques, but was amenable to cyanidation followed by countercurrent adsorption of values from the leach pulp by the anion exchange resin Amberlite. Optimum leach extn. from the ore was 78.4% of the Au and 51.5% of the Ag. An over-all recovery of 74.8% of the Au and 40.7% of the Ag in all ore was effected by countercurrent adsorption and regeneration. Over-all efficiency of adsorption by the resin was 95.4% of the Au and 79.0% of the Ag in the pregnant solns. of the leach pulps. Total recovery in the eluting solns. was 98.7% of the Au and 99.5% of the Ag adsorbed by the resin. NaOH was the best eluting and regenerating agent tested.

9201. Kauko, Yrjo. **The action of water and of calcium hydroxide solution on slag.** *Ing. Vetenskaps Akad., Handl. No.* **201**, 11 pp. (1949).—*C.A.* 44, 23*g*.

A glass electrode was used and results checked against standard buffers at values above pH 10. Oxidation-reduction potentials were also measured. Curves were given in which log OH was plotted against concn. of $Ca(OH)_2$ and against adsorbed OH^-. A reversible adsorption of OH^- on the slag took place which had a zero value at about pH 2.5.

9202. Kemsley, D.S. **Deformation of single crystals of tin in solutions of oleic acid.** *Nature* 163, 404 (1949).—*C.A.* 43, 6028*i*.

Alteration of the surface condition caused no change in crit. shear stress. Various paraffin oils, e.g., hexadecane and kerosene with different viscosities, had no effect on the changes. The elongation of the crystal had no effect on the elec. resistance in air or in the oleic acid soln.

9203. Klassen, V. I. and Ratobyl'skaya, L. D. **Estimation of the flotation activity of mineral surfaces.** *Doklady Akad. Nauk S.S.S.R.* 67, 487-9(1949).—*C.A.* 44, 2821*a*.

Contact angle and hysteresis of wetting were the chief properties considered. For the exptl. work an air bubble of a detd. size was placed on a horizontal surface consisting of a mineral powder fixed to a strip of glass. The slide with adherent bubble was placed under water and tilted until the bubble was displaced. From such an expt. the force required to displace the bubble was calcd. Results were given for expts. conducted with a natural Ca-contg. silicate as the mineral.

9204. Lukashin, V. I. **Conversion of the sulfur contained in the charge into calcium sulfide in metallurgical smelting.** *Izvest. Akad. Nauk, Otdel. Tekh. Nauk* **1949**, 131-5.—*C.A.* 44, 2424*h*.

After preliminary flushing with N_2, 3 hrs heating of the 15-20 g sample of CaO in a 5-6 liter/hr stream of N_2 passed over boiling S, and cooling to room temp. under 18-20 liter/hr. N_2, the product from a sample of CaO (from pure $CaCO_3$, ignited at 1100°C), heated at 400°C, analyzed (CaS, $CaSO_4$, CaO, insol., MgO, "S") 1.01, 0.66, 95.96, 0, 0, 2.26%, and from a sample of CaO (marble, ignited at 1100°), heated at 900°, 58.40, 36.45, 3.11, 0.52, 0.25, 1.13%. At 900°, almost all (96.64%) of the S bound is in the form of CaS + $CaSO_4$, only 3.36% of it in the form of "S". At 400°, only 14.2% of the S bound is in the form of CaS + $CaSO_4$, 85.8% of it in the form of "S". In the reaction between S vapor and pure $CaSO_4$, the product was, at 400° (3 hrs) CaOS, $CaSO_4$ 99.90% (i.e. unchanged), at 600° (3 hrs) 1.60, 98.32%, at 700° (2 hrs) 7.32, 92.48%, and at 900° (6 hrs) 97.73, 2.12%.

9205. Machu, W. **Surface chemistry and kinetics of corrosion processes.** *Arch. Metallkunde* 3, 1-7(1949); *Fortschr. Gebiete Phosphatier* 3, 1-21(1950).—*C.A.* 45, 4196*b*.

Accelerated corrosion tests were run on parkerized, bonderized, and plain steel panels in solns. of Na_2SO_4, NaCl, and Na_2CrO_4. The value of the rate const. for the formation of corrosion products was a numerically exact value for the strength and speed of attack on the metal. The reaction rates at a local anode area were dependent upon the ratio of bare unprotected metal to the nonreactive surface area. The effect of time on corrosion was detd. by the instability of the corrosion layer and the ease with which cathode polarization took place.

9206. Machu, W. **Kinetics in coating methods, especially by the phosphate process.** *Arch. Metallkunde* 3, 203-8(1949).—*C.A.* 44, 958*f*.

The time factor in the coating reaction was proportional to the amt. of exposed anode surface. In accelerated treatments with oxidizing, reducing, or org. addns., the actual rate of deposition deviated from the calcd. value because of interference by the addn. agents. There was probably a cathode reaction superimposed on the anode process.

9207. McLeod, J. M. **The relationship between carbon deposition and reducibility.** *J. West Scot. Iron Steel Inst.* 57, 242-53(1949-50).—*C.A.* 46, 3476*h*.

The carbon deposition range for some Fe ores and sinters were investigated under conditions as similar as possible to those in the blast furnace. Variation in the amount of carbon deposited with different CO/CO_2 ratios was detd. Deposition of carbon was found to be a max. with easily reduced ores and sinters. Carbon deposition was measured in a CO atm. by change in vol. of the specimen and reducibility by the CO_2 produced after correction for that produced by carbon deposition. Samples + 1/4 to -1/2 in. in size and weighing 10 g were used. Carbon deposition started at 450°C, reached a max. at 500°C, and then fell off; at 650°C it was negligible. The significance of the results in terms of blast-furnace operation was outlined.

9208. Neumann, B. and Klemm, H. **The structural formation of iron oxide-silicate bloomery furnace slag and the process for separating the metallic iron out of the slag.** *Arch. Metallkunde* 3, 7-11(1949).—*C.A.* 45, 4186*c*.

The Fe reduction process was carried out in a pit-type furnace. The furnace was brought to heat with an air blast blowing through the bed of charcoal. Alternate layers of charcoal and ore and charcoal mixt. were introduced. The large excess of charcoal goes off as CO_2. This prevented the reduced Fe from oxidizing. Because of the short reduction time, small quantities of FeO remained unreduced in the slag. The reduction of the Fe ore took place at about 1200°C. At this temp. the melting point of the Fe (1528°) was not reached, so it sepd. from the fluid in a pasty state with some slag particles included.

9209. Okamura, Toshihiko; Masuda, Yoshimichi, and Kikuta, Sadao. **Experimental study of the kinetics of sintering of metal powder at constant temperature. I.** *Science Repts. Research Insts. Tohoku Univ.* Ser. A, I, 357-63 (1949).—*C.A.* 45, 4618*f*.

The breaking strength and shrinkage of Cu powder sintered at 500, 550, 660, and 720°C and of Fe powder sintered at 700, 750, 800, 880, and 910°C were measured. With Cu the shape of the breaking strength curve changed abruptly in the neighborhood of 700°C, but the shrinkage curves exhibited no such change. Microscopic examn. indicated that the period in which the breaking strength curve rose steeply coincided with the closing of the open pores in the specimens. The vol. of the pores w varied with time t at const. temp. as follows: $w = At^n$, where A and n were consts. The activation energies for sintering were 56,000 cal/mole for Cu and 65,000 cal/mole for Fe.

9210. Pask, Joseph A. **Adherence of glass to metal.** *Better Enameling* 20, 6-7, 31(1949).—*C.A.* 45, 5382*d*.

Practices involved in making vacuum-tight glass-to-metal seals for the electronics industry were described. An oxide layer was presumed to account for adherence in glass-to-metal seals. A new theory combining the oxide and mech. theories was proposed in which oxide formation was necessary for wetting of metal by glass, but surface roughness caused by oxidation and(or) chem. etching by CoO during firing gave the actual adherence.

9211. Plaksin, I. N. and Dubrovskaya, E. M. **Effect of gases on the flotation of phosphorite ores.** *Doklady Akad. Nauk S.S.S.R.* 68, 361-3 (1949).—*C.A.* 44, 3856*g*.

A lab.-type flotation machine was modified by a cover to prevent entrance of air and devices at the side to supply air from below into the cell. The phosphorite ores were ground to a screen size of 100-270 mesh, deslimed, and dried previous to the flotation. The reagents used were Na_2CO_3, Na silicate, and tallow soap. Practical flotation in N_2 was not feasible. O_2 gave the most noticeable increase in the recovery of P_2O_5. Air and N_2 lowered the recovery of P_2O_5 in the concentrate. O_2 increased the hydrophobicity of the mineral surface and also caused an increase in the thickness of the sorption layer of the collector.

9212. Plaksin, I. N. and Dubrovskaya, E. M. **Effect of the sorption action of gases on the floatability of phosphorites.** *Izvest. Akad. Nauk U.S.S.R., Otdel. Tekh. Nauk* **1949**, 1030-7. —*C.A.* **45**, 8417*g*.

The angle of contact between the mineral surface and the flotation medium was measured. The polished section of phosphorite immediately after exposure of the surface was dipped into collector consisting of a 20% soln. of carboxylic acids in kerosene. After the given time of contact, the polished section was carefully removed from soln., rinsed with distd. water, dried in air for 3 min., and arranged for measurement of contact angle. It was concluded that air, without the influence of collector, promoted the hydrophobization of the surface of the phosphorite mineral. When the phosphorite surface sorbed collector without the influence of air, a 3-hr period of contact with the collector was required for development of the max. contact angle (60°). However, after preliminary action of air on the mineral surface for 2 hrs and subsequent contact of mineral with collector for 1 hr the contact angle increased to 68°.

9213. Plaksin, I. N.; Khazhinskaya, G. N., and Brovkina, T. F. **Influence of the natural composition and structure of zinc blendes on their floatability.** *Izvest. Akad. Nauk U.S.S.R., Otel. Tekh. Nauk* **1949**, 1361-4.—*C.A.* **45**, 7932*f*.

Flotation tests were made with zinc blende from 5 different deposits. The minerals to be tested were ground to -100 mesh (40-50%, -200 mesh). On the basis of the expts. made it was concluded that O_2 activated zinc blende, interacting with the Fe sulfide in it. Graphs were used to show (1) mineral recovery *vs.* length of time of oxygenation of a zinc blende to which $CuSO_4$ was added and (2) mineral recovery *vs.* length of time of oxygenation without addn. of $CuSO_4$. The results of analyses of the zinc blendes for Zn, Cu, Fe, Pb, and insol. residue + silica were given.

9214. Plaksin, I. N. and Kurenkov, I. I. **Intensification of flotation granulation.** *Gornyĭ Zhur.* **123**, No. 4, 34-5(1949).—*C.A.* **44**, 87*f*.

Flotation granulation consisted of combining gravity concn. with flotation. Such condition was obtained when ore was tabled while air was supplied to the treated material. Some of the principles involved in tabling were discussed.

9215. Plaksin, I. N. and Okolovich, A. M. **Depression of pyrite and arsenopyrite in flotation in an alkaline medium.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* **1949**, 907-22. —*C.A.* **45**, 9431*i*.

All expts. were made with ore of two sizes: -100 mesh and -200 mesh. In cases where the effect of the alkali appeared to be chiefly a result of sorption, lime showed considerably greater influence than did NaOH. However, when the depression was a consequence of formation of a deposit on the mineral particles, large differences were not observed. Limed films showed less stability than films formed by the action of NaOH. The high activity of lime appeared to be a result of activity of the Ca^{++} which was involved in formation of films on the mineral surface. Addn. of $CuSO_4$ to the pulp caused an increase in flotation capacity of arsenopyrite in lime medium.

9216. Rebinder, P. A. and Likhtman, V. I. **Influence of the experimental conditions on the effect of adsorption in facilitating the deformation of metal single crystals.** *Doklady Akad. Nauk S.S.S.R.* 69, 219-22(1949).—*C.A.* **45**, 6449*i*.

Adsorption of surface-active substance in microcracks prevented their collapsing and thus facilitated plastic flow. Consequently, this effect could not be expected to be observed either at low rates of deformation, where spontaneous recovery predominated over development of microcracks, or at too high rates where adsorption lagged behind the production of microcracks. The effect of BuOH and $C_7H_{15}OH$ vapor on the stress-strain curve of single crystals of Sn, Pb, Zn, and Al, as compared with the same curves *in vacuo* (10^{-5}mm Hg), was observed with an unetched surface. In observations of the creep, effects of surface-active substances showed themselves in a wide range of loads, and were not contingent on an optimum rate of deformation.

9217. Thon, N.; Kelemen D., and Yang, Ling. **Porosity of electrodeposited metals. A.E.S. Research Project No. 6. IV. Measurement of very low porosities by the low pressure-constant overpressure method.** *Plating* 36, 362-6(1949).—*C.A.* 43, 6923*f*.

Sound wrought Ni foils 2.5 μ thick were found to be incomparably less porous than electrolytic foils of comparable thickness. Ni deposits with preferred orientation of (110) crystal faces parallel to the base metal surface were much more porous than those with (100) faces parallel.

9218. Tittel, Oszkár. **Bentonite as a secondary material in foundries.** *Bányász. Kohász. Lapok* **82**, 490-5(1949).—*C.A.* **45**, 2833*h*.

For the evaluation of Hungarian bentonites as secondary materials in foundries, the amt. of water required to obtain solidification in 24 hrs was detd. Bentonites of first quality took up 15-times their own vol., water absorption in the 2nd group was 10-times, in the 3rd group 7-times as much as the vol. of the sample. Thixotropy and film formation on drying were 2 characteristic properties suitable for application in foundries.

9219. Vajna, Sandor. **Separation of sulfur from Hungarian coals.** *Magyar Kém. Lapja* 4, 25-6(1949).—*C.A.* **45**, 1322*f*.

Hungarian coals had a mean S content of 3-4%, half of which was transformed into H_2S at gas production. Sepn. of S by active carbon was plausible only with gases where previously a proper purifying procedure was made, whereas the $Fe(OH)_3$ mass could be used for gas purification without previous steps.

9220. WARK, I. W. **Methods of separation based on surface properties.** *Roy. Australian Chem. Inst. J. & Proc.* 16, 387-404(1949).—*C.A.* 44, 10384*g*.

The general principles of sepg. phys. mixts. by selective flotation were outlined. The use of zanthates as collectors, the nature of the adsorbed xanthate film, and the use of differential depressants for sepg. minerals of like contact angle properties were particularly discussed. Phys. mixts. could also be sepd. by means of detergents, which like flotation reagents depended on competitive adsorption, and by electrostatic methods.

9221. WU, PAO-ZUNG AND MORRIS, T. M. **The effect of silicate and hydroxyl ions on the abstraction of potassium ethyl xanthate by galena.** *Bull. Univ. Missouri School of Mines and Met., Tech. Ser. No.* 74, 15 pp.(1949).—*C.A.* 44, 3857*i*.

Chem. and flotation tests showed that OH^- and SiO_3^{2-} reduced galena recovery in flotation when KEtX was used as a collector, as these ions retarded the reaction of the xanthate ions and the Pb^{++} at the galena surface.

9222. AKSEL'ROD, R. S. AND TARASOVA, L. S. **Determination of oxygen in steel.** *Zavodskaya Lab.* 16, 1494-5(1950).—*C.A.* 45, 10131*f*.

The molten metal was sampled with a Fe sampling vessel contg. an Al wire spiral (0.3-0.5% of sample wt). The Al_2O_3 formed was detd. and after subtraction of the Al_2O_3 present naturally in the steel, the amt. of O present in the original sample was calcd.

9223. ANDRADE, E. N. DA C.; RANDALL, R. F. Y., AND MAKIN, M. J. **The Rebinder effect.** *Proc. Phys. Soc.* (London) 63B, 990-5(1950).—*C.A.* 45, 4511*i*.

The immersion of wires of certain metals in nonpolar paraffin contg. a little oleic acid increased the rate of flow of the metal under a given stress and increased the elec. resistivity. The mech. effect could be obtained with single crystals of Cd if the surface was contaminated by a thin oxide layer, which was known to increase the crit. shear stress, but not if the surface was clean. The effect was attributed to the disruption of the hardening surface layer by the active agent and not to penetration into the metal.

9224. BELYAEV, A. F. AND KOMKOVA, L. D. **Effect of pressure on the burning velocity of thermites.** *Zhur. Fiz. Khim.* 24, 1302-11(1950).—*C.A.* 45, 3696*h*.

The effect of pressure on the burning rate of solids was used as a criterion for deciding whether the gas phase partakes or not in some rate-detg. step. The systems studied were (1) $Cr_2O_3 + 2Al$, (2) $Fe_2O_3 + 2Al$, (3) $Cr_2O_3 + 3\ Mg$, (4) $1.5\ MnO_2 + 2\ Al$. Pressed cylinders (800 atm.) of the reactants were burned in a bomb under a N_2 pressure up to 150 atm. The linear reaction rate was registered photographically. Runs in an atm. of A showed that formation of nitrides did not affect the rate. The observed rates were of the order of a few cm/sec. The effect of pressure was to regulate the adsorption of the metal vapor rather than to regulate the vaporization of the metal.

9225. BLOODGOOD, D. E. AND STRICKLAND, A. **Chromium removal by ion exchange.** *Water & Sewage Works* 97, 28-32(1950).—*C.A.* 44, 2678*f*.

No satisfactory method was developed for regenerating the resins by direct replacement reactions, for both the chromate and Cr^{+++} appeared to form stable, complex compounds with the resins. A new method of elution, not yet fully tested, suggested the reduction of the chromate adsorbed on the anion exchanger to the cationic Cr^{+++} by means of H_2O_2.

9226. CHVORINOV, NIKOLAJ. **Controlling the shape of graphite in cast iron.** *Hutnické Listy,* Suppl. No. 2, 50-6(1950).—*C.A.* 45, 996*e*.

The factors influencing the graphitization process were studied. The dissolved O_2 and S contents had a decisive influence both in the case of standard types of cast iron and also in the case of nodular cast iron.

9227. COOK, MELVIN A. AND NIXON, JOHN C. **Theory of water-repellent films on solids formed by adsorption from aqueous solutions of heteropolar compounds.** *J. Phys. & Colloid Chem.* 54, 445-59(1950).—*C.A.* 44, 6229*a*.

The most important use of water-repellent films was in flotation. The films were formed by adsorption of collectors which were anionic, cationic, and nonelectrolytic compds. in the order of industrial importance. Zeta potentials and contact bubble data were in accord with the neutral-mol. theory involving the adsorption of mols.

9228. COSTA, R. L. **Regeneration of chromic acid solutions by cation exchange.** *Ind. Eng. Chem.* 42, 308-311(1950).—*C.A.* 44, 3377*a*.

Chromic acid anodic baths, Cu stripping baths, and other chromic acid solutions that were rendered useless by the accumulation of dissolved metals, such as Al, Cu, and Fe were regenerated in passing through a bed of cation exchange resin. The soln. was made suitable for reuse, and the problem of disposing of the waste was minimized.

9229. CRABTREE, E. H. JR.; WINTERS, V. W., AND CHAPMAN, T. G. **Developments in the application of activated carbon to cyanidation, including the desorption of gold and silver from carbons.** *Am. Inst. Mining Met. Engrs., Tech. Pub. No.* 2744-B, *Mining Eng.* 187, No. 2, 217-22(1950).—*C.A.* 44, 2423*c*.

The carbon-cyanidation process was used in a stagnant ore pulp in a 25 ton per day pilot plant. Minus 150-mesh activated carbon, with lime and cyanide, were pulped with Au-bearing tailings residues at a consistency of 75% solids and allowed to stand 15 to 20 hrs. The carbon was then recovered from the dild. pulp by flotation. About 75% of the Au was recovered in the carbon flotation concentrate. Another method which used coarse activated carbon in revolving screen containers partially immersed in a series of 3 agitators recovered 92.7% of the

Au in a coarse concentrate assaying 41.86 oz of Au per ton of carbon. This concentrate was then treated by a desorption method in which 98.4% of the Au was extd.

9230. DUNHAM, K. C. AND TAYLOR, J. T. **The use of diamond-impregnated tools for rock-slicing.** *Mineralog. Mag.* 29, 191-9(1950).—*C. A.* 45, 6880*c*.

Diamond powder was mixed with powd. metal and sintered without fusion of the metal to bond diamonds with metal for use in grinding laths. Diamond-impregnated cut-off disks must rotate at a min. peripheral speed of 6000 feet per min., and a heavy cutting machine was needed.

9231. EĬGELES, M. A. **Kinetics of mineralization of air bubbles in selective flotation and the effect of flotation reagents on it.** *Trudy Soveshchaniya Teorii Flotatsion. Obogashcheniya, Moscow 1948, Rol Gazov i Reagentov v Protsessakh Flotatsii* **1950**, 63-84 (discussion, 84-5).—*C. A.* 47, 6319*g*.

The adhesion of down-falling mineral particles to rising air bubbles was affected by many factors. In a flotation cell the time during which a particle might become attached to a bubble was very short. The max. time of contact, $\tau = 1.6\ R/u$, where R was the radius of the bubble and u the relative rate of motion of particle and bubble, i.e., the sum of the velocities of bubble and particle. This was calcd. to be 0.004-0.008 sec. The flotation properties of a mineral in a one-mineral system depends only on the interaction of the mineral with its own ions, water, and gas. In a many mineral system ions derived from other minerals, however, insol., come into play.

9232. GANDRUD, B. W. **Kerosene flotation: a process for cleaning and dewatering fine sizes of coal.** *Rev. ind. minerale* 31, 230-54 (1950).—*C. A.* 45, 4020*c*.

The process with citation of U.S. Bureau of Mines report was fully described.

9233. GAUDIN, A. M. AND BLOECHER, F. W. **Adsorption of dodecylamine on quartz.** *Trans. Am. Inst. Mining Met. Engrs.* **187**, *Tech. Pub. No.* **2813-B** (in Mining Eng.) **187**, 499-505 (1950).—*C. A.* 44, 5651*d*.

By using radioactive dodecylamine acetate, an isotherm for the adsorption of dodecylamine from soln. on to the surface of quartz was detd. for a pH range of 6 to 7 at 20° to 25°C. At low concns. the amt. adsorbed per g of quartz varied directly as the sq. root of the soln. concn. Pure quartz, with a sp. surface of 4430 cm^2 per g, was floated almost completely (95% recovered), at a pH near 7. This was achieved with 0.1 lb dodecylamine hydrochloride, and 0.08 lb terpineol per ton of quartz. About 60% of the collector was on the mineral surface and 40% in the liquor.

9234. GLEMBOTSKIĬ, V. A. **Mechanism and velocity of collecting in relation to the intensification of the flotation process.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* **1950**, 253-8. —*C. A.* **45**, 9433*d*.

At the beginning of flotation it was possible to increase the speed, in spite of the continuing increase of mineral particles from the pulps tending to reduce the speed. The effect of increasing the speed of flotation without introduction of addnl. collector was explained as proceeding from chemo-sorption. Consideration of velocity-time curves by comparing them with recovery-time curves permitted one to evaluate directly the velocity of the collecting reaction and the distribution of mineral particles according to their chemo-sorption activity.

9235. GYORKI, JÓZSEF. **Enrichment of Hungarian Liassic coals by flotation.** *Bányász. Kohász. Lapok* 5, 83, 504-10(1950).—*C. A.* 45, 8736*g*.

Expts. were conducted in 1922 with Liassic coal from Királd contg. 37.18% ash. The coal was comminuted to a max. grain size of 1 mm, and flotation was accomplished with 1 ml naphthalene oil/kg. The enriched product contained 30.7% ash, and the gang 38.04% ash. Good results were accomplished by similar treatment of coal from Pécs. The optimum amt. of oil was 0.15-0.17%, based on the amt. of dry mud.

9236. HAJTÓ, NÁNDOR. **The production of nodular graphite structures in cast iron by use of alloying materials.** *Bányász. Kohász. Lapok* **5**, 268-79(1950).—*C. A.* 45, 996*f*.

Nodular graphite structures were produced in cast iron by means of Mg-Al and Mg-Al-Si alloys. In some of the experiments Ca was used instead of Mg. Interesting results were obtained by adding approx. 0.7% Ca (as Ca-Si alloy) to the liquid iron and adding 1% Mg (as Mg-Al-Si alloy) after the Ca was dissolved in the iron.

9237. HEDVALL, J. ARVID; GERNANDT, H. O., AND AKESSON, Y. **New uses for Swedish minerals other than ores. Transforming flotation apatite to phosphate fertilizer.** *Trans. Chalmers Univ. Technol., Gothenburg* No. **100**, 3-22 (1950)(in English).—*C. A.* **45**, 4007*d*.

Apatite flotation concentrates, when heated alone up to 1,000°C, showed little change in citrate soly. The addn. of kaolin, pholerite, CaO, CaO with SiO_2, and SiO_2 alone caused only slight increases in the citric acid soly. With 30% SiO_2 added and the mixt. heated at 1400°C for 60 min., in an atm. contg. 33% water vapor, the citric acid soly. was only 40.5% of the total P_2O_5. With 35% serpentine, 40% of the F was vaporized and 97.5% of the P_2O_5 was solubilized in 15 min. at 1520°C. Data and curves were presented which showed that serpentine was more effective than two other Mg silicates at lower concns. in the mix.

9238. HEUBERGER, J. **Powder metallurgy studies. I. Sintered properties of pressed bodies of copper and graphite powder.** *Trans. Chalmers Univ. Technol., Gothenburg, No.* **98**, 3-10(1950). —*C. A.* 45, 91*c*.

Test bodies were prepd. from mixts. of natural graphite 10% and electrolytic Cu powder 90%. The hardness and bulk d. were investigated in the range 500-750°C at 25° intervals. At lower temps. there first occurred a swelling of the pressed body (decrease in bulk d.), which was least prominent in the bodies prepd. at low pressure and most prominent in those prepd. at high pressures. In the range 550°-675°C a marked contraction occurred (increase of bulk d.), which was traceable to the actual sintering of the connected Cu skeleton. The practical sintering temp. of a Cu powder could be lowered by repeated oxidation and reduction at decreasing temps. down to 350°.

9239. HILL, R. A. W.; SUTTON, L. E.; TEMPLE, R. B., AND WHITE, A. **Slow self-propagating reactions in solids.** *Research* (London) 3, 569-76(1950).—*C.A.* 45, 3697*c*.

The self-propagation of slow reactions in mixts. of the following oxidizing and reducing agents was studied by recording the temp. changes as the reaction front passed a point: $Fe-BaO_2$, $Fe-K_2Cr_2O_7$, $S-BaO_2$, $Fe-KMnO_4$, $Mo-BaO_2$, and $Mo-KMnO_4$. Propagation of the reactions occurred only by thermal conduction. Diffusion of hot gaseous products through the interstices might in some cases convey heat over and above that conducted by the solid.

9240. HOPKINS, D. W. AND ADLINGTON, A. G. **Factors affecting the reduction of zinc oxide by carbon. A study of the reduction of zinc metaferrite by carbon.** *Bull. Inst. Mining Met. No.* 530, 117-28(1950).—*C.A.* 45, 2833*f*.

Zn metaferrite, $ZnO.Fe_2O_3$, was heated in a retort with carbon at from 600° to 1050°C for periods of 2 and 4 hrs. Above 560°C Zn metaferrite dissocd. into ZnO and Fe_3O_4. In a charge which was small enough to be at virtually the same temp. throughout, no reduction of ZnO took place until this Fe_3O_4 had been completely reduced to Fe, but on a larger scale overlapping of reactions may occur, and Zn vapor may be reoxidized. The effect of temp. was pronounced above about 920°C.

9241. MERRILL, REYNOLD C. AND GETTY, RAYMOND. **Suspending action of alkaline electrolytes on ilmenite black.** *J. Phys. & Colloid Chem.* 54, 489-97(1950).—*C.A.* 44, 6229*f*.

The suspending action on ilmenite black measured after sedimentation for 3 hrs of solns. (10^{-7} to 10^{-1} M) of NaOH, Na_2CO_3, Na_3PO_4, $Na_4P_2O_7$, Na_3HSiO_4, Na_2SiO_3, $Na_2O\cdot 2\cdot 9SiO_2$, and $Na_2O\cdot 3.3SiO_2$ showed max. efficiencies at low concns. Na dodecyl-benzenesulfonate exhibited max. efficiency at a higher concn. Mixts. of org. and inorg. detergents showed 2 regions of max. efficiency, probably due to each constituent. Nonionic detergents were less effective as suspending agents. The best suspending agents consist of a weakly adsorbed ion and a strongly adsorbed ion, giving the particles a high electrostatic charge or ζ-potential.

9242. MILLAN DEL VAL, FRANCISCO. **Blast-furnace hearth lined with rammed carbon.** *Inst. hierro acero* 3, 210-22, 282-7(1950).—*C.A.* 45, 4183*f*.

In 1943 a carbon-lined blast furnace was started in Spain which successfully produced some 600,000 tons of pig iron. There are now 5 such blast furnaces in operation. The first ones were built with German materials. The blast furnaces so lined were cheaper in materials, and required much less labor.

9243. MINCSEV, MÁRIA RALCSEVA. **Gas-purifying material based on iron oxide produced from roasted pyrite.** *Magyar Kém. Folyóirat* 56, 164-7(1950).—*C.A.* 46, 1228*a*.

Expts. were conducted for the utilization of roast pyrite waste and HCl, obtained as byproducts of H_2SO_4 manuf. Av. compn. of roast pyrite waste was Fe_2O_3 83.5, S 3.74, Zn 4.15, As 0.03, Cu 0.54, and SiO_2 7.56%; 10-40% of the total iron content being present in the form of Fe(II), this latter fact was considerably detrimental to the phys. properties and H_2S-absorption capacity of the gas-purifying material. Roasted pyrite was dissolved in HCl (sp. gr. 1.16) at 70°C, the $FeCl_2$ oxidized with gaseous Cl, then milk of lime or dolomite added to ppt. $Fe(OH)_3$. The ppt. obtained with dolomite showed significantly lower H_2S-absorbing capacity than that produced by milk of lime.

9244. MOORE, GEORGE E.; ALLISON, H. W., AND MORRISON, JAMES. **The reduction of strontium oxide by tungsten in vacuum.** *J. Chem. Phys.* 18, 1579-86(1950).—*C.A.* 45, 6022*f*.

Between 1150-1550°K, SrO was reduced by W in vacuum. The rate of the reaction $3/2\ SrO(s) + 1/2\ W(s) \rightleftharpoons 1/2\ SrWO_3(s) + Sr(g)$ to the right was expressed by the equation $\log M = -[(1.810 \times 10^4)/T] + 8.460$, where M was the rate of evapn. of Sr metal in grams per cm^2 per hr and T was °K. This rate was believed to correspond to the equil. pressure of Sr metal in the above reaction. This equil. pressure was given by $\log P = 2.286 + 0.5 \log T - [(1.810 \times 10^4)/T]$, with P in atms.

9245. PASK, JOSEPH A. **Glass-to-metal seals.** *Product Eng.* 21, No. 1, 129-34(1950).—*C.A.* 44, 8704*c*.

Wettability of the metal by the molten glass at sealing temps. was discussed and sealing procedures were described.

9246. PHILLIPS, D. J. AND THOMPSON, N. **Surface effects in creep of cadmium crystals.** *Proc. Phys. Soc.* (London) 63B, 839-47(1950).—*C.A.* 45, 4515*c*.

A recording rate-of-strain meter was used to investigate the changes in creep rate when the chem. environment of a stressed Cd crystal was altered. Expts. were made with aq. solns. of a no. of inorg. salts of Cd. The observations were explained in terms of variations in the thickness of a surface film of Cd hydroxide, the presence of such a film having the effect of reducing the creep rate by an amt. depending on its thickness. Measurements were also made on the effect of very thin films, formed by immersion in distd. water; these were estd. to be about 10^{-6} to 10^{-7}cm thick. When the films were removed with dil. H_2SO_4 a sudden small-strain increment was observed, the magnitude of which depended on the film thickness.

9247. PHILLIPS, G. C. AND RICHARDSON, J. E. **Preparation of carbon targets.** *Rev. Sci. Instruments* 21, 885-6(1950).—*C.A.* 45, 962*i*.

A thin, pure, uniform carbon target was made by cracking benzene vapor on 3-mil Ag foils at

1500°F in the absence of air. These targets have a carbon deposit of about $25\gamma/cm^2$. Isotopically enriched C^{13} targets were prepd. from enriched MeI on a 1/32-in thick Ni disk heated by means of an induction furnace. The disk was outgassed while hot, MeI vapors were admitted and the disk heated to a red-orange. I_2 deposited on cooler parts of the enclosure but none on the sample.

9248. Plaksin, I. N. **Effect of gases on minerals.** *Gornyĭ Zhur.* 124, No. 2, 32-7(1950).—*C.A.* 44, 5285*h*.

The effect of O_2, N_2, CO_2, and H_2O satd. with O_2 on Au, Ag, Cu, and sulfidic minerals was studied on the floatability of the minerals. The effect of the gases was inferred from the contact angle of H_2O and a given surface following exposure to a gas. O_2 caused Au and Ag to turn hydrophobic and the sulfides to become first hydrophobic and then hydrophilic. In order of increased resistance to oxidation the sulfides were: sphalerite, pyrite, and chalcopyrite.

9249. Plaksin, I. N. **The action of gases and reagents on minerals in flotation processes.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* **1950**, 1827-43.—*C.A.* 46, 69*i*.

Flotation expts. were made to det. the difference in the effect of O_2 on metals and on sulfides. The natural hydrophobicity of minerals was explained by the sorption of O_2 after which the hydrophobicity of the mineral surface decreased. The hydrophobicity of the mineral surface during the action of the collector reached a max., which depended on the chem. activity of the metal. Interaction of the reagent with the mineral was detd. by the compn. as well as by the structure of the cryst. lattice of the latter.

9250. Plaksin, I. N. **Role of gases and chemical interaction with reagents in flotation processes.** *Trudy Soveshchaniya Teorii Flotatsion. Obogashcheniya, Moscow 1948, Rol Gazov i Reagentov v Protsessakh Flotatsii* **1950**, 32-56 (discussion 56-62).—*C.A.* 47, 6319*b*.

While the contact angle was not an abs. measure of floatability, it could be stated that as the contact angle increased, the floatability improved and conversely. The effect of O_2, N_2, and CO_2 on the contact angle was studied on metals (Au, Ag, and Cu), sulfidic minerals (sphalerite, pyrite, and chalcopyrite), and phosphatic minerals. The contact angle made by a drop of H_2O placed on a surface after treating the latter with one of the gases at 20°C was measured over a period of time at 15 min. intervals. O_2 induced hydrophobization, i.e., increase of the contact angle of Au and Ag surfaces. The results for Cu were inconclusive. The hydrophobic properties of phosphate were enhanced in increasing order by CO_2, N_2, and O_2. Expts. with freshly exposed (cleaved) surfaces of minerals showed that they acquired hydrophobic properties as consequence of absorbing O_2.

9251. Plaksin, I. N.; Khazhinskaya, G. N., and Brovkina, T. F. **Effect of the granulometric characteristic on the floatability of zinc blende in relation with self-activation.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* **1950**, 407-11.—*C.A.* 45, 9433*b*.

Zn blende ground to -100, -200, -250, and -325 mesh was studied. The expts. were made by using 40 g of ore in a flotation machine equipped with a mech. stirrer. Flotation took place in an alk. medium, with a charge of 1 kg/ton of lime, 200 g/ton of ethyl xanthagenate as collector, 170 g/ton of pine oil as frother. In one series of expts. an activator (1 kg/ton of $CuSO_4$) was used, in the other series no activator was added. In another expt. a mineral mixt. of the following compn. was floated: ZnS 12.5 and SiO_2 87.5%. Increasing the amt. of collector and lime did not promote the selectivity of sepn. sufficiently. Treatment of the pulp with O_2 gave better results.

9252. Plaksin, I. N. and Kurenkov, I. I. **Enrichment of useful minerals by flotation granulation.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* **1950**, 1189-97.—*C.A.* 46, 71*a*.

The basic app. consisted of a concn. table. There were arrangements for feeding air, together with jets of water, into the table. The table was so constructed that gas could be fed from the sides of its working surface. It was possible to obtain the ore concentrates in both deslimed and non-deslimed form. It was found that preliminary treatment of the ore pulps with O_2 or air considerably increased the grade of concentrates and the recovery of the useful minerals.

9253. Rebinder, P. A. **The importance of flocculation and frothing in flotation concentration processes.** *Trudy Soveshchaniya Teorii Flotatsion. Obogashcheniya, Moscow 1948, Rol Gazov i Reagentov v Protsessakh Flotatsii* **1950**, 13-31.—*C.A.* 47, 6317*g*.

The basic step in flotation was the adhesion of particles to air bubbles. In frothless flotation flocculation was the basis of concn. In froth flotation the adhering particles stablized and reinforced the air bubbles. Flocculation was distinct from coagulation induced by electrolytes. Coagulation by electrolytes, involved a reduction in the thickness of the hydrated double layer. To flotation pulps were usually added org. surface-active substances. The main purpose of these was to render at least part of the surface of the particles hydrophobic. The effect of K, Et, Bu, and Am xanthate, Na oleate, and heptoic acid on monodispersed systems of PbS and malachite was studied. All of these caused flocculation, the degree of which increased with the length of the hydrocarbon chain and with the decrease of the diam. of the particles.

9254. Romwalter, Alfréd and Fekete, László. **Wetting of coal powder.** *Bányász. Kohász. Lapok* 5, (83), 615-17(1950).—*C.A.* 45, 8738*e*.

Expts. proved that the effect of pure water and that of aq. electrolyte solns. were equally unsatisfactory, owing probably to an O-film coating the particles of coal. When coal powder was previously mixed effectively with 33% water, the thick pulp was suitable for wetting coal dust. When such coal-dust pulp dried, the film produced was hydrophilic. For the effective removal of coal dust from coal mines the use of exhaustors was proposed. The cost of this operation could be covered by the fuel value of the coal dust recovered.

9255. Simard, G. L.; Chupak, J., and Salley, D. J. **Radiotracer studies on the interaction of dithiophosphate with galena.** *Am. Inst. Mining Met. Engrs., Tech. Pub. No. 2815-B, Mining Eng.* 187, 369-73(1950).—*C.A.* 44, 3857*b*.

Measurements were made of the rate of uptake, the isotherms, the desorption, and the exchange of dithiophosphate on both ground mineral and single crystals. No single mechanism could account for the observed over-all interaction. The process was complex because of the heterogeneous nature of the galena surface. The interaction was not one of phys. adsorption, but appeared to have characteristics of both chemisorption and surface chem. reaction.

9256. Smith, G. C. and Dewhirst, D. W. **Internal oxidation of dilute copper alloys.** *Trans. Australian Inst. Metals* 3, 71-4(1950); *Australasian Engr.* Nov. 7, **1950**, 61-5.—*C.A.* 46, 7974*e*.

Alloys of Cu contg. Al 0.6, Be 0.2, and Si 0.6% in the form of 1.2-mm strip were heated to 950°C in air for 30 min. followed by the use of N_2 for 90 min. Metallographic examn. revealed internal oxidation with the formation of a subsurface layer of Cu contg. particles of the oxide of the minor constituent. Factors detg. the thickness of the rim and the size, shape, and distribution of the particles were discussed.

9257. Sun, Shiou-Chuan and Zimmerman, R. E. **The mechanism of coarse coal and mineral froth flotations.** *Trans. Am. Inst. Mining Met. Engrs.* 187, *Tech. Pub. No.* 2843-F *Mining Eng.* 187, 616-22(1950).—*C.A.* 44, 5651*g*.

The max. size of bituminous and anthracite coal particles which could be efficiently floated in a lab. Fagergren flotation machine was found to be 3 × 6 and 14 × 20 mesh, resp. The optimum rate of aeration for the flotation of coarse particles in the machine was approx. 450 ml of air per in.^{2} per min.

9258. Thon, N.; Yang, Ling, and Kelemen, Denis. **Porosity of electrodeposited metals. A.E.S. research project no. 6. VI. Effect of surface structure of the basis metal on the permeability and corrodibility of deposits.** *Plating* 37, 280-4(1950).—*C.A.* 44, 4349.

Thin foils deposited on mech. polished surfaces were more permeable and corroded initially at a faster rate than those deposited on cryst. surfaces.

9259. Zadra, J. B. **A process for the recovery of gold from activated carbon by leaching and electrolysis.** *U.S. Bur. Mines, Rept. Invest. No.* 4672, 47 pp.(1950).—*C.A.* 44, 4837*c*.

The Au-laden charcoal was leached with a soln. contg. 30 g Na_2S and 40 g NaOH per liter. Two liters of soln. was required per lb of charcoal. In lab. tests, 97% of the Au in a charcoal, assaying 300 oz of Au per ton, was extd. in 4 hrs. The tests also showed that the leached charcoal could be reused 11 times without reactivating; the adsorptive efficiency for 11 cycles was 97.1%, but decreased thereafter to 82% at the end of the 20th cycle. Charred excelsior and Type 430 stainless-steel wool were studied to det. their efficiency as Au-collecting media. Each had advantages and disadvantages.

9260. Zapffe, C. A. and Landgraf, F. K. **Hydrogenizing effect of steam on ferrous alloys at elevated temperatures.** *Am. Soc. Testing Materials, Symposium on Corrosion of Materials at Elevated Temps., Spec. Tech. Pub.* No. **108**, 50-7, discussion 58(1950).—*C.A.* 45, 8429*e*.

The effect of steam in heat treatment of types 410, 440-C, 414, and 430 stainless steels was investigated. The damage caused by hydrogenization was indicated by a decrease in bendability before fracture. All of the stainless steels tested were susceptible to embrittlement, in some cases after only one min. of exposure to steam. Recovery was accomplished by aging steam-embrittled samples in hot glycerol or by room-temp. aging.

9261. Alexander, Ben H. **Diffusion phenomena occurring during sintering.** *J. Metals* **191**, 95(1951).—*C.A.* 46, 3928*a*.

The compacts of two dissimilar metals were made by winding wires of the two metals on a spool at the same time. Although a perfectly uniform bond or neck was formed between two wires of the same metal, this was not true when the adjacent wires were dissimilar. The bond formed by the preferential movement of one kind of atom, with the result that the bond or neck was asymmetric, i.e., it was wider on one side than the other.

9262. Boshin, Ro. **Chemical polishing of steel wire and lubrication in wire drawing.** *Kinzoku* (Metals) 21, 342-5(1951).—*C.A.* 46, 7971*a*.

A description was given of the pickling or chem. polishing before drawing and some lubricants for wire drawing, such as lime, soap, phosphate coatings, Cu plating, alkalies, talc plus soap powder (or talc plus pigment), graphite, or powd. Cu. The adhesive power of the lubricants and the life of dies depended on pickling of steel wire. Although soap was more expensive than lime, it could be made more economical than the lime by means of special device. Dipping of the chemically polished wire in a $CuSO_4$ soln. gave sufficient Cu deposition for the drawing, but removal of the Cu after drawing was very difficult. Coating the wire by chem. means was insufficient for drawing to higher degrees. Solid dispersions of graphite in higher fatty acids could be used for the drawing with 90% reduction.

9263. BURSTALL, F. H.; KEMBER, N. F., AND WELLS, R. A. **Inorganic chromatography on cellulose: some applications to the analysis of nickel-plating baths.** *J. Electrodepositors' Tech. Soc.* 27, Advance copy No. 11, 12 pp. (1951).—*C. A.* 45, 5571*b*.
Co, Fe, Zn, Cu, Mn, and Cd impurities were sepd. together from a Ni-plating soln. by extn. in a cellulose column with an acetone-HCl-H_2O solvent. Colorimetric methods for estn. of each impurity without further sepn. were described.

9264. CHESTERS, J. H.; ELLIOTT, G. D., AND MACKENZIE, J. **The evolution of the all-carbon blast furnace.** *J. Iron Steel Inst.* (London) 167, 273-82(1951).—*C. A.* 45, 4183*g*.
In spite of burden handicaps No. 6 made 12% and No. 1 4% more iron than in the first year of the previous campaigns. There was no evidence of scab or scaffold trouble in the stack. The main factors leading to scaffold formation were sticking of the burden to the fireclay inwall, carbon deposition forcing the working face nearer to the center of the furnace, alkali attack forming *kalsilite* or *kaliophilite* with the fireclay.

9265. CHRETIEN, ANDRÉ AND FREUNDLICH, WILLIAM. **The formation of a titaniferous slag by selectively reductive fusion of ilmenite.** *Compt. rend.* 233, 413-15(1951).—*C. A.* 46, 864*h*.
Fusion of ilmenite with charcoal and Na_2CO_3 gave 2 liquid layers: a slag contg. 74% TiO_2 and 1.5% Fe and a melt contg. Fe and 0.5% TiO_2. The ratio Na_2O/TiO_2 should be 0.24 to ensure sufficient fluidity of the slag. The amt. of carbon added together with that from the flux and crucible must be limited to that required to reduce the Fe oxides and carburize the Fe. The temp. must be high enough for fusion and fluidity, but not too high or reduction of the TiO_2 will occur.

9266. CLAY, J. E. AND RABONE, PH. **Flotation of pyrite from cyanide residue in acid mine water.** *J. Chem., Met. & Mining Soc. S. Africa* 52, No. 5, 97-104, discussion 105-8(1951). —*C. A.* 47, 2099*f*.
Owing to a shortage of H_2SO_4 which was used in the production of pyrite in S. African ores, expts. were made to produce it by flotation on a cyanide residue from gold mines contg. about 2% FeS_2 as pyrite with a trace of pyrrhotite and no marcasite. A recovery of 90% of the pyrite was obtained. The results were promising economically, especially as some Au was recovered along with the pyrite.

9267. COHEUR, PIERRE. **Bessemer steel low in nitrogen and phosphorus.** *Metal Progress* 60, No. 4, 78-80(1951).—*C. A.* 45, 10162*h*.
The Belgian com. practice of blowing basic Bessemer steel with O_2-enriched air (30% O_2), with or without carbonates, was described. N_2 contents of 0.007 to 0.012% and P as low as 0.05% were accomplished regularly and the steel was suitable for deep-drawing applications. The use of O_2 and steam gave about 0.002% N and 0.035% P.

9268. CONRAD, F.; CREMER, E., AND KRAUS, TH. **The adhesion of magnesite powder on solid surfaces. I.** *Radex Rundschau* 1951, 227-33.—*C. A.* 46, 4320*g*.
In the adhesion of a powder on an inclined plane, an additional adhesive force was introduced besides the frictional force. Adhesive force was detd. by measuring the inclination of the plane required to start the powder moving. The relation between mass of the powder, angle of inclination, adhesive force, friction factor, etc., was mathematically explained.

9269. CRANDELL, MELVIN G. **Surface protection via phosphate coatings.** *Can. Chem. Processing* 35, 994-6, 998-9(1951).—*C. A.* 46, 2817*b*.
Bondertie produced a phosphate coating on Fe, steel, Zn, Cd, Al, and their alloys. Application to the various metals was outlined. Parco compd. provided an effective rust prevention by changing the surfaces of Fe or steel to a water-insol. phosphate coating.

9270. CRAWFORD, A. **Preparation of ultra-clean coal in Germany.** *Trans. Inst. Mining Engrs.* 111, 204-18(1951-52).—*C. A.* 46, 5816*i*.
The first process employed dense-medium washing followed by fine grinding and froth flotation to remove impurities. In the 2nd process jig washing and froth flotation of the finely ground clean coal was followed by a chem. extn. process with HF and HCl for the removal of impurities. A 3rd projected process used a similar preliminary treatment of jigging (2 stages) and froth flotation, but required a 2.5% soln. of NaOH as an extn. agent. This was applied at a pressure of 120 atm. at 250°C.

9271. DAVIES, R. L. **Quantitative chromatographic separation and estimation of cadmium in copper alloys using paper strips.** *Nature* 168, 834(1951).—*C. A.* 46, 2954*h*.
A soln. of the nitrates contg. Cd at 10^{-4} to 10^{-3} g per ml was chromatographed with MeEtCO + 30% by vol. of concd. HCl. The sepd. Cd was eluted with hot 1% HCl and detd. polarographically against an internal standard.

9272. DHINGRA, D. R.; GUPTA, M. G., AND BHATTACHARYA, M. C. **Anodization and multicoloring of pure aluminum.** *J. Proc. Inst. Chemists* (India) 23, 118-34(1951).—*C. A.* 46, 6569*c*.
Sheets of Al (>98% purity) were anodized in 15% H_2SO_4 at 25-30°C, with 12 amp./ft^2 c.d. (12-15 v.) for 50 min. Lower or higher acid concns. gave less desirable coatings. Single-color dyeing was done by dipping in a soln. of acidic dye (1 g/liter, pH 2.6-4.4) and raising the temp. from 50 to 80°C in 5-10 min. Good shades were obtained with Alimax dyes: Yellow N, Orange GR, Red A, Green G, Green BN, Blue BN, and Blue BG. Inorg. solns. such as chromates were not satisfactory. Multicoloring was done by successively dyeing in darker shades, masking the previous

portions with cellulose nitrate or asphalt. Time of immersion was about 1 min.

9273. DIENES, G. J. **The volume diffusion of metals.** *J. Applied Phys.* 22, 848-9(1951).—*C.A.* 46, 2869*g*.

New diffusion data were collected and analyzed. The large neg. value of entropy of activation called for by Zener's alternative theory is pointed out.

9274. EDWARDS, G. R. AND EWERS, W. E. **Adsorption of sodium cetyl sulfate on cassiterite (flotation of cassiterite).** *Australian J. Sci. Research* A4, 627-43(1951).—*C.A.* 46, 4973*i*.

Pure SnO_2, of surface area 10 m^2/g (N_2 adsorption), was prepd. by burning Et_4Sn, atomized in a stream of air, in H_2. For flotation tests the SnO_2 was crystd. from molten borax. Natural SnO_2 (less pure) was used in comparative flotation tests. Adsorption of Na hexadecyl sulfate (Na cetyl sulfate) was detd. by titration of the supernatant soln. after shaking for 18 hrs. The cassiterite surface appeared to be amphoteric in nature with units of the type: $Sn(OH)_2$. Above pH 5, Na rather than hexadecyl sulfate ion was adsorbed by the surface. Titration of cassiterite with 0.01 *N* NaOH indicated one dissociable H^+ per 44 $A.^2$ of surface. Cations from Na_2SO_4, KCl, and $CaCl_2$ also displaced H^+ from the surface. Below pH 5 hexadecyl sulfate ion was absorbed, displacing OH^-; one hexadecyl sulfate ion occupied each 23 $A.^2$ of surface. Complete flotation occurred when as little as 3% of the surface was covered by adsorbed sulfate.

9275. ENGEL, A. L. **Simple treatment methods for oxide gold and silver ores.** *U. S. Bur. Mines, Rept. Invest.* No. 4758, 14 pp.(1951).—*C.A.* 45, 2379*d*.

In 5 samples of marginal ores it was possible to use activated charcoal for simultaneous extn. of dissolved Au and Ag during leaching in cyanide soln. This treatment was applicable to cyanidation of minus 48-mesh material where leaching by agitation could be used. It was of advantage in treating ores that were clayey or otherwise difficult to settle. The charcoal was produced from fruit pits and sized between 10 and 30 mesh.

9276. FERGUSON, IAN. **Flotation in Brunswick Green paints.** *Paint Technol.* 16, 379-91(1951).—*C.A.* 46, 1775*b*.

Since small differences in flotation of various paints were considerably magnified when thicker films were used, the testing procedure adopted was to allow a definite vol. of paint to fall on a level panel and to dry in a draft-free atm. The mottling, thus obtained, bore a direct relationship to the flooding obtained by brushing films of normal thickness. Degree of flooding increased as the ratio of green pigment increased. The extender which reduced flooding most was activated $CaCO_3$. Unbodied linseed-oil paints were noticeably free from flooding. Influence of driers and grinding times were studied and found to be minor. It was noted that thixotropic paints did not have floating tendencies.

9277. GERICKE, SIEGFRIED AND KURMIES, BRUNO. **Significance and sources of the element fluorine in basic Bessemer slags.** *Stahl u. Eisen* 71, 454-7(1951).—*C.A.* 45, 7934*a*.

Comparisons between F-content and P_2O_5 soly. of basic slag showed no definite connection up to 0.020% F. At higher F-contents the P_2O_5 soly. decreased markedly. The av. F-content of basic slag was 0.008%. Since the F-content rarely exceeded 0.020%, the low amt. of F had little effect on the behavior of P_2O_5 in 2% citric acid soln. A F-content of over 0.030% results in a decrease in P_2O_5 soly. With increasing SiO_2 contents, the soly. of P_2O_5 in 2% citric acid soln. generally increased. Higher SiO_2 and lower F-contents insured high soly. of P_2O_5. Tests on the presence of F in the blast furnace and converter showed clearly that the entire amt. of F in the blast furnace passed over into the slag, and that the pig iron was free of F.

9278. GHOSE, T. K. **Demineralizing of Indian coals and graphites by phase exchange method.** *Science and Culture* 17, 47-9(1951).—*C.A.* 47, 2456*b*.

A new approach to the problem was tried by utilizing different interfacial forces of different solid surfaces (both cryst. and amorphous) in the presence of 2 or more immiscible liquids in such a way that slurry phases were developed. If in this condition mech. (shearing) forces were applied externally, the surface affinity of such solid particles towards their respective liquid phases increased, i.e., those solid particles having greater affinity for water migrated into the latter phase, those having greater affinity for oil remain in the oil phase. Carbon particles remained concd. in the oil phase; impurities like clay, carbonates, oxides, sulfides, and silicates migrated towards the water phase in their free form.

9279. GOLDACRE, R. J. **The flotation of King Island scheelite in hard mine water.** *Australian J. Appl. Sci.* 2, 89-107(1951).—*C.A.* 47, 1905*c*.

Various groups of flotation reagents, were tested in hard mine water (Ca 10, Mg 20, and Na 100 mg/liter) in an attempt to find agents for selectively sepg. scheelite from the main impurity, garnet (chiefly andradite) in the King Island ore. With fatty acids, flotation increased with chain length to pelargonic acid (C_9), then decreased. Fatty amines were useful collectors, especially laurylamine (C_{12}), but lacked selectivity at high pH values (above pH 6). "Ninol 400" gave good sepn. but near pH 2. The alkyl sulfates and sulfonates were not collectors for scheelite above pH 6, unless activated. Pb^{++} ion was especially active and gave excellent flotation with sodium laurylsulfate. Selective conditions under which andradite did not float were found only at low pH values, and were therefore not operable in the presence of the impurity calcite.

9280. GRÜNDER, WERNER AND BUNJI, BELA. **Investigation of the flotation of arsenic-rich lead-zinc ores.** *Z. Erzbergbau u. Metallhüttenw.* 4, 341-4(1951).—*C.A.* 46, 71*b*.

Expts. showed that it was possible to obtain a Pb concentrate contg. 80% Pb and less than 0.3% As. Details of the flotation methods were given.

9281. GUTIÉRREZ GUTIÉRREZ, L. AND FOZ GAZULLA, OCTAVIO R. **Elimination of iron from sands for glass manufacture by flotation. I. Characteristics of four Spanish glass sands.** *Anales real soc. españ. fís. y quím.* 47B, 687-98(1951).—*C.A.* 46, 10564*i*.

Small amts. of Fe had some desirable, although mostly detrimental, effects on the properties of glass, particularly on optical characteristics. Certain characteristics of the sands were summarized according to their end use: grain size, type, and amt. of impurities. The sands of Gijón, Avilés, Liria, and Espirda (Spain) were given mech., chem., and mineralogical analyses, and it was necessary to purify them to make a quality glass.

9282. GUTIÉRREZ GUTIÉRREZ, L. AND FOZ GAZULLA, OCTAVIO R. **Sands for glass. Removal of iron by flotation II. Purification experiments on Spanish sands.** *Anales real soc. españ. fís. y quim.* (Madrid) 47B, 777-94(1951).—*C.A.* 46, 4187*b*.

Spanish sands contained too much Fe. Removal of this Fe by treatment with HCl was unsatisfactory. The sands from Gijon and Aviles responded well to double flotation with oleic acid and α-naphthalamine hydrate. The sands so treated were satisfactory for high-quality-glass production. The sands from Liria and Espirdo responded best to flotation first with oleic acid and then "fuel oil."

9283. HINDMARCH, E. AND WATERS, P. L. **Froth flotation of coal.** *Trans. Inst. Mining Engrs.* (London) 111, 221-34(1951).—*C.A.* 46, 5816g.

Milling down to correct size grading was necessary to liberate inter-banded dirt. Expts. were carried out on a coal analyzing moisture 0.6, volatile matter 22.9, fixed C 67.3, ash 9.2, and S 0.6%. Float and sink tests indicated that appreciable yields of coal (greater than 50%) giving less than 1% ash were obtained for all sizes below 20 mesh. Crushing down to minus 100 mesh did not greatly increase the liberation of coal from dirt.

9284. HOFFMANN, KURT. **Physical-chemical questions in thermal zinc recovery and their significance for practice. Reply to comments by H. Grothe.** *Z. Erzbergbau u. Metallhüttenw.* 4, 344-9(1951).—*C.A.* 46, 389*a*.

The reduction of ZnO resulted from action of solid carbon, which was especially effective at the beginning of the process, as well as by CO, which became the principal reducing agent with rising temp. The effective completion of the reaction required a considerable flow of excess quantities of CO through the muffle. By briquetting the charge, advantageous application of the coke with slow evolution of reducing gas and improved operating conditions for Zn recovery in the muffle were obtained.

9285. HORSLEY, R. M. AND SMITH, H. G. **Principles of coal flotation.** *Fuel* 30, 54-63(1951). —*C.A.* 45, 3577*f*.

The more air-avid coals could be floated by the addn. of a frothing agent alone. Several typical frothers (cresols, alcs., etc.) were shown to have no appreciable effect on the air-solid contact. The air-avidity of all coals, except lignite, was greatly increased by the use of an oily collector which increased the natural contact angle and decreased the induction period. Oxidizing agents greatly reduced the contact angle at a coal surface. $KMnO_4$ was most effective, small quantities considerably reducing the floatability of a coal. In industrial practice, oxidation and weathering will tend to reduce, and contamination from lubricants, to increase, the natural floatability of the coal.

9286. IRMANN, R. **Sintered aluminum with high resistance to heat.** *Rev. aluminum* 28, 267-75, 311-16(1951).—*C.A.* 46, 2462*a*.

Under special temp. and compression conditions it was possible to sinter Al powder in spite of the Al_2O_3 film formed naturally on the Al grains. The plasticity of the isolated Al particles enabled one to obtain an intimate contact because the plastic deformation ruptured the oxide film and permitted the sintering to be accomplished after a preliminary compression following which the desired shape was obtained by extrusion or die-forging.

9287. KLASSEN, V. I. AND ERENBURG, R. Z. **Floatability of mineral grains of different sizes in relation to the density of the flotation suspension.** *Doklady Akad. Nauk U.S.S.R.* 79, 855-7(1951).—*C.A.* 46, 4884*h*.

Flotation of natural S was effected with the ordinary lab. flotation machine. It was observed that the floatability of coarse grains improved with diln. of the suspension. Fine grains floated better in more dense suspensions. It was suggested that the effect of the d. of the suspension was of a phys. nature. In the case of the decrease in floatability of coarse particles with increasing d. of suspension, a demineralization of the air bubbles occurred. Coarse particles were more easily sepd. from bubble surfaces than were fine particles. On the other hand, the finer particles were floated more easily from a dense pulp because of the increased probability of contact with the bubble and because of improvement of conditions for overcoming the energetic barrier layer of H_2O between bubble and particle.

9288. KÖSTER, WERNER AND RAFFELSIEPER, JOSEF. **Diffusion during sintering of a nickel-copper alloy.** *Z. Metallkunde* 42, 387-91(1951).—*C.A.* 46, 2467*d*.

The diffusion process during sintering of compressed Ni-Cu powders was followed magnetically. Sintering isotherms between 800 and 1200°C were obtained. The kinetics above and below the m.p. of Cu were about the same. At 1200°C a period of 25 hrs was necessary to produce homogeneity. The activation energy for homogenization was 28.5 kcal/mole and agreed well for the activation energy for the diffusion of Ni into Cu.

9289. KOVAL'SKAYA, T. S. **Investigation of the floatability of small-size fractions of long-**

flame coal. *Ugol* 26, No. 5, 30-1(1951).—*C.A.* 45, 8229*e*.

Flotation was tested on a no. of samples of Lisichansk coal. The final fractions of this coal were contaminated with clayey substances which on softening coated the coal particles and hampered their flotation. Using $CaCl_2$ as a depressor improved the concentrate. Starting with the 6-0 mm fraction, screening out the 1-0 mm fraction, then grinding the oversize to 1-0 mm and floating it improved the concentrate considerably. Under these conditions the concentrate amounted to 70.18% of head and contained 7.89% of ash (the ash content of the head was 19.82%). The tailings amounted to 15.20% with an ash content of 70.72%.

9290. Lownie, H. W. Jr. **Need stronger foundry coke.** *Foundry* 79, No. 7, 72-6(1951).—*C.A.* 46, 239*a*.

Over 100 heats were made in a 10-in. exptl. cupola with a foundry coke manufd. in 1942. On replacing this coke with a coke produced from similar coals and with almost the same coking time, the tapping temp. dropped to 1499°C from 1516°C before the change, and the C in the Fe to 3.40% from 3.60. The old coke contained 7.2% by wt ash and 91.0% fixed C, and the new 9.9% ash and 88.8% fixed C. In the operation of a 54-in. cupola the melting operation was more dependable and satisfactory when using a 28-hr coke than when using a 16-hr coke.

9291. Mindler, A. B.; Gilwood, M. E., and Saunders, G. H. **Metal recovery by cation exchange.** *Ind. Eng. Chem.* 43, 1079-81(1951).—*C.A.* 45, 7490*f*.

Permutit Q in the H-form was used to remove Sn from Na_2SnO_3 solns. The Na_2SnO_3 was passed upflow through the resin in a column jacketed at 77°C and the effluent carrying the H_2SnO_3 floc handled by settling or sludge filtering. The clarified H_2O could then be neutralized and reused for rinsing tinned sheet metal. Zn was removed from relatively strong H_2SO_4 solns. by the Permutit Q; at concn. to 1.0% H_2SO_4 the Zn removal was approx. 95% from solns. contg. 500 p.p.m.

9292. Nedin, V. V. and Morgun, A. P. **Addition of petroleum soap to hard water for better wetting of dispersed dust.** *Gornyĭ Zhur.* **1951**, No. 1, 34-5.—*C.A.* 45, 5952*b*.

The dust of drills in mines was laid by means of water to which petroleum soap was added as wetting agent. For greater effectiveness hard water must be softened. On softening with lime-soda, a gelatinous mass of alk. earth soap formed in the water and clogged the lines and drill passages. Softening the water by passing it through a base-exchange material removed this difficulty.

9293. Piatti, Luigi. **Effect of wetting agents on corrosion. II. The influence of nonionic wetting agents.** *Werkstoffe u. Korrosion* 2, 441-4(1951).—*C.A.* 46, 4456*d*.

Surface-active agents in concn. of 0.4% were used. Nonionic agents caused less loss of wt by corrosion than did ionic agents. The greater the surface-activity of the agent (in the range studied) the more favorable was its effect on corrosion.

9294. Pryor, M. J. and Cohen, M. **Role of dissolved oxygen during the inhibition of the corrosion of iron by sodium phosphate solutions.** *Nature* 167, 157(1951).—*C.A.* 45, 5598*c*.

In phosphate solns. that were satd. with air, passivity of Fe was reached at a pH of 7.25. When all O_2 was removed from the phosphate solns., corrosion was not inhibited. The corrosion product in the absence of O_2 was a colorless tabular cryst. deposit.

9295. Rozhanskii, V. N.; Amfiteatrova, T. A., and Rebinder, P.A. **The change of the crystal structure of a metal in deformation in surface-active media.** *Doklady Akad. Nauk S.S.S.R.* 76, 697-8(1951).—*C.A.* 45, 7403*d*.

The rate of increase of the elongation of an electrolytic Cu wire of 0.05 mm diam. was greater in a surface-active soln. of 0.5% oleic acid or 0.5% cetyl alc. in nonpolar kerosene than in the pure kerosene. The plot of the log of the ratio of the rates in the active and in the inactive medium, as a function of the elongation, passed through a max. at an elongation of about 0.55%. The relative increase of the no. of grains per unit vol. was distinctly faster in the active medium.

9296. Savage, W. H. D.; Brink, P. A. M.; Merwe, J. M. van der, and Malherbe, P. le R. **The float and sink analysis of coal with special reference to the effect of variations in the moisture content of the coal.** *J. Chem. Met. & Mining Soc. S. Africa* 52, 1-11(1951).—*C.A.* 46, 3729*c*.

When coal was analyzed by flotation, and the sink material washed and refloated in the same liquid, addnl. float material was recovered. When samples of coal (smaller than 16-mesh, BSS) of different moisture contents were floated, the coals contg. the least moisture yielded the greatest wt of floats. The dried coal gave the total yield in the first sepn. Since removal of H_2O lowered the apparent sp. gr. of coal, coal recovered by rewashing should not be added to the floats. Drying of refloated coals may be due to evapn. of H_2O when the org. flotation medium was removed or to dehydration of the coal by the liquid. Coals should have the same moisture content before flotation; the most practical method was to sat. the coal with H_2O before flotation.

9297. Shklovskiĭ, I. S. **Corrosion of metals in dry and moist hydrogen sulfide.** *Trudy Inst. Fiz. Khim., Akad. Nauk S.S.S.R.* 2, *Issledovaniya po Korrozii Metal.*, No. 1, 241-56(1951).—*C.A.* 47, 5859*h*.

After an exposure of 180 days to dry H_2S at room temp., Mg, Pb, and 18-8 steel did not change in wt; Al, Fe Avial (Al with Mg 0.45-0.9, Fe 0.6, Cu 0.6, Si 0.5-1.2, Mn 0.35), Zn, brass (Cu 68, P 0.1, Fe 0.1, Sn 0.1, Pb 0.03, Zn rest), Ag, Ni, Cu, in increasing order, gained wt, up to 0.4 mg/cm^2; Ni, Fe, and Pb changed color; Zn showed only interference colors, but 18-8 became covered with black spots. The rate of corrosion of brass and Pb increased slowly with time; that of Cu approached zero rate. Fe formed FeS and the film blistered, resulting in wt-losses of 50 $mg/cm^2/60$ days; Mg corroded linearly with time, with wt-loss as high as 15 mg/cm^2 in 2 days, the products being MgS, MgO, and $Mg(OH)_2$.

9298. SHKLOVSKIĬ, I. S. **Corrosion of metals in mixtures of air with hydrogen sulfide and in solution of hydrogen sulfide.** *Trudy Inst. Fiz. Khim., Akad. Nauk S.S.S.R.* 2, *Issledovaniya po Korrozii Metal.* No. 1, 257-75(1951).—*C.A.* 47, 5860*b*.

Tests were conducted at room temp. for up to 60 days. In air with 5% H_2S and 80-90% humidity, Zn, Al, Fe, Pb, and Avial changed little in appearance and corrosion was negligible; Ag, Sn, and 18-8 steel changed in appearance considerably, but the corrosion film was protective and the corrosion was only 0.2-0.6 mg/cm^2 in 60 days; on brass and Ni, the corrosion films adhered poorly, and corrosion was approx. 3 mg/cm^2 in 60 days; attack on Cu was strong, linear with time, and accompanied by intergranular corrosion, and the products were basic sulfates with Cu_2S; attack on Mg accelerated with time and was very rapid.

9299. SODA, NORIMUNE AND MIYAGAWA, YUKIO. **A relation between the thickness of molecular films and the transition temperatures of friction.** *Ôyô Butsuri* (J. Applied Phys.) 20, 159-60(1951).—*C.A.* 46, 5922*c*.

The mech. transition temps. T were measured of built-up films of Ba stearate on steel with various nos. n of layers. T increased as n increased until T reached the max. temp. 200°C at $n = 9$. At least 10 layers were necessary for the boundary lubrication. This may be because the apparent 10 layers corresponded to the effective monolayer owing to roughness of the substrate surface. T in the case of Cu reached its max. at 100°C with $n = 5$.

9300. SUSUKIDA, HIROSHI AND SANO, KOKICHI. **Effects of some catalysts on reduction velocity of solid iron oxide by carbon.** *Tetsu-to-Hagane* 37, 456-61(1951).—*C.A.* 47, 956*e*.

When a mixt. of Fe_2O_3 and carbon was heated, the following reaction took place: (1) $C + CO_2 \rightleftarrows 2\ CO$; (2) $Fe_2O_3 + 3\ CO \rightleftarrows 2\ Fe + 3\ CO_2$; (3) $Fe_2O_3 + 3\ C \rightleftarrows 2\ Fe + 3CO\ (CO_2)$. The velocities of evolution of the gases for various modes of mixing of catalysts with Fe_2O_3 and carbon at const. temp. were detd.: (*a*) $BaCO_3$ affected favorably reaction (1), and CaO accelerated reaction (2) or (3). (*b*) MgO, TiO_2, Al_2O_3, and SiO_2 were neg. catalysts for the reduction of Fe_2O_3 by carbon.

9301. WADSWORTH, MILTON E.; CONRADY, ROBERT G., AND COOK, MELVIN A. **Contact angle and surface coverage for potassium ethyl xanthate on galena according to free-acid-collector theory.** *J. Phys. & Colloid Chem.* 55, 1219-30 (1951).—*C.A.* 46, 803*e*.

The contact angle ϕ correlated on the basis of the free-acid-collector theory gave a linear relation with the abs. surface coverage θ by the equation $\theta = a\phi + b$, if single-site adsorption was assumed. The consts. a and b were detd. from the exptl. ϕ-pH data. The method of evaluation of the linear relation yielded pertinent information concerning mineral surfaces.

9302. WARREN, DONALD AND LIBSCH, J. F. **Role of gases in the production of high-density powder compacts.** *J. Metals* 3, *Trans.* 774-81 (1951).—*C.A.* 45, 8422*c*.

The influence of various pressing and sintering conditions upon the permeability, d., and percentage of pores connected to the surface of Fe-Co powder compacts were studied. These data led to a study of the effect of evolved gases on the sintering process and to a successful minimization of the influence of such gases.

9303. WILLIAMS, DAVID AND NAKHLA, F. M. **Chromographic contact-print method of examining metallic minerals and its applications.** *Bull. Inst. Mining Met.* No. 533, 257-95(1951).—*C.A.* 45, 6956*g*.

An attacking agent to free metallic ions from a mineral and a specific reagent that combined with the released ions to form a colored compd. indicative of a particular element was used. It was developed to det. the constituent elements of opaque metallic minerals in polished sections and in discrete grains. Gelatin-coated Ag-free paper (Eastman No. 867, or glossy bromide paper soaked 15 min. in $Na_2S_2O_3$ soln. to remove the Ag, washed 1 hr in running cold H_2O, and dried) was used. A piece of gelatin-coated paper was impregnated with an appropriate attacking reagent. On pressing the gelatinized side of the paper against the polished surface of the specimen a thin veneer of the susceptible minerals was attacked and the liberated ions became trapped in the gelatin film. After the paper was removed, it was developed in a reagent that was specific for the element in question.

9304. WILLIAMS, W. LEE. **Behavior of titanium at temperatures to 900°F.** *Iron Age* 167, No. 24, 81-4(1951).—*C.A.* 45, 6554*i*.

Tensile tests of commercially pure Ti showed a leveling off of strength properties in the range of 500-800°F. C and N content had little influence on this. Cold rolling gave higher yield and tensile strength up to 900°F in short time tests. Up to 600 or 700°F stress-rupture curves were very flat. Specimens of Ti were exposed for 45 days to steam from a satd. steam line averaging 550 lb per $in.^2$ gage and 480°F temp. Weight loss was only 0.018 g compared with 0.094 g for Type 403 steel under the same conditions.

9305. ZANDER, J. M. AND LINHART, O. C. **Effect of ferrous and sodium sulfate on the rate of nickel deposition.** *Better Enameling* 22, No. 5, 6-7(1951).—*C.A.* 47, 6276*c*.

A marked retardation of Ni deposition was found when either $FeSO_4$ or Na_2SO_4 was added to an immersion Ni-plating bath. $FeSO_4$ was an end-product contaminant formed by the displacement of Fe for Ni. Na_2SO_4 contamination resulted from adjustment of the pH with caustic.

9306. Zvyagin, B. M.; Rozenbaum, R. B.; Todes, O. M., and Yurovskiĭ, A. Z. **The theory of rock crushing. II. Division of the particles of the products of crushing into two fractions and the calculation of the average composition of these fractions.** *Izvest. Akad. Nauk S.S.S.R., Otdel. tekh. Nauk* **1951**, 1218-29.—*C.A.* 47, 80*e*.

A method was given for detg. the relative no. of floating and depositing particles by distributing them into 2 fractions. Also, a method for detg. the av. compn. of the floating and depositing fractions was provided.

9307. Allan, J. C. **Table flotation for the removal of sulfides from tin-wolfram concentrates in Portugal.** *Bull. Inst. Mining Met.* No. 553, 81-90(1952).—*C.A.* 47, 2654*f*.

By suitable treatment 60% of wt of mixed sulfides was eliminated. The resulting concentrate, carrying 45% WO_3 and 4% Sn, was dried and passed over the magnetic separators. The Sn concentrates contained Sn 72.8, CaO 1.34, Fe 0.77, WO_3 0.41, S 0.23, As 0.13, Pb 0.06, Zn 0.10, and Cu 0.05%. The W concentrates assayed WO_3 73.17, SnO_2 0.04, As 0.18, S 0.48, Zn 0.07, Bi 0.02, Cu 0.02, FeO 20.75, and MnO 4.2%.

9308. Barraclough, K. C. and Sykes, C. **The importance of hydrogen in steel manufacture.** *Inst. hierro y acero* 5, 282-97(1952).—*C.A.* 46, 7019*h*.

The water in raw materials in the charges must be controlled as well as that on equipment used. Up to 1 ml of H_2 per 100 g of steel could be tolerated. Above this, the effect was more pronounced in ordinary and low alloy steels than in high alloy steels, such as stainless steel.

9309. Barwell, F. T. **Effect of surface structure, composition, and texture on friction under boundary conditions.** *Proc. Roy. Soc.* (London) **A212**, 508-12(1952).—*C.A.* 46, 8447*d*.

The coeff. of friction of surfaces lubricated under boundary conditions may be profoundly affected by such factors as the degree of working of the substrate material, the nature of the oxide film, and the degree of roughness of the surface. Expts. were described wherein the frictional behavior of surfaces of stainless steel specimens prepared in various ways was compared. The worked surface layers increased the value of the coeff. of friction, but the effect of surface texture was of predominant importance. The effect of different oxide films was best illustrated by reference to pure Al.

9310. Beeghly, H. F. **Behavior of nitrogen and some of its compounds in steel.** *Anal. Chem.* 24, 1095-1100(1952).—*C.A.* 46, 11070*e*.

A modification of the rapid micro-Kjeldahl procedure for detg. the N-content of the acid-insol. compds. was presented. A simple, economical method for prepg. ammonia-free water with ion-exchange resins was proved and its use was described. Illustrative examples of the behavior of N_2 during thermal treatment of steels contg. Al, Si, and V were given.

9311. Brasunas, Anton deS. **Subsurface porosity developed in sound metal during high-temperature corrosion.** *Metal Progress* 62, No. 6, 88-90(1952).—*C.A.* 47, 1027*a*.

Subsurface voids, resulting from diffusion phenomena and subsequent Cr depletion, in Inconel (Ni 75, Cr 15, Fe 7%) and similar alloys were produced by leaching with molten fluorides above 1300°F, high-temp. vacuum treatment at 2500°F, and high-temp. oxidation in air at 2280°F.

9312. Calvet, J. and Potemkine, V. **Oxidation during smelting of aluminum-magnesium alloys and the protective role of beryllium at very low concentrations.** *Recherche aéronaut.* No. 29, 21-8(1952).—*C.A.* 47, 2667*i*.

Addn. of Be prevented oxidation during smelting operations of Al-Mg alloys and was advantageous, especially when the concn. of Mg was higher than 5%. Alloys made of very pure metals were more sensitive to oxidation than those made of ordinary metals. With refined Al the concn. of Mg in the bath had to be kept under 9.5% to avoid rapid alteration. This concn. could be increased to 11.5% in the case of 99.5% pure Al. Only 0.007% Be was necessary to completely protect a bath contg. 12% Mg during 2 hrs at 750°C; the amt. of Ca necessary to achieve the same result was prohibitive.

9313. Charmandarian, M. O. and Andronikova, N. N. **Corrosion and formation of a negative ferric hydroxide sol.** *Bull. soc. chim. France* **1952**, 99-101.—*C.A.* 46, 6069*h*.

The corrosion of Fe, in the presence of gum arabic, in water and in NaCl and Na_2SO_4 solns., was accompanied by the formation of a negative sol. The corrosion was considerably accelerated by light and the presence of salts, but was usually inhibited by the gum arabic. These results were attributed to the diffusion rate of O_2, the stability of the Fe compds., the nature of the adsorbed films, and the peptizing and coagulating action of the media.

9314. Comeaux, Roy V. **The role of oxygen in corrosion and cathodic production.** *Corrosion* 8, 305-10(1952).—*C.A.* 46, 9498*c*.

In the case of buried steel above pH 4.5 the reduced substance was O_2. The 2 electrons furnished by the corrosion of an Fe atom reduced 1/2 O_2 to OH ion. Corrosion ceased if access of O_2 to all points of the surface was eliminated. Complete cathodic protection was achieved when electrons were supplied at the steel surface at the same rate as O_2 diffused to the surface. Current drainage of 1 ma./ft^2 was equiv. to 6.24 $\times 10^{15}$ electrons/ft^2/sec; this amt. reduced 1.56 $\times 10^{15} O_2$, or the amt. of O_2 in 318 monolayers of water. The influence of the thickness of the diffusion layer on the c.d. requirements for complete cathodic protection could be developed from a simple form of Fick's law of diffusion.

9315. Cook, Melvin A. and Talbot, Eugene L. **Surface hydrolysis in sodium lauryl sulfate solutions and its effect on surface tension and on adsorption at the solid-aqueous solution interface.** *J. Phys. Chem.* 56, 412-16 (1952).—*C.A.* 46, 7769*a*.

Hydrolytic adsorption at the free surface of aq. Na lauryl sulfate solns. was shown by pH measurements correlated with foam extn. of the soap, and by means of surface tension *vs.* pH curves at const. concn. and ionic strength. Values of an apparent *surface hydrolysis const.* of 10^{-7} to 10^{-8} were obtained from the latter procedure, although the hydrolytic adsorption may perhaps be due merely to a fatty acid impurity in Na lauryl sulfate.

9316. CREMER, E. AND CONRAD, F. **The adhesion of magnesite powders on solid surfaces. II.** *Radex Rundschau* 1952, 3-6.—*C.A.* 46, 6899*d*.

The adhesive force of a mixt. of an adhesive and a nonadhesive powder corresponded approx. to the percentage of the adhesive component. The adhesive force of a mixt. of two adhesive powders could be calcd. from the av. grain diam., or the latter could be calcd. from the adhesive force. The adhesive force of raw magnesite was lowered to about 1/5 of its value when dried. It increased slowly with rising temp. without, however, approximating the value of undried magnesite.

9317. CROFT, R. C. **Separation of the anhydrous chlorides of iron and aluminum by formation of graphite complexes.** *J. Appl. Chem.* (London) 2, 557-62(1952).—*C.A.* 47, 444*g*.

The possibility of sepg. $FeCl_3$ and $AlCl_3$ by heating with graphite was studied. Graphite occluded $AlCl_3$ and also $AlCl_3 + FeCl_3$ when both were present. The stability of both these new complexes were studied and also of the mixed $FeCl_3$ and $AlCl_3$. A sepn. of the 2 chlorides by heating with quantities of graphite in suitable proportion to the $FeCl_3$ present was feasible and possibly of some value in the industrial chlorination of ferruginous Al ores.

9318. EMEL'YANOV, D. S. **Role of kerosine in intensification of coal flotation and in improving the quality of the concentrate.** *Ugol* 27, No. 4, 37-40(1952).—*C.A.* 47, 289*b*.

Kerosine alone was effective as collector for hard-to-float coal, but its effectiveness was enhanced when used in conjuction with a reagent of the medium-light oil. Kerosine was preferably added 1-2 min. after the start. Such addn. of kerosine reduced the flotation time, increased the recovery, and reduced the ash content of the concentrate. Kerosine was equally effective when used in conjunction with some frother. Thus, 350, 700, 1000, and 1400 g kerosine/ton gave a recovery of 52.46, 61.48, 83.71, and 87.65% of combustible matter in 10 min.

9319. ESIN, O. A. AND OKUNEV, A. I. **Kinetics of the interaction of metal and slag from the point of view of the ionic theory.** *Izvest. Akad. Nauk S.S.S.R., Otdel, Tekh. Nauk* 1952, 1472-82.—*C.A.* 47, 4811*i*.

The ionic theory assumed exchanges of ions, with neutralization of the excess elec. charges at the boundary through passage of ions in the reverse direction. This scheme was illustrated by a quant. interpretation of data on the desulfurization of pig iron. Passage of S^{--} ions from the metal into the slag produced a neg. charge on the slag side; this was counteracted by a passage of O^{--} ions from the slag into the metal. The rate of the forward reaction should increase not only with increasing S content in the metal, but also with the O^{--} ion concn. in the slag, i.e. with its basicity. This was borne out by the data.

9320. FADGEN, T. J. **Metal recovery by ion exchange.** *Sewage and Ind. Wastes* 24, 1101-7 (1952).—*C.A.* 46, 11525*g*.

Experience with ion-exchange resins for removing Cu, Cr, and Ni from dil. plating rinse waters was given. The practicability and economics of the process were discussed.

9321. FINN, WILLY. **Tin-tungsten ore flotation at the Schwarzwasser/Altenberg Mines.** *Z. Erzbergbau u. Metallhüttenw.* 5, 266-70(1952).—*C.A.* 47, 6320*c*.

With an av. crude ore content at Altenberg of 0.64% Sn, 77% of the Sn was recovered in concentrates contg. an av. of 12% Sn. The tailings contained about 0.15% Sn. At Zinnwald, with an av. crude ore content of 0.43% Sn, 82% of the Sn was recovered in concentrates contg. an av. of 11% Sn. The tailings contained about 0.08% Sn. Part of the water essential for the flotation was obtained from the return water from the concentrator and thickener.

9322. FLEMING, MARSTON G. **Effects of alkalinity on the flotation of lead minerals.** *Trans. Am. Inst. Mining Met. Engrs.* 193, *Tech. Pub.* No. 3424-B (in *Mining Eng.* 4, 1231-6)(1952).—*C.A.* 47, 1550*h*.

The mechanism of alkali depression was investigated in each of the 3 systems: cerussite-aq. carbonate-xanthate, cerussite-xanthate, and galena-xanthate. The action of carbonate-free alk. solns. in preventing the flotation of cerussite may be independent of the collector and may be due entirely to decompn. of the mineral surface. This type of alkali depression may operate in any case where the basic product does not yield simple metal ions.

9323. GINDIN, L. G. AND PUTILOVA, I. N. **Immunizers of metals towards corrosion.** *Doklady Akad. Nauk S.S.S.R.* 86, 973-5(1952).—*C.A.* 47, 5860*f*.

A small amt. of anthraquinone delayed by some 100 days the sulfidation of Cu in a soln. of S in C_6H_6 which otherwise took place within a few tenths of a sec. A similar action was shown by $PhNH_2$, $N(CH_2CH_2OH)_3$, quinoline, $PhCH_2OH$, pyrogallol, 1-$C_{10}H_7NH_2$, o-$C_6H_4(CO)_2O$, o-$C_6H_4(CO_2)NH$, etc.; "the immunity period" increased, in this order, from 50 min. to 18 days. Oxidized unsatd. hydrocarbons, e.g. air-oxidized cracking-gasoline, also had an immunizing effect, evidently owing to the presence of peroxides. They lost this ability after distn., and Bz_2O_2 (and tetrahydronaphthalene peroxide) in amts. of the order of 0.1%, prevented the formation of Cu sulfide for more than 100 days.

9324. GROUNDS, ARTHUR AND WANDLESS, A. M. **The mineral matter in coal and its relation to coal-preparation problems. A special study of ash and clinker in industry.** *J. Inst. Fuel* 25, 170-7(1952).—*C.A.* 46, 8346*g*.

Seams now being mined are dirtier than those worked before the war, and mechanization has led to the hoisting of more dirt with the coal. The influence of the mode of distribution of the mineral matter in the raw coal on the ease or difficulty of cleaning operations was discussed, and reference was made to the difficulty in prepg. coals contg. higher than av. proportions of pyritic S. The methods available for coal cleaning were outlined, and their relative merits and demerits considered.

9325. Gründer, Werner and Bunji, Bela. **Flotation of kaolin-rich lead-zinc ores.** *Z. Erzbergbau u. Metallhüttenw.* 5, 182-5(1952).—*C.A.* 46, 7007*h*.

Increasing kaolin content caused an increased Pb content in the waste and therefore reduced yield of Pb. Finer grinding to less than 0.15 mm was essential, as well as an improvement in the dressing process for high kaolin content (10-20%) which prevented the floating of the sulfide particles in the highly viscous slurry. A rake classifier was required for purification and levigation of the particles of less than 20-25 mm coming from the Symons conical granulator. Pb yield increased by 6-7% and the Pb content in the final concentrate increased from about 68 to 76%.

9326. Hagihara, Hitoshi. **Surface oxidation of galena in relation to its flotation as revealed by electron diffraction.** *J. Phys. Chem.* 56, 610-15(1952).—*C.A.* 46, 7943*d*.

The initial oxidation of galena surfaces was studied in air, in an enclosed atm. in galena powder, in a vacuum furnace, in water, and during dry and wet grinding. In all cases $PbSO_4$ was found as the lowest oxidation product. The next higher oxidation product in air was the basic sulfate Pb_2SO_5. Cryst. carbonate, hydroxide, or the lower sulfur oxides, PbS_mO_n, (with n/m less than 4), were not observed.

9327. Hague, H. G. **Cleaning small coal by froth flotation.** *G.E.C. Journal* 19, No. 2, 117-21(1952).—*C.A.* 46, 6807*i*.

App. suitable for cleaning down to a very fine coal below 30 mesh in size was described. Cresol, mixed in 1-3 lb per ton of water, was used to produce the bubbles. Tests of performance were given and cost discussed.

9328. Harris, J. H. **A standard laboratory procedure for the evaluation of East African graphite ores, with special reference to crucible-grade flake graphite.** *Bull. Inst. Mining Met.* No. 552, 43-53(1952).—*C.A.* 47, 1870*g*.

Details were given of a method of extn. of graphite by crushing, sieving, and flotation. The flotation concentrate was filtered, dried, and weighed, and reported as total commercially recoverable graphite. The dried concentrate was sieved, and the wt of -60-mesh graphite recorded as the percentage of graphite fines in the original sample.

9329. Hoar, T. P. and Farthing, T. W. **Solid films on electropolishing anodes.** *Nature* 169, 324-5(1952).—*C.A.* 46, 8990*h*.

Evidence for the presence of a solid film on the surface during electropolishing was obtained on Cu and brass anodes in H_3PO_4. Hg drops were allowed to fall on a horizontal sheet anode during electropolishing. The drops either (a) did not wet the surface but slowly rolled over it and off the specimen after being in contact with it for several min.; (b) became immobilized on the surface, which was then wetted by the Hg over a small area that did not spread while the anodic current flowed, but which began to spread within a sec. or so after the current was switched off; or (c) if very small, sometimes became immobilized on the surface but gave no visible wetting or amalgamation.

9330. Horsley, R. M. **Oily collectors in coal flotation.** *Trans. Inst. Mining Engrs.* (London) 111, 886-94(1952).—*C.A.* 47, 4579*a*.

The more air-avid coals were floated by means of a frothing agent alone, but the addn. of an oily collector greatly enhanced the air-avidity of all coals, with the exception of lignite. A hydrocarbon oil readily displaced H_2O from the surface of coal, forming a surface film that resulted in an increased contact angle and a decreased induction period. Consequently, air bubbles more easily attached themselves to the surface, and improved flotation results.

9331. Horsley, R. M.; El-Sinbawy, H., and Smith, H. G. **Xanthates in coal flotation.** *Fuel* 31, 302-11(1952).—*C.A.* 46, 7730*g*.

Contact-angle expts. demonstrated that pure alkali xanthates were not collectors for coal but that the com. products or pure xanthates in the presence of oxidizing agents had a collecting action. Oxidation resulted in the formation of dixanthogen, which was a powerful collector for coals of all ranks except lignites.

9332. Houtermans, F. G.; Vincent, D., and Wagner, G. **The inclusion of sulfur in the electrodeposition of copper from copper sulfate solution and the measurement of the ionic radius in the formation of unimolecular surface layers.** *Z. Elektrochem.* 56, 944-6 (1952).—*C.A.* 47, 6276*a*.

With S^{35} as a tracer, the inclusion of SO_4^{2-} in the anode and cathode during electrolysis of a 1:1 $CuSO_4$-H_2SO_4 soln., 0.1 *N* in SO_4^{2-}, with a c.d. of 5 ma./cm^2, was detd. by measuring the activity of the Cu electrodes. Both electrodes showed a surface layer of SO_4^{2-}, which could not be washed off with H_2O, but could be dissolved with dil. HCl after oxidation of the Cu surface. This did not change the wt appreciably, but removed the activity completely from the anode and almost completely from the cathode. When 10 mg/cm^2 of Cu was sepd., the deposited Cu contained S $6\text{-}8.10^{-8}$ g/g of Cu. In sepns. of 500 mg/cm^2 of Cu, there was S 7.10^{-5} g/g of Cu. This was probably due to catalysis of the SO_4^{2-} inclusion by the Cu_2O which appeared after 5 hrs of electrolysis, rather than to preferential adsorption of S^{35}.

9333. Hukki, R. T.; Palomäki, Antti, and Orivuori, Erkki. **Electrophoretic investigation of the activation of sphalerite by copper sulfate in flotation.** *Suomen Kemistilehti* 25B, No. 9, 42-9(1952)(in English).—*C.A.* 47, 4262*d*.

Sphalerite was, electrophoretically speaking, a neg. mineral. The ζ-potential of sphalerite particles became more neg. with increasing pH. Floatability of activated sphalerite by xanthates was comparable to that of true Cu sulfide minerals. In activation of sphalerite by $CuSO_4$: $ZnS + Cu^{++} \rightarrow CuS + Zn^{++}$, a pos. ion (presumably Cu^{++}) was adsorbed by pure sphalerite, the extent of adsorption being a function of the pH of the soln. Max. adsorption at the concn. of 25 mg of $CuSO_4$ per liter, took place between pH 7 and 8.

9334. IRMANN, R. **Sintered aluminum with high strength at elevated temperatures.** *Metallurgia* 46, 125-33(1952).—*C.A.* 47, 84*h*.

Sintered compacts prepd. from pure Al powder were much stronger at room temps. than pure Al itself; they were also superior at elevated temps. to the usual Al alloys. Methods of prepg. Al powder and its properties were described. Tensile strength of Al-powder compacts, as extruded, was 32-6 kg per mm^2; for *Anticorodal* (Al-Si-Mg), as heat treated, it was 32-42; for *Avional* (Al-Cu-Mg), as heat-treated, it was 40-8.

9335. KIKUTA, SADAO AND MASUDA, YOSHIMICHI. **Adhesion of small particles of some metals and glass at high temperatures.** *Ôyô Butsuri* (J. Applied Phys.) 21, 114-18(1952).—*C.A.* 46, 10711*c*.

Micrographical measurements in connection with powder metallurgy were reported of the rate *R* of neck formation by adhesion between 2 small spherical solid droplets of glass at 650-80°C and of Ag at 850-910°C. *R* was intensively affected by the geometrical configuration. A possible explanation of the result was the surface diffusion in the earlier stage and the vol. diffusion in the later period. The shrinkage in the distance between centers of the 2 particles was measured and showed a certain geometrical relation with the change in form of the neck.

9336. KIRCHBERG, H. AND SCHUBERT, H. **Separation of pyrites and arsenopyrite by flotation in alkaline medium.** *Bergakad., Freiberg Forsch. A., Bergbau* 3, No. 7, 54-61, discussion, 61 (1952).—*C.A.* 47, 455*h*.

Arsenopyrite, a by-product of Pb and Zn mining, could be concd. by flotation in an alk. medium (pH = 8) contg. amyl xanthate in a concn. of 40 g/1000 kg. The concentrate contained 45% S and less than 1% As. An As concentrate did not appear to be economical to prep. from the available raw material.

9337. LAST, GEORGE A. AND COOK, MELVIN A. **Collector-depressant equilibrium in flotation. I. Inorganic depressants for metal sulfides.** *J. Phys. Chem.* 56, 637-42(1952).—*C.A.* 46, 7008*f*.

The "bubble pick-up" method was employed to obtain comprehensive equil. data for the system potassium amylxanthate—sodium sulfite—galena at 25°C. A free acid collector-free acid depressant single-site mechanism was developed based on the Cooke hydrolytic adsorption theory. It was found to give a complete and self-consistent correlation of the exptl. results of this study. The adsorption potentials for the depressant and the collector, resp., were independent each of the other.

9338. LAST, GEORGE A. AND COOK, MELVIN A. **Collector-depressant equilibrium in flotation. II. Depressant action of tannic acid and quebracho.** *J. Phys. Chem.* 56, 642-8(1952).—*C.A.* 46, 7008*g*.

An exptl. investigation of the systems galena-amylxanthate-tannic acid and galena-amylxanthate-quebracho was carried out. These depressants were regarded as having two surface-active groups capable of adsorbing on a galena surface, namely, the carboxyl and phenolic groups. Not all of the phenolic groups were active as depressants, but only the undissocd. trihydroxyphenyl radical. Tannins in the colloidal form were ineffective as depressants for galena.

9339. LEWIS, A. G. L. **Cupola coke: with particular reference to high-ash coke.** *Foundry Trade J.* 93, 89-93(1952).—*C.A.* 47, 3545*a*.

The effect of high-ash coke and variations in coke quality on the production of iron castings from cupola melts were detailed. C pick-up was the indication of efficiency for cupola melting generally, and as the ash in coke increased, the percentage of C pick-up fell. Other conditions remaining const., as the ash in foundry coke increased, metal temp. decreased. The problem of using high-ash coke can be met (1) by optimum cupola design and operation, (2) by the use of a suitable low-ash C substitute to offset the high ash, such as pitch coke, (3) by the use of the coal-fired air or reverberatory furnace instead of the cupola.

9340. LIVINGOOD, MARVIN D. **Flotation of copper silicate by selected alkyl-substituted polyhydroxy nitroso phenols.** *Univ. Microfilms* (Ann Arbor, Mich.), *Pub.* No. 4027, 164 pp. (microfilm $2.05, paper enlargements $16.40); *Dissertation Abstracts* 12, 659(1952).—*C.A.* 47, 1549*i*.

9341. LOISON, R. **Underground gasification in different countries. VI. French tests of underground gasification at Djerada, Morocco.** *Am. mines Belg.* 51, No. 1, 9-27(1952).—*C.A.* 47, 2455*f*.

The gasification was made with an air current not enriched with O_2 on a coal contg. 89.0% C, ashes 5.4%, and humidity 2%; the upper heating value of the coal is 7925 cal/kg. The tests (described in detail) gave a gas of 350 cal on the av., 500-600 cal for long periods. The thermal efficiency was low (50-60% at the most, 20% in unfavorable periods).

9342. MAURER, JOSEPH. **The influence of adsorption of gas on the surface transformation of a martensitic structure during the tempering of steel.** *Compt. rend.* 234, 1773-5(1952).—*C.A.* 46, 7960*h*.

The hardness of the surface of a piece of steel contg. 0.8% C dropped from initial value of about 595 in all gases at 200°C to values of about 380, 330, 320, 280, and 240 for vacuum, Ne, H, A, or CO_2 atms., resp. Similarly, Brinnell-hardness values dropped from 242 for heating in vacuum or treating with H_2 or A at 200°C down to values of about 170, 150, and 130 for values of heat treating at 500°C in vacuum, in H_2 and A, resp. The results were interpreted as indicating the influence of adsorbed gas on the stability of the surface structure during the transformation of martensite to pearlite.

9343. Merwe, J. W. van der. **Pressure gasification of Uereeniging coal.** *S. African Mining Eng. J.* 63I, 831-3(1952).—*C.A.* 47, 2455*g*.
The carbon in the coal was gasified by the pressure of O_2 and steam resulting in the formation of CO and CO_2, H_2, H_2O as steam, and CH_4. The by-products of the gasification were (per ton of coal): tar and oil 2.2 gallons, gas naphtha 2 gallons, ammonia 18 lb, tar acids 11 lb, CO_2 13,000 ft^3, and sulfuretted H 12 lb. The importance of the process, especially for South African coal mine conditions, was discussed.

9344. Nurse, T. J. and Wormwell, F. **The isolation and examination of films from metal surfaces: an improved technique.** *J. Appl. Chem.* (London) 2, 550-4(1952).—*C.A.* 47, 1018*g*.
A means of strengthening films stripped from metals was sought. The object, such as oxide-covered steel, was immersed in 0.25-1% soln. of Formvar in a mixt. of 2 parts by vol. of acetone and 1 part by vol. of trichloroethylene for 1-2 min., removed, and allowed to drain for 5 min. The film was then stripped in an anhyd. deaerated soln. of I_2 in alc. and washed in anhyd. deaerated methanol. Applications of the technique were cited for oxide films on heated mild steel, the films produced on Fe or steel by industrial treatment, oxide films on polished stainless steel, and the oxide films on Cu, brass, Zn, Ti, Al, Al-Cu, and Al-Si alloys.

9345. Ostrof, Bernard and Thum, Ernest E. **Ion exchange: a new technique for metallurgists.** *Metal Progress* 62, No. 1, 67-74(1952).—*C.A.* 46, 7827*g*.
Uses were described of synthetic resins for ion exchange in H_2O purification, Cr plating, recovery of Cu and Zn from wastes, sepn. of rare earths, and purification of Zr.

9346. Paulson, C. F. **Profitable chromate wastes.** *Metal Finishing* 50, No. 5, 48-50, 56 (1952).—*C.A.* 46, 6577*b*.
The system recommended was a cation exchanger to remove metallic cations from the strong chromic acid soln. and an anion exchanger to recover the chromate from the dil. rinse solns.

9347. Paulson, C.F. **Metal recovery by ion exchange.** *Plating* 39, 1330-4(1952).—*C.A.* 47, 4226*f*.
Processes for recovery of Zn, Sn, Cu, Ni, Au, Ag, and Cr were described. A flow sheet and cost analysis were given for a system for recovering Cu, Ni, and Cr. Ion-exchange recovery was shown to nearly pay for itself as compared to expensive waste-disposal methods.

9348. Philippoff, W. **Some dynamic phenomena in flotation.** *Trans. Am. Inst. Mining Met. Engrs., Tech. Pub.* No. 3265-B (in *Mining Eng.* 4, 386-90)(1952).—*C.A.* 46, 4443*d*.
A possible mechanism for the attachment of a conditioned mineral particle to a rising bubble was developed. The time during which the phenomenon occurred was detd. by the time of impact. During this time the film of liquid between the particle and the bubble must recede, creating the particle-air interface. This velocity of film-recedence was both calcd. and measured and found to be dependent on the dynamic receding contact angle, which was much smaller than the equil. contact angle, measured in the bubble machine. This mechanism, as distinct from the static equil., accounted for the more difficult flotation of fines and slimes. Expts. were made by using particles within the range of sizes used in flotation, but large enough to give easily measurable contact times.

9349. Piatti, Luigi. **Effect of wetting agents on corrosion. III. The influence of the constitution of cation-active wetting agents.** *Werkstoffe u. Korrosion* 3, 186-8(1952).—*C.A.* 46, 7978*g*.
Two cation-active wetting agents, both derived from the same mono-acetylated diamine, were examd. under exactly equal conditions. The hydrochloride gave a practically total protection of the steel while the corresponding methyl ammonium sulfomethylate permitted an attack essentially greater than that by water without the addn. of the wetting agent.

9350. Popel, S.I.; Esin, O.A., and Nikitin, Yu. P. **Effect of carbon on the interfacial tension of iron in contact with slag.** *Doklady Akad. Nauk S.S.S.R.* 83, 253-5(1952).—*C.A.* 46, 8581*f*.
Detns. of the interfacial tension σ between Fe with up to 5% C and a synthetic slag of the compn. CaO 39, SiO_2 36, Al_2O_3 26%, were made at 1400°-1500°C by the method of the sitting drop on a corundum support in a graphite crucible. The interfacial tension decreased uniformly with increasing C content of the iron, i.e. C was surface-active also at the boundary with the slag. The values were close to the surface tension against air; this was due to the absence of chem. interaction between the iron and the slag.

9351. Powers, Robert A. and Hackerman, Norman. **Nickel plating by chemical reduction. I. Effect of the basis metal.** *J. Phys. Chem.* 56, 187-8 (1952).—*C.A.* 46, 7485*f*.
Plating was attempted on evapd. films of Ni, Fe, Au, Cu, and Pt. On only the 1st three, did plating occur. Electron-transmission patterns after stripping the plate from the basis metal gave only the diffraction rings of the basis metal. This indicated that surface geometry, catalytic effects of the surface, and similarity to the Ni lattice were not factors.

9352. Sarjant, R.J. **Fuel and metal.** *Foundry Trade J.* 92, 619-28(1952).—*C.A.* 46, 8343*i*.
The properties of coke as affected by the coal from which it was made and by the carbonizing conditions and the influence of the properties on performance of the fuel in the cupola and blast furnace were considered. Studies on coke reactivity showed that in the cupola, and possibly in the blast furnace, rates of melting and temps. of

the metal were influenced materially by the reactivity. Increased velocity of blast produced the equiv. of a fall in reactivity for a particular temp.

9353. SUBRAMANYAM, G.V. AND NARAYANAN, P.I.A. **Flotation of sulfur from sulfur-bearing clays from Near Masulipatam, Madras.** *J. Sci. Ind. Research* (India) 11B, 423-6(1952).—*C.A.* 47, 4562*d*.

Elemental S of biochem. origin present in a clay deposit was concd. by flotation. At a pulp pH of 4.2, stage addns. of cresylic acid and light Diesel oil produced a concentrate contg. 52% S, being 81% of the S in the feed. Na_2CO_3 and Na metasilicate were used to control pH and deflocculate slimes. The material tested contained about 22% free S.

9354. THEWS, E.R. **The deoxidation, desulfurizing and outgassing of remelted alloys by lithium.** *Metall* 6, 431-3 (1952).—*C.A.*46, 11076*h*.

Although Li was very effective it could be used only where cheaper means were not available. Deoxidation could be accomplished by a no. of metals and compds. such as Al, Mg, Mn, P-Cu. Mg and Mn were also good desulfurizers and P-Cu is good for outgassing. However, for Ni-rich alloys such as Ni bronzes, new Ag-and Pb-contg. bearing metals, Li was required to give sufficiently dense and homogeneous alloys. To avoid the harmful effect of excess Li, not enough was added completely to deoxidize, desulfurize, and outgas the metals, but it was used rather as an adjunct in very small quantities.

9355. TÖDT, FRITZ. **The limits of the electrochemical investigation of corrosion processes and oxygen contents.** *Werkstoffe u. Korrosion* 3, 205-9 (1952).—*C.A.* 46, 7978*d*.

Very small amts. of O_2 or of oxide films on Fe were detd. from the current generated in galvanic cells, in which the current-generating process at the cathode occurred exclusively by an O_2 depolarization. By switching off the current after some time, an equally increasing growth of the current output occurred, which permitted almost unlimited sensitivity in the detn. of very small amts. of oxide films.

9356. VEĬLER, S. YA. **The negative lubricating action of some liquid media in deep drawing of metals.** *Doklady Akad. Nauk S.S.S.R.* 83, 709-12(1952).—*C.A.* 46, 8836*f*.

The relation between *P*, the tangential stress and the chain length of the org. compd. was nearly linear. Solid lubricants, with a pos. lubricating action, lost their effectiveness on softening. With steel, a 5% soap soln. (pos. lubricant) decreased *P* from 650 to 500 kg; under the same conditions, CCl_4 increased *P* from 650 to 1050 kg. The degree of deformation with CCl_4 was 1-2% higher, and with the soap soln. 1-1.5% lower, than under dry conditions. Surface hardening of steel was increased somewhat in CCl_4 and decreased with soap.

9357. WILLIAMS, J. **Trapping of gases in cold-compacted powders.** *J. Iron Steel Inst.* (London) 172, 19-24(1952).—*C.A.* 46, 11063*b*.

With ThO_2 powder, the exptl. method used for Fe did not distinguish the effect of mechanically entrapped gas from that of adsorbed gas because of the large amts. adsorbed. ThO_2 compacts on standing adsorbed further quantities of gas. This was explained on the assumption that an increase of the adsorbing surface occurred by reason of relaxation of the interparticle forces, the slight sepn. of these particles allowing entry of gas to these fresh surfaces.

9358. WROBEL, S.A. **Study in flotation frothing—surface tension: air-solution.** *Bull. Inst. Mining Met.* No. 549, 505-17 (1952).—*C.A.* 46, 11061*c*.

Surface tension was detd. by measuring the pull on a vertical mica plate dipping into the soln.; the app. was described in detail. Variations of surface tension with time were shown only by solns. of some frothers—notably pine oil and 1,1,3-triethoxybutane.

9359. YUDENICH, G.I. AND BOGDANOVA, Z.S. **Flotation of ferrous metal ores.** *Gornyĭ Zhur.* 126, No. 10, 29-33(1952).—*C.A.* 47, 1015*c*.

The original ore was crushed to 3 mm and subjected to wet magnetic sepn. yielding middlings and tailings. The middlings were ground to 0.1 mm and subjected to a 2nd magnetic sepn. yielding a magnetite concentrate and tailings. The latter contained Fe 15-22%, mostly as hematite. Flotation expts. were carried out on these tailings. Collectors in order of their effectiveness were: igepon, Na oleate, merzolate C-4, oxidized kerosine, and fatty acids (paraffin oxidation condensate).

9360. ZADRA, J.B.; ENGEL, A.L., AND HEINEN, H.J. **Process for recovering gold and silver from activated carbon by leaching and electrolysis.** *U.S. Bur. Mines, Rept. Invest.* No. 4843, 32 pp. (1952).—*C.A.* 46, 3923*h*.

Activated carbon was sometimes used in treating Au ores contg. very little sol. Ag. When the carbon was loaded with a suitable amt. of Au, the Ag load was negligible. In the process described, the loaded carbon was leached with a boiling soln. contg. 1.0% NaOH and 0.1% NaCN. The soln. was circulated through a bed of loaded carbon and then to a circular electrolytic cell which included a stainless steel screen anode and a pervious cathode contg. stainless steel wool. Lab. expts. confirmed by pilot-plant operations, showed that 2 liters of soln. per lb of carbon could be used in continuous leaching and electrolysis, regardless of the precious metals load on the carbon.

9361. ANON. **Ion-exchange processes in the plating and allied industries. I. An assessment of their position in the plating and anodizing process.** *Electroplating* 6, 3-9 (1953).—*C.A.* 47, 4225*i*.

Many of the plating defects are caused by suspended matter, often originating as hardness in the make-up or rinse water. Ppts. of $CaSO_4$, $PbSO_4$, $CaCO_3$, etc., in the baths for plating Ni, Cu, Ag, etc., were common sources of trouble. Ion-exchange processes gave waters which had distd.-water quality at lower cost, and justified use (even in rinsing) by virtue of the savings realized in fewer rejects.

9362. ANON. **Ion-exchange processes in the plating and allied industries. II. Ion exchange in recovery processes.** *Electroplating* 6, 121-30 (1953).—*C.A.* 47, 6275*g*.

In the case of CrO_3 contg. anodizing baths for Al, it was possible to justify the complete initial and operating cost amortization within a few years in CrO_3 savings by removing the accumulated Al ions. In the case of Cr-plating baths, after proper diln. of small portions, contaminating metal ions of Fe, Ni, Cu, or Cr(III) could be removed to acceptable levels, thereby keeping such baths operating indefinitely, requiring only make-up. The CrO_3 in the drag-out and rinse water was recoverable. Although reactivation of H_2SO_4 or HCl pickle baths was not feasible, the recovery of H_3PO_4 pickle baths was justified.

9363. BAILEY, R. AND WHELAN, P.F. **The influence of pulp temperature on the froth flotation of four British fine coals.** *J. Inst. Fuel* 25, 304-7(1953).—*C.A.* 47, 5094*h*.

The influence of pulp temp. was studied over the range 5-70°C and was found to be important in the froth flotation of fine coals from Penallta, St. John's, Gresford, and Bedlington E pits, with 2:1 creosote/cresylic acid mixts. as frother. Best results, in terms of wt yield, high-tailings ash, and rapidity of frothing and filtration were obtained at 25-30°C, but even at 20°C good performance was usually possible. Over 30°C there was no improvement.

9364. EMEL'YANOV, D.S. **Lowering the sulfur content of coal flotation concentrates.** *Ugol* 28, No. 4, 36-9(1953).—*C.A.* 47, 7189*e*.

The S in coal-flotation concentrates was decreased by sep. flotation of size fractions and proper selection of kind and quantity of reagent. Removal of the highly dispersable material, e.g., 0.05-0.0 mm, gave a concentrate which contained less ash (6.10-7.93%) and S (1.62-2.86%) than was obtained without removing this fraction (ash 6.82-11.40 and S 2.10-3.08%). With solar oil the S content increased as the amt. of oil increased from 500 to 1000g/ton, but with kerosine the reverse was true.

9365. EVANS, L.F. **The flotation of topaz using sodium hexadecyl sulfate as collector.** *Australian J. Appl. Sci.* 4, 165-73(1953).—*C.A.* 47, 7171*a*.

Sodium hexadecyl sulfate was a poor collector for freshly crushed topaz, but flotation was improved after the mineral had reacted with water, and further improved by pretreating the mineral with ferric or Pb chloride solns. ($10^{-3}M$). The collector was pptd. almost quantitatively by Ca salts, and hence had to be added in excess if Ca was present; Mg salts did not interfere similarly since the pptn. of Mg hexadecyl sulfate was very slow. No method was found for sepg. topaz from cassiterite by flotation, the flotation properties of the two being identical.

9366. GAUDIN, A.M. AND CHARLES, W.D. **Adsorption of calcium and sodium on pyrite.** *Trans. Am. Inst. Mining Met. Engrs.* 196, *Tech. Pub.* No. 3491-B (in *Mining Eng.* 5, No. 2, 195-200)(1953).—*C.A.* 47, 3772*h*.

To measure the difference in adsorption of Ca and Na, radionuclides of Ca and Na were used to evaluate the effect of dissolved O_2, the concn. of Ca or Na, the H-ion concn., and anions present. O_2 in soln. increased the adsorptive power of pyrite for Ca and Na, being greater for Ca. The adsorption d. of Ca increased with increase in Ca concn. and with pH. Na adsorption d. increased with pH and decreased with increasing concns. of Ca and cyanide ions. Ca adsorption decreased slightly in the presence of Na and (or) cyanide ions. In a soln. contg. K ethyl xanthate more Ca and (or) more Na was adsorbed than in the absence of the collector.

9367. GAUDIN, A.M. AND COLE, R.E. **Double-bond reactivity of oleic acid during flotation.** *Trans. Am. Inst. Mining Met. Engr.* 196, *Tech. Note* 144-B (in *Mining Eng.* 5, No. 4, 418) (1953).—*C.A.* 47, 5732*c*.

In the case of fluorite and C-18 fatty acids having 1 or 2 nonconjugated double bonds, there was practically no change of the fatty acid mol. or ion during the flotation operation. The extraordinary utility of these reagents was related to some property of the compds. other than the oxidizability of their double bonds.

9368. GRÜNDER, W. AND DULOVIC, M. **Cerrusite flotation.** *Z. Erzbergbau u. Metallhüttenw.* 6, 99-3(1953).—*C.A.* 47, 4809*f*.

The conditions essential for the flotation sepn. of oxidic Pb ores were discussed, including the influence of the type of sulfidizing agents used such as xanthates, Na_2S and H_2S, the grain size, time of treatment.

9369. HALL, C.L. AND WHELAN, P.F. **Laboratory tests on the concentration of witherite from the Northern Pennines by froth flotation.** *Trans. Inst. Mining Met.* 62, Pt. 6 (in *Bull.* No. 556, 271-83(1953).—*C.A.* 47, 4809*g*.

After grinding to 75% minus 200-mesh B.S. the coal and metallic sulfides could be removed together in a frothing process with $CuSO_4$ as modifier a xanthate collector, and pine oil as frother with simultaneous loss of only about 2.5% of the witherite input. By using under 10 lb of com. oleic acid as collector and about 1 lb of Na silicate as SiO_2 depressant per ton input, the crude 75% $BaCO_3$ ore ground to 75% minus 200-mesh could be made in batch tests to yield a concentrate assaying 90% $BaCO_3$, 90% of the input witherite being recovered in the concentrate, while 70% of the gang was discarded in tailings.

9370. SUN, SHIOU-CHUAN. **Frothing characteristics of cresylic acids in flotation.** *Bull. Inst. Mining Met.* No. 557, 301-20(1953).—*C.A.* 47, 5732*e*.

Cresylic acid is a complex mixt. of alkyl phenols. The frothability of the chem. constituents of cresylic acid was chiefly governed by the balance between their polar and nonpolar groups and consequently by their solubilities. The frothability of different grades of the acid was detd. by chem. compn. The frothability of cresylic acid and its principal components was generally independent of pH values ranging from 3.4 to 7, then increased gradually from pH 7.5 to 10, fell sharply at pH 11, and finally increased again at and beyond pH 11.5.

9371. TRUSHLEVICH, I.V. **Fixing the flotation time of coal slimes more accurately based on the study of the kinetics of flotability of petrographic varieties of coal.** *Ugol* 28, No.2 11-13(1953).—*C.A.* 47, 6631*d*.

Samples of concentrate were examd. with a binocular equipped with an integrator. The yield of lustrous, dull, lustrous-dull agglomerate, dull-gang agglomerate, and gang varieties were plotted on distinctly marked separate curves by variously shaded circles. The diam. of the circle indicated the size. The time needed to obtain a high-grade coking concentrate, fraction suitable for recleaning, fraction suitable for power-house fuel, and fraction suitable for boiler fuel were detd.

9372. WALKER, CHARLES A. AND ZABBAN, WALTER. **Disposal of plating-room wastes. V. Treatment of cyanide waste solutions by ion exchange.** *Plating* 40, 165-8(1953).—*C.A.* 47, 4226*b*.

Ion-exchange principles were discussed. The lab. ion-exchange app. was described.

9373. WULLHORST, B. **Activated carbon in electroplating.** *Metalloberfläche* B7, No. 2, 25-9 (1953).—*C.A.* 47, 4225*e*.

9374. GABRIELSON, GUNNAR. **The determination of boric acid in nickel plating and acid zinc plating baths by means of cation exchangers.** *Plating* 41, 47-54 (1954).—*C.A.* 48, 4368*g*.

Strongly acidic cation exchange resins in the H-form (Amberlite IR-120) were employed to remove Ni, Zn and other interfering ions in the detn. of H_3BO_3 in Ni and acid Zn plating baths. The soln. to be detd. was passed through an exchange column, which adsorbed the Ni^{++} and Zn^{++} liberating equivalents of H^+. The column was then rinsed with distd. water and effluent and rinse waters titrated with NaOH against bromthymol blue. At endpoint, mannitol was added, and the titration continued again to the color endpoint. The max. relative error was reported at less than 0.5%.

V-12. Miscellaneous Applications (Carbon Black, Leather, Lubrication, Paints)

9375. HOEVEN, C. VAN DER. **Displacement of adsorption. A contribution to the practical application of the adsorption theory.** *Chem. Weekblad.* 19, 555-7 (1922).—*C.A.* 17, 1179.

It was not sufficient simply to extract leather with water in order to det. H_2SO_4. Part of it was retained by adsorption. Extraction with 8% Na_2HPO_4 soln. which displaced the adsorbed SO_4^{--} made it possible to wash out the H_2SO_4 contained in the leather.

9376. HOUGHTON, A.S. **Thermal effect of vapors on rubber.** *Proc. Phys. Soc.* 35, 39-44 (1922).—*C.A.* 18, 341.

When rubber was immersed in the vapor of ether, of benzene, pyridine, water, ammonia, toluene, chloroform, oil of lavender, and oil of geraniol, a heating effect was obtained. The effect was maximal within a fews secs, and disappeared within a few min.

9377. HARDY, W. **Free and bound fluid in gels.** *Kolloid-Z.* 46, 268-77 (1928).—*C.A.* 23, 1553.

The range of cohesion at the surface of steel, copper, glass or quartz was large and was the sum of the attractions of the individual mols. The effect of orientation increased cohesion range. Frozen joints of a lubricant between metal surfaces were broken to show the range of influence of metal in preventing crystn. in the adsorbed material.

9378. JOHNSON, C.R. **Carbon black. I. A study of its volatile constituents.** *Ind. Eng. Chem.* 20, 904-8(1928).—*C.A.* 22, 4273.

Complete analyses were made of 5 types of carbon blacks, before and after evacuation, and of the gases removed. The volatile matter in a carbon black had no determinant effect of the properties imparted to rubber, but above certain limits it reduced the reënforcing power of the carbon black and retarded the rate of vulcanization. The gases extracted from the carbon blacks contained CO, CO_2, H_2, N_2, CH_4, C_2H_6, illuminants and O_2. CO and CO_2 may have been reaction products of the O_2 originally present.

9379. WIEGAND, W.B. AND BOGGS, C.R. **Carbon black in rubber insulating compounds.** *Ind. Eng. Chem.* 22, 823(1930).—*C.A.* 24, 4958.

Carbon black had no deleterious effect on the insulating properties of rubber compds., and actually improved them in many cases. Expts. were carried out on 3 compds. in which whiting was replaced by carbon black in various amts. With a 40% rubber compd., the use of 3 1/4% carbon by vol. had the following effects: resistivity increased 68%; breakdown voltage increased 40%; dielec. const. increased 10% (d.c.); dielec. const. at 1000 cycles increased 14%; dielec. const. at 440,000 cycles increased 9%; power factor at 1000 cycles decreased 24%; power factor at 440,000 cycles decreased 19%. With a 30% compd. and with a 35% compd. contg.22% reclaimed rubber, similar improvements were observed, but of less magnitude.

9380. KAUFMANN, CHARLES. **Acetylene carbon black.** *Can. Chem. Met.* 17, 93-5 (1933).—*C.A.* 27, 3782.

Three methods of manufg. carbon black from C_2H_2 were outlined and the phys. and chem. properties listed. The black produced by the thermal process of splitting C_2H_2 into the elements possessed a marked wetability as compared to other carbon blacks. Thermic C_2H_2 blacks were used increasingly in connection with pyrolusite (MnO_2) and graphite for depolarizing purposes.

9381. DROGIN, I. **An outline of carbon black.** *India Rubber J.* 90, 259-74(1935).—*C.A.* 29, 8249^2.

The manuf. of carbon black was described including the methods of production, the characteristics of the factory for producing carbon black, the importance of the lava tip, examn. and analysis of carbon-black deposit, factors which influence the recovery and quality of carbon black, and the application of carbon black to various industries.

9382. ESCH, WERNER. **Active and inactive carbon blacks in the past, present and future.** *Rev. gen. Caoutchouc* 14, no. 135, 3-18 (1937).—*C.A.* 32, 1412[5].

9383. WIEGAND, W.B. **pH properties of colloidal carbon.** *Ind. Eng. Chem.* 29, 953-6 (1937).—*C.A.* 31, 6832[1].

If one part of colloidal carbon be boiled for 15 min. or more with 3 to 10 parts of distd. H_2O, and cooled, the supernatant liquid decanted, and the sludge placed in contact with the glass electrodes of a pH electrometer, a reading was obtained characteristic of the material, e.g., high-grade impingement blacks 2.6 to 4.1; lampblacks 3.1 to 4.2; rubber-grade impingement blacks 3.6 to 5.7, non-impingement carbon 8.2 to 9.3. The pH remained unchanged, within exptl. error, after repeated extn. by distd. H_2O.

9384. DROGIN, I. **A survey of methods for evaluating carbon blacks.** *Rubber Tech. Conf. London, Preprint No.* 18, 12 pp. (May, 1938).—*C.A.* 33, 2290[4].

The evolution of methods for testing channel-process carbon blacks used in rubber manuf. was described from a historical point of view. The numerous phys. and chem. characteristics of carbon blacks were tabulated, with information on the range of the exptl. values of each property and the influence of each of these properties, so far as known, on the properties imparted by the blacks to rubber.

9385. THEIS, EDWIN R.; GANZ, JEROME, AND JACOBY, THOMAS F. **Chrome liquors. X. The effect of dichromate concentration during reduction upon the chemical characteristics of the chrome liquor. XI. The effect of excess sugar during reduction upon the basicity.** *J. Am. Leather Chem. Assoc.* 34, 461-3, 705-9 (1939).—*C.A.* 33, 9705[8]; 34, 2201[8].

In liquors prepd. by adding H_2SO_4 to sugar-dichromate solns. contg. variable sugar, and boiling under reflux, the observed basicity was always lower than that calcd. from the dichromate-acid ratio, owing to formation of org. acids. The basicity decreased with increasing excess of sugar. At 1 and 2.5% Cr_2O_3 reduction was incomplete. At and above 5% Cr_2O_3 reduction was complete, basicities were const., and percentages of all org. acids increased with dichromate concn.

9386. THEIS, EDWIN R. AND GANZ, JEROME. **Chrome liquors. XII. Comparison of the chemical characteristics of basic chromium sulfate liquors made with and without reflux.** *J. Am. Leather Chem. Assoc.* 34, 709-11 (1939).—*C.A.* 34, 2201[9].

The lowering of the basicity caused by org. acids formed from incomplete oxidation of sugar was almost as great when reduction was done in an open vessel (simulating com. practice) as when done under reflux. Prolonged boiling raised the basicity slightly by partial expulsion of volatile acids.

9387. WORNUM, W.E. **Physical aspects of resin and oil systems.** *Varnish Making, Oil & Colour Chem. Assn.* **1939**, 61-75.—*C.A.* 34, 6466[5].

A maleic resin ester and Congo copal resin were heated at several temps. between 200° and 275°C for varying periods and with different proportions of linseed oil. The dispersion of common varnish resins in hot oils was not simply due to soln. At 200° to 225°C adsorption of oil was probably only intermicellar, i.e., flocculates only were dispersed, the micelles remaining intact; bright mixings were not obtained. At 250°C intramicellar adsorption ensued; the brightness of the mixings and tolerances for white spirit increased.

9388. BEECK, OTTO; GIVENS, J.W., AND SMITH, A.E. **On the mechanism of boundary lubrication. I. The action of long-chain polar compounds.** *Proc. Roy. Soc. London* A177, 90-102 (1940).

Lubricants showing little or no surface orientation had a const. coeff. of friction of about 0.1 over the available velocity range from 0 to 1 cm sec. With oils which showed high surface orientation imparted by addn. of long-chain polar compds., a sudden decrease of the coeff. of the friction was observed at various velocities of the sliding surfaces, depending upon the compd. used. The regions of sudden decrease of the coeff. of friction corresponded to a change from metallic contact to extremely high electrical resistance. Long-chain polar compds. acted primarily by inducing the 'wedging effect' and not by giving a direct protection to the surface.

9389. BEECK, OTTO; GIVENS, J.W., AND WILLIAMS, E.C. **On the mechanism of boundary lubrication. II. Wear prevention by addition agents.** *Proc. Roy. Soc. London* A177, 103-18(1940).

Wear preventing agents were effective through their chemical polishing action, by which the load became distributed over a larger surface and local pressures and temps. decreased. Especially effective were compounds containing P or other elements or group V of the periodic system. These were found to form a metal phosphide or homolog on the surface which were able to alloy with the metal surface, lowering its melting point markedly, and by this action aiding greatly in maintaining a polish.

9390. GEHMAN, S.D. AND FIELD, J.E. **X-ray structure of rubber-carbon black mixtures.** *Ind. Eng. Chem.* 32, 1401-7 (1940).—*C.A.* 34, 8332[9].

The effects of carbon blacks of different av. particle sizes on the X-ray structure of stretched vulcanized rubber were investigated. For a given carbon black, the elongation at which a pattern appeared decreased as the proportion of carbon black increased. For a given proportion of different blacks, the elongation at which a pattern appeared varied directly with the av. particle size of the black. The exptl. results indicated the existence of a region of increased stress in the vicinity of the carbon black particles.

9391. HAUSER, E.A. AND LEGGETT, M.B. **Color reactions between clays and amines.** *J. Am. Chem. Soc.* 62, 1811-14(1940).—*C.A.* 34, 6480^7.

Discoloration of white rubber in tires was due to color reactions between clay fillers and antioxidants belonging to the class of amines. To study the reaction further, the color effects produced by a great variety of amino compds. on Wyoming bentonite were examd. The color was specific to the amine of the aniline type and could be produced with all reactive types of clay; benzidines gave blue, anilines green, and toluidines, pink or yellow colors; the intensity of the color depended on the type of clay. The color reaction was not regarded as a simple base exchange reaction.

9392. PARKINSON, D. **Carbon black in compounding rubber.** *Trans. Inst. Rubber Ind.* 16, 87-104 (1940).—*C.A.* 35, 655^2.

The centrifugal method of measuring particle size was applied to carbon blacks. The procedure was to disperse the black (first washed with NH_4OH) in a dil. soln. of NH_4 oleate and tannic acid, and then to sediment in a Hearson centrifuge. In this last operation, agglomerates larger than 0.2 μ were first thrown out, the unsedimented part was dild. to the required concn., and centrifuged for periods of 0.5-24 hrs. The main bulk of the black was composed of particles 25-35 $m\mu$ in diam. Particles smaller than 20 $m\mu$ may have been present.

9393. ANON. **Adsorbers guard telephone equipment.** *Heating, Piping Air Conditioning,* 13, 557(1941).

Loss in transmission and amplification efficiency had been traced to the tarnishing of the Ag contactors of the automatic selectors. This staining was a film deposit caused by minute quantities of certain gases, particularly SO_2, entrained in the air coming in contact with the metal. Adsorbers removed the gaseous impurities from the ventilating air.

9394. DAWSON, T.R. AND MESSENGER, T.H. **A comparison of gas blacks.** *J. Rubber Research* 10, 15-19 (1941).—*C.A.* 35, 5286^5.

Three gas blacks and an acetylene black were compared with respect to grit, coloring power, d., flow in oil, sedimentation in dil. alc., ash, acetone ext., petr.-ether ext. and the phys. properties (rate of vulcanization, extensibility, rigidity, resiliency and hardness) imparted to vulcanizates.

9395. GEHMAN, S.D.; WOODFORD, D.E., AND STAMBAUGH, R.B. **Dynamic properties of rubber. Dependence on pigment loading.** *Ind. Eng. Chem.* 33, 1032-8 (1941).—*C.A.* 35, 8358^4.

A method for measuring the dynamic properties of rubber was described. The dynamic properties of vulcanizates contg. Superspectra black, channel carbon black, Thermatomic black, ZnO, clay and blanc fixe were measured. The dynamic properties of vulcanized rubber depended on the pigment which it contained.

9396. HALL, O.D. **Carbon black.** *Gas.* 17, no. 4, 12-15 (1941).—*C.A.* 35, 3798^2.

The larger part of the carbon black production was by the channel process, in which a natural gas-burner flame impinged on a plate or channel, leaving a deposit of carbon black (about 1.45 lb per 1000 ft^3 gas). One plant burned sour fractionator-vapors, consisting largely of butane and propane, using the channel process, with channels 8 in. wide and 140 ft long. Another plant produced carbon black by the controlled combustion of natural gas in a special furnace.

9397. KANAGY, JOSEPH R. **Evolution of carbon dioxide and water from vegetable-tanned leather at elevated temperatures.** *J. Am. Leather Chem. Assoc.* 36, 609-23 (1941); *J. Research Natl. Bur. Standards* 27, 257-67 (1941) (Research Paper No. 1418).—*C.A.* 36, 1801^9.

Evolved CO_2 and H_2O were absorbed and weighed. H_2O evolved at 60°C did not increase materially after the first day and was considered absorbed H_2O. Evolution of CO_2 at 60°C was slight but measurable. Rate of evolution at any temp. declined slightly with time. H_2O evolved in O_2 (after deducting absorbed H_2O) was about 1.5 times that evolved in air, and 6 times that evolved in inert gas. Evolution of H_2O and CO_2 from vegetable-tanned leather appeared to be due principally to oxidation of the tanning material.

9398. SIMIZU, MAKOTO. **The adsorption of chrome liquors by hide powder.** *Bull. Tokyo Univ. Eng.* 10, 2(1941).—*C.A.* 38, 2235^4.

Hide powder and basic Cr salt solns. were used to det. the influence of time, basicity and concn. on the max. amt. of Cr adsorbed.

9399. TABOR, D. **Desorption or "surface melting" of lubricant films.** *Nature* 147, 609-10(1941).—*C.A.* 35, 6098^4.

Solid films of satd. hydrocarbons or of normal alcs. gave continuous sliding; the transition to stick-slip occurred at the m.p. In the normal satd. acids from pelargonic to stearic, the transition occurred about 75°C above the m.p. The transition was due to the desorption or deorientation of the adsorbed film or to a change of state from closely packed to less-closly packed.

9400. UEBERREITER, KURT. **Active fillers in micro-and macromolecular liquids.** *Angew. Chem.* 54, 508-12(1941).—*C.A.* 36, 4628^4.

An explanation of the effect of carbon black filler on rubber was offered. A "wetting temp.," the range in which the cohesive power of the liquid mols. became equal to the elastic binding power of the active surface, was assumed. It was always higher than the congealing temp. and since rubber-like high polymers congeal far below the temp. at which they are used, carbon black was effective in them only at room temp.

9401. WIEGAND, W.B. **Further electron microscope studies on colloidal carbon, and the role of surface in rubber reinforcement.** *India Rubber World* 105, No. 3, 270-2; *Can. Chem. Process Inds.* 25, 579-81 (1941).—*C.A.* 36, 2443^3.

Nine different com. colloidal carbons were examd. physically and chemically, with particular attention to particle size and shape, color, oil absorption, general colloidal properties, and the properties which they imparted to raw and vulcanized rubber.

9402. AKAMATSU, HIDEO. **Adsorption at the solid-liquid interface. IV. Relation of adsorption, oiliness, and flocculation of powders.** *Bull, Chem. Soc. Japan* 17, 333-8(1942).—*C.A.* 41, 4350*c*.

Adsorption was a necessary condition to reduce friction. For a certain homologous series of lubricants the longer the mol. chain the better was the oiliness. Among the polar radicals, the carboxyl radicals were most readily adsorbed by the glass surface. The oiliness of toluene or xylene soln. contg. a small quantity of fatty acid was explained by the assumption that the fatty acid was selectively adsorbed by the friction surface. If a powder was hydrophilic, it was not likely to flocculate in the polar liquid and the sedimentation vol. was small.

9403. CHESHIRE, A., AND HOLMES, N.L. **The influence of bound water on the equilibrium in leather-water systems.** *J. Intern. Soc. Leather Trades' Chem.* 26, 237-55(1942).—*C.A.* 37, 5615^4.

Equil. in vegetable-tanned leather-H_2O systems was studied over the range 2-28% sol. matter in the liquid phase. Defatted, shaved leather was allowed to stand 2 days with various amts. of H_2O. The leather was then pressed at about 10 tons/cm^2. Hide substance and H_2O were detd. in the pressed leather, and total solids in the expressed soln.

9404. DENFELD. **The oil-adsorption capacity of various working metal surfaces with and without special graphite.** *Deut. Motor-Z.* 19, 102-4 (1942).—*C.A.* 37, 5229^6.

The spreading and adherence of oil drops which were sprayed or run on gliding disks of steel or brass were tested. Untreated oil and oil treated with "Zafit", which was a slipping agent consisting of colloidal graphite in a suspending medium, were used. The wetting and the adherence of oil on metal surfaces were considerably improved.

9405. DÉRIBÉRÉ, MAURICE. **Bentonites.** *Papeterie* 64, 258-62 (1942).—*C.A.* 38, 2204^8.

European bentonites were used for the fixation of pigments and loading materials, in printing paste, in water purification and in miscellaneous ways.

9406. DROGIN, I. **Carbon blacks in natural and synthetic rubbers. III.** *India Rubber World* 107, 272-7(1942).—*C.A.* 37, 1896^9.

Lampblack had the same effects as semireënforcing furnace black in the rubbers; acetylene black gave results intermediate between those with furnace black and channel black. The color (nigrometer), sp surface area, oil absorption, volatility, diphenylguanidine adsorption, pH value, hygroscopicity, max. vol. loading in smoked sheet and extrusion in rubber of representative channel black, 2 furnace blacks, lamp-black and acetylene black were tabulated.

9407. KAMBARA, SHU. **Activation of fillers for rubber mixtures. II. Treatment of calcium carbonate with cation soap.** *J. Soc. Chem. Ind. Japan* 45, 967-70(1942).—*C.A.* 43, 1599*e*.

$CaCO_3$ was treated with an alc. 1-dodecylpyridinium bromide, the solvent was removed by evapn., and its effect on the activity of $CaCO_3$ as a filler for rubber was studied. When $CaCO_3$ after such treatment was used as a filler, vulcanized rubber of much higher tensile strength but with a slightly less elongation was obtained than when ordinary $CaCO_3$ was used, and vulcanization was accelerated. The most suitable proportion of cation soap was found to be 0.26% in wt of $CaCO_3$, which corresponded to the proportion required to cover $CaCO_3$ particles with a single mol. layer of the soap.

9408. LUPPO-CRAMER. **Adsorption processes in photographic emulsions.** *Chem.-Ztg.* 66, 265-7 (1942).—*C.A.* 38, 687^9.

A review of grain-and nucleus-isolation reactions of abnormal adsorption processes, was given especially in the Sterry effect and photographic reduction processes.

9409. MIZUNO, KENJIRO. **Evaluation of the particle size of Japanese carbon blacks for rubber compounding.** *J. Soc. Chem. Ind. Japan* 45, 692-5 (1942).—*C.A.* 43, 1599*i*.

The particle size of Japanese carbon blacks was evaluated by x-ray investigation. The tensile strength, elongation, and elec. cond. of rubber compds. contg. various kinds of blacks were measured, and the relation between these properties and the size of the particles was discussed.

9410. PIETSCH, E. **Effect of stationary strata on the lubrication between sliding and rolling surfaces.** *Kraftstoff* 18, 75-9 (1942).—*C.A.* 37, 4950^9

Stationary strata in moving, lubricated members were points of increased wear. Examples of this were the dead points on pistons and dead centers on roll bodies. The corrosion on such points was not traceable to direct contact between metals, but resulted from changes in mol. phys. processes in the boundary layer of the lubricant.

9411. RUYSSEN, R.G. **The determination of the surface tension of liquids by using the principle of Wilhelmy.** *Meded. Kon. Vlaamsche Acad. Wetensch., Letteren schoone Kunsten België, Klasse Wetensch.* 4, No. 1, 1-17 (1942).—*C.A.* 38, 3177^2.

A Pt plate (thickness 0.005-0.05 cm) was tared and dipped into the liquid to be investigated; then, the wt required to bring the plate back to its original position was detd. Measurements on H_2O, C_6H_6, EtOH and CCl_4 gave good agreement with known values. The values were affected by increasing the thickness of the Pt plate and also its form.

9412. SAMUELSON, OLOF. **Fractionation of sulfite waste liquor.** *Svensk Papperstidn.* 45, 516-18 (1942).—*C.A.* 37, 2573^3.

Sulfite waste liquor was fractionated by means of an exchange of anions. It was possible to sep. the nonelectrolytic components from the acids by selective adsorption of anions. The sepn. of the isolated acids from each other was also possible. The adhesive properties of the waste liquor depended upon the nonelectrolytic components, whereas the lignosulfonic acids did not have any adhesive effect.

9413. VEITH, H. **The absorption of water by rubber in its relation to some general problems of**

swelling. *Kolloid-Z.* 98, 52-62 (1942).—*C.A.* 36, 6372^9.

The absorption of water by tech. rubber mixts. contg. relatively high proportions of fillers (whiting, carbon black, talc and clay) as a function of time could be represented by the equation: $n = Kt^{0.5}$, where n was the quantity of water absorbed per unit vol. and K was a const.

9414. WINTERKORN, HANS F. **Applications of modern clay researches in construction engineering.** *J. Geol.* 50, 291-306(1942).—*C.A.* 37, 737^8.

In highway engineering, the soils considered were within the zones of daily and seasonal moisture and temperature changes. Therefore, their properties must be known as functions of these variables. Base exchange was employed in construction to alter undesirable soil properties (Treasure Island, San Francisco). The ease with which a road-bed was stabilized by means of bitumen of portland cement depended upon the SiO_2-R_2O_3 ratio and on the type and amount of exchangeable ions of the clay fraction.

9415. ANON. **1. Proposed method for measuring the absorption of water by sole leather. 2. Proposed impact method for measuring resistance of coated light leathers to cold cracking. 3. Proposed method for measuring resistance of leathers to deterioration at high temperatures.** *J. Am. Leather Chem. Assoc.* 38, 2, 48-9, 176-8 (1943).—*C.A.* 37, 5887^1.

9416. CHESHIRE, A. **Tanning as a polar adsorption.** *J. Intern. Soc. Leather Trades' Chem.* 27, 123-38, 145-82(1943).—*C.A.* 38, 1901^4.

The adsorption theory of tanning was reviewed. Over a wide pH range the increase in degree of tannage with decreasing pH was const. At any tannin concn. the degree of tannage decreased with increasing temp. Desorption of tannin varied inversely as the surface tension of the H_2O. This was also true in H_2O-acetone or H_2O-alc. mixts. For any leather-solvent system, the product of the equil. concn. of sol. matter and the surface tension was const. Salts, e.g., $MgSO_4$, which raised the surface tension of H_2O also increased fixation of tannin. Tanning was regarded as a polar adsorption of tannin mols., carrying a layer of bound H_2O, upon the surface of collagen, which also carried a layer of bound H_2O.

9417. COTTRELL, J.A. **Some fundamental properties of solid surfaces.** *Paint Tech.* 8, 153-4, 161 (1943).—*C.A.* 38, 4455^5.

Surface phenomena dealing with the spreading of liquids on solid surfaces, of importance in the technology of paints and varnishes, was discussed.

9418. DALLA, VALLE, J.M. **A course of instruction in micromeritics.** *J. Chem. Education* 20, 557-61(1943).—*C.A.* 38, 1160^3.

In many respects fine particles showed the properties of fluids in that they flowed and could be distd. in a current of air; however, in many other respects they had little resemblance to the fluid state.

9419. FURUKAWA, TONOSUKE. **Some experiments on natural inorganic fillers comprising chiefly calcium carbonate. I. Testing of natural fillers by the Meigen reaction and by fineness.** *J. Soc. Rubber Ind. Japan* 16, 123-35 (1943).—*C.A.* 43, 8187*i*.

Compns. of various types of natural and synthetic $CaCO_3$ were tested by the Meigen reaction, and the effects of compn. and fineness on the properties of vulcanized rubber were studied.

9420. HIRANO, S. **The effect of the adsorbed gas on the breakdown of liquid insulation.** *J. Inst. Elec. Engrs. Japan* 63, 463-5(1943).—*C.A.* 42, 1092*g*.

The change of dielec. strength of liquid insulation with a change of atm. pressure depended on the adsorbed gas on the electrode and was independent of the gas dissolved in the oil. The larger the quantity of adsorbed gas, the lower the dielec. strength. The breakdown strength of the adsorbed gas on the pos. electrode was larger than that of the adsorbed gas on the neg. electrode. The breakdown of liquid insulation was attributed to ionization by collision.

9421. JOHANSSON, C.H. AND PERSSON, G. **The diffusion of atmospheric moisture through small openings.** *Iva* 1943, 160-5.—*C.A.* 38, 5127^7.

Relatively large amts. of moisture could enter a container in which dry air was almost hermetically sealed. Diffusion was believed to occur by displacement of a layer of moisture sorbed on the solid surface.

9422. KENDALL, C.E. **Water absorption of varnish and paint films.** *J. Oil & Colour Chem. Assoc.* 26, No. 273, 35-47(1943).—*C.A.* 38, 6113^7.

Conditions were standardized as follows: temp. 20°C, humidity 65%, drying time 7 days, immersion in distd. H_2O at 20°C for 24 hrs. Panels were removed from the H_2O, shaken and blotted to remove surface moisture and cleaned of adhering fibers-all in 10 sec. By studying the evaporation rate of H_2O from the film, it was possible to estimate the moisture in the film before evapn. began by extrapolating the logarithmic curve wt vs. time to zero time. For accurate work corrections should be made for H_2O-sol.matter (about 0.30% in a 100% phenolicwood oil varnish) and moisture present in the film before immersion. The use of glass, Cu, Al and tin plate panels were considered. The last two surfaces gave the smaller absorptions, and their use was recommended.

9423. MAESER, MIETH. **Air permeability of light leather.** *J. Am. Leather Chem. Assoc.* 38, 3-19(1943).

The time required for a unit vol. of air to pass the leather diaphragm was increased by the elimination of doming. Decreasing the doming of the sample by use of a star foot caused the air flow to remain more nearly proportional to the pressure. If some method could be found to hold a diaphragm flat, without reducing the permeability of the leather, or if the leather was thick enough and stiff enough so that doming was practically eliminated, a diaphragm would follow Poiseuille's law.

9424. OKUNO, TOSHIRO; IMADA, FUMIO, AND YOSIDA, KAORU. **Studies on carbon. XI. Some experimental studies on carbon mixture in air-**

dry cells. *Technol. Repts. Kyushu Imp. Univ.* 18, 201-7(1943).—*C.A.* 43, 5572g.

The active carbon (from Quercus and Pinus) alone or mixed with NH_4Cl was molded into a cylinder to incase a CS_2 impregnated graphite anode. It was tested with a Zn cathode in a dry cell for the adsorption of O_2, H_2O, and ionic NH_4Cl and the drop and recovery of e.m.f. after discharge with 5-10 v.

9425. PARKINSON, D. **Effect of diameter and surface area of carbon black particles on certain properties of rubber compounds.** *Trans. Inst. Rubber Ind.* 19, 131-55(1943).—*C.A.* 38, 2844[7].

The fineness of particle size was the controlling factor in the reenforcing properties of carbon blacks. Carbon blacks fell into 4 classes: (1) furnace blacks and impingement blacks (rubber grades); (2) thermal blacks (coarse and fine); (3) lampblack and acetylene black, and (4) impingement blacks (color grades). Carbon black was present in vulcanized rubber in 4 different states: (1) compact clusters of particles; (2) networks of strings or chains in which individual particles were in direct contact; (3) dispersed particles whereby each particle was sepd. from its neighboring particles, but not bonded firmly to the rubber; and (4) dispersed particles which were linked to the macromols. of rubber.

9426. SCHOFIELD, M. **Carbon black and lampblack.** *Paint Manuf.* 13, 233-5 (1943).—*C.A.* 38, 653[2].

The development of methods of production were reviewed together with the relative positions of the 2 forms as pigments. Both pigments absorb far more oil in grinding than do mineral and bone black, yet this was offset by the greater hiding power of these pigments and of carbon black in particular.

9427. SPEEDY, ALAN. **The surface area of colloidal carbons. V. The role of surface area in rubber reenforcement.** *Rubber Age (London)* 24, 182,184(1943).—*C.A.* 38, 5107[5].

Proof resilience, tensile strength, stress modulus, hardness, rebound resilience and plasticity were shown as functions of the loading of a standard rubber mixt. with different types of carbon black.

9428. SPEEDY, ALAN. **The surface area of colloidal carbons. VI. The role of surface area in rubber reenforcement.** *Rubber Age (London)* 24, 206, (1943).—*C.A.* 38, 5107[5].

Tabulated data on loading capacity and elec. resistivity were presented.

9429. SPEEDY, ALAN. **The surface area of colloidal carbons. VII. The role of surface area in rubber reenforcement.** *Rubber Age (London)* 24, 232, 234 (1943).—*C.A.* 38, 5107[6].

The relations of the surface chemistry of different types of carbon black to the phys. properties imparted to rubber were discussed. In general, chem. compn. did not give a clue to the properties imparted to rubber. The relations between colloidal properties and surface area were discussed.

9430. SWEITZER, C.W. AND BRAENDLE, H.A. **The pH, surface and structure of colloidal carbons.** *India Rubber World* 107, 468, 476 (1943).—*C.A.* 37, 1897[3].

Unpublished expts., involving electron-microscopic examn. of rubber-P-33 cements, showed that, in conformity with its surface inertness (low bound-rubber, hardness, modulus and adsorption of rubber), P-33 C black dispersed easily and completely. Assocd. with the lack of C-C bonding was a deficiency of C-rubber bonding, which was confirmed by the low reenforcing power of this type of black.

9431. TURNER, L.B.; HAWORTH, J.P.; SMITH, W.C., AND ZAPP, R.L. **Carbon black in butyl rubber.** *Ind. Eng. Chem.* 35, 958-63(1943).—*C.A.* 37, 6934[2].

Data on the effects of different types of carbon black on the phys. properties (tensile strength, modulus, extensibility, hardness, resistance to tearing, permanent set, resilience, heat build-up, and artificial aging) of butyl-rubber vulcanizates were recorded graphically and discussed. Carbon blacks which reenforced natural rubber did not reenforce the tensile strength of butyl rubber, whereas with respect to other phys. properties, carbon blacks were the same as for natural rubber.

9432. DROGIN, I.; GROTE, H.W., AND DILLINGHAM, F.W. **Behavior of blacks in rubbers. Effect of Banbury mixing.** *Ind. Eng. Chem.* 36, 124-8 (1944).—*C.A.* 38, 1393[1].

The effects of 13 types of carbon blacks (including channel-process blacks and furnace-process blacks made by combustion and by thermal decompn.) in smoked sheet rubber, Buna-S, Buna-N, Butyl rubber, Neoprene-GN and Thiokol-FA were studied. The differences between the phys. and chem. properties of the individual blacks and between their reenforcing powers were shown in their effects in Banbury mixing. Blacks with relatively large specific surface areas, high proportions of volatile components and high pH values caused relatively great power consumption and generated relatively high heat.

9433. FREWING, J.J. **The heat of adsorption of long-chain compounds and their effect on boundary lubrication.** *Proc. Roy. Soc. (London)* A182, 270-86 (1944).—*C.A.* 38, 4175[9].

The frictional behavior between mild steel surfaces lubricated with solns. in white oil of long-chain compds. consisting of halides, acids, α-substituted acids, esters, cyanide, thiocyanate and a nitro deriv. was investigated under high loads at low speeds. Each soln. built up and was in equil. with an adsorbed and oriented film of the polar compd. on the surface. An equation was deduced relating the concn. and the transition temp. with the heat of adsorption. Long-chain polar compds. were adsorbed by the interaction of their dipoles with the atoms in the metal surface.

9434. SCHWARZ, H.F. **Compounding GR-S with channel black and mineral rubber.** *Ind. Eng. Chem.* 36, 51-4 (1944).—*C.A.* 38, 1141[6].

So-called "mineral rubber" (hard asphalt) had certain advantages in GR-S (Buna-S) in addn. to its functions as a softening agent, dispersing agent, filler and extender as in crude and reclaimed rubber. The base mixt. was composed of GR-S 100, S 2, mercaptobenzothiazole 1.5, stearic acid 2 and ZnO 5, to which were added 0 to 130 parts of channel black (EPC) and 0 to 115 parts of mineral rubber (m.p. 300-20°F). The effects of different proportions of GR-S, mineral rubber and carbon black on various phys. properties were shown graphically by method of trilinear compounding.

9435. SERGEANT, S.V. **Reconditioning of transformer oil with activated alumina.** *Proc. Tech. Sect., Paper Makers' Assoc. Gt. Brit. & Ireland* 25, 260-3(1944).—*C.A.* 40, 447^8.

Lab. trials confirmed the efficacy of activated Al_2O_3 in removing acidity from oil, a temp. approaching 100°C was advisable; 10% Al_2O_3 for 30 min. was satisfactory. Because of cost, the catalyst must be reactivated below 700°C.

9436. SPEEDY, ALAN. **The surface area of colloidal carbons. VIII. The role of surface area in rubber reenforcement.** *Rubber Age (London)* 24, 260-1(1944).—*C.A.* 38, 5107^7.

Tinting strength, color and absorption characteristics were discussed, and the general trends of these properties, existing anomalies and suggested hypotheses reviewed.

9437. SPEEDY, ALAN. **The surface area of colloidal carbons. IX.** *Rubber Age (London)* 24, 286, 288 (1944).—*C.A.* 38, 5107^7.

Absorption vs. surface area, loading capacity, the effect of surface on reenforcement, modulus, hardness and rebound resilience were discussed.

9438. SPEEDY, ALAN. **The surface area of colloidal carbons. X.** *Rubber Age (London)* 25, 14, 16, (1944).—*C.A.* 38, 5107^8.

The relation between surface area and rubber properties and the roles of surface and structure were discussed and summarized. A table classified colloidal carbons with respect to their behavior in rubber, their tinctorial properties and their colloidal properties.

9439. SWEITZER, C.W. AND GOODRICH, W.C. **The carbon spectrum for the rubber compounder.** *Rubber Age* (N. Y.) 55, 469-78(1944).—*C.A.* 38, 6602^9.

It was possible to predict the behavior of a carbon black in *Hevea* rubber or in GR-S by the evaluation of 3 properties. The pH value, as measured with a carbon black slurry, was an index of the rate of vulcanization. Specific surface area, was an index of reënforcement, tensile strength, energy and rebound resilience. Structure, as measured by oil absorption and correlated with known surface-area values, was an index of anomalies in modulus, hardness, behavior on extrusion, etc.

9440. BOWDEN, F.P.; GREGORY, J.N., AND TABOR, D. **Lubrication of metal surfaces by fatty acids.** *Nature* 156, 97-101 (1945).—*C.A.* 39, 5074^5.

Metals which were reactive enough to form soaps, e.g., Zn, Cd, Cu, and Mn, were efficiently lubricated by 1% lauric acid in paraffin oil; materials which were unreactive, e.g., Pt, Ni, Cr, and glass, were poorly lubricated. The temp. at which the transition from smooth to stick-slip motion occurred was much higher for the active metals.

9441. COMMISSION OF TESTING METHODS FOR PAINTS. **Water absorption and extraction by water (of paint and varnish coatings).** *Verfkroniek* 17/18, 129-30(1945).—*C.A.* 40, 1323^5.

Smooth, stainless-steel plates, e.g., V2A steel, with a coating of at least 30-40μ, were immersed in a trough of water-resistant material filled with distd. H_2O maintained between 15° and 25°C. The plates resting on specially provided ridges were in vertical position at intervals of at least 1 cm. The H_2O extended 1 cm above their upper edges. All air bubbles were removed and the H_2O renewed every day. After 1, 4, 7, 10, and 14 days the plates were taken out, dried well with strong filter paper or a clean, lint-free towel, and weighed. The apparent water absorption was the increase in wt of the plates, and expressed in mg per dm.^{2}. For the detn. of the extn. of the coatings by H_2O the plates treated as above are dried to const. wt (after the wiping with paper or towel), in an atm. having the same temp. and moisture as that in which they were kept before immersion.

9442. DUMAS, J. **Analysis of activated carbons which are used as depolarizers in batteries.** *Ann. chim. anal.* 27, 11 (1945).—*C.A.* 40, 3062^5.

The activity was detd. by the method of Freundlich. A carbon was said to be impermeable when a piece of it placed in a beaker of water did not fall to the bottom even when agitated violently. Very small quantities of Fe or Zn salts were detrimental. A good specimen should render water very slightly basic to phenolpthalein.

9443. FISK, NEIL R. **Chromatography.** *Paint Tech.* 10, 85-9(1945).—*C.A.* 39, 3990^2.

The principles, app., technique, and scope of the method were described. The method was applied successfully to the sepn. of fatty acid mixts., cellulose acetate fractions, terpenes, etc.

9444. FURUKAWA, TONOSUKE. **Studies on activation of inorganic fillers.** *Bull. Rubber Research Inst. Japan No.* 1, 11-12(1945).—*C.A.* 44, 5628*h*.

Surface treatment of clay, iron oxide, bentonite, diatomaceous earth, Japanese acid clay, and active clay was studied with 10 surface-active materials.

9445. GALLIE, JOHN F. **Carbon black; its relation to the natural-gas industry.** *Gas* 21, No. 9, 19-20(1945).—*C.A.* 39, 5433^9.

The channel process and the thermal decompn. and combustion-furnace processes were described. The Philblack process utilized preheated degraded oil and natural gas in conjunction to produce a high modulus furnace-type black. Recovery of the carbon content was said to run as high as 60%, as against 25-50% for furnace-type plants using only natural gas and 3 to 5% for contact black plants. However, each type of black had its specific uses.

9446. GORDON, M. **Decolorization in perfumery.** *Chimie & industrie* 53, 314-18(1945).—*C.A.* 40, 3228^9.

A study was made of the decolorization of concretes, absolutes, and resinoids by various methods: fractionation, entrainment with glycol, entrainment with phthalate, extn. with alc., decolorization with bone char, with activated charcoal, and with decolorizing earth. The activated charcoal method seemed to be the most effective. The ethyl phthalate method may in certain cases be used, particularly when it is sought to incorporate the solvent into the com. product. The use of decolorizing earths alone did not appear to be of any interest; in presence of activated charcoal they seemed to have some decolorizing power.

9447. HEDIN, RUNE. **Chemical processes in the hardening of portland cement.** *Svenska Forskningsinst. Cement Betong vid Kgl., Tek. Högskol. Stockholm Handl.* No. 3, 5-150(1945).—*C.A.* 40, 6775^8.

The chem. reactions that take place when a mixt. of portland cement and water hardens under normal conditions were studied.

9448. LEACHY, A.B. **Use of Dicalite filler materials.** *Paper Mill News* 68, No. 18, 16, 18, 22 (1945).—*C.A.* 39, 5482^6.

The use, effects, and advantages were discussed of the different grades of Dicalite, a diatomaceous earth consisting of practically pure amorphous SiO_2.

9449. MILLS, M.R. **The application of chromatography to the problems of oil and varnish chemistry.** *Paint Tech.* 10, 107-12(1945).—*C.A.* 39, 5091^3.

Chromatographic methods were utilized to fractionate fatty acid mixts., to separate mono, di, and triglycerides, to sep. the glycerides of linseed oil and to study oil, oxidation products.

9450. PARKINSON, D. **Carbon blacks in GR-S rubber mixtures.** *Trans. Inst. Rubber Ind.* 21, 7-30(1945).—*C.A.* 39, 5539^9.

To 4 base GR-S mixts., contg. different proportions of S, mercaptobenzothiazole, diphenylguanidine, ZnO, softening agent, and stearic acid, were added a medium thermal black, lampblack, fine thermal black, 2 semi-reënforcing blacks, 2 high-modulus furnace blacks, acetylene black, fine furnace black, easy-processing channel black, and medium-processing channel black. The numerous mixts. were vulcanized to different states, and were then tested for tensile strength, modulus, extensibility, recovery, hardness, rebound resilience, tear resistance, and abrasion resistance. The results were presented in detail graphically and were discussed at length.

9451. ADAMS, ROBERT S. **The use of ion-exchange resins in the study of chrome (tanning) liquors.** *J. Am. Leather Chem. Assoc.* 41, 552-73 (1946).—*C.A.* 41, 2924*c*.

Amberlite IR-100 and IR-4 (analytical grades) were used as cation and anion exchanger, resp. The amts. of Cr, acid, and various anions removed were detd. by analysis of the effluents. Anionic Cr was always present in Cr sulfate solns. Results obtained with Amberlite IR-4 (analytical grade) confirmed the presence of anionic Cr. The sum of the percentages of Cr removed from different portions of the same soln. by Amberlite IR-100 and by Amberlite IR-4 (analytical grades) was less than 100 for some solns.

9452. BENSON, G.; GLUCH, J., AND KAUFMANN, C. **Electric-conductivity measurements of carbon blacks.** *Trans. Electrochem. Soc.* 90, 441-7 (1946).—*C.A.* 44, 2815*h*.

The elec. conductivities of carbon blacks, particularly those with highly developed chain structure (e.g., acetylene black), when compressed to a standard apparent d., were more in accordance with their performances in dry cells than the values obtained by measurement under standard pressure.

9453. FISCHER, EARL K. AND GANS, DAVID M. **Dispersions of finely divided solids in liquid media.** *Colloid Chemistry* 6, 286-327(1946).—*C.A.* 40, 2374^7.

Pigments, paints, and printing inks were examples of the solids and liquids and modifying agents dispersed by many types of app. A discussion was given of the liquid phase, the comminuted phase, mech. dispersion, the solid-liquid interface, rheological properties, sedimentation equilibria, contact-angle relations, heat of immersion, adsorbed water, surface-active agents.

9454. GALLIE, JOHN F. **Carbon black in its relation to the natural gas industry.** *Mines Mag. (Colo. School of Mines)* 36, *No.* 1, 19-25(1946).—*C.A.* 40, 3249^9.

9455. GALLIE, JOHN F. **Carbon black manufacture.** *Petroleum Processing* 1, 197-206(1946).—*C.A.* 42, 9122*f*.

Channel, thermal, and various furnace methods of production were described and analyzed with respect to both quantity and quality of yields. Although paraffins were the best raw material, methods were devised to use olefins, diolefins, acetylene, and anthracene. The economics of carbon black manuf. was also discussed.

9456. GUSTAVSON, K.H. **Investigation of complex formation in chromium salts by means of organolites (a preliminary summary).** *J. Intern. Soc. Leather Trades Chem.* 30, 264-79(1946).—*C.A.* 41, 877*d*.

The uncharged complex in 26% acid Cr chloride (72% of the total Cr) had the approx. compn. $[Cr_2Cl(OH)_5]$. Pelt fixed cationic complexes of low mol. wt as the residual liquor contained practically all Cr in the uncharged state. Effect of aging was studied by boiling under reflux for 2 min. a soln. of 66% acid Cr sulfate (sucrose reduced, said to be free from org. anions) contg. 1 g equiv. Cr per liter, and passing 1 ml through the organolite columns after aging for 0 to 6 weeks. While the reaction of Cr with the organolite was primarily ionic, secondary covalent linkages with phenolic groups might be formed.

9457. KITTELBERGER, W. AND ELM, A.C. **Water-immersion testing of metal-protective paints. Role of osmosis in water absorption and blistering.** *Ind. Eng. Chem.* 38, 695-9(1946).—*C.A.* 40, 5575^9.

A paint system consisting of one coat of Zn chromate primer and one coat low-gloss, alkyd hull paint (Navy specifications 52-P-18 and 52-P-25) was applied to Fe, Al, Zn. and glass surfaces and immersed from 24 hrs to 840 hrs in distd. water, NaCl, and sucrose solns. of osmotic pressure from 6 to 30 atm. Results indicated that regardless of metal surface covered, water absorption and blistering increased with time, but decreased markedly with increasing osmotic pressure.

9458. KUNZ, CHARLES J. AND IVES, CHARLES E. **Use of desiccants with undeveloped photographic film.** *J. Soc. Motion Picture Engrs.* 46, 475-510(1946).—*C.A.* 40, 6351^8.

Excessive moisture can be removed from motion-picture film in a roll within a period of several days by a desiccant packed with the film, more rapidly by ample exposure to large quantities of desiccant at normal or reduced pressure, with the aid of refrigeration, or directly by pumping down to the desired vapor pressure. Data were given on the rate of moisture uptake by $CaCl_2$, silica gel, activated alumina, tea, rice, cotton, charcoal, and Drierite.

9459. LERCH, WILLIAM. **The influence of gypsum on the hydration and properties of portland cement pastes.** *Am. Soc. Testing Materials* 46, Preprint A4, 41 pp. (1946).—*C.A.* 40, 4861^7.

Twelve com. clinkers of different compns. were ground to a specific surface of 1900 cm^2/g, with various quantities of gypsum. Five of these clinkers were ground to various degrees of fineness with SO_3 const. at 1.8%. Rate of hydration of neat cement pastes was measured with a conduction calorimeter. Fineness and the alkali and $3CaO.Al_2O_3$ content influenced the gypsum required to secure max. strength and min. contraction on drying.

9460. PETTYJOHN, E.S. **Germany made acetylene and carbon black by cracking natural gas in electric arc.** *Natl. Petroleum News.* 38, No. 32, R596-604 (1946).—*C.A.* 42, 9098*c*.

Complete details were given of the process developed by the Germans for manufg. CH:CH and carbon black by the thermal cracking of natural gas in an elec. arc of d.c. at 7000 v. The cracking took place at high temps. and normal pressures, with rapid quenching to retard polymerization of the low-mol wt hydrocarbons. Mean gas temp. for conversion was 1600°C. After cooling by water spray, the gas passed through a trap and cyclone separators to remove carbon black and was then water-washed, scrubbed with absorption oil, desulfurized, and purified.

9461. PICCINELLI, GIOVANNI. **Italian bentonite and its use in the paint and varnish industry.** *Pitture e vernici* 2, 363 (1946).—*C.A.* 41, 4317*f*.

Italian bentonite could be activated, obtaining neutral products with const. pH value. The gels of this bentonite (5-6%) gave H_2O-oil emulsions, which maintained in suspension even the heaviest pigments, increased the stability and plasticity, did not give premature hardening, had a good covering power, and showed a certain antiseptic action against terrestrial and marine microorganisms.

9462. RIETZ, R.C. AND ANDERSON, L.O. **Use of paperboard as a sorptive material in protective packaging.** *Paper Trade J.* 122, No. 11, 47-50 (1946).—*C.A.* 40, 2626^4.

The most effective packaging method for metal parts that corrode easily used a desiccant to maintain a low relative humidity within the package and an impervious moisture-vapor barrier to enclose the desiccant and the item. A less-exacting packaging method used a corrosion-preventive compd. on the item, and the whole was enclosed within a water-barrier. This was called a "conforming pack", because the package shape conformed roughly to the shape of the item. When a paperboard container housed the preservative-treated part and the water-barrier enclosed the container, the pack was called "nonconforming". Lab. exposure tests showed that the nonconforming pack was consistently superior to the conforming pack regardless of whether the water-barrier had a low or a high transmission rate.

9463. ROEY, G. VAN. **The determination of the adsorbent capacity of the filtering mass.** *Bull. assoc. anciens étud. brasserie, Univ. Louvain* 42, 13-20 (1946).—*C.A.* 41, 2282*d*.

Factors concerned in the filtration of solns. of tannin, peptone, and dextrins through filter pads contg. asbestos were discussed. The type of fiber and its compn. were as important as pore size in removing colloidal material from solns.

9464. SHELTON, J. REID AND WINN, HUGH. **Oxidation of GR-S vulcanizates.** *Ind. Eng. Chem.* 38, 71-6 (1946).—*C.A.* 40, 2345^1.

The effects of the state of cure, temp., and surface area of a vulcanizate (GR-S 100, S 2, Santocure 1.2, fat acid 1.5, Bardol 5, ZnO 5, and channel carbon black 50) on its rate of absorption of O_2 were detd. by measuring this rate of absorption volumetrically at practically const. pressure and correlating the results with the corresponding changes in phys. properties. Chem. reactions, and not diffusion, were the factors controlling the rate of absorption of O_2.

9465. STALEY, FABIAN R. **Carbon-black industry strains to meet requirements for rubber.** *Oil Gas J.* 44, *No.* 44, 86-90(Mar. 9, 1946).—*C.A.* 40, 4195^4.

The use of synthetic rubber tripled the demand for carbon black of which about one-half was made (1946) by the furnace process in comparison with 7% in 1938. Several processes of manuf. were briefly described.

9466. THOMAS, ALBERT. **Experiments on the incorporation of carbon black in latex before coagulation.** *Rev. gén. caoutchouc* 23, 232-3 (1946).—*C.A.* 41, 611*f*.

S, carbon black, etc., were mixed into a homogeneous paste with water, this paste was mixed into latex before coagulation, the mixt. was then coagulated by acid (which also facilitates and completes the blending of paste and latex), most of the serum was squeezed from the coagulum on rolls, the sheets were allowed to drain for 2 days, they were then creped, and finally were used for molding and vulcanizing the products desired.

9467. WHITWELL, JOHN C. AND TONER, RICHARD K. **Correlation of equilibrium moisture data.** *Textile Research J.* 16, 255-67(1946).—*C.A.* 40, 4892^1.

The extrapolations and corrections for all textile data were studied. The data and the const. regain lines were extended statistically to a common point of intersection characteristic of any one fiber in any one process of sorption or desorption. Regions of moisture regains were found which gave conclusive evidence of pure adsorption uncomplicated by swelling.

9468. BARRER, R.M. **Solubility of gases in elastomers.** *Trans. Faraday Soc.* **43**, 3-11(1947). —*C.A.* **41**, 5333*g*.

An extension of the statistics of liquid-elastomers mixts. gave explicitly the sorption isotherm of gases in elastomers above their crit. temps. This isotherm was used to compare the exptl. and theoretical soly. consts. of several permanent gases in various elastomers, with good agreement. Isotherms of a no. of vapors in rubbers were also calcd. For the benzene-rubber system the actual data were successfully reproduced by the isotherm derived from Miller's equation which assumed random mixing. Other mixts. which did not deviate greatly from this isotherm were $CHCl_3$-rubber, heptane-rubber, and toluene-rubber.

9469. BELLAMY, L.J.; LAWRIE, J.H., AND PRESS, E.W.S. **Chromatographic analysis of rubber compounding ingredients and their indentification in vulcanizates. I. General principles and methods.** *Trans. Inst. Rubber Ind.* **22**, 308-13 (1947); *Rubber Chem. and Technol.* **21**, 192-219, 734(1948).—*C.A.* **41**, 6549*d*; **42**, 9224*b*.

Accelerators, antioxidants, and other components of the acetone ext. of a vulcanizate could be sepd. and identified. Activated alumina was used as absorbent, benzene for introducing the material into the column, and benzene, EtOH-benzene (1:99), EtOH-benzene (5:95), and anhyd. EtOH for subsequent development. Reverse chromatograms also were found to be effective for rapid sepn. and avoidance of packed columns. In sepg. accelerators and antioxidants, the possible interference of paraffin wax, mineral oil, pinetar, and fat acids were studied.

9470. BELLAMY, L.J.; LAWRIE, J.H., AND PRESS, E.W.S. **Chromatographic analysis of rubber compounding ingredients and their identification in vulcanizates. IV. Identification of antioxidants.** *Trans. Inst. Rubber Ind.* **23**, 15-20 (1947).—*C.A.* **42**, 400*a*.

It was possible to sep. paraffin wax, fat acid, accelerators, and antioxidants, not only from each other, but also from naturally occurring color and degradation products. Subsequent identification of the main fractions was then simple, e.g., tests such as the Co oleate reaction for accelerators and spot reactions for antioxidants could be applied without interference from other components.

9471. BLOOMFIELD, G.F. **Chromatographic analysis of accelerators.** *Trans. Inst. Rubber Ind.* **23**, 172(1947); *Rubber Chem. and Technol.* **21**, 735 (1948).—*C.A.* **42**, 4788*a*, 9225*f*.

The mercaptobenzothiazole in an eluate from an alumina column did not prove that benzothiazoyl disulfide was converted into mercaptobenzothiazole. Many grades of alumina converted benzothiazoyl disulfide to mercaptobenzothiazole. A less active column, e.g., sucrose or silica gel, might not give this effect, and would offer better evidence whether or not benzothiazoyl disulfide was converted to mercaptobenzothiazole.

9472. BOWLES, R.F. **Further observations of wetting and dispersion.** *Official Digest Federation Paint & Varnish Production Clubs No.* 274, 634-8(1947).—*C.A.* **42**, 2155*h*.

Recent work and theories on the subject were discussed. Chemistry and physics of materials were of less importance than their geometry, which might prove to be the most important consideration with wetting agents.

9473. BRISTOW, J.R. **Kinetic boundary friction.** *Proc. Roy. Soc. (London)* **A189**, 88-102(1947).—*C.A.* **42**, 1477*b*.

Expts. on sliding friction and relaxation oscillation were described. Curves of coeff. of friction against velocity were given for: (1) a series of ethyl esters of satd. fatty acids for hard steel on hard steel and phosphor bronze on hard steel at room temp.; (2) a mineral oil contg. addns. of oleic acid, with sliding surfaces of steel on steel, and brass on hard steel at room temp.; (3) ethyl palmitate lubricating the sliding of tin on hard steel, and (4) a mineral oil as lubricant for steel sliding on hard steel at various temps. The esters used were ethyl formate, ethyl acetate, ethyl propionate, ethyl valerate, ethyl enanthate, ethyl caprylate, ethyl pelargonate, ethyl laurate, and ethyl palmitate. At high speeds, the friction fell continuously with increasing mol. wt for hard steel sliding on hard steel, and for phosphor bronze on hard steel no max. was shown even at very low speeds.

9474. BRODSCHI, J. **Chromatography of rosin oil.** *Congr. tech. intern. ind. peintures inds. assoc.* 1, 212 17(1947)(in French).—*C.A.* **45**, 4944*g*.

Rosin oil, dissolved in petr. ether, was chromatographed on alumina to isolate the constituent responsible for darkening of the oil on storage. The colored portion was strongly adsorbed; it was eluted by C_6H_6. It was phenolic and had O-content of about 10%, hydroxyl no. 220, and av mol. wt 243. The decolorized portion (mainly hydrocarbons) did not darken on subsequent storage. It absorbed O_2 more rapidly than the original oil.

9475. BROOKE, MAXEY. **pH of nonaqueous colloidal carbon sludges.** *Ind. Eng. Chem.* **39**, 846 (1947). —*C.A.* **41**, 5360*h*.

The pH of a series of com. carbon black sludges in H_2O, MeOH, EtOH, and iso-PrOH were reported.

9476. CARPENTER, A.S. **Absorption of oxygen by rubbers.** *Ind. Eng. Chem.* **39**, 187-94(1947).—*C.A.* **41**, 3651*b*.

The value of the manometric method was studied as a tool in fundamental work and in comparing the resistance to oxidation of technical types of rubber, and to study the phys. chemistry of the reaction between rubber and O_2. The results were in accord with a free-radical chain reaction mechanism.

9477. COLIN-RUSS, A. **A theory of desorption in extraction systems of porous complexes.** *J.*

Intern. Soc. Leather Trades' Chemists. 31, 369-78 (1947).—*C.A.* 42, 1101*g*.

9478. Cotton, P. **The spreading of fatty acids on vaporized metallic films.** *Compt. rend.* 224, 1005-7(1947)—*C.A.* 43, 4923*h*.

Drops of oleic and pelargonic acids were found to spread on a Ag surface vaporized on a glass or quartz carrier, provided the metal film thickness was less than 1 mμ for oleic and 2 mμ for pelargonic acid.

9479. Dawson, T.R.; Porritt, B.D., and Scott, J.R. **Comparison of different types of carbon black.** *J. Rubber Research* 16, 199-203(1947).—*C.A.* 41, 7801*b*.

The bulk vol., tinting strength, gloss, and color (alone and with ZnO) of 11 com. carbon blacks were given. It was possible to distinguish so-called gas blacks from other types by a comparison of these properties. The comparative effects obtained with 5 gas blacks, acetylene black, lamp black, thermal blacks, and 2 mineral blacks were studied by detg. the rates of vulcanization, tensile strengths, breaking elongations, hardnesses, permanent sets, and resistances to abrasion at 20°C and resistances to tearing at 20° and 100°C of mixts. of the tire-tread type.

9480. Dogadkin, B.A. and Uzina, R. **Structure and properties of loaded rubber mixtures. I. Mixtures of natural and synthetic latex with bentonite clays.** *Kolloid. Zhur.* 9, 97-108 (1947).—*C.A.* 47, 1963*h*.

Latex concd. in a centrifuge was mixed with clay (x parts for 100 parts rubber) and dried to a film on glass. The breaking stress P for stretching in 1 or 2 dimensions was min. (e.g., 18 and 44 kg wt/cm^2, resp.) when x = 5 to 15%; then P increased with x to e.g., 40 and 195, resp., at x = 40%; at higher x (50 and 60%) P decreased again. The rate of diffusion of H_2O vapor through the films was max. at x = 20%, which max. was 4 times as great as the diffusion at 5% or 40%.

9481. Doi, Iwao. **Studies on the prevention on the effect of carbon black in accelerating the deterioration of rubber caused by oxidation. I. Aging tests of rubber compounded with carbon black.** *J. Soc. Rubber Ind. Japan* 20, 121-3 (1947).—*C.A.* 45, 6417*c*.

Though carbon was a superior reinforcing ingredient in rubber, it accelerated the deterioration of rubber. To study methods to eliminate this effect, various kinds of com. carbon black were mixed in a base mixt. (rubber 50, S 1.5, stearic acid 2, mercaptobenzothiazole 0.5, ZnO) in the proportion of 30, 50, and 70% carbon to rubber. The test-pieces contg. carbon black deteriorated much faster than the blank test-pieces which contained ZnO only.

9482. Doi, Iwao. **Studies on the prevention on the effect of carbon black in accelerating the deterioration of rubber caused by oxidation. II. Control on oxidation by heat-treatment of carbon black.** *J. Soc. Rubber Ind. Japan* 20, 123-5 (1947).—*C.A.* 45, 6417*d*.

When a mixt. of carbon and S in the proportion of 10 to 1 was heated at about 500°C, a considerable quantity of S unextractable by acetone was formed in the black. The carbon black thus treated was highly effective against oxidation of vulcanized rubber, compared with vulcanizates which contained untreated carbon.

9483. Elm, A.C. **Paints as moisture barriers.** *Official Digest Federation Paint & Varnish Production Clubs.* No. 267, 197-228 (1947).—*C.A.* 41, 7133*d*.

Regardless of the nature of the immersion bath, H_2O absorption increased with immersion time. While the films immersed in the salt solns. approached satn. more or less rapidly, the films immersed in the distd. H_2O continued to absorb H_2O, and the curve gave no indication that the satn. point would ever be reached. H_2O absorption, swelling, and blistering decreased sharply as the osmotic pressure of the bath increased. The affinity of a paint coating for H_2O could not always be predicted from the H_2O soly. of the contained pigments. The osmotic pressure gradient responsible for H_2O absorption was largely the result of the formation of hydrophilic org. compds.

9484. Everetts, John Jr. **Sorbents regulate humidity by soaking up the moisture in air.** *Power* 91, No. 11, 74-7 (1947).—*C.A.* 42, 799*c*.

Damage due to moisture in the way of corrosion, mold, mildew, etc., and the need of controlled moisture content, were discussed. Dehumidification could be accomplished by refrigeration or the use of sorbents. Sorbents, both liquid and solid, were listed and their various properties outlined.

9485. Gregory, J.N. and Spink, J.A. **Lubricating properties of molecular layers of stearic acid and calcium stearate on metal surfaces.** *Nature* 159, 403(1947).—*C.A.* 41, 4693*g*.

From 1 to 21 mol. layers of Ca stearate and stearic acid were deposited on Pt, Cu, and stainless steel, from 0.0001 M $CaCO_3$, at pH 6. These layers contained 60% soap and 40% acid. The coeff. of friction k was detd. at various temps. on these surfaces. On Cu, there was permanent increase in k at and above the softening point of Cu stearate. On stainless steel there was an increase in k at and above the softening point of Ca stearate; there were no changes at the m.p. of stearic acid or of ferric stearate. On Pt, there was a temporary increase in k at the temp. at which β,α phase changes occurred, followed by a permanent increase at and above the m.p. of the acid.

9486. Gustavson, K.H. **The problem of equilibrium in chrome fixation by collagen.** *J. Intern. Soc. Leather Trades Chem.* 31, 181-6(1947).—*C.A.* 41, 5331*c*.

The hydrolytic theory of Cr tannage required that the same limiting fixation should be reached, from a given system at all temps. The amt. of Cr fixed after 4 weeks' tannage increased with temp. (4° to 40°C), and that the acidity of the Cr compd. fixed (ratio of total sulfate to total Cr in washed leather) decreased with increasing temp. With base- and acid-exchange resins it was shown that the cationic Cr content of a 65% acid Cr sulfate liquor decreased from 97 to 71% when the temp. was increased from 20° to 40°C. Uncharged Cr increased from 3 to 22% and anionic Cr increased from 0 to 7%. No change in ionic constitution resulted upon cooling from 20° to 4°C.

9487. GUSTAVSON, K.H. **Experimental arguments against the concept of chrome tanning as an adsorption process.** *J. Phys. & Colloid Chem.* **51**, 1181-8 (1947).—*C.A.* 42, 397*b*.

The adsorption concept could not explain the effect of neutral salts nor the tanning action of certain mixed organosulfatochromium complexes in the isoelec. zone of collagen or on its alk. side. Pre-treatment of skin with lyotropic agents or heat denaturation of skin increased its affinity for Cr but did not affect acid fixation. The main reaction in tanning was an attachment of cationic acidochromium complexes to the charged acidic groups of collagen with simultaneous coordination of the complexes to the basic groups of adjacent protein chains. The chelated Cr complexes behaved as bridges between adjacent protein chains resulting in stabilization of structure.

9488. HILL, J.A. **The chemistry and application of detergents.** *J. Soc. Dyers Colourists* **63**, 319-22 (1947).—*C.A.* 42, 3921*i*.

Synthetic anion-active-, cation-active, and non-electrolytic detergents were considered. In general, increase in the wetting power was dependent upon a decrease in surface tension, but in certain processes where penetration into small capillaries was required, a decrease in surface tension might be undesirable. Na alkyl sulfates had a temp. of max. effectiveness, as the mol. wts increased. In general, cation-active compds. had greater bactericidal power than anion-active and non-electrolytic compds.

9489. KANAGY, JOSEPH R. **Adsorption of water vapor by untanned hide and various leathers at 100°F.** *J. Research Natl. Bur. Standards* **38**, 119-28 (1947)(Research Paper No. 1763); *J. Am. Leather Chem. Assoc.* 42, 98-117 (1947).—*C.A.* **41**, 3311*i*.

Adsorption and desorption curves were detd. at relative humidities of 0-96%. Materials studied were com. hide powder (collagen), vegetable-tanned sole leather, the same degreased and washed to remove glucose, salts, etc., Cr-tanned hydraulic packing leather, Cr-vegetable-retanned upper leather, degreased, vegetable-tanned calf, and vegetable-tanned belting, all ground to less than 4 mm. Samples were first brought to equil. at 0% relative humidity over $MgClO_4$, in which condition they contained 0.12-0.94% H_2O (further loss at 100°C). Equil. (adsorption) was reached in 1 day at 11% relative humidity and in 6 days at 54% relative humidity. Adsorption curves were all of the sigmoid type previously found by other workers. The B.E.T. equation was found to apply at relative humidities up to about 33%.

9490. LANDLER, IVAN. **Chromatographic fractionation of some synthetic elastomers.** *Compt. rend.* **225**, 629-31 (1947).—*C.A.* 42, 2128*h*.

Three elastomers (GR-S, Perbunan, and Vistanex) were fractionated by filtration of their solns. in a poor solvent, viz., toluene contg. just too little MeOH to ppt. the elastomer, through a tube contg. 3 layers of an adsorbent mixt. of 75% gas black (80 m^2/g) and 25% active granulated carbon black. The column was washed with the same solvents. The 3 layers were sepd. and washed with true solvents (toluene, CCl_4, and C_6H_6); any of the absorbent mixt. carried into the soln. was centrifuged.

9491. LESSER, MILTON A. **Dishwashing detergents.** *Soap Sanit. Chemicals* **23**, No. 6, 43-6, 195 (1947).—*C.A.* 41, 4937*c*.

9492. MELIKZADE, M.M. AND IVANOVA, T.M. **Determination of quality of carbon black.** *Azerbaĭdzhanskoe Neftyanoe Khoz* **26**, No. 10, 11-12(1947)—*C.A.* 43, 3993*h*.

Methods were suggested for detn. of grit, ash, and moisture in carbon black. For detg. grit an app. was devised which eliminated variable results due to differences in stiffness of brush, hand pressure, etc. Ash was detd. on 8-10 g samples since those previously used (2 g) gave results within exptl. error. For detn. of moisture the temp. was raised from 105-10° to 125-30°C and the time of drying shortened from 2 hrs to 15 min.

9493. MULLINS, L. **Effect of stretching on the properties of rubber.** *J. Rubber Research* **16**, 275-89(1947).—*C.A.* 42, 2463*i*.

An extensive investigation was made of the effects of stretching under different conditions on the tensile stress-strain, stress relaxation, swelling, elec. cond., and elec. power factor of vulcanizates loaded with different types of reënforcing or stiffening fillers, including carbon black, whiting, colloidal clay, amorphous silica, and Mg carbonate.

9494. ODA, RYOHEI; FUZITA, TOSHIRO, AND KIDA, WASAKU. **Fillers for adhesives of urea resins. I. Effect of surface grooves on the adhesion strength. II. Effects of fillers.** *Chem. High Polymers* (Japan) 4, 31-2, 33-4 (1947).—*C.A.* **45**, 2712*h*.

Grooves were cut on a beech block in different directions. Adhesion strength was lowest when the grooves were cut parallel to the tensile direction. Various fillers, such as Bakelite carbon, ebonite, cement, active carbon, lignin, diatomaceous earth, and Al_2O_3 were added to adhesive paste. The decreases of adhesion strength were least when 10% Bakelite carbon powder was added. Cement and active charcoal were undesirable.

9495. PATTERSON, J.B. **Silicone resins in finishes.** *Org. Finishing* **8**, No. 4, 32-7(1947).—*C.A.* 43, 1214*a*.

With some silicones, the use of curing catalyst was detrimental to flexibility and heat aging. With others, catalysts were desirable for obtaining practical curing rates, gloss, hardness, mar-resistance, and freedom from thermoplasticity. These catalysts had no effect on discoloration other than the tinting effect of the metallic salt. The high curing temp. required for silicone resins did not eliminate the use of colors such as lithol and toludine reds. Those which discolored in alkyds at 300°F could be held at 400°F in silicone enamels for several hrs with no appreciable color change. TiO_2 enamels could be held at 500°F for as long as 100 hrs with no discoloration.

9496. PRESS, E.W.S. **Chromatographic analysis of accelerators.** *Trans. Inst. Rubber Ind.* **23**, 172(1947).—*C.A.* 42, 4788*c*.

Although complicating the analytical application of the chromatographic method, the evidence of Bloomfield did not invalidate the conversion of benzothiazoyl disulfide to mercaptobenzothiazole during vulcanization. The green color reaction with Co oleate was obtained in the acetone ext. before passage through alumina, and when a C_6H_6 soln. was poured onto the column, a clear zone was formed at the top before decompn. could occur on elution with EtOH.

9497. SIEMS, NORMAN E. **Paper-mill applications of activated silica sols.** *Paper Mill News* 70, No. 51, 80-1(1947).—*C.A.* 42, 1055*a*.

Applications of activated silica sols included raw water coagulation, stock conditioning, fiber and filler retention, white water treatment, and general mill water treatment.

9498. SODA, NORIMUNE. **The two kinds of boundary friction.** *Rept. Inst. Sci. Tech.* (Tokyo Univ.) 1, 50-9(1947).—*C.A.* 45, 3587*c*.

In ordinary friction observed at lower pressure there existed oriented or unoriented films of uni- or multimol. layers, whereas in the 2nd kind of friction whose coeff. was higher than the ordinary one, the absorbed mols. lost their properties as films. The second kind of boundary friction was found at higher pressure exerted perpendicularly at the boundary surface. In ordinary friction, the boundary surface was scarcely injured, while in the 2nd kind it wore out.

9499. TATSUNO, TSUNEO. **Bagasse as water-absorbing material.** *Rept. Taiwan Sugar Expt. Sta. (Formosa) No.* 1, 111-16(1947).—*C.A.* 42, 1031*i*.

Dried and powd. bagasse absorbed 20% of its weight of moisture from an atm. satd. at 25-30°C and retained 3-5 times its wt. of liquid water. A mixt. of 50g of the air-dry powder and 200 ml of a 20% brine of $MgCl_2$, when dried, absorbed 155% of its wt. of water from air of 100 relative humidity in 18 days. Pure $CaCl_2$ or $MgCl_2$ did not absorb as much under the same conditions.

9500. WATSON, JOHN H.L. **Observations of crystal structure and particle shape in electron micrographs of several carbon blacks.** *Trans. Electrochem. Soc.* 92, 13 pp.(1947)(Preprint).—*C.A.* 41, 6453*d*.

Electron micrographs were shown of the so-called amorphous carbon blacks. The effect of variable particle shape on mean particle diam. and specific surface calcns. was pointed out. All the exptl. evidence, including electron and x-ray diffraction data, suggested that the crystal particles were small graphitic units, and that the graphitic nature of the carbon black was a surface rather than a vol. phenomenon.

9501. WHITWELL, JOHN C. AND TONER, RICHARD K. **Predicting equilibrium moisture relations with particular reference to textile fibers.** *Textile Research J.* 17, 99-108(1947).—*C.A.* 41, 2904*d*.

Methods used in extrapolating exptl. equil. moisture regain data were discussed. Procedures were outlined by which an entire family of equil. curves could be predicted with a min. of exptl. data.

9502. WHITWELL, JOHN C. AND WILLMER, DAVID B. **Calculation of equilibrium moisture relations (with particular reference to low temperature conditions).** *Textile Research J.* 17, 664-9 (1947).—*C.A.* 42, 1429*e*.

Equil. moisture data for some textiles were extended to lower temp. regions than covered by expt. For any single isotherm (moisture-regain vs. relative-humidity) there were potentially two limiting lines if the temp. was below freezing, whereas there was only one point at freezing and only one line for any temp. above freezing.

9503. BASIAK, JAN AND NIEWIADOMSKI, TADEUSZ. **Carbon black.** *Przemysl Chem.* 4, 304-7(1948). —*C.A.* 42, 9123*a*.

The methods of producing carbon black in the U.S. and Europe were reviewed and the properties and uses of the principal com. grades given.

9504. BOWES, J. H. AND MORSE, G. O. **The use of salts in the finishing of sole-leather bends. III. The effect of magnesium sulfate, cane sugar, and glucose on the drying of leather and on the water content of leather at different relative humidities.** *J. Soc. Leather Trades' Chemists* 32, 343-54(1948).—*C.A.* 43, 427*h*.

Leather samples, immersed in satd. $MgSO_4$, 50% glucose, 50% sucrose, and satd. $MgSO_4$ plus glucose or sucrose, lost H_2O more slowly than leather immersed in H_2O, during the initial stages of drying at 20°C and 40 to 70% relative humidity. The H_2O content of leather at equil. with air of various relative humidities was affected as follows: 40% relative humidity, no effect; 70-75% relative humidity, increased slightly by $MgSO_4$ but not by sugars; 85-100% relative humidity, increased markedly by $MgSO_4$ and by the sugars. The increase in the presence of $MgSO_4$ plus glucose or sucrose was greater than with either alone.

9505. BRAENDLE, H. A.; STEFFEN, H. C., AND SHEPPARD, J. R. **Carbon pH and structure in rubber compounding.** *India Rubber World* 119, 57-62(1948).—*C.A.* 43, 892*d*.

The effects of new type of carbon blacks in rubber and GR-S depended not only on their fineness, as with previous standard types of carbon black, but also on 2 factors which have hitherto been relatively unimportant: high pH and sp. structure.

9506. BREMMER, G. M. AND COLPITTS, J. H. **Attempt to produce carbon black by fine grinding.** *Trans. Inst. Rubber Ind.* 24, 35-51 (1948).—*C.A.* 43, 1169*h*.

The ultimate particle size was little influenced by dry or wet grinding, aids such as stearic acid, naphthalene, S, and BzH, the gaseous atm. (N_2, CO_2, and C_2H_2), or the pressure (vacuum to 100 p.s.i. of CO_2). The particle size depended primarily on the raw materials, as shown by tests with anthracite coke, pitch coke, active charcoal, wood charcoal, coal, retort carbon, paraffin coke, sugar charcoal, and coke-oven cokes. In general, a particle size was reached by ball-mill grinding which remained unchanged by further prolonged grinding.

Ground coke was characterized by an extremely large surface area relative to the dispersable size. These observations were reconcilable if it was assumed that grinding produced extremely small particles, part of which grouped together and formed non-dispersable clusters.

9507. CATTON, N. L. AND THOMPSON, D. C. **Effect of carbon blacks on swelling of Neoprene GR-M-10 vulcanizates.** *Ind. Eng. Chem.* **40**, 1523-6(1948).—*C.A.* 42, 8515*f*.

The degree of swelling of Neoprene-C black vulcanizates in a petroleum oil depended on both the percentage of carbon black and the type. With increase in percentage vol. of carbon black, the swelling decreased relatively rapidly up to about 20% by vol., then decreased in simple proportion to the increase in loading. Above this crit. range, carbon black functions merely as a diluent. The greater the surface area of the black, the greater was this initial disproportionate decrease in swelling with increase in loading. The swelling was, in general, inversely proportional to the log of the surface area of the carbon black. The state of cure also affected the swelling, i.e., the longer the cure, the less was the swelling.

9508. CLARK, GEORGE L.; ECKER, ALFRED C. JR., AND BURTON, ROBERT L. **Commercial and experimental carbon blacks.** *Ind. Eng. Chem.* **41**, 201-8(1948).—*C.A.* 43, 1949*g*.

A crit. and quant. x-ray diffraction study was made of 66 carbon black samples. The measurements involved were primarily two interplanar spacings. No 2 carbon blacks gave even approx. the same x-ray pattern. A direct relationship was established between the ratio of the 2 cryst. dimensions which measured flatness of shape, and ease of processing of channel carbons and structural characteristics. Details were given for various carbon blacks and graphitic acids. One series of exptl. carbon blacks was subjected to correlative phys. electron-microscope, and x-ray tests. The electron-microscope particle was of the order of 25 primary crystallites measured from x-ray data.

9509. COHAN, LEONARD H. AND SMITH, ROBERT E. **The effect of pigments on the hardness of natural and synthetic rubbers.** *Rubber Age* (N.Y.) 63, 465-8(1948).—*C.A.* 42, 7083*i*.

If an elastomer contg. a pigment or filter was assumed to be a uniform elastic matrix contg. inelastic particles, its modulus could be calcd. At equiv. states of cure, hardness appeared to depend primarily on the percentage loading and on the particle shape and not to be influenced by particle size, cryst. structure, chem. nature of the particle surface, or chem. compn. of the pigment.

9510. COHAN, LEONARD H. AND SPIELMAN, RUSSELL. **Inorganic pigments in natural and synthetic rubber.** *Ind. Eng. Chem.* 40, 2204-10(1948).—*C.A.* 43, 1593*c*.

The behaviors in elastomers of $CaCO_3$ pigments was governed by the av. diam. of the particles, i.e., by the surface area of the pigments, in a manner similar to that already reported to be true of carbon blacks. When different inorg. pigments were compared, factors other than surface area, e.g., particle shape, cryst. structure, and nature of the surface, must be taken into account. A special study of the effect of different proportions of pptd. $CaCO_3$ showed that, with increase in loading, the resistance to tearing, stiffness, and hardness of natural rubber, GR-S, Hycar, Neoprene, and Butyl increased. The tensile strength of GR-S and Hycar increased considerably, that of natural rubber and Neoprene slightly, and that of Butyl decreased.

9511. CRANOR, D. F.; SNYDER, J. W., AND COBBE, A. G. **The vulcanizing characteristics of reënforcing furnace carbon.** *India Rubber World* **117**, 749-51, 797(1948).—*C.A.* 42, 4788*e*.

A major difference between furnace carbon blacks and channel blacks in rubber was their differing effects on the rate of vulcanization. With equal percentages of mercaptobenzothiazole, the mixt. contg. Statex-K vulcanized in about 0.5 the time required for that contg. EPC channel black. A reduction in mercaptobenzothiazole to compensate for this impaired the phys. properties. If the T-50 test and true coeff. of vulcanization were reliable criteria of the phys. state of cure, then modulus was not an index of the comparative states of cure of vulcanizates contg. carbon blacks with different degrees of reticulate chain structure (symmetry of particle aggregates).

9512. DANNENBERG, E. M. **Carbon black-loaded GR-S stocks. Relationship between reënforcement and swelling properties.** *Ind. Eng. Chem.* **40**, 2199-2202(1948).—*C.A.* 43, 2014*a*.

An exptl. study was carried out to ascertain the effects of various types of carbon black on the swelling of the elastomer component in unvulcanized and vulcanized GR-S mixts. The swelling of the elastomer component was not influenced significantly by the type of black. The fact that equil. swelling measurements did not indicate any strong interaction of a primary-valence type, did not exclude the possibility of weaker attractive forces or an undetectably small amt. of primary-valence cross-linking. Elastomer-C black systems should be regarded as simple phys. mixts.

9513. DOGADKIN, B.; PECHKOVSKAYA, K., AND DASHEVSKIĬ, M. **Structure and properties of filled rubber mixtures. III. Mixtures of sodium-butadiene rubber with channel black.** *Kolloid. Zhur.* **10**, 357-68(1948).—*C.A.* 43, 8188*c*.

The elec. resistivity *R* of mixts. of butadiene rubber with carbon black (av. particle size 35 mμ) was decreased 10-fold by good mixing. When the wt ratio (r) of carbon black to rubber increased from 0.2 to 0.4, *R* decreased from 1.8×10^8 ohm-cm to 1.8×10^5, while further increase of r to 0.6 lowered *R* to 1.5×10^6 only. Ohm's law was valid in all mixts. Presumable at $r > 0.2$, carbon black particles did not touch each other; between $r = 0.2$ and 0.4 they formed chains, and above $r = 0.4$ they gradually filled the space between the chains. Stearic acid (5%

of the carbon) slightly increased *R* and slightly decreased the swelling ability of the mixt.

9514. DOORENTZ, R. AND ETTEL, O. **Lignite filter ash as a binding material.** *Bauplan u. Bautech.* 2, 293-7(1948).—*C.A.* 45, 7768*i*.
The suitability of lignite filter ash as a binding material varied greatly depending on the origin of the coal and the type of combustion to which it was subjected. Setting proceeded probably with the formation of gypsum, silicic acid, or Ca carbonate. Steam-setting gave good results. The fine-grained fraction was the decisive factor in the process of setting, since the coarse grains contained carbon particles surrounded by a clinker film. Ash from low-temp. coke showed the best binding properties.

9515. DROGIN, I. **The effects of carbon blacks on the viscosity of rubber.** *Proc. Rubber Tech. Conf. London* **1948**, 17 pp.(Preprint).—*C.A.* 43, 7251*c*.
The effects of 24 carbon blacks and 4 inorg. fillers (barytes, pptd. $CaCO_3$, clay, and ZnO) on the viscosity of natural rubber were studied when mixed in a lab. Banbury machine (960 g rubber and 24 g carbon black and equal vols. of fillers, starting temp. 85°F). During the initial stages, the viscosity depended chiefly on the properties of the pigment, particularly on the size, surface, shape, structure, and the adsorptive capacity. The greater the surface area, oil absorption, and the diphenylguanidine adsorption, and the lower the nigrometer index, the higher was the viscosity after very short mixing times. The greatest change in viscosity occurred in the first 4 min., and the decrease was greater with a relatively fine pigment than with a coarse one. Viscosity measurements also indicated the extent of wetting and progress of dispersion of each pigment.

9516. DUFFY, GEORGE J. **New carbon black for the ink industry.** *Am. Ink Maker* 26, No. 11, 23-6 (1948).—*C.A.* 43, 1196*f*.
The use of liquid hydrocarbons as a raw material for furnace blacks resulted in the deposition of a very small amt. of partially polymerized, firmly bonded hydrocarbon on the surface of the blacks. This coating improved wetting and dispersing properties and corrected tendencies to settle out in light-bodied oils. The structure of these blacks enabled them to produce much better and bluer top tones, resulting in copy that was sharper, blacker, and cleaner.

9517. GENERAL TIRE & RUBBER CO. **GR-S black 1 and GR-S black 2.** *India Rubber World* **118**, 660-2(1948).—*C.A.* 42, 9230*g*.
GR-S black 1 and GR-S black 2 were masterbatches of GR-S and carbon black prepd. from GR-S latex and contg. 50 and 46 parts, resp., EPC black per 100 parts of solid GR-S. GR-S black 1 and GR-S black 2 had the advantages over mixts. of GR-S and EPC black prepd. by milling in that subsequent time of mixing was shorter, power consumption was less, operations were cleaner, optimum uniform dispersion of carbon black was assured, and storage and handling were simpler.

9518. GOBHIL, R. K.; GUPTA, A. C., AND ATHAWALE, D. Y. **High-temperature graphite lubricant-oil dag.** *Proc. Ann. Convention Oil Technol. Assoc. India* 3, 10-16(1948).—*C.A.* 45, 8751*f*.
The graphite should be ground and levigated so that it passed through a 300-I.M.M. sieve. Use of vegetable oil in place of mineral oil had no adverse effect for a product required for glass molds. Al soap of peanut oil (1.5%) was suitable as the emulsifying agent.

9519. GONGWER, L. F. **Clays for rubber.** *India Rubber World* **118**, 793-5(1948).—*C.A.* 42, 9226*h*.
The properties which clays impart to vulcanized rubber and Gr-S were shown by tabulated data of the results of tests of representative vulcanizates contg. so called hard and soft clays. The lower grit content of a clay showed the better the performance of the vulcanizate. Particle-size distribution was a contributing factor in the performance of the vulcanizate. In synthetic elastomers in particular, clays were outstanding in the reenforcement which they imparted in comparison with other nonblack fillers.

9520. GREGORY, J. N. AND NEWING, MARJORIE J. **Lubrication of metal surfaces by silicone films. Synthesis and analysis of chlorosilanes.** *Australian J. Sci. Research, Ser. A*, 1, 85-97(1948).—*C.A.* 43, 7219*d*.
Silicone films were prepd. on polished metal surfaces from mono- and di-ethyl- and mono- and di-isoamylchlorosilanes. Monocetylchlorosilane was unsatisfactory. The films could not be obtained by direct adsorption. The metal surface must first have adsorbed water. Cu, mild steel, Ag, and Pt were examd. The silicone layers reduced the coeff. of friction to values characteristic of good boundary lubrication even up to 200°C. The addn. of paraffin destroyed the wear resistance of the film on Ag but increased it on Pt. The films on Cu and mild steel were not affected. The hydrocarbon part of the mol. was turned outwards from the metal surface and was water-repellent.

9521. GWATHMEY, ALLAN T.; LEIDHEISER, HENRY JR., AND SMITH, PEDRO G. **Influence of crystal plane and surrounding atmosphere on some types of friction and wear between metals.** *Natl. Advisory Comm. Aeronaut., Tech. Note* No. **1461** 37 pp.(1948).—*C.A.* 42, 8041*c*.
The effect of crystal plane on dry static friction was detd. between 2 single crystals of Cu. The pull required to sep. a spherical crystal resting on a flat face was measured at room temp. after previously heating the crystals in H_2 to 500°C to remove any oxide present on the surfaces. The coeff. of friction between the (100) faces was greater than 100, and that between (111) faces was approx. 25. The atms. used were H_2, and N_2 contg. 0.2% O_2.

9522. HALL, R. H. AND MITTON, R. G. **The water absorption of vegetable-tanned sole leathers.** *J. Soc. Leather Trades' Chemists* 32, 331-43 (1948).—*C.A.* 43, 427*f*.
Water absorption was measured both by the conventional method (increase in wt of blotted specimen after 15 min. or 24 hr immersion) and

by change in apparent wt of a specimen suspended in H_2O from a balance arm. The latter gave results differing considerably from the former, owing to change in vol. of the leather on wetting, but permitted measurements at very short immersion periods. Absorption took place in 2 stages —a very rapid initial absorption, probably due to filling of capillaries, followed by a much slower absorption due to diffusion into the fibers and soln. of entrapped air.

9523. HIESTER, NEVIN; MCCARTHY, JOSEPH L., AND BENSON, H. K. **Separation of lignosulfonic acids from sulfite waste liquor by batch dialysis.** *Paper Trade J.* 126, No. 16, 58-61 (1948).—*C.A.* 42, 3953*e*.

Direct batch dialysis of sulfite waste liquor was carried out by a procedure which could be used to obtain purified Ca lignosulfonates in quantities sufficient to permit the substances to be lab. tested for various utilization applications. Other salts or lignosulfonate acids could be obtained by cation-exchange procedures by using appropriate resins. Analyses were given of products dialyzed for 213 to 335 hrs.

9524. JUNGBLUT, C. **The role of sulfur in machining lubricants.** *Rev. inst. franc petrole* 3, 307-12(1948).—*C.A.* 43, 3999*g*.

The incorporation of elemental S into fuel oils permitted these to be used as machining lubricants in the steel industry. Simple soln. of S in the oil was ineffective. On heating a mixture of S and oil to 250°C H_2S was evolved. Thus treated oils showed improved performance. The S in the oil formed a sulfide film on the metal surface to be machined, as shown by increased S in the metal. This layer facilitated oil wetting of the surface. The active S-content of an oil was detd. by finding the amt. of S deposited per unit time at standard temp. on a Cu powder prepd. by reduction of a $CuSO_4$ soln by Al.

9525. KAHN, J. M. **Application of a flocculation-type unit in paper-mill white-water treatment.** *Paper Trade J.* 127, No. 24, 57-9 (1948); *Tech. Assoc. Papers* 31, 136-8(1948).—*C.A.* 43, 1185*d*.

Provision was made for recirculation of previously treated white water and slurry so that coagulation of the suspended solids took place in the presence of previously formed floc. White water from a mill manufg. liner board and contg. 3 lb suspended solids, after treatment with alum and activated silica, had its 5-day B.O.D. reduced 59% and a reduction in suspended solid of 94%.

9526. KAJISAKI, CHIYOTOSHI; MIZUHARA, YUZO; HORI, KAZUHIKO, AND TANAKA, YASUO. **Effects of carbon on the coloring of porcelain. I. Preliminary tests.** *Bull. Govt. Research Inst. Ceramics* (Kyoto) 2, No. 1, 16-20(1948).—*C.A.* 46, 6351*i*.

Test pieces made of various clays, quartz, silica gel, diatomaceous earths, etc., were fired in an atm. of coal gas at 300°, 600°, and 900°C. The deposition of carbon was detd. by wt increase or by oxidizing carbon to CO_2 with H_2SO_4 + $K_2Cr_2O_7$. Deposition of carbon was observed not only on clays, but also on quartz, feldspar, diatomaceous earths, or silica gel. The contents of Fe or TiO_2 had no apparent relation to the amt. deposited. Test pieces of clay heated at 400°C in coal gas after preliminary heating at 300, 600, or 900°C in air showed more deposition than test pieces not preheated.

9527. KAJISAKI, CHIYOTOSHI; HORI, KAZUHIKO, AND TANAKA, JUN'ICHI. **Effects of carbon on the coloring of porcelain. II. Action of carbon monoxide on ferric oxide and titanium dioxide.** *Bull. Govt. Research Inst. Ceramics* (Kyoto) 2, No. 2, 39-42(1948).—*C.A.* 46, 6352*a*.

Pure Fe_2O_3 and TiO_2 and their mixts. were heated in CO at 900-950°C for 1 hr, and the amt. of carbon deposited was detd. TiO_2 had only slight decompn. activity on CO compared with Fe_2O_3, which showed its highest activity at 450-550°C.

9528. KAJISAKI, CHIYOTOSHI; HORI, KAZUHIKO, AND TANAKA, JUN'ICHI. **Effects of carbon on the coloring of porcelain. III. Behavior of carbon before and after the sintering of bodies.** *Bull. Govt. Research Inst. Ceramics* (Kyoto) 2, No. 2, 43-46(1948).—*C.A.* 46, 6352*b*.

Tests pieces made of porcelain bodies, i.e., mixts. of china stone and feldspar, were heated at 1250°C in mixts. of N_2 and coal gas. The deposition of carbon depended largely on the compn. and flowing speed of the gas. The limiting porosity was found to be about 5%, and each body had its own limiting temp. where this limiting porosity was attained. If decarbonizing reactions occurred at this temp., the body bubbled, and if not, it sintered and became colored. To avoid coloring by carbon, therefore, the decarbonizing reaction should be completed before reaching the limiting temp.

9529. KANAGY, JOSEPH R. AND CHARLES, ARBELIA M. **Effect of temperature and time on the weight loss of leather.** *J. Am. Leather Chemist's Assoc.* 43, 274-93(1948).—*C.A.* 42, 8507*e*.

Samples of standard hide powder and of 9 different types of com. leathers were heated at various temps. in a Brabender moisture tester. At 80°C equil. was attained in 4-6 hrs for all leathers except sole leather. At 100°C and above the wt-loss increased slowly with time of heating. For the leather samples the wt-losses detd. by heating to equil. at 80°C were generally only slightly lower than those detd. by extrapolating the straight-line portions of the 100°C-curves to zero time. These results indicated that the equil. at 80°C represented the liberation of nearly all of the adsorbed water from the leather.

9530. LOUTH, GEORGE D. **Determination of free carbon in compounded rubber and synthetic elastomers.** *Anal. Chem.* 20, 717-19(1948).—*C.A.* 42, 8512*a*.

Add 10 ml 1,1- 2,2-tetrachloroethane to 0.1-0.15 g sample, heat until the latter is well softened, add 15 ml boiling HNO_3 (d. 1.42), simmer until the sample is completely decompd. and the carbon black thoroughly dispersed. Cool to 20°C, add 25 ml Et_2O (agitation), allow to stand until 2 layers form, decant the top layer through a Gooch crucible, repeat until the top layer is colorless, after the final decantation, wash down repeatedly with 5 ml acetone and Et_2O, wash with Et_2O, dry the Gooch crucible 30 min. at 250-300°C, cool, weigh. Heat at 900°C, cool, weigh, and calc. loss in wt as free carbon black.

9531. Madigan, J. C. and Adams, J. W. **Latex-incorporated carbon black for synthetic rubber.** *Chem. Eng. Progress* 44, 815-20(1948).—*C. A.* 43, 894*c*.

The process for the incorporation of carbon black in GR-S latex at the synthetic rubber plant was discussed. Expanded use of this type of product was forseen, and the research efforts now being expended on the problem promise continued improvement in quality and reduction in cost.

9532. Morris, Ross E. and Hollister, Joseph W. **Carbon-black dispersion in rubber. Effect of fatty acids.** *Ind. Eng. Chem.* 40, 2325-33 (1948).—*C. A.* 43, 1599*f*.

Adsorption isotherms of stearic acid and other long chain aliphatic acids on various types of carbon blacks were detd. In most cases heptane was the solvent, but in some cases benzene and cyclohexane were used. Considerably more acid was adsorbed by channel blacks from heptane and cyclohexane than from benzene solns. The adsorption isotherms for the acids on channel black on a molal basis came close to coincidence. In general, the finer the black, the greater the adsorption of stearic acid, but the amt. of adsorption was influenced also by the surface condition of the blacks. Stearic acid had little, if any, effect on the dispersion of these types of carbon black and butyl rubber.

9533. Paetsch, Hildegard. **Examination of carbon black in the rubber industry.** *Kautschuk u. Gummi* 1, 241-4, 277-80(1948).—*C. A.* 43, 6454*g*.

A review with special reference to methods of analysis, and data on German and other carbon blacks was presented.

9534. Parkinson, D. and Blanchard, A. F. **Factors influencing the configuration of carbon particles.** *Trans. Inst. Rubber Ind.* 23, 259-79 (1948).—*C. A.* 42, 8008*g*.

Rubber-carbon black mixts. contg., resp., no addnl. ingredient, urea, thiourea, and benzidine were heated 20 and 60 min. at 158°C; corresponding unheated mixts. were prepd. All 12 mixts. were converted to a tire-tread type of mixt., vulcanized, and tested for phys. properties. The vulcanizates prepd. from the unheated mixt. contg. urea, thiourea, and benzidine, from the mixts. contg. the 3 agents heated 20 min., and from all mixts. heated 60 min. had many times the elec. resistance of the vulcanizate prepd. from the unheated mixt. contg. no agent. All 3 agents also increased the resilience and hardness.

9535. Ramsauer, Rembert. **Physical problems of frictional resistance. II. Energy considerations in frictional resistance.** *Kolloid-Z.* 111, 145-55(1948).—*C. A.* 43, 6879*e*.

In the case of metallic faces in vacuo the surface atoms approached within crystal distances, so that for a tangential strain appreciable forces must be overcome. The reduction in friction caused by a lubricant was due to the reduction in shear strength of the surfaces. Ordering was promoted by adsorption on the surfaces. Beyond this adsorbed film and depending on the strength of the intermol. forces, other ordered layers were produced having a quasicryst. condition with favored glide planes parallel to the surface.

9536. Sengoku, Tadashi; Iki, Sataro, and Nishizawa, Shingo. **Studies on carbon black. II. Property of various kinds of carbon blacks.** *J. Soc. Rubber Ind. Japan* 21, 26-31 (1948).—*C. A.* 42, 9228*b*.

Sixteen samples of carbon black obtained by 7 different manufg. methods were compounded in different proportions in rubber. The reinforcing effect was detd. The I_2 adsorption values of the carbon blacks also were detd. to find the relation between I_2 absorption and reinforcing effect. No definite relation was found.

9537. Sengoku, Tadashi and Nishizawa, Shingo. **Studies on carbon black. III.** *J. Soc. Rubber Ind. Japan* 21, 56-60(1948).—*C. A.* 42, 9228*b*.

The vulcanizates contg. the 16 kinds of carbon black were tested for abrasion, heat resistance, aging, and resistance to oil.

9538. Serfass, Earl J.; Theis, Edwin R.; Thorstensen, Thomas C., and Agarwal, Raj. K. **Chrome liquors. XIII. An investigation of anion penetration through the use of ion-exchange resins and diffusion measurements.** *J. Am. Leather Chemists' Assoc.* 43, 132-65(1948). —*C. A.* 42, 7075*e*.

Na salts of org. acids were added in various amts. to 33% basic Cr sulfate solns. prepd. by SO_2 reduction of $Na_2Cr_2O_7$. The solns. were dild. to 1% Cr_2O_3 and aged at 70°F. Samples were taken at various time intervals for examn. by cationic exchange resin and diffusion techniques. Sample aliquots were shaken 1/2 hr with Ionac C-200 resin. The resin was washed free of unadsorbed Cr with water, and Cr and sulfate were detd. in the combined wash and filtrate. Cationic Cr was stripped from the resin with 6 *N* H_2SO_4, and Cr and org. anion present in the cationic complex were detd. in the acid soln.

9539. Skoczynski, Wladyslaw and Szostak, Tadeusz. **Production of carbon black in Poland.** *Przemysl Chem.* 4, 307-9(1948).—*C. A.* 42, 9122*i*.

The properties and uses of the various grades of carbon black were reviewed and the methods used by 2 Polish producing plants were described in detail.

9540. Smith, W. R. and Schaeffer, W. D. **The nature and activity of carbon-black surfaces.** *Proc. 2nd Rubber Technol. Conf.* (London) **1948**, 403-13; *Rubber Chem. & Technol.* 23, 625-34(1950).—*C. A.* 44, 3332*d*; 45, 2650*f*.

The electron-microscope and adsorption-isotherm techniques for evaluating the particle size and surface area of carbon blacks showed that reinforcement could not be interpreted by these methods alone. The activity of the surface also must be taken into account and heats of adsorption offered a means of doing so. The differential heats of adsorption for N_2 and for a series of C_4 hydrocarbons on a group of carbon blacks of differing reinforcing power in rubber were measured. Surface activity decreased with increase in surface coverage. The magnitudes of the initial heats paralleled the reinforcing properties of the carbon blacks. The surface activity and reinforcing power of an MPC type of carbon black was greatly reduced by subjection to high temps. Aldehyde and carboxyl radicals in high concn. and hydroxyl radicals in almost as high concn. were observed.

9541. SODA, NORIMUNE AND MIYAGAWA, YUKIO. **The mechanical transition temperatures. (Fundamental studies on the combination of bearing metals.)** *Rept. Inst. Sci. and Technol. Univ. Tokyo* **2**, 23-30(1948).—*C.A.* **45**, 6373*d*.

Sliding friction was measured for the pairs of Cu-Cu, Ni-Ni, Cu-Ni, and soft iron-soft iron lubricated with normal aliphatic acids of C_4-C_{16}. The mech. transition temps. where stick-slip changes to smooth sliding were different for each pair of metals. Those for soft iron pair were the highest and fairly coincident with the transition temps. observed by electron diffraction, where mols. adsorbed on the metallic surface lost their orientation only by thermal agitation.

9542. SODA, NORIMUNE AND MIYAGAWA, YUKIO. **Thermal limitation in thin-film lubrication of oils.** *Rept. Inst. Sci. and Technol. Univ. Tokyo* **2**, 49-57(1948).—*C.A.* **45**, 6373*e*.

Three kinds of transition temps. were found for sliding friction of metallic surfaces lubricated with thin films of normal aliphatic acids of C_4-C_{16}. At the lowest one T_n smooth sliding changes to stick-slip, which was due to the disappearance of orientation of adsorbed mols. The second one T_o, where stick-slip changed to smooth sliding, was concluded to be due to the oxidation of the lubricant oil and the formation of an orientated film of the oxidation product. At the highest one T_d smooth sliding changed again to stick-slip, increasing the amplitude with temp. and at last it changed to irregular and fluctuating friction characteristic of dry metallic friction.

9543. STUART, A. H. **The adhesion of paint films—some fundamental principles.** *Paint Manuf.* **18**, 347-9(1948).—*C.A.* **43**, 869*b*.

Some of the basic principles which made for good adhesion were stressed. A few lab. tests were reported.

9544. TAYLOR, THOMAS G. **Effect of carbon black and black ion oxide on air content and durability of concrete.** *J. Am. Concrete Inst.* **19**, 613-24(1948).—*C.A.* **42**, 6076*d*.

Carbon black and black iron oxide added to concrete mixts. as coloring agents were tested for effects on air content of concrete, resistance to freezing and thawing, and surface scaling. A general reduction of air content of concrete was found. Effects on strength were variable.

9545. TRILLAT, J. J. **Molecular adsorption and the state of the lubricated surface.** *Bull assoc. franc. techniciens petrole No.* **69**, 17-44(1948).—*C.A.* **43**, 1953*b*.

The adsorption of lubricating films showed the influence by the mol. structure of the oil (especially when modified by additives such as oleic or stearic acids) and the phys. and chem. properties of the metal surface.

9546. ALLEN, E. M.; GAGE, F. W., AND WOLF, RALPH E. **Compounding of natural rubber with a new fine-particle silica.** *Rubber Age (N.Y.)* **65**, 297-303(1949).—*C.A.* **43**, 7251*a*.

Hi-Sil, a hydrated form of silica, had an av. particle size of 0.025 and d. of 1.95. Tests in various proportions in natural rubber mixts. contg. different accelerators showed that it imparted to vulcanizates high tensile strengths, good resistance to abrasion, and high resistance to tearing. In general, it imparted better quality than did any other com. filler other than carbon black. Because of its high adsorptive capacity, higher proportions of accelerator and stearic acid than normally used with ordinary fillers were needed in many cases.

9547. AMBORSKI, LEONARD E. AND GOLDFINGER, GEORGE. **Mechanism of reinforcement. III. Viscosity of carbon black suspensions in GR-S solutions.** *Rev. trav. chim.* **68**, 733-44(1949) (in English); *Rubber Chem. & Technol.* **23**, 803-11(1950).—*C.A.* **44**, 4277*i*; **45**, 8800*a*.

The technique for measuring the viscosities of suspensions of different concns. of carbon blacks in xylene solns. of different concns. of GR-S was described. It was possible to det. the thickness and rigidity of the GR-S layer and the shift in concn. of GR-S with respect to solvent. However, carbon black spheres surrounded by GR-S were not rigid nor was the GR-S soln. continuous, but by measuring viscosity at various rates of shear and extrapolating to zero shear, both these difficulties were minimized. The thickness of the adsorbed layer of GR-S on the carbon black particle was of the order of 150-200 A., in agreement with electron microscopic examn.

9548. BADDELEY, A. R. W.; NISSAN, A. H., AND GARNER, F. H. **Detergency of carbon black in hydrocarbons solution. I.** *J. Inst. Petroleum* **35**, 141-70(1949).—*C.A.* **43**, 5933*d*.

With increasing concns. of Ca naphthenate a more uniform rate of settling was obtained. The adsorption of Ca naphthenate on the carbon black (Micronex) was detd. by measuring the concn. of Ca naphthenate in the clear soln. from which the black had settled out; force-area curves obtained on the Langmuir trough were used to det. the concn. The degree of dispersion measured in this way and the adsorption of Ca naphthenate on the carbon black approached a max. at about 0.188% Ca naphthenate in toluene. With the series of suspensions of Micronex ranging from 0.1 to 1 g in 25 ml of soln., the max. adsorption was reached in all cases at about the same figure, 0.094 to 0.188% concn. of Ca naphthenate in toluene.

9549. BARNETT, C. E. AND JONES, H. C. **Role of adsorption in reinforcement of GR-S.** *Ind. Eng. Chem.* **41**, 1518-22(1949).—*C.A.* 43, 8188*h*.
Non-carbon pigments affected the reinforcing properties of GR-S in a manner which was related to the surface activity of the pigment. Extended studies of GR-S with basic $ZnCO_3$ calcined over a range of temps. showed that tensile strength reached a max. at 350°C calcination for the $ZnCO_3$ and thereafter declined at higher temps. Adsorption studies of toluene-GR-S-pigment cements were made by aging and centrifugation, followed by analysis of the sepd. pigment. The effects of Ca silicate, ZnO, $ZnCO_3$, $Al(OH)_3$, Al_2O_3, MgO, and various carbon blacks on tensile strength, % elongation, modulus, % permanent set, Shore hardness, soln. viscosity, etc., of the GR-S polymers recovered from the cements were summarized.

9550. BIKERMAN, J. J. **Effect of surface roughness on rolling friction.** *J. Applied Phys.* **20**, 971-5(1949).
The minimum tilt at which bearing balls rolled down an inclined plate of stainless steel was greater for rough than for smooth surfaces. The balls used were between 0.159 and 0.635 cm in radius. Capillary attraction presumably did not interfere as superficial drying of the system had no effect. Surface roughness, which was the cause of Coulomb's sliding friction, seemed to cause also rolling friction at low pressures.

9551. COTTON, P. **Spreading of oils over the surfaces of gold and silver films.** *Research (London), Suppl., Surface Chemistry* **1949**, 233-8(in French)(English summary).—*C.A.* 43, 8799*a*.
Au and Ag films were deposited by evapn. and cathodic sputtering on polished surfaces of glass, quartz, or mica. Spreading of a nonpolar paraffin oil and 2 fatty acids (C_9 and C_{18}) on these metal films was studied in dry and in moist air, in a closed chamber. The nonpolar oil in dry air showed no appreciable variation of spreading speed with film thickness; in air satd. with water vapor, spreading took place as in dry air on films having a thickness of more than about 15 A., whereas no spreading was observed on films of less than 10 A. thickness. The polar oils failed to spread in dry air on thick metal films; whereas below a crit. film thickness, slow spreading took place. The different properties of thinner films were attributed to the characteristic "hedgehog" structure of the microcryst. metal films.

9552. DANNENBERG, E. M. AND STOKES, C. A. **Characteristics of reinforcing furnace blacks. Processing shrinkage.** *Ind. Eng. Chem.* **41**, 812-17(1949).—*C.A.* 43, 4887*a*.
An extrusion shrinkage test was described by means of which processing characteristics of rubber mixts. contg. carbon black was studied. The effects of furnace blacks on the processing of rubber and GR-S were studied with special reference to shrinkage and scorching or initial rate of vulcanization. The manuf. of a furnace carbon black which did not tend to make rubber mixts. abnormally scorchy was practicable, and results were given obtained with such a carbon black in rubber mixts. accelerated by mercaptobenzothiazole. The ability of carbon blacks to reduce shrinkage in processing was discussed.

9553. DERYAGIN, B. V. AND ZAKHAVAEVA, N. N. **The stability of thin lubricant films deposited on solid surfaces.** *Kolloid. Zhur.* **11**, 230-1(1949). —*C.A.* 44, 828*f*.
Lubricant was deposited on solid surfaces and then blown off so that only a thin wedge remained; its thickness was detd. interferometrically. The wedge of turbine oil contg. Al oleate, Al stearate, or $BuOCH{:}CH_2$ polymer was more stable on steel than on glass or Cr coating. This explained why lubrication of Cr surfaces was difficult.

9554. DOSCHER, TODD M. **Characteristics of detergent-suspended clays.** *J. Phys. & Colloid Chem.* **53**, 1362-71(1949).—*C.A.* 44, 6607*e*.
Addn. of some nonionic detergents (polyethylene oxide derivs. of an alkylphenol, sorbitol oleate, and tall oil), petroleum oil, and $CaCl_2$ to clay suspensions produced stable dispersions which possessed relatively low visocosities, gel strengths, and fluid losses. The effective nonionic detergent differed from other nonionic detergents in the interaction of polar ends and relatively high polarity of nonpolar ends. Addn. of alcs. which were adsorbed preferentially led to breakdown of the suspensions. The detergent-suspended clays were used in the drilling of oil wells.

9555. DROGIN, ISAAC; BISHOP, HESTER R., AND WISEMAN, PAUL. **High-temperature mixing of fully reenforcing carbon blacks in synthetic and natural rubbers. II.** *India Rubber World* **121**, 57-66(1949).—*C.A.* 44, 362*g*.
The effects of mixing S and carbon blacks in GR-S and natural rubber at 375°F were compared with the effects at conventional temps. Mixing of GR-S X-478 (made at 41°F) at high temps. (around 375°F) involved lower power consumption and resulted in higher viscosity, little increase in shrinkage with furnace blacks and no difference with channel black, less tendency to scorch with furnace black, more tendency with channel black, more bound polymer and gel with channel black and slightly less with furnace black, higher stress modulus, and little change in hardness and tensile strength.

9556. GODFREY, DOUGLAS AND NELSON, ERVA C. **Oxidation characteristics of molybdenum disulfide and effect of such oxidation on its role as a solid-film lubricant.** *Natl. Advisory Comm. Aeronaut., Tech. Note No.* **1882**, 28 pp. (1949). —*C.A.* 43, 6816*g*.
Expts. were conducted with an app. that caused a spherical rider to slide in a spiral path on a rotating disk at velocities between 50 and 8,000 ft per min. and a load of 269 g (126,000 p.s.i., initial Hertz surface stress). A coating of MoS_2 serving as a high-temp. solid-film lubricant maintained low coeff.-of-friction values during its oxidation to MoO_3 as long as an effective subfilm of MoS_2 remained. Films of

MoO_3 alone produced very high friction. MoS_2 began to oxidize slowly in air at 750°F, the rate increasing steadily and becoming high at 1050°F. In vacuum MoS_2 maintained its original structure at 1000°F.

9557. GUSTAVSON, K. H. **Helpful hints in analysis of chromium compounds by means of ion exchangers.** *J. Am. Leather Chemists' Assoc.* 44, 388-92(1949).—*C.A.* 43, 7863*a*.

Some of the apparently insignificant details associated with the chromatographic study of the various complexes formed in Cr salts were of real importance. The effect on accuracy of the degree of fineness of the exchanger, variations in cation content, rate of filtering, size of large complexes, interaction with the phenolic groups of the molecules, the presence of "zwitter ions," etc., were described.

9558. GUSTAVSON, K. H. **Study of the formation of complexes in concentrated solutions of basic chlorides and sulfates (of chromium) by means of ion exchange and by spectrophotometric methods, and their action on collagen.** *Union intern. socs. chimistes inds. cuir, Congr. intern.* 1, 21-45(1949).—*C.A.* 45, 3632c.

9559. HEINLEN, W. H. JR. **An acceleration study using reënforcing furnace blacks in natural rubber treads.** *Rubber Age (N.Y.)* 65, 431-4 (1949).—*C.A.* 43, 7251*h*.

Expts. showed that the tendency of rubber mixts. contg. reënforcing furnace black to scorch could be minimized by using aliphatic thiazoyl disulfides for acceleration and N-nitrosodiphenylamine as retarding agent, without detriment to the phys. properties of the resulting vulcanizates.

9560. JAMAIS, J. **Bloating of clays at high temperatures.** *Bull. soc. franc. céram.* 1949, No. 5, 32-36.—*C.A.* 46, 5804*d*.

Bloating was caused not only by entrapped air, but by gas emitted from (1) carbonaceous material, (2) carbonate and sulfate salts, (3) Fe oxide being reduced to a lower state, and (4) decompn. of certain accessory clay minerals, such as mica.

9561. MARCELIN, A. **Boundary films. The solid/solid boundary and the lubricating films.** *Research (London), Suppl., Surface Chemistry* 1949, 223-31(in French)(English summary).—*C.A.* 43, 8799*d*.

A thick layer ensured perfect hydrodynamic lubrication. This layer became progressively thinner under increasing load or decreasing speed until it reached a min. crit. thickness of about 1μ. The min. liquid film, corresponding to the 2nd stage, was remarkable for its stability when the relative speed of the metal surfaces became extremely small or even zero; the film could resist pressures up to 100 kg/cm^2 without being crushed. When the crit. load was passed, the min. liquid film suddenly collapsed. Then lubrication was provided by means of stratofilms formed by the superposition of one or more double layers of mols. In this stage, wear and tear of metallic surfaces took place.

9562. MILL, C. C. AND BANKS, W. H. **Interpretation of oil absorption of pigments.** *J. Oil & Colour Chemists Assoc.* 32, 599-609(1949).—*C.A.* 45, 365*f*.

Various theories of the absorption of oil by a pigment were presented and analyzed. Oil absorption was essentially a measurement of the oil required to fill the interstices of the particles of a surface-coating. There were several voidage concepts: a partial filling of the spaces created by spherical particles in a plane surface by the formation of liquid menisci, or by the complete filling of the total space. Other concepts were the complete filling of voids created by particles lying immediately above another, thereby giving a max. void, or the filling of voids created by particles that took the shape of a rhomboid thereby giving a min. void.

9563. MULLER, OSCAR P.; JORDAN, J. W., AND BRANCATO, J. J. **Bentonite flatting and gelling agents.** *Official Digest Federation Paint & Varnish Production Clubs No.* 294, 451-62(1949).—*C.A.* 43, 8704*e*.

Long-chain amine bentonites contg. 8, 18, and 34 C atoms (prepd. by the base-exchange reaction $Na^+bentonite^- + amine^+Cl^- \rightarrow$ amine bentonite + NaCl) displayed the following swelling properties: C-8, a low swelling type, giving uniformly dispersed particles suitable for flatting purposes; C-18, a high swelling type, providing max. gelling efficiency in mixts. of polar and nonpolar solvents; and C-34, a high swelling type with distinct properties of thickening coating compns. in which petroleum solvents were the sole thinner. C-18 could be used for the prepn. of solvent-type cleaning fluids and paint removers.

9564. NAGAI, YUSABURO AND HASEGAWA, HIROSHI. **Studies on the oiliness of lubricating oils. I. Frictional coefficients of lubricant oils at various temperatures.** *Rept. Inst. Sci. and Technol. Univ. Tokyo* 3, 15-18(1949).—*C.A.* 45, 6374*c*.

Degeneration of oils at the frictional surface was either due to the oxide films and O_2 adsorbed at the frictional surface, or due to the O_2 contained in the oils.

9565. NAGAI, YUSABURO AND HASEGAWA, HIROSHI. **Studies on the oiliness of lubricating oils. II. The influence of purification upon frictional coefficients of degenerated lubricant oils.** *Rept. Inst. Sci. and Technol. Univ. Tokyo* 3, 54-6(1949).—*C.A.* 45, 6374*d*.

In the case of oils contg. comparatively large quantities of polar substances the frictional coeff. decreased by repeated measurements and converged to a stationary value. With oils contg. extremely small quantities of polar substances the frictional coeff. decreased successively without limit. With purified oils it increased at first slightly and soon came to a stationary value.

9566. ODA, RYOHEI AND SHIMIZU, HIROSHI. **Cation-exchange resin from natural rubber. VI. Drying conditions and decrease of exchange capacity. VII. Summary of manufacturing conditions and characteristics of the resin.**

Chem. High Polymers (Japan) 6, 29-30(1949).—*C.A.* 46, 1184*h*.

H_2SO_4 produced during the thermal drying of the resins, was attributed to the decompn. of SO_3H groups in the resins. The sum of the free H_2SO_4 and the cation-exchange capacity of the heated resin was nearly const.

9567. Parkinson, D. **Reënforcing furnace blacks.** *Trans. Inst. Rubber Ind.* 24, 267-73(1949).—*C.A.* 43, 7251*i*.

Developments in the manuf. of various types of carbon black were reviewed and their comparative properties discussed. Unpublished work indicated the possibility that the crystallite size of carbon black played a part in its reënforcing properties and that a strongly reënforcing carbon black was characterized by a combination of small particles and small crystalite within the particles.

9568. Perchet, R. **Use of activated alumina as an adsorbent.** *Génie civil* 126, 208-9(1949).—*C.A.* 43, 9296*d*.

Advantages and applications were discussed, particularly its use in reclaiming transformer oils.

9569. Roga, B. and Szuba, J. **Physicochemical properties of gas blacks.** *Przemysl Chem.* 5(28), 357-64(1949).—*C.A.* 45, 10556*a*.

The properties of a no. of Polish gas blacks were investigated and an attempt was made to correlate the data with tests carried out on a no. of prepd. rubber samples contg. gas black. Physicochem. data such as adsorptive capacity, heat of wetting, ignition point, and activity could be used in production control as well as in carrying out a rough selection of gas blacks for use in rubber mixts.

9570. Roux, D. G. **The purification of black wattle tannin and its effect on combustion analyses.** *J. Soc. Leather Trades' Chemists* 33, 393-407(1949).—*C.A.* 44, 2781*c*.

Combustion analyses were made on wattle tannin, extd. from fresh bark with MeOH, and freed as far as possible from nontannins and oxidized materials by one or a combination of the following methods: sorption of tannin on hide powder, washing, and partial stripping with 50% aq. MeCO. A second and third stripping gave darker products. Pptn. with $Pb(OAc)_2$, centrifuging, suspending the ppt. in H_2O and treating with H_2SO_4 or $(COOH)_2$ to ppt. Pb and leave a tannin soln. (pH 3).

9571. Schneider, C. G. **Polymeric phosphate in tanning.** *Am. Leather Chemists' Assoc.* 44, 596-604(1949).—*C.A.* 43, 9509*i*.

Hide powder was treated with polymeric Na metaphosphate (Calgon) in H_2SO_4 at pH 3.7 and 2.25. The latter gave a fixation of Calgon almost equiv. to the acid-combining power of the protein.

9572. Siesholtz, Herbert W. and Cohan, Leonard H. **Calcium carbonate extender pigments.** *Ind. Eng. Chem.* 41, 390-95(1949).—*C.A.* 43, 6836*b*.

The effects of particle size of $CaCO_3$ extenders on the phys. properties of paints were studied. The low-n $CaCO_3$ pigments used in the expts. ranged in particle size from 0.05 to 3.9μ. Five pigments in 3 paint formulations were studied and compared with an unextended TiO_2 enamel. The gloss, lightness, and hiding power of the paint films increased with reduced particle size of the extender pigment. Despite the lower opacity in oil, the hiding power of the ultrafines was doubtless enhanced by their improved dispersive action. Decreasing particle size of the $CaCO_3$ extender resulted in a regular increase in the consistency and yielded values of the fluid paints. Graphs of the rheological properties and a math. discussion were presented.

9573. Stokes, C. A. and Dannenberg, E. M. **Carbon blacks—comparison of a fully reinforcing furnace black and easy processing channel black.** *Ind. Eng. Chem.* 41, 381-9(1949).—*C.A.* 43, 6855*a*.

Rubber compounding tests with a com. fully reinforcing furnace black and an easy processing channel black showed a greater tendency of the furnace black stocks to cause scorching. This was thought to be related to a difference in surface constitution, as evidenced by the distinctly greater elec. cond. of the furnace black. Other phys. properties of the rubber compds. were practically identical. Tire treads made with each type of carbon black had similar road-wear performance. These data were significant because of the inherent manufg. difficulties in producing channel black.

9574. Sveda, Michael. **New silica for floor wax. II.** *Soap Sanit. Chemicals* 25, No. 8, 115-17(1949).—*C.A.* 43, 7724*e*.

"Ludox" colloidal silica contained 30% SiO_2 in aq. soln. Light scattering technique was used in detg. its av. mol. wt of 2 million. In combination with shellac, manila gum, and waxes with small particle size, it gave high skid-resistance and also increased gloss and decreased tackiness in water waxes. Freeze resistance was obtained by use of ethylamine. An electromicrographic technique was developed for studying the surface of wax films.

9575. Sweitzer, C. W.; Goodrich, W. C., and Burgess, K. A. **The carbon black gel complex in cold-rubber reenforcement.** *Rubber Age* (N.Y.) 65, 651-62(1949).—*C.A.* 43, 9515*d*.

The carbon black gel complex was the C_6H_6-insol. rubber formed in unvulcanized rubber-carbon black mixts. Many factors detd. the % gel formed. The temp. of mixing had the greatest effect; particle size, structure factors and a specific surface activity of the carbon black influenced the rate of formation of the gel. This activity could be estd. by the behavior of the carbon black toward O_2. Carbon blacks which were highly active in gel development must be mixed at relatively low temps. to avoid scorching; carbon blacks which had only normal activity attained an adequate gel level for full reinforcement with normal high-speed mixing.

9576. Tabor, D. and Tingle, E. D. **Surface attack of metals by fatty acids and the formation of lubricating layers.** *Research (London)*, *Suppl., Surface Chemistry* **1949**, 217-22 (in English and French).—*C.A.* 43, 8799*h*.

Fatty acids were no more effective as boundary lubricants on Ag or Pt than paraffins or alcs. of corresponding chain length. On reactive metals, friction and surface damage remained low up to the softening point of the metallic soap formed at the surface. Lateral adhesion between the lubricant mols. was assumed to be of primary importance in providing lubrication. Phys. adsorption of the mol. at the metal surface was only of secondary importance. Friction expts. on surfaces from which the oxide film had been removed indicated that this reaction did not occur directly with the metal, even in this case of electroneg. metals. Adequate soap formation required the presence of water during the formation of oxide film.

9577. TAYLOR, C. L. **British-made carbon black with special reference to the manufacture of "Seval."** *Petroleum Times* 53, 10-11(1949).—*C.A.* 43, 2407*b*.

The manuf. of Seval, a medium carbon black, by cracking hydro-carbon fuel in checker-brick-type furnaces was described.

9578. TUCK, D. H. **The dyeing of leather.** *J. Soc. Dyers Colourists* 65, 386-9(1949).—*C.A.* 43, 8184*i*.

Basic dyes were employed mainly for dyeing vegetable-tanned leather, all the loose tannin being first fixed with tartar emetic, K Ti oxalate, etc., and for dyeing mordanted chrome leather. Basic dyes yielded very full, rich, powerful surface dyeing, with dyeings fast to perspiration. Disadvantages include lack of penetration and accentuation of grain defects. Acid dyes were applicable to all types of leather. The pH was lowered, generally with HCO_2H to obtain fixation; conversely, by raising the pH with NH_4OH the acid dyes could be made to penetrate. Oil and CH_2O leathers might require application of a chrome alum mordant prior to dyeing with acid dyes.

9579. VULPESCU, GH. **The industrial utilization of glass-wool filters in carbon black factories.** *Rev. Teh. AGIR* 3, 208-11(1949).—*C.A.* 44, 11066*c*.

Glass-wool filters were used at the carbon-black plant near the natural-gas fields of Copsa-Mica. The glass wool effectively retained the fine solid matter which otherwise would cause trouble in the distributing pipes. The initial cost of the glass wool, which is manufd. in Rumania, was low and the flow rates used were similar to those used with elec. filtering devices.

9580. WATSON, JOHN H. L. **The morphology of carbon-black particles in shadowcast specimens.** *J. Applied Phys.* 20, 747-54(1949).—*C.A.* 43, 9418*f*.

A reticulate chain structure was favored for carbon black. The discovery of "hollow" particles in carbon black dispersions of P-33 and Thermax was reported along with possible explanations for the observed image intensities which gave rise to the interpretation of hollowness. Striated surfaces strongly suggestive of a laminar structure and serrated edges were detected. Rough areas arranged both in lines and at random were observed over the surfaces of some particles.

9581. ZHURBENKO, M. P.; RYKBERG, K. V., AND GERASEV, S. V. **High-dispersion clays as leather fillers.** *Legkaya Prom.* 9, No. 4, 15-16(1949).—*C.A.* 47, 1961*g*.

Clays capable of forming highly dispersed suspensions in water could be used as fillers for sole and insole leathers. The clay was bonded more firmly with the leather fibers than were glucose and salts. Filling with clay raised considerably the coeff. of tanning.

9582. AMBORSKI, LEONARD E.; BLACK, CARL E. III, AND GOLDFINGER, GEORGE. **Mechanism of reënforcement. IV. Adsorption of GR-S by carbon black.** *Rubber Chem. & Technol.* 23, 417-24 (1950).—*C.A.* 44, 7575*i*.

A comparison of the ratios of the extinction coeffs. for the original GR-S and for the remaining fractions after certain fractions were specifically removed by carbon black indicated no preferential adsorption by carbon black of any of the units considered. The exptl. error was 5%. However, a change in concn. of 5% of polystyrene would not result in large differences in the tensile strength and modulus of GR-S treated with carbon black. The selectivity must, therefore, be based on mol. wt. The concn. of styrene was measured in relation to the 1,2- to 1,4-addn. units of polybutadiene. The ratios of 1,2- to 1,4-units in GR-S alone and in GR-S treated with a furnace black and channel black, resp., also were detd. There was no selective adsorption in any case.

9583. AMON, FRED H. **Carbon black manufacture in Great Britain.** *Trans. Inst. Rubber Ind.* 26, 177-91(1950).—*C.A.* 45, 1325*g*.

The development of the furnace process was described, and the increased utilization of liquid hydro-carbons in place of gaseous hydrocarbons was pointed out. Analytical tests, lab. compounding tests, and road tests of tires were described, with tabulated data, to show the comparative results obtained with furnace oil black (HAF type) and with channel carbon black.

9584. BOETTCHER, A. **Aerosil, a highly active light-colored filler.** *Kautschuk u. Gummi* 3, 357-60(1950).—*C.A.* 45, 1369*f*.

Aerosil was a colorless silicic acid with d. 2.2, n value 1.55, and particle size 15-25 mμ. Representative data on natural-rubber vulcanizates showed that better quality could be obtained with Aerosil than with CK-3 type of carbon black. Aerosil was of particular interest in the manuf. of transparent rubber products of high quality.

9585. BOSTWICK, R. AND CAREY, R. H. **Filled polyethylene compounds.** *Ind. Eng. Chem.* 42, 848-9(1950).—*C.A.* 44, 6673*h*.

The utility of inorg. fillers as stiffening agents in polyethylene was studied. The fillers included $BaSO_4$, 2 grades of ground $CaCO_3$, pptd. $CaCO_3$, carbon black, clay, $MgCO_3$, and 3 grades of silica. The fillers did not influence materially the characteristics of polyethylene during process and injection molding. In general, the smaller the particle size of the filler, the greater was its stiffening effect. All the fillers reduced mold shrinkage, tensile strength, resistance to tearing, and elongation at rupture, lowered the brittle temp., and increased the initial modulus, dielec. const., power const., and water absorption.

9586. Cabot, Louis W.; Edminster, J. W., and Stokes, C. A. **The manufacture of furnace carbon black from liquid hydrocarbons at Ellesmere Port.** *J. Inst. Petroleum* 36, 707-26(1950).—*C.A.* 45, 2650*g*.

The process used at Ellesmere Port began with the formation of the carbon black from an oil as the result of partial combustion accompanied by thermal decompn. and the building up of fully dehydrogenated fragments into carbon particles. The heat necessary for cracking the hydrocarbon to black was supplied by the combustion of a fraction of the hydrocarbon entering the refractory-lined steel carbon black furnace. After cooling the carbon black aerosol further to 450-500°F by water injection, it was passed through a Lodge-Cottrell precipitator. The carbon black was removed from the electrodes by wrapping; the precipitator was followed by 3 cyclone separators —the combined action of the precipitator and cyclones removed 90-95% of the carbon black. The balance of the carbon black was removed by water scrubbing and a final wet Lodge-Cottrell precipitator.

9587. Crennell, J. T. **Electrochemical behavior of paint film on steel in sea water.** *J. Soc. Chem. Ind. (London)* 69, *Suppl. No.* 1, S36-8 (1950).—*C.A.* 45, 5943*i*.

Submerged painted surfaces were normally cathodic to a bare surface. Metals were not capable of evolving H_2 from sea water so reduction of dissolved O_2 occurred. The cathodic current was stimulated by the presence of O_2. If O_2 was more available in 1 part than another, that part tended to be cathodic. Corrosion occurred at areas of poor aeration which were anodic. On this theory paint surfaces should be anodic, but were actually cathodic.

9588. Dannenberg, E. M.; Jordan, M. E., and Stokes, C. A. **Effect of mechanical aggregation on the dispersion characteristics of carbon black.** *India Rubber World* 122, 663-71 (1950).—*C.A.* 44, 10367*a*.

The topics discussed were: the influence of mech. aggregation of HAF black on the dispersibility in water, influence of the dry d. of channel-grade ink black on the rheological properties of news ink, influence of the bulk d. of MPC channel black on the properties of natural rubber and low-temp. GR-S tread mixts., the effect of bulk d. of HAF black on the properties of natural rubber and low-temp. GR-S tread mixts., the dispersion of oil-type furnace black in Butyl of different viscosities, and the dispersibility of SRF black in butadiene-acrylonitrile copolymer, and of carbon blacks in polyethylene.

9589. Finlayson, C. Malcolm and McCarthy, P. R. **Bentone greases.** *Inst. Spokesman* 14, No. 2, 13-23(1950).—*C.A.* 44, 7053*b*.

Montmorillonite, after removal of nonclay impurities, was treated with an alkyl ammonium salt contg. 16-18 C atoms to produce bentones which when dispersed in mineral oils formed lubricating greases. In comparison with conventional soap-thickened greases, they showed no transitions with temp., had less tendency to sep. oil, had comparable wear properties, but were inferior in rust-prevention. Although bentone greases absorbed large quantities of water, they were resistant to its washing action.

9590. Foreman, G.; Thompson, G. W. H., and Tolliday, J.D. **The use of ion-exchange resins in the study of chrome (tanning) liquors.** *J. Am. Leather Chem. Assoc.* 45, 378-87(1950). —*C.A.* 44, 11144*i*.

Ionac C200 resin adsorbed HCOOH under static conditions used to investigate the compn. of Cr liquors contg. Na formate. The resin did not adsorb HCOOH when used in the percolation method because of the short time of contact necessary. It was suggested that ion-exchange resins be used in the Na-form for the investigation of Cr liquors contg. Na salts.

9591. Gale, E. S. and Staneslow, B. J. **Rheology of carbon-paper inks.** *Am. Ink Maker* 28, No. 12, 34-41, 67(1950).—*C.A.* 46, 5335*d*.

Carbon paper inks were mixts. of pigments (carbon black, Prussian blue, etc.), dyes, waxes, and mineral oil. The present study of the rheology of carbon-paper inks in the molten condition had, as its aim, the substitution of vegetable waxes, such as carnauba, on which the good flow properties of these inks have in the past depended. A carbon black, which was thought to have a H rather than a C oxide complex adsorbed on it, did not disperse more readily in petroleum oils (contrary to previous suggestions), and a carbon black which normally flowed was found after H_2 treatment to have zero flow value. The charged-particle and wetting concepts of dispersion were adversely criticized; it was found that wetting caused a gas pressure build-up in the mill and a lack of flow value.

9592. Gustavson, K. H. **Investigation of complex formation in solutions of basic chromium compounds by means of ionic exchangers, spectrophotometric methods, and interaction with collagen.** *J. Soc. Leather Trades' Chemists* 34, 259-78(1950).—*C.A.* 44, 11148*f*.

Ion-exchange expts. indicated that in both dil. and concd. (0.4 and 8.0 equiv./liter) solns. of $Cr(OH)SO_4$ and dil. solns. of $2\ Cr(OH)SO_4.Na_2SO_4$, 92-100% of the Cr was present as a cationic complex with 2 Cr atoms binding 1 sulfate group. In concd. solns. of $2\ Cr(OH)SO_4.Na_2SO_4$ only 36% of the Cr complexes were cationic and 59% were uncharged. In the initial stages of tanning (2-4 hrs), concd. solns. of $2\ Cr(OH)SO_4.Na_2SO_4$ fixed 50-100% more Cr than dil. solns., but after 24 hrs the fixations were the same. This difference in initial Cr fixation was due to the greater takeup of uncharged complexes, which gradually converted to cationic complexes.

9593. HARRIS, B. L. AND WOLOCK, IRVIN. **Porosity of paint films.** *Official Digest, Federation Paint & Varnish Production Clubs* No. **308**, 645-8(1950).—*C. A.* **46**, 10635*h*.

The structure and characteristics of paint films were elucidated by a no. of permeability studies. Krypton adsorption of peeled dried linseed-oil films indicated no appreciable quantity of fine pores large enough to allow phys. transmission of water vapor. Extn. with acetone increased the porosity only 20%, indicating no penetration of the film.

9594. KAJISAKI, CHIYOTOSHI; HORI, KAZUHIKO, AND SHIBATA, TAMOTSU. **Effects of carbon on the coloring of porcelain. IV.** *Bull. Govt. Research Inst. Ceramics* (Kyoto) 3, No. 2/3, 74-79(1950).—*C. A.* **46**, 6352*b*.

The discoloring and bubbling of porcelain caused by the decarbonizing action of CO_2 and H_2O on carbon which deposited in the body and glaze before the sintering were studied. H_2O was more effective for removing deposited carbon, but it often produced large bubbles in the glaze. Even after the glaze was melted, CO_2 and H_2O dissolved in it and reacted with carbon. To prevent the discoloring and bubbling, the partial pressure of hydrocarbon which causes the deposition of carbon should be at a min.

9595. KAJISAKI, CHIYOTOSHI; HORI, KAZUHIKO, AND SHIBATA, TAMOTSU. **Effects of carbon on the coloring of porcelain. V. Differences in oxidizing rate of deposited carbon by glaze raw materials.** *Bull. Govt. Research Inst. Ceramics (Kyoto)* 4, No. 1, 8-10(1950).—*C. A.* **46**, 6352*e*.

Discoloration by carbon was greatest in lime glazes and least in talc glazes. Powders of kaolin, quartzite, feldspar, china stone, dolomite, and talc were heated to 1000°C in air, and then coal gas was passed over them at 1150° and 1250°C. After the deposition of carbon, the samples were again heated to 900°C, and CO_2-free air was passed over them to oxidize the carbon. The CO_2 formed by oxidation was detd. The samples showed carbon deposition at 1150°C to be greatest with lime, then dolomite, and least with talc.

9596. KAJISAKI, CHIYOTOSHI; HORI, KAZUHIKO, AND SHIBATA, TAMOTSU. **Effects of carbon on the coloring of porcelain. VI. Relation between oxidizing ratio of carbon deposited on glazes and fired porosity.** *Bull. Govt. Research Inst. Ceramics (Kyoto)* 4, No. 1, 10-13(1950).—*C. A.* **46**, 6352*f*.

The oxidizing ratio, i.e., the ratio of the amt. of carbon oxidized by passing air over the specimen to the total amt. of carbon deposited, was greatest with talc, then dolomite, and least with lime. The total carbon was detd. by wet oxidation of powd. samples. Lime glaze was most likely to be colored by carbon. In lime glazes the oxidizing ratio was proportional to the porosity.

9597. KAJISAKI, CHIYOTOSHI; HORI, KAZUHIKO, AND SHIBATA, TAMOTSU. **Effects of carbon on the coloring of porcelain. VII. Yellowish discoloration by carbon and sulfur compound.** *Bull. Govt. Research Inst. Ceramics (Kyoto)* 4, No. 1, 13-16(1950).—*C. A.* **46**, 6352*g*.

Bodies discolored by carbon contained more carbon and S than those not discolored. Whether or not S was necessary for discoloration was not detd. For yellow coloration, dispersion of colloidal carbon was necessary, and this occurred when the glaze was melting. CH_4 caused discoloration, but if H_2S was present CO caused discoloration even in the absence of CH_4.

9598. KANAGY, JOSEPH R. **Influence of temperature on the adsorption of water vapor by collagen and leather.** *J. Am. Leather Chemists Assoc.* **45**, 12-41(1950).—*C. A.* **44**, 3734*a*.

Moisture-relative humidity isotherms were detd. at 28, 50, and 70°C for prepd. collagen, com. hide powder, and several vegetable- or Cr-tanned leathers. Similar detns. were made for chestnut and quebracho tannins at 28°C. Collagen adsorbed more H_2O at all humidities than did com. hide powder. Adsorptions calcd. for vegetable tanned leather from the data on hide substance and tannin alone were less than observed values below 75% relative humidity, but higher above this point. Free energies, heats of adsorption, entropies, and surface areas were calcd. The surface area of Cr leather did not change on heating over the whole range, but that of the other leathers decreased markedly.

9599. KOLTHOFF, I. M. AND GUTMACHER, R. G. **Determination of free carbon in cured rubber stocks.** *Anal. Chem.* 22, 1002-3(1950).—*C. A.* **44**, 10365*c*.

The method was based on the fact that rubber contg. ethylenic double bonds was oxidatively cleaved by *tert*-Bu-hydroperoxide in the presence of OsO_4. The procedure was to soften the cut rubber sample in gently boiling p-$C_6H_4Cl_2$, add *tert*-Bu-hydroperoxide and a catalytic amt. of OsO_4, filter through a Gooch crucible, wash with C_6H_6,HNO_3, and water, dry the residue at 350°C, cool, weigh, burn off the carbon black at low red heat, cool, and weigh again. The loss in wt equaled the carbon black originally present.

9600. KOLTHOFF, I. M. AND KAHN, ALLAN. **Sorption of GR-S-type rubber by carbon black. I. Sorption from benzene solution by Graphon.** *J. Phys. & Colloid Chem.* 54, 251-6(1950).—*C. A.* 44, 7084*i*.

The effects of temp. between 30° and 50°C, time of shaking up to 120 hrs, degree of conversion between 38 and 90%, and proportion of black (about 2-12%) were examd. and the results summarized. The first two factors were insignificant as far as the total amt. adsorbed was concerned. The intrinsic viscosity, however, decreased with increased time of shaking. This may be explained by a gradual replacement of the more rapidly sorbed small mols. by larger ones.

9601. LEE, HAMPTON. **Notes on the base-exchange-resin method for salt estimations.** *J. Soc.*

Leather Trades' Chemists 34, 150-51(1950).—*C.A.* 44, 9714*e*.

Correct ratio of resin to liquor sample, washing of the resin after passage of the sample, proper diln. of the sample before percolation and preconditioning of a new resin were all important factors.

9602. Maschka, A. and Mendl, A. **Investigation by means of ultraviolet spectroscopy of the catalytic bodying of linseed oil (comparison with the uncatalyzed process).** *J. Polymer Sci.* 5, 429-42(1950)(in German).—*C.A.* 45, 4944*e*.

The bodying of linseed oil at 285°C in CO_2 with and without Ni on asbestos as catalyst was studied by detg. I_2 no., viscosity, d., n_D^{20}, acid no., and absorption spectra at 2200-3000 Å. throughout the process. The results were consistent with the intermediate formation of compds. with conjugated double bonds, followed by their disappearance.

9603. McFarlane, J. S. and Tabor, D. **Adhesion of solids and the effect of surface films.** *Proc. Roy. Soc.* **A202**, 224-43(1950).—*C.A.* 45, 6007*d*.

The adhesion was negligibly small with clean hard surfaces in dry air. In moist air, appreciable adhesion might be observed, owing to the surface tension of a thin film of adsorbed water. With very soft metals (Pb or In), marked adhesion was observed in air, if the surfaces were freed of grosser contaminants. If the surfaces were covered with oxide films of appreciable thickness, the amt. of metallic interaction was diminished with a corresponding reduction in the adhesion. Lubricant films had a similar effect. Those materials that were most effective in reducing the adhesion, were also most effective, as boundary lubricants, in reducing the friction.

9604. Meakins, R. J.; Mulley, Joan W., and Churchward, Vivienne R. **Tropic-proofing of electrical materials 1943-6. III. Some experiments on the application of organosilicon compounds to glass and ceramic.** *Australian J. Applied Sci.* 1, 113-19, 1950.—*C.A.* 45, 287*a*.

The elec. insulation resistance of glass and steatite exposed to moist conditions, which normally suffered severe surface leakage due to adsorbed water, were greatly improved by treatment with methyl and ethyl chlorosilane. Preliminary cleaning with chromic acid was not necessary for effective treatment. With other organosilicon reagents, viz. methyl- and ethylsilicon amines and organosilicon varnishes, oils and greases, improved insulation resistances were obtained, but cleaning with chromic acid was necessary, the uncleaned samples having resistances little better than those of the controls.

9605. Meakins, R. J. **Tropic-proofing of electrical materials 1943-6. IV. Treatment of glass and ceramic with quaternary ammonium compounds.** *Australian J. Appl. Sci.* 1, 120-7 (1950).—*C.A.* 45, 287*b*.

Treatment of glass and steatite ceramic with aq. solns. of certain quaternary ammonium compds. improved the elec. insulation resistance (measured at 98-100% relative humidity) by a factor of nearly 1000; a mechanism of adsorption was proposed to explain these results. The durability of the adsorbed amine films depended on the method of prepg. the samples for treatment, vigorous preliminary cleaning with chromic acid giving the best results. Treatment with benzene solns. of laurylamine, cetylamine, cetylpyridinium bromide improved the resistances of glass and steatite if previously cleaned in chromic acid, but not if merely polished with a cloth.

9606. Merriman, P. **Net volume osmosis of various liquids with rubber membranes.** *India-Rubber J.* **119**, No. 9, 7-8, 10(1950).—*C.A.* 45, 21*g*.

When two liquids interdiffused through a rubber membrane, any net osmotic shift was thought to occur away from the liquid having the greater swelling power. By use of membranes of latex-impregnated sintered glass, this trend was verified for the case in which the more-swelling liquid had the lower mol. wt, even when this liquid was relatively the more polar (e.g. chlorinated hydrocarbons); but when the less-swelling liquid had the lower mol. wt, there were instances of osmosis towards the more-swelling liquid, even though this might sometimes be a less-polar chlorinated hydrocarbon.

9607. Moakes, R. C. W. and Pyne, J. A. **Examination of German and Belgian "White Carbons."** *J. Rubber Research* 19, 4-7(1950).—*C.A.* 44, 4278*d*.

Samples of "white carbon" (amorphous silica) of German origin (Aerosil-K3C) and of Belgian origin (silica white) were compared with MPC black as reinforcing agents in natural rubber. The first gave relatively hard vulcanizates, with high extensibility and low modulus. Vulcanization was slow and tensile strength low when normal percentages of accelerator (Vulkacit-Az) were used; with 3 times the normal percentage of Vulkacit-Az, the rate of vulcanization was normal, and the resulting tensile strength approached that obtainable with Vulkacit-Az, whereas the resistance to abrasion was considerably lower.

9608. Modak, K. V. **Carbon blacks.** *Rubber India* 2, No. 9, 9-17(1950).—*C.A.* 45, 4079*c*.

The nomenclature of carbon blacks with respect to the various types, and the mech. and phys. properties imparted by them to vulcanized rubber were described.

9609. Motoyoshi, Masanobu. **Sizing. I. Effect of acid clay on sizing. II. Change of paper size in contact with drying metal plates and wet web. III. Some characteristic sizing effects of bentonite filler. IV. Effect of bentonite filler on sizing. V. Effects of fillers and mechanism.** *J. Soc. Textile Cellulose Ind.* (Japan) 6, 132-4, 319-21, 388-90, 449-51, 522-5(1950).—*C.A.* 46, 6832*h*.

Acid clay added to rosin used for sizing bleached sulfite pulp prevented paper from decreasing in size resistance on drying. The changes in size of handmade paper sized with rosin and dried on various metal plates was prevented by adding bentonite to the rosin. The shrinkage of rosin-sized paper in direct sunlight and its breaking in hot H_2O were also prevented. Dehydrated (by heating up to 800°C) bentonite decreased the effect of rosin sizing. As compared with acid clay, bentonite was highly hydrophilic and dispersed in H_2O as a colloid and formed a film around single fibers of paper.

9610. PISARENKO, A. P. AND REBINDER, P. A. **The vulcanization of synthetic rubbers.** *Doklady Akad. Nauk S.S.S.R.* 73, 129-32(1950).—*C.A.* 44, 10368*a*.

The role of the bridge S in vulcanization was secondary. The main effect of the bound S was its addn. to double bonds and formation of polar groups; the high cohesive forces of vulcanized rubbers were due to attraction between such polar groups. This point of view was corroborated by the decrease, with rising temp., of the mech. strength of vulcanized rubbers, illustrated by curves for diacrylo nitrile, Na-butadiene, and polychloroprene rubber. Vulcanization effects were observed under conditions where bridge formation by bound S was still out of the question.

9611. PROBER, P. V. **The absorptivity of paper and its influence on wallpaper quality.** *Bumazh. Prom.* 25, No. 4, 41-4(1950).—*C.A.* 46, 736*d*.

The requirements of paper for wallpaper manuf. in the USSR was discussed and also the relation between wallpaper quality and the absorptivity of the paper, a comparison of various methods of detg. the H_2O-absorptivity of paper, a rapid and simple method of detg. absorptivity, and the results of testing a no. of papers.

9612. REICH, GEORGE. **Graphite as a black pigment.** *Paint Varnish Production* 30, No. 2, 11, 14, No. 3, 11, 17-19(1950).—*C.A.* 44, 5115*h*.

Classification, properties, and uses in paints were reviewed.

9613. RUDKIN, A. W. **The role of the hydroxyl group in the gluing of wood.** *Australian J. Applied Sci.* 1, 270-83(1950).—*C.A.* 45, 3191*e*.

From glue shear strength tests and from the nature of failure of these joints it appeared that: (1) Methylation of up to 15% of the available wood OH groups did not affect the adhesion of casein glue to wood. (2) Acetylation appreciably reduced the strength of adhesion of urea-formaldehyde resin to the wood, suggesting that chem. bonding was a factor in the adhesion of this type of resin to wood.

9614. SCHNEIDER, C. G. **The effect of metaphosphate on tannin absorption in chrome-vegetable tanning.** *J. Am. Leather Chem. Assoc.* 45, 670-81(1950).—*C.A.* 45, 4073*h*.

Cr-tanned hide powder was treated at room temp. in solns. contg. various concns. of polymeric Na metaphosphate (Calgon). The washed powders were retanned in analytical-strength vegetable-tannin soln. (50% quebracho, 25% hemlock, 25% oak, on tannin basis), and the percentage of sol. solids removed from soln. was detd. Analysis of the treated powders before retannage showed that Cr-bound sulfate was replaced with an approx. equiv. amt. of Calgon. Pretreatment with orthophosphates did not decrease the affinity for tannin. The vegetable tannins may combine with Cr leather partly by displacing aquo groups from the Cr complex.

9615. SHUTTLEWORTH, S. G. **A low-temperature conductometric elucidation of chromium sulfate complex ions.** *J. Soc. Leather Trades' Chemists* 34, 186-96(1950).—*C.A.* 44, 9712*h*.

Titrations were made at 5°C instead of 25°C. The slopes of different parts of the titration curves could then be used to calc. complex bound sulfate. Titration of a freshly boiled 10% soln. of 1/3% basic chrome alum showed 80-90% of the titratable sulfate to be in the complex. If the complexes were mainly dimers, 60-80% were uncharged and the remainder was cationic. Titrations of freshly boiled chrome alum solns. contg. 1, 10, and 150 g/liter gave values of 60, 78, and 83% complex bound sulfate, resp. It was suggested that the 6-membered ring formed by sulfate with 2 olated Cr atoms was more stable than the 4-membered ring formed by a single Cr atom with sulfate.

9616. SHUTTLEWORTH, S. G. **The theory of chrome tanning.** *J. Soc. Leather Trades' Chemists* 34, 410-37(1950).—*C.A.* 45, 4073*d*.

Because carboxyl groups were known to form stable coördination complexes with Cr under conditions similar to tannage, it was assumed that Cr fixation by collagen was due in part to coördination of the protein carboxyl groups to Cr. Inactivation of the carboxyl groups by methylation resulted in greatly reduced Cr fixation and no increase in thermal stability. Cr fixation increased with increase in pH because of the increased no. of carboxyl ions available for coördination with the Cr. A high concn. of neutral salts during tanning caused aggregation of the Cr complexes and these larger particles diffused less readily into the protein network resulting in decreased Cr fixation.

9617. SODA, NORIMUNE AND MIYAKAWA, YUKIO. **Friction of uni- and multimolecular layers.** *Rept. Inst. Sci. and Technol. Univ. Tokyo* 4, 176-89(1950).—*C.A.* 45, 7408*i*.

The kinetic frictions of uni- and multimol. layers of stearic acid and Ba stearate deposited by the Langmuir-Blodgett technique (Y-deposition) were measured for various loads, temps., curvatures of sliders, and combinations of rubbing materials. The friction decreased with the increase of the no. of layers, but the min. no. of layers sufficient for the satn. of lubricating action and the limiting value of the friction largely depended on the curvature of the slider and the kinds of rubbing materials. It was computed that the layer worn by friction was not repaired by the supply from the surrounding layers.

9618. SPERBERG, L. R.; POPP, G. E., AND BAIRD, C. C. **Electrical resistivity of various carbon blacks in natural, GR-S, cold, and Butyl**

rubbers. *Rubber Age* 67, 561-4(1950).—*C.A.* 44, 10367*e*.

The degree of milling of rubber-carbon black mixts. had a major influence on the elec. resistivity of the mixts. when the blacks were of intermediate or large particle size. This influence was insignificant with carbon blacks of relatively fine particle size. The type of rubber governed the elec. resistivity for a given proportion of carbon black; the degree of dispersion was governed by the viscosity (thermoplasticity) of the rubber at the temp. of mixing. Flexing did not notably lower the cond. of a vulcanizate contg. carbon black by rupturing the carbon black chains.

9619. TAKAHASHI, HIROSHI. **Studies on boundary lubrication.** *Rept. Inst. Sci. and Technol. Univ. Tokyo* 4, 29-33(1950).—*C.A.* 45, 6374*b*.

Friction of mineral and vegetable oils was measured by a pendulum-type oiliness tester. In non-polar mineral oils the friction increased with the repetition of measurements, perhaps owing to wear of the surface film. In polar vegetable oils the friction decreased with the no. of measurements, perhaps owing to the fact that the adsorbed film was more and more completed.

9620. THIAGARAJAN, V. AND SRIKANTAN, B. S. **Lubricating properties of vegetable oils. IV. Measurement of oiliness of raw neutral oils through adsorption.** *J. Indian Chem. Soc. Ind. & News Ed.* 13, 219-26(1950).—*C.A.* 46, 1240*e*.

Oiliness, as measured by the interfacial tension of drop numbers, was shown to be increased with the ability of the oil to adsorb on the metal surface. Tests on each oil through packed columns of Cu and Ni balls indicated mohua oil to be the best lubricant. Unsatn. was an indication of lubricating property, but more than one unsatd. group interfered.

9621. TINGLE, E. D. **Importance of surface oxide films in the friction and lubrication of metals. I. Dry friction of surfaces freshly exposed to air.** *Trans. Faraday Soc.* 46, 93-7 (1950).—*C.A.* 44, 6613*h*.

A smooth shallow track on the metal surface was made by a cutting tool of WC. The slider used in the detn. of friction passed over this track immediately behind the cutting tool so that the interval between exposure of the metal and measurement of friction was very short. With unlubricated surfaces the oxide film generally produced a marked reduction in friction even though the period of exposure to the atm. of a freshly cut surface was only a few sec. With subsequent growth of the film there was further reduction but the effect was less marked. The thin layer of oxide immediately adjacent to the surface played a more significant part in reducing the friction than the thicker layers of oxide above it.

9622. TINGLE, E. D. **Importance of surface oxide films in the friction and lubrication of metals. II. Formation of lubricating films on metal surfaces.** *Trans. Fraday Soc.* 46, 97-102(1950)—*C.A.* 44, 6614*a*.

A diamond-edged cutting tool made a smooth shallow track on the lower Cu surface under a pool of the lubricant soln. The combined action of water and O_2 on the surface of a reactive metal was often able to produce a penetrable film which reacted with a fatty acid to give an effective lubricating layer. Long-chain fatty acids might lubricate metals which form a thick permeable layer of oxide capable of reacting with fatty acids to form a soap; or they might lubricate metals whose oxides, although probably capable of reaction with fatty acid, were formed on the surface as compact skins; or they lubricate metals which form no oxide film or only a very thin film.

9623. TJEBBES, E. J. AND ULDEN, J. V. VAN. **Use of bentonite in the flow-casting process.** *Ingenieur* (Holland) 62, Mk, 104-5(1950).—*C.A.* 45, 4477*a*.

Some types of latex gave bad results in flow-casting. Great improvements were obtained by addn. of bentonite. To prevent coagulation by Ca ions, Vulcastab L.W. was added. Often no more bentonite than 1% could be used. Either the thickness of the layer may be increased or the time of settling reduced, compared with the mixtures without bentonite.

9624. VEǏLER, S. YA; SHREǏNER, L. A., AND REBINDER, P. A. **Investigation of the lubricating action on a model of deep drawing.** *Doklady Akad. Nauk S.S.S.R.* 73, 511-13(1950). —*C.A.* 45, 921*h*.

A band of metal folded in a U-shape was drawn out with the aid of a vertical die, between 2 horizontal cylindrical matrixes, and the normal compressive stress exerted between the matrixes and the die was recorded by an indicator connected with the spring dynamometer housing the matrixes. The lubricant detd. the max. possible reduction, e.g., for steel in CCl_4, in mineral oil, and in oxidized paraffin; it was 49, 57, and 65%, resp. The increased ability of the metal to be drawn out in the presence of lubricants was due not only to reduced friction, but also to the greater ease of surface flow in the presence of surface-active substances.

9625. VERRALL, A. F. AND MOOK, P. V. **Adsorption of sap stain and mold-control chemicals by wood.** *Ind. Eng. Chem.* 42, 1350-5(1950).—*C.A.* 44, 8586*b*.

Lab. and field tests with aq. solns. of a mercurial fungicide used in the continuous dipping of green lumber showed a loss in concn. of the soln. owing to adsorption of the mercurial on the wood. Addn. of borax decreased the rate of loss. Solns. based on the chlorophenates did not lose strength with use. The most feasible means of maintaining adequate strength of soln. was to keep a const. level of soln. in the dipping vat by frequent replenishment with a soln. of normal concn.

9626. WAARDEN, M. VAN DER. **Stabilization of carbon black disperions in hydrocarbons.** *J. Colloid Sci.* 5, 317-25(1950).—*C.A.* 44, 10451*c*.

Carbon black was rubbed in a mortar with 20 parts of white petrolatum, and the jelly-like dispersion was added to hydrocarbon oil to form a 0.1% dispersion. The degree of flocculation was rather marked unless the oil contained alkylated aromatic hydrocarbons. The stabilizing effect of these aromatics increased with length and no. of the alkyl chains over the range investigated (up to 16 C atoms long and 2 in no.).

9627. WOLF, RALPH F. AND GAGE, F. W. **Compounding of Neoprene with fine-particle silica.** *Rubber Age* 67, 317-22(1950).—*C.A.* 44, 7577*b*.

Hi-Sil was a particularly valuable pigment in Neoprene, as was shown by comparative tests of Neoprene-GNA vulcanizates contg. 10, 20, 30, and 40% by vol. of Hi-Sil, Ca silicate (Silene-EF), and EPC black, resp. The measurements showed that, in general, Hi-Sil could be used successfully in Neoprene formulations when properties approaching those of Neoprene-EPC black vulcanizates were required of light-colored Neoprene vulcanizates. It was also an excellent and economical substitute for ZnO used as a pigment.

9628. WOLOCK, IRVIN AND HARRIS, B. L. **Porosity of paint films. Adsorption studies of unsupported linseed-oil films.** *Ind. Eng. Chem.* 42, 1347-9(1950).—*C.A.* 44, 9159*e*.

Surface areas of the order of 1000 cm^2 were measured by Kr adsorption at -204.5°C and applied to the study of unsupported oil films. The av. roughness factor of 1.14 for these films indicated that there was no appreciable quantity of fine pores large enough to allow phys. transmission of water vapor.

9629. YAVOROVSKAYA, S. F. **Evaluation of some building and technical materials as to permeability and adsorption of mercury vapor.** *Gigiena i Sanit.* 1950, No. 11, 22-8.—*C.A.* 45, 4017*f*.

The behavior in respect to Hg vapor was detd. largely by porosity size and shape, with some effect of fibers within the structure. Satn. with tars, oils, and bitumens significantly reduced permeability and adsorption of Hg. The detn. was done in Petri dishes contg. Hg covered with sheets of the test materials, with detection being done on the outer side of the covering by means of Prilezhaev test papers at 18-22°C. Expts. on sorption were run for 3 months.

9630. ANDRESEN, ANDRASCH. **The accelerator-adsorption of rubber fillers, especially light intensifying fillers.** *Gummi u. Asbest* 4, 76-81(1951).—*C.A.* 46, 8407*e*.

The adsorption of mercaptobenzothiazole (MBT) and diphenylguanidine (DPG) was detd. Carbon black (2 g) was shaken with 100 ml DPG in MeOH for 5 times 30 min., the mixt. centrifuged, filtered, and 10 ml filtrate titrated with MeOH-HCl soln. of the same normality to give the DPG no. as g DPG adsorbed by 10 kg carbon black. A 0.01 *N* soln. of accelerator was found to be the optimum for adsorption measurements, giving a sharp color change. The DPG and MBT nos. were detd. for various fillers of the SiO_2 type, Teg type, and of different carbon blacks.

9631. ANON. **Carbon black.** *Chem. Eng.* 58, No. 7, 176-9(1951).—*C.A.* 45, 8233*b*.

The plant operated by Phillips Chem. Co. at Borger, Tex., for the production of furnace-type carbon black from petroleum oils was described.

9632. BOWDEN, F. P. **Influence of surface films on the friction adhesion and surface damage of solids.** *Ann. N.Y. Acad. Sci.* 53, 805-23 (1951).—*C.A.* 46, 2876*b*.

The effect of films on surfaces cleaned *in vacuo* by heat was reviewed. Introduction of O_2, H_2O, or caproic acid vapor reduced friction. Caproic acid plus O_2 gave a lower coeff. of friction than did the acid alone. Cl compds. lowered the friction but by heating the metal to 300-400°C, Cl_2 was driven off and the friction increased. Although H_2S did not reduce the friction as much as Cl, the FeS films were stable up to over 800°C. If the oxide film was harder than the underlying metal, it would not protect the surface from adhesion. Air or O_2 reduced friction on diamonds.

9633. BOWDEN, F. P. AND YOUNG, J. E. **Friction of diamond, graphite, and carbon and the influence of surface films.** *Proc. Roy. Soc.* (London) A208, 444-55(1951).—*C.A.* 46, 6889*f*.

The removal of surface films by vacuum outgassing caused a large increase in the friction. The admission of a small amount of O_2, water vapor, or other contaminant reduced the friction. Both phys. adsorption and chem. adsorption were important. With clean graphite surfaces there was strong adhesion at the interface, so that slip and shearing occurred beneath the surface. Carbon and graphite had a neg. temp. coeff. of friction. The low friction normally observed with diamond was due to the presence of adsorbed O_2 and other gases. The friction of clean diamond on diamond was high, and the shear strength at the interface was comparable with the shear strength of diamond. The pressure of water vapor necessary in these expts. to give a low friction on clean graphite was much less than that found necessary to reduce the wear.

9634. BOWMAN, A. AND HUGHES, W. **Wetting and dispersion with particular reference to titanium oxide.** *J. Oil & Colour Chemists' Assoc.* 34, 412-45(1951).—*C.A.* 47, 1404*e*.

The factors affecting the stability of aq. dispersions were particle size, surface elec. potential, and electrolyte concn. TiO_2 aq. dispersions showed that once peptization had occurred, increase of the electrolyte concn. subsequently effected reflocculation. The elec. potential of the adsorbed layer was investigated by the method of the streaming potential. The major stabilizing factor in nonaq. dispersions was the adsorbed dipole potential rather than the adsorbed ionic potential. A description of the dispersion of TiO_2 in the following was included: C_6H_6, xylene, CCl_4, $CHCl_3$, white spirit, MeOH, EtOH, PrOH, iso-PrOH, *sec*-BuOH, BuOH, AmOH, MeOAc, EtOAc, BuOAc, acetonitrile, Ac_2O, HCO_2H, $PhNO_2$, acetone, and Et glycol.

9635. BROPHY, J. E. AND ZISMAN, W. A. **Surface chemical phenomena in lubrication.** *Ann. N.Y. Acad. Sci.* 53, 836-61(1951).—*C.A.* 46, 3250*c*.

Phys. adsorption on metals, chem. reaction at the solid-liquid interface, colloidal behavior of polar mols. in nonaq. liquids, and the activity of the liquid lubricant phase as a source for surface-active materials were reviewed. Measurement of the friction and wear-reducing properties of certain ester oils showed no significant difference from mineral oils.

9636. Bucchi, Renato. **Reactions of gypsum in setting portland cement.** *Chimica e industria* (Milan) **33**, 685-94 (1951).—*C.A.* **46**, 3726*h*.

$CaSO_4$ was introduced as natural gypsum, as anhydrite, or as $CaSO_4.0.5H_2O$. The specific surface factors were detd.; color effects were discussed. The first reaction of $CaSO_4$ and the clinker minerals was the formation of $3CaO.Al_2O_3.CaSO_4.12H_2O$, mixed with $3CaO.Al_2O_3.Ca(OH)_2.13H_2O$ or $3CaO.Al_2O_3.3CaSO_4.nH_2O$. Extensive expts. were made on the progress of the reaction between $CaSO_4$ and the aluminates for different specific surfaces, for a const. temp. of 21°C and a H_2O:cement ratio of 0.3. All the Al_2O_3-contg. crystal phases of the clinkers (including $4CaO.Al_2O_3.Fe_2O_3$) reacted with $CaSO_4$. Hydrolysis and soln. of the Al_2O_3-contg. phases was the slowest, and regulates the total reactions.

9637. Carr, W. **Wetting agents in the paint industry.** *Official Digest Federation Paint and Varnish Production Clubs* No. **319**, 510-16 (1951).—*C.A.* **46**, 7783*f*.

In nonaq. systems the degree of wetting of the pigment by the medium controlled the apparent dispersion of the pigment together with the flow and storage properties of the system. Products which reduced the grinding time and produced good wetting reduced the tendency to structure formation(thixotropy). In a specific example, a triethanolamine soap was added in small amts. to a pigment-oil mixt. which exhibited a marked degree of "false body." The over-all viscosity of the mixt. was greatly reduced.

9638. Clayton, D. and Jenkins, C. H. M. **Physical changes in rubbing surfaces on scuffing.** *Phys. of Lubrication, Brit. J. Applied Phys.*, Suppl. **1**, 69-78(1951).—*C.A.* **45**, 4915*e*.

Cast iron surfaces rubbing against steel developed a thin layer of a "white constituent" when scuffing occurred or was approached. This appeared to contain cementite and a quenched high-C ferritic phase developed from austenite resulting from the high temp. developed by rubbing. In wear tests the scuffing load for castor oil for a ball running on 3 piston-ring segments was about 500 kg compared with 250 kg for plain mineral oil. There was no difference when the free fatty acid (1.6%) was carefully neutralized and the soap removed; thus the glyceride was the effective lubricant.

9639. Cohan, Leonard H. and Watson, John H. L. **Shape factor and other fundamental properties of carbon black.** *Rubber Age (N.Y.)* **68**, 687-98(1951).—*C.A.* **45**, 6009*c*.

Carbon black particles were formed in the flame and consisted of ellipsoidal units firmly attached to one another. Shape factors detd. electron-microscopically were compared with factors derived from modulus and hardness values. There was a rough correlation between the shape factor as measured by, and as calcd. from, modulus and hardness for semireinforcing and channel blacks. Surface areas were calcd. from the ellipsoidal unit-size distribution derived from electron micrographs. Agreement with B.E.T. and I_2 adsorption areas were only within 25-50% for most of the blacks tested. For channel blacks the relatively high area values detd. by adsorption were explained by assuming that a surface roughness factor was involved.

9640. Dannenberg, E. M. and Seltzer, K. P. **Aqueous dispersion of carbon blacks.** *Ind. Eng. Chem.* **43**, 1389-96(1951).—*C.A.* **45**, 8797*a*.

The controlling factors in the wetting of carbon black with water contg. dispersing agents were the bulk d. of the carbon black and the proportion of extractable hydrocarbons on the surface of the black. Fluffy blacks of low bulk d. are difficult to wet. The percentage of dispersing agent depended on (1) the degree of mech. aggregation of the dry carbon black; (2) surface area of the carbon black; (3) percentage of inorg. contaminants, and (4) surface oxidation or the proportion of chemisorbed O. Large surface area and high inorg. solids content reduced the effectiveness of the dispersing agent. The agglomerates produced in the dry state in making pelleted carbon black are not completely dispersed in water and are still present in the final carbon black masterbatch.

9641. Duke, June; Taft, W. K., and Kolthoff, I. M. **Formation of bound rubber of GR-S type of polymers with carbon blacks.** *Ind. Eng. Chem.* **43**, 2885-92(1951).—*C.A.* **46**, 3314*f*.

The carbon blacks were milled into the elastomers at several temps. The higher the loading of carbon black, the higher the percentage of copolymer-carbon black complex, but at the high range of loading it decreased per unit of carbon black. The temp. of mixing had a marked effect; at lower loadings, the higher the temp., the higher the proportion of copolymer-carbon black complex, but with increase in loading the effect became less, and with 100-125% by wt of carbon black, the temp. had no influence. Fractionation of the sol. phase showed that with increase of carbon black loading copolymer of progressively lower mol. wt combined with the carbon black.

9642. Dupont, G.; Dulou, R., and Leon, V. **New method for catalytic dehydrogenation of abietic or resin esters.** *Bull. soc. chim. France* **1951**, 239-41.—*C.A.* **45**, 8784*i*.

Ni on Ni chromite and Ni on diatomaceous earth, in an autoclave, in the presence of a H-acceptor did not effect dehydrogenation of abietic acid or rosin esters at 300°C. Raney Ni was totally inactive even at 350°C. Me abietate was dehydrogenated by Ni formate to the extent of 40-45% of theory, and by a mixt. of Ni formate and active carbon a H-yield of 94% and 70-75% crystd. Me dehydroabietate was attained. Neither this catalyst nor divided Ni could be used for the dehydrogenation of abietic acid because it caused decarboxylation. The dehydrogenation by Pd-carbon was slow but very regular, while Ni formate + carbon was very rapid and stopped quickly. Eight times more Ni than Pd was required.

9643. Garner, F. H. and Baddeley, A. R. W. **Detergency of carbon-black suspensions. III. In toluene.** *J. Inst. Petroleum* 37, 426-9(1951).—*C.A.* 46, 282*b*.

The rates of carbon-black suspensions in toluene were compared after the addn. of stearic, oleic, and linoleic acids, and Ca oleate and linoleate. The acids had practically no effect on the rate of setting, and were not significantly adsorbed on the carbon. The Ca soaps were adsorbed, and the effect on the rates of settling was dependent on the amt. adsorbed; the order found, in increasing effectiveness, was Ca naphthenate, oleate, and linoleate.

9644. Gwathmey, Allan T. **Fundamentals of lubrication with the aid of large metal crystals.** *Ann. N.Y. Acad. Sci.* 53, 987-94(1951).—*C.A.* 46, 3250*g*.

By use of single crystals of Cu it was found that the chem. properties, friction, and wear depended on the crystal face exposed at the surface. A polycryst. Cu sphere was lubricated with mineral oil and pressed against a Pb-plated Cu rotor. In an atm. of air and with a thrust of 400 g, 200 min. was required to wear through the Pb film, while 1 min. was required to wear through this film in H_2. In a similar test with a dry Cu sphere pressing against a rotating Cu-plated steel shaft, in H_2, 5 sec. was required to expose the steel, while in an atm. consisting of 500 parts of N_2 and 1 part of O_2, 6000 sec. was required to expose the steel.

9645. Herrent, P.; Ludé, A., and Jnoff, G. **Filtration of viscose.** *Svensk Papperstidn.* 54, 153-68(1951)(in English).—*C.A.* 45, 9858*f*.

Filtering data were given for the effect of reproducibility, aging of the alkali cellulose, cellulose and soda concn., addn. of TiO_2, Dicalite, and alkali cellulose to the viscose, concn. of hemicellulose to the steeping liquor for pulp in slurry and in sheets, thickness of filter, type of filter material and support, ripening of viscose, presence of Fe salts, and preliminary swelling and nonswelling filter material. Comparable filtrations were also made with mineral oil which had the same viscosity as viscose and in which were suspended TiO_2 and Dicalite.

9646. Hillis, W. E. **The chromatographic examination of tannin extracts.** *J. Soc. Leather Trades' Chemists* 35, 211-18(1951).—*C.A.* 45, 10635*c*.

Com. extracts of cube gambier, Indian cutch, quebracho, wattle, myrobalan, "Myrtan," and solns. extd. from mallet and Dundas mahogany barks were compared by paper partition chromatography with resolving solvent mixts. of BuOH:AcOH:water; *m*-cresol:AcOH:water; and phenol:2 *N* AcOH and HCl. Examn. of the chromatograms under ultraviolet light or by spraying with Tollen's reagent showed all samples to be complex mixts. No sugars were revealed by phthalic acid-aniline spraying and no carbonyl compds. were detected with 2,4-dinitrophenylhydrazine.

9647. Honn, F. J.; Bezman, I. I., and Daubert, B. F. **Autoxidation of drying oils adsorbed on porous solids.** *J. Am. Oil Chemists' Soc.* 28, 129-33(1951).—*C.A.* 45, 4943*h*.

The rate of O_2 uptake of purified soybean oil was detd. as a function of the dispersion of the oil on the surface of highly porous silica gel. The most rapid consumption of O_2 took place at well-defined oil-to-solid ratios characteristic of the specific surface areas of the adsorbents. At the crit. concns. the oil constituted a closely packed uni-mol. layer.

9648. Kato, Jotaro and Nagano, Yoshiaki. **Japan wax. Decoloration of Japan wax. The structure of glycerides of dibasic acids in Japan wax.** *Kogaku Iho, Kyushu Univ. (Technol. Rept., Kyushu Univ.)* 24, 34-8, 38-43(1951).—*C.A.* 47, 1409*h*.

In comparative study on the various methods of decolorizing crude Japan wax by adsorption, passing 5-25% C_6H_6 soln. chromatographically through the activated carbon was best. The structure was discussed with relation to the character of chromatographic fractions of Japan wax.

9649. Khoroshaya, E. S. and Avilov, A. A. **Rapid colorimetric determination of the pH of carbon black latex mixtures.** *Legkaya Prom.* 11, No. 3, 41-2(1951).—*C.A.* 45, 9294*c*.

A carbon black latex mixt. 5 was dild. with water 25 ml and the pH detd. with a pencil colorimeter, the pencil and colorimetric scale No. 4 being used. If a crimson coloration was obtained which corresponded to the extreme right value of pH, the detn. was repeated with pencil scale No. 5. The av. deviation from values obtained with a potentiometer and glass electrode was 0.2 pH.

9650. Kiddoo, Gordon. **Carbon black.** *Chem. Eng.* 58, 104-8(1951).—*C.A.* 45, 4911*h*.

A general trend from the channel process to the furnace process was evident, along with a shift from natural gas to petroleum oils as raw materials.

9651. Kinsman, R. G. and Bowles, R. F. **The flocculation of pigment suspensions.** *J. Oil & Colour Chemists' Assoc.* 34, 592-610(1951).—*C.A.* 46, 8871*i*.

Microscopic measurements, the rate of flow, and the change in cond. and dielec. const. under shear on suspensions of anatase TiO_2, rutile TiO_2, blanc fixe, and various carbon blacks in linseed lithovarnish were described. Systems in which flocculation could be detected microscopically also showed its presence by the other methods. Flocculation was observed both as chain and cluster formation.

9652. Kolthoff, I. M.; Gutmacher, R. G., and Kahn, Allan. **Sorption of GR-S type rubber by carbon black. II. Effect of variables on the sorption by Graphon.** *J. Phys. & Colloid Chem.* 55, 1240-6(1951).—*C.A.* 46, 5878*g*.

Gel-free rubber, in contrast to microgel, could be completely sorbed from benzene soln. by Graphon black. The effect was studied of solvent, mol. wt, and degree of unsatn. of the rubber. Copolymers of butadiene and styrene covering the whole range of compn. were prepd. by the GR-S recipe at 50°C, going to 60% conversion. From the pure diene polymer down to 95% styrene there was little change in the amt. adsorbed. A marked decrease occurred with pure polystyrene. Within a range of mol. wts from 2.3 × 10^5 to 3.2 × 10^4 there was no appreciable variation in the behavior of C_6H_6 solns.

9653. Kremen, S. S. and Lollar, R. M. **A study of the moisture relationships and thermal properties of skin and leather.** *J. Am. Leather Chemists' Assoc.* 46, 34-56(1951).—*C.A.* 45, 8281*e*.

The removal of H_2O from hide powder, depickled calfskin, and Cr-tanned calfskin was studied by a solvent distn. method with various hydrocarbons b. 50-204°C. The shrinkage temps. $[T_s]$ of the heated samples were detd. on an electronic force-shrinkage meter. Cr tannage produced no significant change in the H_2O-binding power or in the dry T_s (detd. in paraffin oil) of collagen.

9654. Kuz'minskiĭ, A. S.; Shanin, L. L., and Lezhnev, N. N. **Diffusions of oxygen and oxidation of rubber in the presence of phenyl-2-naphthylamine.** *Doklady Akad. Nauk S.S.S.R.* 79, 467-70(1951); *Rubber Chem. & Technol.* 25, 230-33(1952).—*C.A.* 46, 285*h*, 11742*i*.

Under const. O_2 pressure p_o, the rate of oxidation (measured by the rate of consumption of the antioxidant phenyl-2-naphthylamine) of films of Na butadiene rubber 30-40μ thick was const. With varying p_o (10-760 mm), the rate w of the inhibited oxidation increased approx. proportionally to the square root of the concn. c of dissolved O_2, $w = k_1c^{1/2}$. In a film 1 cm thick, with both sides exposed to oxidation, stationary distribution of O_2 over the thickness was established, at 120°C in 14 hrs, and in a film 0.1 cm thick in 10-15 min. Practically, on account of the actual dependence of the rate on $c^{1/2}$ (rather than on c), stationary distribution was attained somewhat later.

9655. McGavack, John and Bevilacqua, E. M. **Absorption of oxygen by ammonia-preserved rubber latex.** *Ind. Eng. Chem.* 43, 475-9(1951).—*C.A.* 45, 3634*h*.

Exptl. data on the absorption of O_2 by *Hevea* latex were reported and discussed. Absorption resulting from bacterial invasion could be quantitatively titrated as carboxyl, whereas only a very small proportion of O_2 could be identified in carboxyl form when sterile latex is oxidized. The most rapid absorption of O_2 occurs at a pH value at which most com. latex was imported.

9656. Mills, H. **Pigment surface.** *J. Oil & Colour Chemists' Assoc.* 34, 497-518(1951).—*C.A.* 46, 8872*g*.

The effect of particle structure, as detd. by length of calcination time, on the behavior of lithopone pigments and the relation between oil absorption and paint consistency were discussed. As calcination time increased from 20 to 60 min. particle size increased and surface area, sedimentation vol. in linseed oil, oil absorption, absorption of oleic acid from soln., and thixotropy decreased. These results were explained by the healing of cracks between unit particles initially sintered together and the further sintering of particles as calcining proceeds.

9657. Moore, A. C. **The adsorption of lubricant films: a study of radioactive tracers.** *Phys. of Lubrication, Brit. J. Applied Phys.*, Suppl. 1, 54-7(1951).—*C.A.* 45, 4915*g*.

Exptl. data were reported on the chem. reaction between radioactive metal (Pt, Au, Zn, Cd, and Cu) surfaces and adsorbed monolayers of stearic acid, ethyl stearate, and octadecyl alcohol. If no reaction occurred, lubrication was only found below the bulk m.p. of the lubricant. Reaction, when it did occur, did not cease with the formation of a monolayer of soap on the metal surface, but, if sufficient materials were present, thick films of soap were built up.

9658. Mullins, L. and Whorlow, R. W. **Effect of fillers on plasticity of unvulcanized rubber.** *Trans. Inst. Rubber Ind.* 27, 55-74(1951); *Rubber Chem. & Technol.* 24, 232-49.—*C.A.* 46, 3312*b*.

Rubber contg. a filler softened when masticated and stiffened on subsequent standing. This thixotropic behavior was explained by the disentanglement and orientation of the long-chain rubber mols. caused by shearing. On standing, the structure again formed as the mols. returned to a random orientation because of const. thermal motion. Further, the proportionate stiffening by carbon black was much greater when detd. at low rates of shear than at high rates. The capacity of a filler to form the structure could be altered by the addn. of small proportions of surface-active substances.

9659. Otto, Gerhard. **The sensitivity of lime of anionic leather dyes.** *Das Leder* 2, 210-13 (1951).—*C.A.* 46, 5876*e*.

To test the effect of lime in hard water on dyeing, a dispersion of $CaCO_3$, (74 g of CaO per liter) was prepd. One ml of the dispersion and 10 ml of dye soln. (contg. 6.6 × 10^{-5} *M* pure dyes) were mixed and left overnight. Acid dyes were absorbed only slightly or not at all, but many substantive dyes were completely pptd. In general, a dye reacted with $CaCO_3$ if it contained (1) a nucleus with 2 attached amino groups but without a sulfo group, (2) an aromatic nucleus with 2 OH groups, or (3) a naphthol nucleus with an amino group.

9660. Parkinson, D. **The reinforcement of rubber by carbon black.** *Brit. J. Applied Phys.* 2, 273-80(1951).—*C.A.* 46, 1281*i*.

9661. Pasch, B. Richard and Kluge, Karl Heinz. **The causes of floating of paint pigments.** *Farbe u. Lack* 57, 243-4(1951).—*C.A.* 45, 7799*f*.

Various ZnO whites (NT, GM2, WS, GS, RS) and a lithopone (RS), 25%, black Fe oxide, 2.3%, Signal blue, 0.6%, and yellow Fe oxide, 0.1%, were ground in a vehicle made by heating Alkydal TO and linseed oil standoil 30 min. at 260°C, reducing with mineral spirits, and adding a Pb-Mn Soligen drier. Panels dipped in these rust-protection paints showed medium to considerable floating of unwetted ZnO, and streak formation, increasing with decreasing quality of the pigments. Chrome yellow-milori blue caused only a blue floating effect. Turkey red oil and Silicone oil AL eliminated the floating.

9662. Rabinowicz, E. **An investigation of surface damage with radioactive metals.** *Phys. of Lubrication, Brit. J. Applied Phys.*, Suppl. 1, 82-5(1951).—*C.A.* 45, 4915*i*.

Exptl. autoradiographical data reported showed that when a radioactive metal hemisphere slid over a nonradioactive metal surface, metal transfer took place in the form of discrete fragments and that well-lubricated surfaces gave less transfer than clear surfaces by factors of 400 or more. On heating well-lubricated surfaces, both the coeff. of friction and the amt. of metal transfer increased markedly at the m.p. of the surface film. The metal transfer, however, in contrast to the friction, was sensitive also to temp. change below the surface film's m.p.

9663. Rehner, John Jr. **Thermodynamics and mechanics of filler reinforcement.** *J. Polymer Sci.* 7, 519-36(1951).—*C.A.* 46, 1281*i*.

The reinforcement energy was regarded as a neg. measure of reinforcement, and its component terms (elastic and surface energies) were estd. With very active fillers, e.g., carbon blacks in natural rubber, the surface energy term was dominant. The elastic energy term may become dominant with inert fillers.

9664. Riedel, C. Martin. **Chemicals stop Coffer Dam leaks.** *Civil Eng.* 21, No. 4, 23-4(1951). —*C.A.* 45, 10540*d*.

The silicic gel produced by injection of water glass and $CaCl_2$ soln. cemented the soil into a soft sandstone impervious to water even under considerable hydrostatic head and with a bearing strength up to 50 tons/ft^2.

9665. Savage, Robert H. **Physically and chemically adsorbed films in the lubrication of graphite sliding contacts.** *Ann. N.Y. Acad. Sci.* 53, 862-9(1951).—*C.A.* 46, 2876*a*.

The friction of clean graphite in a vacuum was high. The chief requirement for lubrication was a "separating mol." which was physically adsorbed on a C atom. O_2 increased the attraction for H_2O on graphite so that the H_2O mol. could be used more efficiently.

9666. Schmidt, Ernst. **Effect of colloidal noncarbon pigments on elastomer properties.** *Ind. Eng. Chem.* 43, 679-83(1951).—*C.A.* 45, 6410*h*.

Colloidal SnO_2, SiO_2, ferric ferro-cyanide, polystyrene, and casein in GR-S were studied. These were added as colloidal solns. to GR-S latex, and the mixts. were dried. All increased the strain modulus and tensile strength to different degrees. Colloidal SnO_2 gave the highest tensile strength and modulus values, and these exceeded the values obtained with an equal vol. loading of EPC black. The best results with colloidal pigments should be obtained with stable colloidal solns. of substances which carry elec. charges of the same sign as those of the latex and which contain small amts. of electrolyte.

9667. Smith, W. R. **The behavior of carbon black in rubber and plastics.** *India Rubber World* 125, 325-6(1951).—*C.A.* 46, 4262*i*.

9668. Staudacher, Hans. **The prevention of sediment in paints.** *Deut. Farben-Z.* 5, 381-3 (1951).—*C.A.* 46, 1775*e*.

The sedimentation of certain paints was studied by placing them in test tubes filled 14 cm high, and testing the consistency of the sediment from time to time with a needle ending in a disk-shaped head. A paint made from 67 parts limed rosin soln. (70 parts in 50 parts of mineral spirits) and 33 parts Fe_2O_3-$BaSO_4$ showed slight sedimentation. This was inhibited by wetting the pigment with 10 parts BuOH before adding the limed rosin; the further addn. of 2 parts Aco-Netzmittel 457 to the BuOH made the sedimentation worse. Colloidal silica (Aerosil) ground in mineral spirits (10/70) stabilized a paint made from mineral spirits and Fe_2O_3-$BaSO_4$ pigment if BuOH was used to wet the pigments, but not when mineral spirits were used instead. Polar additives in the right proportion will inhibit sedimentation, and were best used to wet the pigments and inerts before adding vehicles.

9669. Stearns, R. S. and Johnson, B. L. **Interaction between carbon black and polymer in cured elastomers.** *Ind. Eng. Chem.* 43, 146-54 (1951).—*C.A.* 45, 4079*c*.

The thermodynamic changes assocd. with the extension and retraction of unloaded and loaded vulcanizates were described. The thermodynamic changes assocd. with deformation showed that phys. adsorption of the van der Waal type at the interface of polymer and pigment was inadequate to account for the exptl. observations. On the other hand, if chem. bonding took place at the interface of polymer and pigment, it was possible to derive a relation between the entropy of deformation and the extent of the bonding. It was then proved experimentally by a calorimetric method that the surface of a carbon black contained sites which reacted with Br_2 with liberation of the same amt. of heat as do olefins of low mol. wt.

9670. Stokes, C. A. **Fuel aspects of carbon black manufacture.** *J. Inst. Fuel* 24, 90(1951). —*C.A.* 45, 4429*f*.

The mechanism of the formation of carbon black was reviewed; this involved the cracking and polymerization and (or) condensation of hydrocarbons or of org. compds. contg. a large proportion of H and C, the reaction being carried out in the vapor phase; the growth of the particle must occur on a gas-suspended nucleus. With the increasing cost of natural gas, the U.S. was changing over to liquid hydrocarbons as the raw material. The best raw material was of a highly aromatic nature, especially when modern high-structure carbon blacks are to be produced.

9671. Thirion, P. and Chasset, R. **Application of the measurement of the dielectric constant and loss angle to the study of the structure of vulcanizates loaded with carbon blacks.** *Trans. Inst. Rubber Ind.* 27, 364-81(1951).—*C.A.* 46, 3316*f*.

The dielec. loss angles as a function of temp. of vulcanizates contg. carbon blacks made possible differentiation of the Debye type of absorption in the rubber matrix from a supplementary absorption which was influenced only slightly by the temp. and frequency and which was characteristic of carbon blacks possessing definite structures. The exptl. results indicated no differences, either in the chem. or phys. state, between the matrix occupying the space between the particles of carbon black in a loaded vulcanizate and the vulcanizate of the corresponding unloaded base mixt. Dielec. absorption should be of value as a nondestructive test to reveal the colloidal structure of rubber mixts. contg. carbon black.

9672. Voyutskiĭ, S. S.; Zaĭonchkovskiĭ, A. D.; Kargin, V. A., and Rubina, S. I. **Structures in lampblack suspensions.** *Doklady Akad. Nauk S.S.S.R.* 76, 419-22(1951).—*C.A.* 45, 6009*h*.

Suspensions of 5% lampblack in a mineral oil with no observable elec. cond., placed in a rotating viscometer, showed in the direction perpendicular to that of the flow, an elec. cond. λ decreasing with increasing velocity gradient g, and falling, at about $g = 1$ sec^{-1}, to a very low value, but still readily observable. When measured 1 min. after cessation of the flow, λ was in all cases several times as high as when measured during the flow; this, of course, indicated restoration of the structure at rest. An analogous behavior, during the flow and after its cessation, was observed in the direction parallel to the flow. Consequently, the lampblack particles must have a shape close to spherical, since for rod-shaped particles λ ought to increase with increasing g.

9673. Voyutskiĭ, S. S.; Zaĭonchkovskiĭ, A. D.; Kargin, V. A., and Rubina, S. I. **Structure in soot suspensions. I. Effect of the rate of flow, time, temperature, and soot concentration on the structure of soot suspensions.** *Kolloid. Zhur.* 13, 333-8(1951).—*C.A.* 46, 2376*a*.

A carbon suspension in mineral oil was confined between a resting internal cylinder and a rotating external cylinder. The elec. cond. k of the suspension was detd. either between these cylinders (i.e. across the direction of flow, k_1) or between 2 points on the internal cylinder, i.e. along the flow (k_2). Both k_1 and k_2 decreased when the rate of shear (τ) increased; this showed that the particles were nearly equal in size in all directions. At the highest used τ (5-7 sec^{-1}), k_1 and k_2 became independent of τ without declining to zero; this showed that either the structure was not destroyed at τ as high as 7 sec.$^{-1}$ or k is > 0 also in the absence of a structure. The relation between k and τ was identical, whether τ was increasing or decreasing. The cond. method of studying suspensions had the advantage of being nondestructive.

9674. Wolf, Ralph F. and Gage, F. W. **Compounding of Butyl rubber with fine-particle silica.** *India Rubber World* 123, 565-9(1951).—*C.A.* 45, 6415*d*.

Hi-Sil (hydrated silica) was the first filler which was found to give Butyl vulcanizates which had better phys. properties than those contg. semireinforcing furnace blacks and which, at the same time, could be processed satisfactorily. Graphs and tables showed representative results with different proportions of Hi-Sil, various accelerators, different temps. of cure, and different types of Butyl rubber.

9675. Wolf, Ralph F.; Hall, Geo. E. Jr., and Bachmann, John H. **Color reactions between silica pigments and certain accelerators and antioxidants.** *Rubber Age* (N.Y.). 69, 55-6, 104(1951).—*C.A.* 45, 6384*i*.

The discovery that clays gave color reactions with many amines had an analogy in the behavior of Hi-Sil (com. hydrated silica) and Silene-EF (Ca silicate) with certain accelerators and antioxidants. These color reactions were important because, in formulating white rubber mixts. contg. either silicate, accelerators and antioxidants which gave such color reactions must be avoided. The color reactions obtained with various important accelerators and antioxidants were described. These colors may result from reactions between the accelerator or antioxidant and O_2 adsorbed.

9676. Bowden, F. P. and Tabor, D. **The influence of surface films on the friction and deformation of surfaces.** *Symposium on Properties of Metallic Surfaces* (Inst. Metals, London) **1952**, 197-212.—*C.A.* 47, 2570*h*.

In the absence of all contaminating films, gross seizure occurred and sliding was impossible. The smallest quantities of gases or vapors greatly reduced the interaction. This decrease was partly due to chemisorbed films and partly to van der Waals adsorption. Similar, though less marked, effects were observed with nonmetals. The physically adsorbed films were only one or two mol. layers in thickness, and the heavier adsorption often observed with water was due to the presence of hygroscopic impurities on the surfaces. The friction and surface damage of inert metals immersed in an electrolyte may be greatly affected by small changes in the interfacial potential. The oxide film normally present on most metal surfaces can also provide considerable protection.

9677. Bowden, F. P.; Young, J. E., and Rowe, G. **Friction of diamond, graphite, and carbon: the influence of adsorbed films.** *Proc. Roy. Soc.* (London) A212, 485-8(1952).—*C.A.* 46, 8462*g*.

The mechanism of friction for nonmetallic solids was generally similar to that proposed for metals.

9678. Braendle, H. A. **The role of heat in the carbon black reinforcement of rubber. II. Carbon black dispersion and heat in factory processing for optimum reinforcement.** *Rubber Age* (N.Y.) 72, 205-10(1952); *Can. Chem. Processing* 37, No. 1 76-7(1953).—*C.A.* 47, 903*h*. 7247*b*.

Exptl. evidence showed that uniform particle dispersion of carbon black in rubber did not give the best mech. properties, e.g., resistance to abrasion, to a vulcanizate, and that hot mixing was extremely effective in obtaining the best ultimate quality, i.e., toughness, wear, and resilience.

9679. British Standards Inst. **Black (carbon) pigments for paints.** *Brit. Standards* **284, 285, 286**: 1952, 15 pp., 2s.—*C.A.* 46, 9319*e*.

Standards were given for carbon black, bone black, and lamp (vegetable) black. These specified residue on sieve, oil-absorption value, color, tone and staining power, loss in wt. at 100-105°C, ash, ether ext., and matter sol. in water.

9680. Buzágh, A. **Relation between adhesion and stability of disperse systems.** *Kolloid-Z.* 125, 14-21(1952).—*C.A.* 46, 6462*h*.

The adhesion of homodisperse quartz suspensions was measured by the parting angle (adhesion no.) method, dependent on particle size. The sp. adhesion of electrically charged quartz particles went through a min.-max. curve as the particle size increased. With isoelec. quartz, only a max. with a steeply descending branch was obtained. The coagulating effect of $BaCl_2$ on homodisperse quartz suspensions varied with the colloid particle size, and went through a min. value, below which the particles exhibited Brownian movement.

9681. Chodkiewicz, S. A. **Purification of potassium nitrate process liquors: comparison between the filtration, froth flotation, and sedimentation of insolubles.** *J. Appl. Chem.* (London) 2, 639-41(1952).—*C.A.* 47, 4562*c*.

The removal of impurities from KNO_3 process liquor after reaction of $NaNO_3$ and KCl was investigated. Filtration through a sand filter and a filter press did not prove feasible because impurities plugged the filter. Froth flotation and sedimentation proved satisfactory, although the former method did not remove grit and the latter left impurities that floated. In flotation a good sepn. was achieved after treating liquor with K oleate and Turkey red oil.

9682. Collyer, Harry J. **Additional aspects of British carbon black technology.** *Rubber Age & Synthetics* 33, 121-4(1952).—*C.A.* 46, 11742*g*.

Raw materials, the processes for making different types of carbon black, and their behavior in rubber were described.

9683. Compagnon, Patrice and Liponski, Maurice. **The preparation of a natural rubber-carbon black master batch.** *Rev. gén. caoutchouc* 29, 272-5(1952).—*C.A.* 46, 6422*h*.

The prepn. of natural rubber-carbon black master batches directly from latex were extended to channel blacks. The carbon black dispersions were prepd. both by a purely mech. process and with the aid of a dispersing agent such as Darvan. No difficulties were encountered in the incorporation of the carbon blacks in the latex, in coagulation, or in the drying process. In general, the prepn. of master batches from latex offered several advantages: preservation of a large proportion of the natural accelerators in the latex, less loss of carbon black, saving of time in mixing, and more rapid vulcanization.

9684. Dannenberg, E. M. **Carbon black dispersion and reinforcement.** *Ind. Eng. Chem.* 44, 813-18(1952).—*C.A.* 46, 10671*b*.

The degree of dispersion of carbon black in natural rubber, GR-S, Butyl, nitrile rubber, and Neoprene was controlled by the speed of the Banbury mixer and the time. Elec. resistivity detns. and electron-microscope studies indicated large differences in the degree of dispersion. Losses by abrasion and other phys. properties showed that, in some cases, poor dispersion resulted in relatively poor reinforcement. When the reinforcement was very poor, large unwetted aggregates of carbon black were visible before vulcanization. Virtually complete reinforcement was attained at a min. point of mixing, although, judged by elec. resistivity, the degree of dispersion would be regarded as poor.

9685. Dogadkin, B. A.; Pechkovskaya, K., and Mil'man, Ts. **Structure and properties of loaded rubber mixtures. X. Alteration of the carbon structures by heat treatment.** *Kolloid Zhur.* 14, 346-56(1952).—*C.A.* 47, 1964*c*.

The vulcanized mixts. contained 6 parts carbon black per 10 parts rubber. From 20° to 100°C, the elec. resistivity $\rho = \rho_0 \exp(\alpha t)$ (t is temp.); α is detd. by the black rather than by the rubber. The above equation was invalid when ρ was detd. on samples extended to double length. The tensile strength of rubbers filled with channel black decreased on heating (up to 80°C) less than in the presence of other blacks. Short heating at 100°C or long (>10 hr) heating at 60°C caused partial destruction of the structures.

9686. Drucker, C. **Gas friction and adsorption.** *Acta. Chem. Scand.* 6, 671-77(1952)(in German). —*C.A.* 47, 1989*f*.

The coeff. of friction for N_2, H_2, and their mixts., both dry and moist, was shown to be larger when the gas flowed through a capillary tube than when it flowed through a fritted-glass plate. A qual. interpretation was given on the basis that the layer of gas adsorbed at the walls increased the friction at the boundary of this layer above that in the inner part of the gas mass.

9687. Esposito Vitolo, A. and Fornari, A. **Characterization of inks from the standpoint of criminology. II. Chromatographic analysis.** *Minerva medicolegale e arch. antropol. criminale* 72, 59-62(1952).—*C.A.* 47, 5844*h*.

Chromatographic characteristics were given for 30 ink samples, the colors tabulated being referred to "Code universel des couleurs" by Seguy; the results of examn. in ultraviolet light in zones of the absorption column were also listed.

9688. Falk, Hans L. and Steiner, Paul E. **The identification of aromatic polycyclic hydrocarbons in carbon blacks.** *Cancer Research* 12, 30-9(1952).—*C.A.* 46, 8831*h*.

Benzene exts. of some carbon blacks contained the strong carcinogen 3,4-benzopyrene, the weak carcinogen 1,2-benzopyrene, and pyrene, fluoranthene, 1,12-benzoperylene, anthanthrene, and coronene. Furnace blacks, with an av. particle diam. of 80 mμ or more, possessed all 7 of these aromatic hydrocarbons; blacks with particle size below 50 had few or none. These hydrocarbons were not detected in any channel blacks, which had particle diam. of 10-30 mμ, and were made by a different process. Soot itself appears to be carcinogenic on skin but possibly not on respiratory tract epithelium.

9689. Feng, I-Ming. **Lubricating properties of molybdenum disulfide.** *Lubrication Eng.* 8, 285(1952).—*C.A.* 47, 1451*h*.

The lubricating ability of MoS_2 was related to its crystal structure. It was shown by electron microscopy to have a laminar structure similar to graphite. Coeffs. of sliding friction of MoS_2 in thin films and in compressed pellets were detd. to be about 0.20. X-ray results for thin rubbed films showed oriented laminas, the orientation increasing with rubbing pressure.

9690. Ford, F.P. and Gessler, A.M. **Some properties of Butyl rubber-carbon black systems.** *Ind. Eng. Chem.* 44, 819-24 (1952).—*C.A.* 46, 10666*h*.

Butyl rubber mixts. contg. different types of carbon black were studied before and after vulcanization. With the raw mixts., the processing of the mixts. when the carbon black was dispersed to different degrees was studied. The degree of dispersion was detd. by photometry of dil. suspensions, by plastometry, and by electron microscopy, and the effects of the degree of dispersion were judged by extrusion and calendering. The effects of aging, temp., pressure, and mech. dispersion were evaluated.

9691. Ford, F.P. and Mottlau, A.Y. **The dispersion of SRF carbon black in Butyl rubber.** *Rubber Age* (N.Y.) 70, 457-63(1952).—*C.A.* 46, 3790*e*.

Large differences in the degree of agglomeration of carbon black were found, and these micrographs and light-transmission measurements of dil. solns. of the elastomer mixts. in heptane showed good correlation. The differences in degree of dispersion were reflected in the phys. properties of the unvulcanized mixts., and, consequently, in processing behavior, as evidenced by differences in viscosity (measured by the parallel-plate plastometer).

9692. Godfrey, Douglas and Bisson, Edmond E. **Bonding of molybdenum disulfide to various materials to form a solid lubricating film. I. The bonding mechanism.** *Natl. Advisory Committee Aeronaut.*, **Tech. Note** No. 2628, 16 pp. (1952).—*C.A.* 46, 5303*a*.

Air drying and heating of a mixt. of MoS_2 powder and some liquid vehicles caused the decompn. and polymerization of the vehicles. The resin product bound the particles of MoS_2 together and to the surface to be lubricated. MoS_2 was bonded to steel, Al, brass, stainless steel, and glass by the use of vehicles such as asphalt-base varnish, silicones, glycerol, ethylene glycol, polyglycol ether, and corn sirup but not by the use of a light petr. oil vehicle. The reduction of Fe_2O_3, formed by preheating steel in air, to Fe_3O_4 by corn sirup improved the lubricating properties of the solid film.

9693. Godfrey, Douglas and Bisson, Edmond E. **Bonding of molybdenum disulfide to various materials to form a solid lubricating film. II. Friction and endurance characteristics of films bonded by practical methods.** *Natl. Advisory Committee Aeronaut.*, Tech. Note, No. **2802**, 16 pp.(1952).—*C.A.* 47, 2469*e*.

MoS_2 could be bonded to metal with resin-forming liquid vehicles. For bonding thinned asphalt-base varnish, silicon varnish and glycerol were recommended; they gave just as satisfactory results as corn sirup. Application by brushing was followed by air drying, infrared drying, and oven curing. Bonding did not depend on any special surface finish. Friction and endurance tests showed excellent lubricating qualities of films 0.0002-0.0005 in. thick. At low sliding speeds asphalt-varnish bonded films were somewhat inferior.

9694. Gustavson, K.H. **Physicochemical studies of extremely basic chromic chlorides.** *J. Am. Leather Chemists' Assoc.* 47, 151-65 (1952).—*C.A.* 46, 10801*c*.

A soln. of strongly basic (31% acid) Cr chloride of formula $Cr_2(OH)_4Cl_2.2NaCl$ was prepd. by boiling hydrous Cr_2O_3 with HCl, adding NaOH, and again boiling. Analysis by means of 5 different sulfonic acid-type cation exchangers showed 30% of the total Cr to exist as cationic complexes forming salts of 67% av. acidity, corresponding to $Cr_2(OH)_2Cl_4$. The remainder of the Cr consisted of uncharged complexes of 15-18% acidity, corresponding to $[Cr_2(OH)_5Cl]$. Operation of the exchangers in the Na- or H-cycles gave identical results with the aged, boiled solns., but with freshly prepd., unheated solns. the Na-cycle gave higher values for noncationic Cr. All the Cr migrated as complexes of different mobility. The presence of uncharged, nonmigrating complexes, in addn. to cationic complexes of greater mobility, was shown by paper electrophoresis.

9695. Gwathmey, A.T.; Leidheiser, H. Jr., and Smith, G.P. **Friction and cohesion between single crystals of copper.** *Proc. Roy. Soc.* (London) A212, 464-7(1952).—*C.A.* 46, 8447*h*.

Friction and adhesion expts. were made between 2 large crystals of Cu of controlled orientation from the surface of which all oxide had been removed. One crystal was in the form of a sphere and the other was a sphere with 2 flat surfaces cut parallel to particular planes. The coeff. of dry static friction between two (100) faces was greater than 100 and between (111) faces was approx. 25. The greater value for the (100) faces was attributed to the greater digging-in and the increased area of contact produced by slip as displacement occurred.

9696. Hill, L.M. **Kubelka water absorption and free water determinations on vegetable-tanned sole leathers.** *J. Soc Leather Trades' Chemists* 36, 365-75(1952).—*C.A.* 47, 900*i*.

Free water and water absorption were detd. on 7 2-in. squares cut from a 7-in. × 7-in. square taken from the shoulder-belly corner of each of 22 sole leather bends of satisfactory quality. Analysis of variance showed that variability between bends was much greater than variability between squares from the same bend. The squares farthest removed from the shoulder-belly corner gave slightly lower values than others.

9697. Hirst, W.; Kerridge, M., and Lancaster, J.K. **Variation with load of the coefficient of friction and metallic transfer under con-**

ditions of boundary lubrication. *Proc. Roy. Soc.* (London) **A212**, 516-19(1952).—*C.A.* **46**, 8839*h*.

Data were reported for Cu surfaces, lubricated with 1 and 5 monolayers of stearic acid.

9698. HOUWINK, R. **The reinforcement of rubbers.** *Rev. gén. caoutchouc* **29**, 346-53 (1952).—*C.A.* **46**, 7808*c*.

Dispersion of a filler in a polymer and adhesion between the filler and polymer was easy if heat of wetting was evolved. When a sufficient proportion of solvent was added, the polymer mols. glide through the layers of solvent mols., which thereby act as a plasticizing agent. The adsorptive or reactive power of the surface of most filler particles was not evenly distributed over the surface because of chem. constitution and stereo conditions on the surface. Although some evidence indicated the formation of chem. bonds between polymer and filler, the major part of the reinforcing effect was attributable to van der Waal's forces, the energy spectrum of which depended on the chem. and stereo conditions of the filler surface.

9699. KILCHER, H. **Paper chromatography and tannins.** *J. Soc. Leather Trades' Chemists*, **36**, 331-5(1952).—*C.A.* **47**, 3017*f*.

Solns. (5% aq.) of various tannin exts. were examd. by the Rutter disc technique with 40 and 80% AcOH as the mobile phase. Under ultraviolet light each tannin gave characteristic zones of well-defined R_f values and colors. A grouping of tannins according to their fluorescence colors was proposed. Quebracho, oak wood, wattle bark, and tizera gave predominantly green fluorescence, while chestnut, oak bark, valonea, sumac, myrabolans, and Chinese and Aleppo galls gave mainly violet.

9700. KIRBY, K.S.; KNOWLES, E., AND WHITE, T. **Tannins. III. Fractionation of mimosa extract.** *J. Soc. Leather Trades' Chemists* **36**, 45-59 (1952).—*C.A.* **46**, 9877*b*.

Mimosa (wattle) tannin ext. and the fractions obtained by solvent extn. and by countercurrent distribution in immiscible solvents were examd. by 2-way chromatography. The papers, sprayed with ammoniacal $AgNO_3$ and bis-diazotized benzidene, showed the presence of 27 different polyphenolic substances. Examn. under ultraviolet light before and after exposure to NH_3 vapor showed the presence of 10 fluorescent substances most of which were in addn. to those shown by spraying. No one fraction contained less than 2 nor more than 11 substances.

9701. KIRCHHOF, F. **Technical carbon blacks and their use in the rubber industry. I. II. III.** *Gummi u. Asbest* **5**, 218-21, 306-8, 347-8, 350 (1952).—*C.A.* **46**, 11750*d*.

The history of carbon blacks, raw materials used in their manuf. and the characteristics of different types of carbon blacks were described, with diagrams of equipment. Phys. testing methods for detg. some of the properties of carbon blacks and the current classification of different types of carbon blacks were given. The properties imparted to various rubber products and to some plastics by different types of carbon black were described.

9702. KLING, W. AND LANGE, H. **Electrophoretic behavior of pigment particles in detergent solutions.** *Kolloid-Z.* **127**, 19-27 (1952).—*C.A.* **46**, 8932*c*.

Electrophoretic data showed that the neg. ζ-potentials of lampblack, Fe_2O_3, and powd. lignite in H_2O were raised considerably by anion-active detergents (Na dodecyl sulfate, K laurate, Na alkylbenzenesulfonate). In 0.02 N Na_2CO_3, which raised the mobilities in the absence of detergents, further increase in mobility was produced by K laurate only above 0.01 M in the case of Fe_2O_3. Nonionic detergents (polyethylene oxide products) lowered mobilities, especially in the presence of salt, and eventually to discharge the particles. Dodecylpyridinium chloride also caused discharge at concns. of $6 \times 10^{-5} M$ (for lampblack) and $6 \times 10^{-4} M$ (for Fe_2O_3). In detergent solns. added salts had very little effect on the mobility of Fe_2O_3.

9703. KOLTHOFF, I.M. AND GUTMACHER, R.G. **Sorption of GR-S type of polymer on carbon black. III. Sorption by commercial blacks.** *J. Phys. Chem.* **56**, 740-5(1952); *Rubber Chem. & Technol.* **26**, 102-14 (1953).—*C.A.* **46**, 9880*f*; **47**, 6169*b*.

A study of the sorption capacities toward GR-S of 5 com. types of carbon black was made to det. the influence of (1) nature of the carbon black; (2) solvent effect; (3) previous recent history of the carbon black; (4) degree of unsatn. of GR-S; (5) mol. wt of GR-S; and (6) shaking time. For the sorption capacities of the carbon black in decreasing order were Spheron-6, Vulcan-1, Philblack-O, Sterling-105, and Philblack-A. For sorption of GR-S by Vulcan-1, sorption increased with decreasing solvent power.

9704. KUZ'MINSKIĬ, A.S.; LYUBCHANSKAYA, L.I.; KHITROVA, N.G., AND BASS, S.I. **Effect of carbon black on the development of oxidation processes in crude and vulcanized rubbers.** *Doklady Akad. Nauk S.S.S.R.* **82**, 131-3 (1952).—*C.A.* **47**, 4641*g*.

Carbon black had an inhibiting action on oxidation of Na-butadiene rubber because of the decompn of both stable peroxides of rubber and peroxide radicals on its surface. This inhibiting action of carbon black was more pronounced during free (autocatalytic) than during inhibited oxidation. A portion of the inhibitor was sorbed and held firmly on the surface; this eliminated the influence of the inhibitor on the oxidation process.

9705. MANOV, G.G. AND BIZZELL, OSCAR M. **Radioisotopes in paint technology.** *Paint Technol.* **17**, 241-51(1952).—*C.A.* **46**, 10636*i*.

Possible uses of radioisotopes in the protective coatings industries included methods for detg. film continuity and uniformity, film thickness, wear resistance, optimum mixing times, adsorption, diffusion through films, cleanliness of metals, permanency of plasticizers, mechanism of corrosion, and mechanism of drier action. Pile-produced isotopes showed promise as activators in luminous paints.

9706. McKinney, John E. and Roth, Frank L. **Carbon black differentiation by electrical resistance of vulcanizates.** *Ind. Eng. Chem.* 44, 159-63(1952).—*C.A.* 46, 4835*c*.

The resistivity of vulcanizates contg. carbon blacks was affected considerably by flexing, but by avoiding flexing after vulcanization and before testing, the variation coeff. of the resistivity of identical vulcanizates prepd. on different days was approx. 10%. The resistivity decreased with increase in the time of vulcanization rapidly during the undercured stage and slowly during the overcured range. For states of cure where strain tests could be made, the resistivity decreased with the time of vulcanization in accordance with the equation: $(R - R_0)(t - t_0) = 1/b$, which is of the same form as that relating strain and time of vulcanization. Elec. resistivity could be used as a criterion for differentiating between different types of carbon blacks and for detecting differences between different lots of the same type.

9707. Parker, C.A. **Chromatography of rubber accelerators and antioxidants on silica gel.** *Nature* 170, 539-40(1952).—*C.A.* 47, 2528*e*.

Celite allowed chromatographic adsorption of some compds. from acetone exts. of vulcanized rubbers without the destruction of labile compds., as occurred when Al_2O_3 columns were used. Portions of the ext. corresponding to 0.2-0.4 g of rubber were chromatographed on a column 1 cm in diam. The positions of the zones were found by streaking the extruded columns with appropriate reagents. As little as 0.05 mg of most compds. could be detected.

9708. Parker, C.A. and Berriman, Joyce M. **Chromatographic analysis of vulcanized rubbers. Some rapid methods for the detection of certain accelerators and antioxidants.** *Trans. Inst. Rubber Ind.* 28, 279-96 (1952).—*C.A.* 47, 3602*e*.

The chromatographic behavior of 32 com. accelerators and antioxidants on silica gel-Celite adsorbent was studied. The compds. were extd. from the rubber mixts. by hot acetone, the exts. were freed completely of acetone, and solns. for chromatographing were prepd. from the residues by soln. in methylene chloride or CCl_4. Adsorption series were established with 4 binary solvent mixts., and, based on the results, some simple and rapid methods were developed for the identification of the different compds. Different streak reagents were used on the extruded chromatographic column, and with many of the compds. studied, the reagents, in conjunction with the positions of developed zones gave almost unambiguous identification.

9709. Paulson, C.F. **Profits from wastes.** *Industry and Power* 62, 83-84 (1952).

The use of a strongly acidic cation exchanger to purify chromic acid anodizing solns. and a strongly basic anion exchanger to recover chromate from dil. rinse solns. was considered. A process was described which was claimed to be operating on a commercial scale. The advantages over previously employed methods of treating chromate solns. were outlined. Some cost figures and a flow diagram of a chromate recovery system were included.

9710. Pechkovskaya, K.; Mil'man, Ts., and Dogadkin, B. **Structure and properties of loaded rubber mixtures. IX. Alteration of the carbon structures by repeated deformations.** *Kolloid. Zhur.* 14, 250-9(1952).—*C.A.* 46, 9879*i*.

In vulcanized rubber contg. carbon black, the elec. c.d. $i = V^n/pl$, where l was the distance between the electrodes and V the voltage. The resistivity p was an inverse measure of the extent of structure formation by carbon black, and n was greater the more numerous the rubber interstices between the black particles. When rapid extensions and contractions were repeated, p became an almost definite function of the length of the specimen, decreasing when the length increased. After 360,000 extensions and contractions carried out within 12 hrs, p increased 5- to 50-fold, depending on the type of rubber.

9711. Phender, Max. **A simple method for testing lubricants by boundary friction.** *Erdöl u. Kohle* 5, 342-8 (1952).—*C.A.* 46, 8839*f*.

Small test pieces of soft lead were compressed between two parallel planes to which the lubricant was applied. Two forces opposed the force of compression, a force resisting deformation and a radial force resisting the sliding motion on the two planes. The load was applied at a const. rate up to a P max. = 2000 kg. Values for mean surface pressure at P = 2000 kg., mean friction, and lubricating values were given for various soaps, NaOH, mineral oils, rapeseed oil, and tallow.

9712. Popp, G.E. and Harbison, Lynn. **Ozone and sunlight effect on aging of carbon black vulcanizates.** *Ind. Eng. Chem.* 44, 837-40 (1952). —*C.A.* 46, 10668*e*.

Natural rubber-carbon black vulcanizates and GR-S (low-temp. polymer)- carbon black vulcanizates contg. and not contg. an antioxidant were exposed to sunlight and to atm. O_3, resp. Germicidal lamps in a special cabinet were utilized for the O_3 tests; the sunlight tests were in the spring in Ohio. Two series of specimens were exposed: (1) elongated 100% and (2) bent 180°. Deterioration by sunlight or O_3 did not differ with the type, particle size, structure, and phys. properties of carbon black.

9713. Ratner, S.B. **The law of static friction.** *Doklady Akad. Nauk S.S.S.R.* 83, 443-6 (1952).—*C.A.* 46, 8462*d*.

Exptl. detns. of the friction coeff. μ defined by $F = \mu N$ (where F = friction force, N = force applied in pressing one solid against the other), for different resins on steel, and Al alloy, and on plexiglas, showed a linear increase of μ as a function of $1/N$. The data could be represented by $\mu = a + (b/N)$.

9714. Ratner, S.B. and Sokol'skaya, V.D. **Effect of fillers on the coefficient of static friction of resins.** *Doklady Akad. Nauk S.S.S.R.* 86, 121-4(1952).—*C.A.* 47, 1971*c*.

The dependence of the friction coeff. μ on the stress N, of the form $\mu = \mu_\infty + (A/N)$, was verified for resins contg. 10, 45, and 60% carbon black, on Plexiglas, steel, and an Al alloy. The const. A increased with decreasing amt. of filler but was independent of the nature of the support. This meant that the adhesion of the resin to the solid surface was detd. essentially by the hardness of the softer component, i.e. of the resin, and that was detd. by the amt. of filler. The value of μ_∞ was independent of the amt. of filler, but did vary with the nature of the support. Graphite had the same effect as other fillers, but some lowering of μ_∞ was found with sufficiently large amts. of graphite.

9715. RESEN, F. LAWRENCE. **New carbon-black plant completes shakedown run.** *Oil and Gas J.* 50, No. 41, 114, 116(1952).—*C.A.* 46, 4206*b*.

The new carbon-black plant of the Continental Oil Black Co., located at Lake Charles, La., was currently producing high-abrasion carbon-black.

9716. ROUX, D.G. **The fractionation and paper chromatography of black wattle extract.** *J. Soc. Leather Trades' Chemists* 36, 274-84 (1952). —*C.A.* 47, 3017*h*.

Black wattle ext. was fractionated to yield gums, sugars, and polyphenolic tannins, by the following method: A 10% aq. soln. was treated with an equal vol. of EtOH to ppt. gums. These remained stationary both on one- and 2-dimensional chromatograms, with water a minor proportion of the developing agent. One-dimensional chromatograms of the sugars showed the presence of sucrose, glucose, and fructose. One-dimensional paper chromatography of polyphenolic tannins showed small amts. of 3 fluorescent materials, one of which was identified as fisetin.

9717. SCHULZ, E.F. **An improved water extraction test for polyvinyl chloride elastomers.** *ASTM Bull.* No. 183, 75-8(1952).—*C.A.* 46, 9885*b*.

Because of the low water soly. of the plasticizers in vinyl sheeting, large amts. of fresh water must be used in the extn. test. Adding activated carbon to the water prevented satn., and permitted a test with a limited amt. of extractant. The percentage water extn. decreased with increasing specimen thickness, but increased with test temp. and plasticizers concn.

9718. SHEEHAN, G.M.; KRAUS, GERARD, AND CONCIATORI, A.B. **Carbon-black flocculation in rubber-to-metal cements.** *Ind. Eng. Chem.* 44, 580-2 (1952). —*C.A.* 46, 5353*c*.

Vulcanizable GR-S mixts. contg. different loadings of carbon black were used. Milling the individual ingredients and xylene in a ball mill gave strong bonds between rubber and brass and between rubber and steel covered with chlorinated rubber, chlorinated polyisoprene, and butadiene-methacrylic acid copolymer, resp., were obtained. Rupture was entirely in the rubber or at the rubber cement interface. For a given loading, acidic carbon blacks gave the strongest bonds. Under all the conditions studied, adhesion was ascribed either to covalent bonds or to H-bonds.

9719. STUDEBAKER, MERTON L. **The relationship between the modulus of reinforced rubber compounds and the physical properties of various carbon blacks.** *India Rubber World* 127, 215-19, 225(1952).—*C.A.* 47, 1419*h*.

The more strongly hydrophobic a carbon black was the greater was the force of attraction between a given area of carbon black surface and the rubber in which it was dispersed. The carbon to-rubber forces per unit surface were greatest on carbon blacks contg. the highest percentage of H and lowest percentage of O. Probably both phys. and chem. forces play active parts in the reinforcement of rubber by carbon black.

9720. SWAMINATHAN, V.S. **Large carbon-black plant now operating in Britain.** *Petroleum Refiner* 31, No. 1, 124-5(1952).—*C.A.* 46, 2782*e*.

The Philblack Ltd. carbon-black plant near Bristol was in operation. This plant will produce 30 million lb per yr of medium-abrasion furnace (A) black 20 and high-abrasion furnace (O) type from 70,000 tons a yr of a special petroleum fraction obtained in the U.S.

9721. SWEITZER, C.W. **The role of heat in the carbon-black reinforcement of rubber. I. The carbon gel complex in reinforcement.** *Rubber Age* (N.Y.) 72, 55-63 (1952); *Can. Chem. Processing* 36, No. 12, 94-9 (1952).—*C.A.* 47, 903*d*, 5712*e*.

Results were given of expts. on the carbon gel of *Hevea* rubber contg. different types of carbon black, i.e., the effect of surface area on the proportion of carbon gel; the effect of temp. on the proportion of carbon gel in *Hevea* rubber and in GR-S; the effect of the mol. wt and unsatn. of polyisobutylene on carbon gel formation; and a photographic proof of the presence of carbon gel in *Hevea* rubber-carbon black mixts. Fineness, i.e., total surface area of the carbon black was the dominant factor in the development of carbon gel. Structure, pH, and other properties of carbon black played differing but minor roles. The higher the mol. wt and unsatn. of the polymer, the higher the carbon gel content.

9722. SWEITZER, C.W. AND LYON, FRANCIS. **Oxidation of unvulcanized cold rubber. Influence of adsorption by carbon black.** *Ind. Eng. Chem.* 44, 125-31 (1952).—*C.A.* 46, 3312*g*.

Efforts were made to overcome reversibility by removal of solvent. Evapn. to dryness was necessary; then adsorption increased sharply and the temp. coeff. became pos. Under conditions where scission predominated, carbon black depressed the scission reaction. Under conditions where cross-linking dominated, carbon black depressed the aggregative process. The role played by carbon black was its capacity to remove intermediate oxidation products which caused scission and gelation. These results came sufficiently close to paralleling those obtained with mixts. prepd. on a mill to suggest the use of this method to predict the behavior of carbon black in elastomer mixts.

9723. SWEITZER, C.W.; VENUTO, L.J., AND ESTELOW, R.K. **Properties and uses of colloidal carbon.** *Paint, Oil, Chem. Rev.* 115, No. 8, 22-4, 26, 28, 30, 32, 55, 58-60, 62,64 (1952).—*C.A.* 46, 6361*h*.

Colloidal carbon included all carbon pigments in the range from approx. 13 mμ to 150 mμ. Raw materials, manufg. processes, and conditions existing during manuf. affected particle size, shape, porosity, pH, chem. activity, etc. The type of process had the greatest influence. Electron micrographs show that all forms had a reticulate chain structure. Tremendous surface area, as much as 12 acres per lb, accounted largely for their effectiveness in reinforcing rubber. pH, porosity, and adsorptivity may have beneficial or harmful effects on vulcanization and end properties. Adsorptive ability was affected by structure, porosity, O-contg. volatile matter, unsatn., and alkali salts from cooling water.

9724. TABOR, D. **Boundary and extreme-pressure lubrication. Mechanism of boundary lubrication.** *Proc. Roy. Soc.* (London) **A212**, 498-505 (1952).—*C.A.* 46, 8839*i*.

The most effective lubrication was provided by a solid boundary film that possessed a close-packed strongly oriented structure. Fatty acids were generally more effective than hydrocarbons or alcs., since they could react with the surface to form metallic soaps of relatively high m. ps. This chem. attack generally occurred via the metal oxide film on the surface. The soap formation and the difference between a physically adsorbed and a chemically formed layer were investigated by radioactive methods. At the m.p. of the lubricant film a marked increase in pick-up and friction occurred. At still higher temps. a second deterioration in lubricating properties occurred, corresponding to the desorption of the lubricant film.

9725. TOLSTOI, D.M. **Molecular theory of the slip of liquids on solid surfaces.** *Doklady Akad. Nauk S.S.S.R.* **85**, 1089-92(1952).—*C.A.* 47, 1450*c*.

The velocity of slip V_s in a unimol. layer of liquid adjacent to a solid was treated by applying Frenkel's theory of liquids. The effect of slip in the absence of wetting could be considerable, but for Hg it should be observable only in capillaries of diam. of the order of 1-10μ.

9726. VODRA, VICTOR H. **Ultra-fine precipitated calcium carbonate as a "white carbon black."** *Rubber Age* (N.Y.) 71, 507-14 (1952).—*C.A.* 46, 10670*c*.

The subjects discussed were definitions of reinforcement, differences in the phys. and phys.-chem. character of com. grades of $CaCO_3$ and carbon blacks, differences among various types of $CaCO_3$, the effects of particle size of $CaCO_3$ on the quality of vulcanized rubber, dispersion and processing, and the special features of ultra-fine pptd. $CaCO_3$. The effects of the particle size of $CaCO_3$ on the tensile strength, resistance to tearing, and flexing life of vulcanized natural rubber and GR-S were shown.

9727. WILLIAMS, C.G. **Mechanism of action of extreme-pressure lubricants.** *Proc. Roy. Soc.* (London) **A212**, 512-15(1952).—*C.A.* 46, 8840*b*.

Under progressively increasing load the oil film between sliding metals eventually became discontinuous and metallic contact began to occur. The loading practicable without serious surface damage could be increased many fold by using a lubricant contg. an additive capable of reacting chemically with the sliding surfaces to provide emergency protection. The reaction was accelerated by the sharply rising temp. assocd. with incipient seizure, and the protective product was formed in just those places where temps. and pressures rose to values which were extreme relative to those typical of hydrodynamic lubrication.

9728. WILLIAMS, IRA. **Some effects of solid fillers in rubbers.** *India Rubber World* **126**, 359-63 (1952).—*C.A.* 46, 8886*i*.

An organized type of rubber, e.g., natural rubber, was characterized when vulcanized by high-tensile strength and an x-ray diffraction pattern on stretching. This favorable position of the rubber mols. for bonding and efficient vulcanization must either be originally and naturally existent or be effected by a strong external force. Neoprene and Butyl rubber also were organized; butadiene-styrene copolymers were the unorganized type. Organized rubber could be partially disorganized before vulcanization by swelling with an oil, whereas after vulcanization the same oil had no such effect. Pigments contributed to the reinforcement of rubber in 3 ways: (1) mechanically, (2) firm adsorption of the rubber by the filler, and (3) most important, an organizing effect which resulted in more efficient cross-bonding of the rubber mols. during vulcanization.

9729. WILSON, R. **Influence of oxide films on metallic friction.** *Proc. Roy. Soc.* (London) **A212**, 450-2(1952).—*C.A.* 46, 8462*f*.

The mechanism of metallic friction, in air, was investigated for loads ranging from 0.003 to 10,000 g on Pt, Au, Ag, Cu, Sn, Pb, Zn, Cd, Mg, Al, and Cr. With most metals the natural oxide layer was sufficient to prevent metallic contact at very small loads. The degree of protection depended on surface, roughness, the thickness of the oxide film, the relative hardness of the oxide and the metal substrate, etc.

9730. YOUNG, LUTHER O. **Characteristics of flatting agents.** *Paint Varnish Production* **42**, No. 6, 17-20, 44(1952).—*C.A.* 46, 9861*f*.

The synthetic silicas were the best of the commonly used flatting agents. The synthetic silicas were competitive with other types of flatting agents when flatting efficiency was considered. For flat lacquers of spraying viscosity, silicas of 6-14 μ particle size gave the highest flatting efficiency. Synthetic silica flatting agents of this particle-size range required no milling, only dispersing into the desired vehicle. Because of comparatively low loading necessary to get flat films, coatings flatted with synthetic silica had superior flexibility and washability.

9731. ZUEV, YU. S. **Role of carbon black in the action of light on rubber.** *Doklady Akad. Nauk S.S.S.R.* **82**, 935-8 (1952).—*C.A.* 46, 8406*g*.

The rate of elongation of polybutadiene rubber films, kept at 25° ± 0.1° under const. tensile stress increased by simultaneous illumination, more strongly when the rubber contained carbon black. With polyisobutylene rubber, without carbon black, the rate of deformation was the same in the presence or absence of light, but with carbon black illumination increased the rate considerably. The effect of carbon black was not specific: 1% of the dye Sudan black in Butyl rubber and 2% in polybutadiene rubber were even more effective than carbon black. The effectiveness of small amts. (0.2% carbon black and of the black dye), indicated that their action was linked with absorption of light and not with a sepn. of chains by the filler.

9732. AMERONGEN, G.J. VAN. **Influence of carbon black on the oxidation of natural rubber.** *Ind. Eng. Chem.* 45, 377-9 (1953).—*C.A.* 47, 5710*f*.

The study included carbon blacks of different particle sizes, and involved 4 sets of measurements: rate of oxidation, direct and indirect detn. of the soly. of O_2 in rubber, and adsorptive power of carbon black for iodine. Rubber-carbon black mixts. were studied in both the raw and vulcanized states. The greater the sp. surface area, the greater the absorption of I_2 and the soly. of O_2. The normal absorptive power was the same for free carbon black and for the same carbon black in rubber. The higher the temp., the smaller the differences in O_2 soly. The rate of chem. absorption of O_2 was higher at the early stage of oxidation than later, and the greater the surface area of the carbon black, the higher was this rate.

9733. BANIGAN, THOMAS F. JR. **Differential migration of rubber by reversed-phase partition chromatography.** *Science* 117, 249-50 (1953).—*C.A.* 47, 7247*a*.

Rubber was reproducibly chromatographed by using cyclohexanone or mixts. of butyldiethyleneglycol acetate with cyclohexanone or xylene, and filter paper, e.g., Whatman No. 1, treated with a 5 vol. % soln. of methyltrichlorosilane in benzene. The partitioned rubber was stained by a 0.25% soln. of oil blue NA(Calco) in aq. EtOH (1:1). Chromatograms showed increased soln. mobility caused by progressive breakdown of deresinated guayule on mill rolls and by the presence of 1% Cl_3CCOOH in guayule and in *Hevea* rubber.

9734. POLLEY, M.H.; SCHAEFFER, W.D., AND SMITH, W.R. **Development of stepwise isotherms on carbon black surfaces.** *J. Phys. Chem.* 57, 469-71 (1953).—*C.A.* 47, 7285*b*.

The adsorption of A, N_2 and O_2 by carbon black at -195°C was measured after various heat-treatments. The carbon black was partially graphitized by heating at 1000, 1500, 2000, and 2700°C. The structure was altered by these heat-treatments, as shown by x-ray diffraction. Electron-microscopic studies indicated a transition from approx. spherical particles to irregular polyhedra for the graphitized samples. The original carbon samples exhibited the usual sigmoid-type isotherms, whereas with increasing degree of graphitization as many as 3 steps appeared in the adsorption isotherms at relative pressures of 0.35, 0.63, and 0.86.

9735. RAGG, M. **Effect of surface properties and surface reactions on the growth formation on ship bottoms.** *Farbe u. Lack* 59, 17-20(1953).—*C.A.* 47, 3001*f*.

The absence of growth on the thalli of seaweed or algae was interpreted as the result of the low adsorbing power of surfaces with low surface energy, e.g. hydrophilic surfaces in water. Water-insol. hydrophilic coatings would inhibit the deposition of "primary" slime on ship bottoms, particularly in conjunction with poisons. Another surface property of structural materials was their neg., acidoid charge in water which leads to a strong adsorption of metallic ions and creates the laminary zone rich in poison ions which would otherwise be rapidly depleted, but also helps the attachment of the protein surfaces of balanide larvae, etc.

9736. SCHYTIL, F. AND VOLPERS, R. **The reinforcing action of rubber fillers.** *Kolloid-Z.* 130, 110-15(1953).—*C.A.* 47, 6689*i*.

The effect of particle size on the reinforcing action of Al_2O_3 was measured by prepg. optimum vulcanizates from the mixt.: rubber 100, S 3, Vulkacit-D and -DM 1, ZnO 5, wool fat 4, heavy MgO 2, and Al_2O_3 90 parts. The bulk d. of the Al_2O_3 varied from 120 to 200 g per liter. The finer particle sizes resulted in higher tensile strength, elongation, and tear strength, and lower modulus, hardness, and rebound. Stress-elongation curves, obtained in the range 253-353°K, indicated that the vulcanizates with fine Al_2O_3 had lower internal energy owing to the higher neg. entropy term of the finer particles.

9737. SHELTON, J. REID AND COX, W.L. **Effect of oxygen concentration on aging of rubber vulcanizates. I. Effect of partial pressure of oxygen on rate of absorption.** *Ind. Eng. Chem.* 45, 392-6 (1953).—*C.A.* 47, 6169*e*.

The effects of the partial pressure of O_2 on the rate of absorption of O_2 by inhibited and uninhibited natural rubber-carbon black and GR-S-carbon black vulcanizates were studied. The expts. were limited to the const.-rate stage. The rate of O_2 absorption, K_2, in the const.-rate stage was a function of the sq. root of the partial pressure of O_2 for amine-inhibited natural rubber and GR-S vulcanizates. A general equation of the form: $K_2 = b(P + a)^{0.5}$, where P = pressure of O_2 was in good accord with the exptl. data. Initiation by direct attack of O_2 on the hydrocarbon was an important factor in the mechanism of oxidation of amine-inhibited vulcanizates in the const.-rate stage.

9738. SHELTON, J. REID AND COX, W.L. **Effect of oxygen concentration on aging of rubber vulcanizates. II. Effect of partial pressure of oxygen on changes of physical properties accompanying oxidation.** *Ind. Eng. Chem.* 45, 397-401 (1953).—*C.A.* 47, 6169*i*.

The higher the concn. of O_2, the higher was the rate of increase of O_2 absorption, and the higher was the net rate of deterioration of phys. properties. Chain scission was promoted by a high concn. of O_2, whereas cross-linking took place to a relatively great extent at low concns. of O_2. R-radicals were more effective than RO_2-radicals in reacting with double bonds to form cross-links. Heat aging in the absence of O resulted in notable stiffening, particularly for the GR-S vulcanizate. Since lowering of tensile strength was a direct indication of deterioration of natural-rubber vulcanizates, the aging of the latter in air at room temp. was better than would be predicted by tests in O_2 at elevated temps. On the contrary, with GR-S vulcanizates, oxidative hardening was the most serious effect of aging.

V-13. Catalytic Processes on Carbon Adsorbents

9739. Rhead, T.F.E. and Wheeler, R.V. **The rate of reduction of carbon dioxide by carbon.** *J. Chem. Soc.* **101**, 831-45(1912).

The gases were recirculated by means of an automatic Sprengel pump for periods from 4.5 to 40 min. The temp. of the "purified carbon" was varied from 750° to 1100°C. The values of the rate const., k, and the %CO_2 reduced in a given time were detd. by the conditions of expt. as regards rate of circulation of the gases and the length of the column of carbon. The results were of value in regard to the mode of combustion of carbon by O_2. In the series of expts. in which a mixt. containing 20% CO_2 and 80% N_2 was employed, the mean values of k were: 900°C, 0.00060 (t = 1 min.); 950°C, 0.00374; 1000°C, 0.01764; 1050°C, 0.05760; 1100°C, 0.10570.

9740. Rhead, T.F.E. and Wheeler, R.V. **The combustion of carbon.** *J. Chem. Soc.* **101**, 846-56 (1912).

Some CO was produced during the oxidation of a purified wood charcoal at low temps. under conditions which did not admit of the reduction of CO_2 by carbon. CO_2 was undoubtedly produced at low temps. in quantity which could not be altogether accounted for by the supposition that CO was first formed and then oxidized to CO_2. When carbon was burned at low temps., therefore, CO_2 and CO were produced simultaneously.

9741. Gwosdz, J. **Theory of water-gas formation.** *Z. angew. Chem.* **31**, *I*, 137-40 (1918); *J. Soc. Chem. Ind.* 37, 538A.—*C.A.* **13**, 1009.

Superheated steam was passed over various forms of heated carbon and the compn. of the issuing gases detd. The temps. varied from 855° down to 560°C, and the speed of the current of steam was also varied. Natural forms of carbon contg. ash in appreciable quantities behaved in a markedly different manner than purified carbon almost free from ash. With gas coke (8.5% ash) and wood charcoal (1.4% ash) a considerable proportion of CO_2 was always formed (up to 29%). On the other hand lamp carbon (0.1% ash) at temps. down to 600°C gave mixts. closely resembling com. water-gas.

9742. Gwosdz, J. **The principles of water-gas production. Decomposition of steam by red-hot charcoal.** *Verhandl. ver. Bef. Gewerbfleisses* **1918**, 33-45, 55-70; *J. Soc. Chem. Ind.* **38**, 125-6A(1919).—*C.A.* **13**, 2753.

CO was produced as primary product even at a relatively low temp., using charcoal contg. a min. ash content. Further, at the surface of the charcoal, CO_2 was produced by the interaction of CO and steam, the extent of this reaction being largely conditioned by the ash content of the charcoal. The quantity of steam decompd. in unit time varied with the surface area of the charcoal.

9743. Hodsman, H.J. and Cobb, J.W. **Oxygen in gas production.** *Gas J.* **150**, 640-7(1920); *Gas World* 72, 510-17(1920).—*C.A.* 14, 2408.

By using a mixt.of O_2 and steam the coke could be converted into gas with a small expenditure of heat, while the sensible heat of the water gas could be used for carbonizing the coal, thus attaining the max. thermal efficiency. Carbonization with steam would enable nearly 95% of the heating power of the coal to be saved.

9744. Bourcoud, A.E. **Gasification of powdered coal.** *Chem. Met. Eng.* 24, 600-4 (1921).—*C.A.* **15**, 1798.

The problem was to convert ordinary coal and oils completely into gas without leaving unconsumed carbon, and to regulate the time and temp. necessary to complete the reaction. Complete reduction could not be obtained unless the last traces of the first products of combustion reacted with the last traces of carbon in suspension at a temp. well above equil., in general 1100-1150°C. Preheated primary air, from 400 to 560°C must be added. In those examples representing the best results, a temp. of 1700-1800°C was reached in the combustion chamber.

9745. Kohn, S. **Theory of the water-gas process.** *Ind. Eng. Chem.* **14**, 69-72(1922).—*C.A.* **16**, 634.

Ten possible and the 3 probable combinations of reactions which could be used to explain the water-gas process were discussed. Conclusions were drawn from the compn. of the resulting gases to the actual procedure of the reactions.

9746. Sinnatt, F.S. and Slater, L. **Producer gas from pulverized fuel.** *Fuel* 1, 2-3(1922).—*C.A.* **16**, 2980.

By heating bituminous coal powder for a short time to 420-500°C its coking qualities were destroyed although the loss in volatile matter was comparatively small. The fineness of the coal was unaltered by the treatment, and it was then used in the gasification chamber without larger aggregates being produced. The same coal powder cohered badly if an attempt was made to gasify it without previous destruction of its coking properties.

9747. Haslam, R.T.; Hitchcock, F.L., and Rudow, E.W. **Water-gas reactions.** *Ind. Eng. Chem.* **15**, 115-21 (1923).—*C.A.* 17, 868.

The formation of water gas was studied from 650° to 1200°C by varying the steam pressure in the generator and using 2 kinds of carbon. The essential reactions were: (1) $C + H_2O = CO + H_2$; (2) $C + 2H_2O = CO_2 + 2\ H_2$; (3) $C + CO_2 = 2CO$. These reactions took place at the surface and were monomol. The rate of formation of CO_2 below 900°C was $CO_2 = 0.5\ [H_2O - (H_2O)^2]$ and above 900°C $CO_2 = 0.47\ [H_2O - (H_2O)^{1.85}]$.

9748. Lewis, W.K. **Chemistry of combustion in coal-fired furnaces.** *Ind. Eng. Chem.* **15**, 502-3(1923).—*C.A.* 17, 2041.

The percentages of O_2, CO_2 and CO in gases drawn from different levels of the fuel bed of a coke-fired furnace showed (1) that CO_2 was the initial product of interaction of O_2 with carbon and that CO was formed only by reduction of CO_2; (2) the limiting factor in rate of CO_2 formation was the speed of diffusion of O_2 through the inert gases around the carbon particle rather than rate of chemical combination, while the CO concn. depended upon the rate of chem. reaction.

9749. Haslam, R.T. **Producer gas-apparent equilibrium between its constituents and influence of depth of fuel bed.** *Ind. Eng. Chem.* **16**, 782-4(1924).—*C.A.* **18**, 3704.

The constituents of producer gas came to an apparent equil. value dependent on the thickness of the fuel bed alone and independent of gas velocity (rate of firing), ratio of steam to coal, or temp. in the exit gases. A hypothesis explaining this was given, based on the reaction $H_2O + CO = CO_2 + H_2$ being catalyzed by hot surfaces which the gases could reach only by diffusion.

9750. Newell, H.E. and Sinnatt, F.S. **The carbonization of coal in the form of fine particles. I. The production of cenospheres.** *Fuel in Science & Practice* **3**, 424-34 (1924).—*C.A.* **19**, 883.

Coal (60-90 mesh) was dropped through N_2 or coal gas at a definite temp. with recovery of the residue. At 600°C the particles became spherical and swollen, with a lustrous black pitchy appearance and minute vesicles on the surface. The term cenosphere was proposed. These were reticulated and hollow with a ribwork of a brownish black substance and thin films, termed windows. The latter were transparent, varying in color from colorless to brown and in size and thickness according to the carbonizing temp. and 1 expt. varied in no. from 24 to 104 per cenosphere.

9751. Pexton, S. and Cobb, J.W. **Gasification of coke in steam with special reference to rates of gasification and the composition of the gas.** *Gas J.* **167**, 161-9; *Gas World* **80**, 675-8(1924).—*C.A.* **19**, 3368.

A steady stream of N_2 satd. with steam at a known temp. was passed through a column of coke (3 in. in length and 1 in. in diam.) maintained at a desired temp. The steam was passed at different rates and the compn. of the gas produced and the amts. of steam decompd. were detd. The production of high-grade water gas was unlikely under conditions which favored NH_3 preservation. The remaining series of expts. was conducted at 1000°C. The rates of gasification of the carbon of the 900°C coke, the 1270°C coke, and the works-oven coke at 1000°C for a rate of steam such that the time of contact was 2 seconds were as 10:7:5.

9752. Bone, W.A. **Combustion of carbonic oxide.** *Gas J.* **174**, 725-31; *Gas World* **85**, 4-6, 34-8 (1926).—*C.A.* **21**, 2799.

A brief historical survey of the subject was given, followed by a description of recent investigations.

9753. Marson, C.B. and Cobb, J.W. **Influence of ash constituents in carbonization and gasification of coal. II.** *Gas J.* **175**, 882-91 (1926).—*C.A.* **21**, 2548.

Special cokes were made by adding 5% of SiO_2, Al_2O_3, CaO and Fe_2O_3 and equiv. quantities of $CaCO_3$ and Na carbonate to sep. portions of a coal contg. less than 1% of ash. The addns. of SiO_2, Al_2O_3 and fireclay gave similar results to the "pure" coke, but the CaO, Fe_2O_3 and Na carbonate showed a marked increase in reactivity. At 10 liters/hr the steam decompd. was 61% for the "pure" coke, 82, 91, 98% for the CaO, Fe_2O_3 and Na carbonate cokes, resp., while the corresponding percentages of CO_2 in the water-gas made were 9.2, 5.4, 2.6 and 0.4.

9754. Newell, H.E. and Sinnatt, F.S. **The combustion of particles of coal in air. II. The study of cenospheres.** *Fuel in Science & Practice* **5**, 335-9(1926).—*C.A.* **20**, 3342.

When particles of vitrain or clarain from coking coals were heated in an inert atm., cenospheres were formed. Microscopical examn. showed that these were hollow spheres built up by a lattice, the spaces of which were filled with films. Formation of cenospheres was dependent largely upon temp., 600-650°C being most favorable; at higher temps. their size in relation to coal particles was greater and their structure was more fragile.

9755. Agde, G. and Schmitt, H. **Researches on the reduction capacity of coke.** *Z. angew. Chem.* **40**, 1003-8, 1027-32(1927).—*C.A.* **21**, 4052.

Expts. were carried out by heating various cokes such as a model coke made from nearly ash-free soot and pitch, pitch and graphite, pitch coke, and some com. cokes in a tube through which dry CO_2 was passed. Data were taken on the rate of flow of gas, analysis of effluent gases, temp. of tube, size and condition of coke particles, and duration of run. Temps. varied from 600° to 1000°C.

9756. Bone, W.A. and Forshaw, A. **Catalytic combustion. V. The union of carbon monoxide and other gases with oxygen in contact with a fireclay surface at 500°.** *Proc. Roy. Soc.* (London) **114A**, 169-80(1927).—*C.A.* **21**, 1745.

The rate of catalytic combustion of moist H_2 far exceeded that of moist CO. With a moist mixt. of CO and O_2 in combining proportions, the rate of combination was always directly proportional to the pressure of the dry mixt., provided that the CO_2 was quickly removed from the system. When the CO and O_2 were present in other than their combining proportions, their rate of combination was proportional to the partial pressure of the CO. The catalyzing power of the fireclay surface could be temporarily stimulated by previous exposure to the combustible gas and could be removed by exposing the surface to O_2 at the reaction temp.

9757. Brender À. Brandis, G.A. and LeNobel, J.W. **The reactivity of coke.** *Het Gas* **47**, 37-47(1927).—*C.A.* **21**, 2376.

Dry CO_2 was passed through 3-cm columns of six different cokes (2-4 mm particles), charcoal, and retort graphite at 900°C using 35 cm pressure and analyzing the gas. Results in % CO were: 44.2, 17.2, 14.7, 13.0, 28.9, 6.4, 79.6 and 5.7. CO_2 percentages formed at 450°C in air at 25 cc. per min. were, with the same app. 12.7, 11.2, 9.4, 10.1, 12.1, 6.5, 20.8 and 4.7. The usual rapid increase in CO_2 content of the gas, the actual cause of temp. rise, was approx. 20° lower and was a better measure of reactivity.

9758. Haslam, R.T.; Mackie, R.F., and Reed, F.H. **Reactions in the fuel bed of a gas producer. II. Effect of depth of fuel bed and rate of**

firing. *Ind. Eng. Chem.* 19, 119-24(1927).—*C.A.* 21, 813.

At const. steam rate, the cold gas efficiency, the gas heating value, and the % steam decompn. were all increased by increasing either the firing rate or the depth of fuel. The thickness of the oxidation zone and of the primary reduction zone were independent of the firing rate or the total depth of fuel, the improved results above-mentioned being due to increased temp. of the primary reduction zone.

9759. HASLAM, R.T.; WARD, J.T., AND MACKIE, R.F. **Reactions in the fuel bed of a gas producer. III. Effect of the steam-coal ratio.** *Ind. Eng. Chem.* 19, 141-4(1927).—*C.A.* 21, 813.

At a firing rate of 40 lb coal/ft^2/hr, the optimum steam ratio was 0.7-0.8 lb/lb coal, this optimum value increasing with increased rate of firing, and vice versa. The thickness of the oxidation and of the primary reduction zones were independent of the steam ratio, but the temp. of the primary reduction zone decreased with an increasing ratio.

9760. SINNATT, F.S. **The carbonization and combustion of particles of coal: the structure of cenospheres.** *Trans. Inst. Min. Eng.* 73, 147-68 (1927).—*C.A.* 22, 310.

When particles of coking coal of a critical size were exposed to a certain temp. in an inert atm., hollow spheres (cenospheres) were formed. In certain circumstances the cenospheres might be 8 times the vol. of the original coal particles. Cenospheres consisted of 2 major structures—a lattice with the spaces covered by transparent "windows." If cenospheres were exposed to air at a certain temp., the windows were the first portion to undergo oxidation, leaving the lattice as a residue.

9761. SINNATT, F.S.; MCCULLOCH, A., AND NEWALL, H.E. **The study of cenospheres. V. The carbonization of particles of coal.** *J. Soc. Chem. Ind.* 46, 331-5T(1927).—*C.A.* 21, 3729.

Expts. were described of coking particles of coal in coal gas, H_2, steam, coal gas at a reduced pressure, and coal mixed with different per cents of electrode carbon, briquetted and then pulverized. In mixts. made with coal and increasing amts. of electrode carbon the cenospheres became reduced in size and modified in structure.

9762. JONES, J.H.; KING, J.G., AND SINNATT, F.S. **Reactivity of coke.** *Iron Steel Inst.* May, 1928 (advance copy), 20 pp.—*C.A.* 22, 3036.

The reactivity values were measured by the vol. of CO produced when a definite vol. of CO_2 was passed at a constant rate over a definite vol. of sized coke at a const. temp. The previous heat treatment of the coke appeared to have an effect upon the reactivity value. Cokes from various localities differed quite markedly, although carbonization was carried out in similar ways. Reactivity values were characteristic for any one coke and could be arrived at by using CH_4, CO or O_2, as well as by using CO_2.

9763. SINNATT, F.S. **The formation and structure of cenospheres.** *J. Soc. Chem. Ind.* 47, 151-5T (1928).—*C.A.* 22, 3516.

A description was given of the vertically placed silica tube (28 1/2"× 1 1/2") and app. used to produce cenospheres by heating powd. (60-90 or 40-50 mesh I.M.M.) coal or pitch at different temps. from 420° to 950°C. Differences in appearance, diameters and coking properties of cenospheres formed at 500°, 550° and 600°C from durain, vitrain and clarain were tabulated. The av. diam. of cenospheres from clarain at 800°C was 0.55 mm.

9764. BONE, W.A.; FINCH, G.I., AND TOWNEND, D.T.A. **The fundamental aspects of combustion.** *Trans. Fuel Conference, World Power Conference, London,* 1928, 2, 143-85(1929).—*C.A.* 23, 4795.

In the combustion of carbon there were 3 steps: "fixation" of O_2 at the carbon surface, the evolution of oxides of C, and the adjustment of mobile equil. in the reversible system $2CO \rightleftharpoons C + CO_2$ in consonance with the temp. Presence of steam was not essential to ignition and explosion of $CO\text{-}O_2$ mixts. When undried CO burned, both direct and indirect oxidations proceeded simultaneously and independently. The presence of H_2 and steam favored the indirect oxidation.

9765. HUBBARD, D.W. AND REES, W.J. **Dissociation of carbon monoxide in contact with refractory materials.** *Trans. Ceram. Soc.* 28, 277-307 (1929).—*C.A.* 23, 5290.

The progress of the reaction $2CO \rightarrow CO_2 + C$ was followed by the decrease in gas pressure and also by the estn. of the CO_2 formed. The following materials promoted the dissocn. of CO: pure kaolin 450°C, 470-495°; pure silica 520-570°; pure alumina 260°, 350°; firebrick 410°, 430°, 500°; kaolin treated with aqua-regia 430°, 480°, 520-545°; silica brick 530-540°; reburned firebrick 380°, 470°; Scotch firebrick 340-450°, 470-500°; calcined clay 300-400°; calcined dolomite 370-770°; pure Fe_2O_3 300-700°C.

9766. BUNTE, K. AND GIESSEN, A. **Influence of coke reactivity on water gas formation.** *Gas u. Wasserfach* 73, 241-7 (1930).—*C.A.* 24, 2862.

The reactivity of various cokes with respect to water vapor decreased in the following order: wet-quenched, low-temp. lignite coke; wood charcoal; dry-quenched, low-temp. lignite coke; semicoke; wet-quenched gas coke; dry-quenched gas coke and oven coke. This was in the same order as detd. for O_2 alone and O_2 in CO_2. Some relationship could be noted between water vapor decompn. and ignition temp. of the coke, but this was obscured by the effect of undecompd. steam passing through the fuel bed on the water gas equil. in the gaseous phase.

9767. JONES, J.H.; KING, J.G., AND SINNATT, F.S. **The reactivity of coke. III. The influence of iron compounds. Dept. Sci. Ind. Research, Fuel Research** *Tech. Paper* No. 25, 42 pp. (1930) —*C.A.* 24, 4377.

Those Fe compds. which were capable of easy reduction to the metal had an accelerating effect upon the reaction between CO_2 and coke. The activating effect produced by metallic Fe was large; that due to FeO was small. "Reactivation" (autoactivation occurring with certain cokes) was due to reduction of the Fe oxides by the coke to the metal during passage of N_2 and occurred only in cokes with the most Fe. Metallurgical cokes contained some unreducible Fe.

9768. Key, Arthur and Cobb, John W. **Determination of the reactivity of a coke to steam and carbon dioxide.** *J. Soc. Chem. Ind.* **49**, 439-44T, 454T(1930).—*C.A.* **25**, 579.

If two columns of a coke (A) were taken, identical in all respects except that one was of unit length and the other of length *n*, the second column presented *n* times the amount of the same kind of surface to the reacting gas, and its total reactivity was *n* times that of the first column. If a column of unit length of another coke (B) decomposed as much gas as the column of length *n* of coke A under the same conditions, the total reactivities of the two columns were equal, and since the percent decompd. by coke B of unit length was its specific reactivity, this must be equal to *n* times that of coke A. If the specific reactivity of coke B was unity, that of A was $1/n$, and this gave a definition of reactivity, as the reciprocal of the length of a standard coke under the same conditions.

9769. Sihvonen, V. **The reaction mechanism of carbon combustion at low pressures.** *Z. Elecktrochem.* **36**, 806-7(1930).—*C.A.* **25**, 2629.

Kinetic measurements on the carbon combustion at low O_2 pressures, in general, indicated a reaction of the first order. The combustion in streaming O_2 between 800° and 1400°C formed a gas mixt. of const. compn. ($CO_2 + 2CO$). Between 1400° and 1500°C the carbon surface suffered a change whereby, according to the observation of Langmuir, CO was vaporized. Here the velocity curves of both combustion products indicated a break. Between 800° and 1200°C CO formation was promoted through autocatalysis. The presence of CO_2 retarded the combustion of CO and carbon. At 1600°C a minute addn. of water vapor accelerated the formation of both combustion products catalytically.

9770. Burke, S.P. and Schumann, T.E.W. **Kinetics of a type of heterogeneous reactions. The mechanism of combustion of pulverized fuel.** *Ind. Eng. Chem.* **23**, 406-13(1931).—*C.A.* **25**, 2542.

A theory of the kinetics of the combustion of pulverized solid fuel was developed mathematically. This theory gave results in accord with exptl. data.

9771. Drakeley, Thomas J. **The reactivity of coke.** *J. Soc. Chem. Ind.* **50**, 319-30T(1931).—*C.A.* **26**, 1754.

A lab. study of the reaction $CO_2 + C \rightleftharpoons 2CO$ through a temp. range of 950° to 1100°C, on small samples of coke prepd. at temps. from 450° to 1100°C was described. The app. consisted of a silica tube (2 cm by 76 cm), electrically heated, through which CO_2 was circulated. The rate of CO formation and also the coke reactivity were expressed by the equation: $d\,(CO)/dt = k_1(CO_2) - k_2(CO)^2$. Reactivity could not be expressed by a single coeff. k_1 but that k_2, the coeff. of the reverse reaction, must also be given. Results indicated that at high temps. these values approached equality.

9772. Fox, David and White, Alfred H. **Effect of sodium carbonate upon gasification of carbon and production of producer gas.** *Ind. Eng. Chem.* **23**, 259-66(1931).—*C.A.* **25**, 1970.

Na_2CO_3 reacted in appreciable measure with carbon above 800°C and the rate became rapid above 900°C. The reactions were: $Na_2CO_3 + 2C = 3CO + 2Na$; $2Na + CO_2 = Na_2O + CO$; $Na_2O + CO_2 = Na_2CO_3$. The net effect was to increase the vapor pressure of C to 10^{15} times its actual value. The use of coke impregnated with Na_2CO_3 in the gas producer gave gases higher in CO than would otherwise be obtained.

9773. King, J.G. and Jones, J.H. **The reactivity of coke.** *J. Inst. Fuel* **5**, 39-55(1931).—*C.A.* **26**, 3361.

The effect of certain inorg. compds. on the reactivity of industrial cokes was studied. CO_2 at the rate of 5 cc. per min. was passed through a column of 10- to 20-mesh (I.M.M.) coke 7.5 cm long for 20 min. at 950°C. The catalytic effect of Fe was nullified by treating the cokes contg. Fe with TiO_2 or SiO_2. At 1000°C a similar effect was produced by sulfiding the Fe with H_2S. Coke contg. much extractable Fe was reactivated after testing to a const. R_3 value, by cooling in N_2 or by heating with H_2. The addn. of MnO_2 and MgO did not increase coke reactivity but addn. of $CaCO_3$ or Na_2CO_3 did.

9774. Neumann, Bernhard; Kröger, Carl, and Fingas, Ernst. **The reaction of water vapor and carbon in the presence of catalysts.** *Z. anorg. allgem. Chem.*, **197**, 321-38(1931).—*C.A.* **25**, 3908.

The quantities of reaction products formed by passing water vapor over hot graphite with and without added catalysts were detd. at 450° to 1000°C at atm. pressure. Graphite contg. 8% of either Fe_2O_3, CuO, U_3O_8, Al_2O_3, Cr_2O_3 or K_2CO_3 was much more reactive than pure graphite at a given temp. The temp. at which reaction first occurred was lowered from 650°C for pure graphite to 600°, 420°, 625°, 632°, 579° and 550°C, resp., for the above-mentioned catalysts.

9775. Neumann, Bernhard; Kröger, Carl, and Fingas, Ernest. **The effect of various forms of carbon on water-gas formation.** *Gas u. Wasserfach* **74**, 565-72(1931).—*C.A.* **25**, 4687.

Expts. were carried out with wood charcoal, acetylene soot, active charcoal and a very pure electrode graphite alone and with the addn. of Fe_2O_3. A series of expts. were made with each by starting at a temp. 50-100°C above that at which the reaction was initiated. Fe_2O_3 facilitated water-vapor decompn. on graphite, the reaction starting 70°C lower than with pure graphite. C_2H_2 soot and wood charcoal (same grain size as the graphite) were more reactive than the graphite.

9776. Sihvonen, V. **The kinetics of the Boudouard reaction.** *Ann. acad. sci. Fennicae* **33A**, No. 13, 1-14(1931).—*C.A.* **25**, 5069.

The chem. heat of adsorption of CO on carbon at the limiting pressure of CO in the case of the reaction $C + CO_2 = 2CO$ was estimated to be 17 kcal. A noticeable desorption began between 1400° and 1500°.

9777. Smith, David F. and Gudmundsen, Austin. **Mechanism of combustion of individual particles**

of solid fuels. *Ind. Eng. Chem.* **23**, 277-85 (1931).—*C.A.* **25**, 4684.

The specific surface-reaction rate for carbon spheres burned in dry and moist air was a complex function of the particle size. It was enormously larger for a small particle than for a large one. The temp. of the surface increased as the particle was reduced in size. For the same air velocity and same surface temp., a small particle had a higher sp. surface reaction rate than did a large one. Carbon spheres of surface area 70 to 10 mm^2 burned faster in moist air. An increase in surface temp., for particles in dry air, increased the reaction rate, i.e., the temp. coeff. was positive. An increase in surface temp. for particles burned in wet air at low velocities decreased the reaction rate.

9778. Broom, W.E.J. and Travers, Morris W. **Reactions between carbon and certain gases.** *Proc. Roy. Soc.* (London) **A135**, 512-37(1932).—*C.A.* **26**, 3427.

A continuously operating Sprengel pump for evacuating a reaction vessel to 10^{-4} mm Hg and collecting the gas removed was described. The equil. const $K = P_{CO}/P_{CO_2}$ was detd. at 746°C to be 0.225 on coconut charcoal and sugar charcoal that had not been heated above 1000°C. The sugar charcoal after being heated *in vacuo* to 1170°C gave the const. *K* about 0.36. Kinetic equations were derived for the rate of reaction of CO_2 with carbon to form CO if it was assumed that the first step involved formation of a C-oxygen complex and one mol. of CO, the second step the decompn. of the complex into CO and carbon.

9779. Burke, S.P. and Schumann, T.E.W. **Kinetics of a type of heterogeneous reactions. II. The mechanism of the combustion of lump fuels.** *Ind. Eng. Chem.* **24**, 451-3(1932).—*C.A.* **26**, 2845.

A math. theory of the combustion of lump fuel limited to a single piece of solid fuel was developed. The theory was in general agreement with recent exptl. results on fuel combustion.

9780. Dolch, M. and Kollwitz, J. **The reaction of water vapor upon glowing coke. Contribution to the oxidation of coal.** *Braunkohle* **31**, 607-10, 628-32, 645-9(1932).—*C.A.* **26**, 5735.

In studying effects of rate of steam flow upon compn. of gas formed, the reaction $C + H_2O = CO + H_2$ with bituminous cokes were found more rapid, and the reaction $C + 2H_2O = CO_2 + 2H_2$ with brown-coal cokes. With cokes of intermediate coals, this distinction was not noted.

9781. Dolch, M. and Schindler, R. **Change of state of coalification of lignitic brown coal by heating with water under pressure.** *Braunkohle* **31**, 801-6(1932).—*C.A.* **27**, 2556.

Synthetic coalification of fuel constituents with H_2O at 300°C for 1 hr has been demonstrated but at the cost of incombustibles. Loss of O far exceeded that of C and H; 1/3 to 60% appeared as CO_2 in the gas formed, 50-20% as H_2O and the rest as solids or tar. Heating value of the coal increased 15-18%.

9782. Dolch, Paul. **Action of steam on coal. Study of superimposed equilibria.** *Z. Elektrochem.* **38**, 596-601(1932).—*C.A.* **26**, 5193.

The action of steam on coal lead to the formation of CO and H_2. The formation of CO_2 was a secondary reaction ($CO + H_2O = CO_2 + H_2$), the extent of which depended on the active coke surface. There was no evidence for the reaction $C + 2H_2O = CO + 2H_2$. Expts. with CO_2 and H_2 which were passed over coke confirmed this.

9783. Dolch, Paul. **Water-gas generation from coke and coal.** *Gas u. Wasserfach* **75**, 807-11 (1932).—*C.A.* **27**, 399.

The reaction of water vapor on carbon and the formation of CO_2 was detd. by the water-gas equil. rather than by the water-gas reaction. The degree of attainment of the water-gas equil. depended on the reactivity of the coke on which the reaction took place. No evidence was found for the direct action of water vapor according to the reaction $C + 2H_2O = CO_2 + 2H_2$. Expts. with mixts. of CO_2 and H_2 over wood charcoal at 600-1000°C indicated that CO_2 and H_2 first reacted to form CO and H_2O at about 600°C while CO_2 first began to react with carbon at about 750°C; with coke the corresponding temps. were 800° and 980°C.

9784. Sherman, Ralph A. **An experimental study of the burning characteristics of pulverized fuels.** *Proc. 3rd Intern. Conf. Bituminous Coal* **2**, 510-51(1932).—*C.A.* **26**, 4152.

The primary product that appeared in the combustion of fuel in pulverized form was CO_2. With ratios of air to coal = or > required, CO appeared only in small amts. in the initial carbonization of the coal. CO found in industrial furnaces was formed in the stream of coal and primary air and persists because of slow mixing with secondary air. The sp. surface did not have greater significance than the amt. passing 200-mesh. For equal amts. passing 200-mesh, the amt. retained on 100-mesh was markedly significant. The rates of combustion and percentages of unburned carbon varied greatly with the type of fuel.

9785. Dolch, Paul. **Surface equilibria. II. A thermodynamic measure of the activity of catalysts.** *Z. Elektrochem.* **39**, 602-7(1933).—*C.A.* **27**, 4996.

The variation of the equil. consts. of a reaction with different catalysts at different temps. was studied. The difference between the equil. const. and the reaction isochor was taken as a measure of the catalytic activity of a catalyst. The calcns. were applied to the reaction between H_2O vapor and carbon and to the contact process for the manuf. of H_2SO_4.

9786. Dolch, Paul. **Influence of reactivity of cokes upon the behavior of carbon dioxide-hydrogen mixtures at 600-1200°.** *Brennstoff-Chem.* **14**, 261-3(1933).—*C.A.* **27**, 5173.

Both bituminous coke and wood charcoal accelerated the reaction of CO_2 with H_2. Below 970°C with 3:7 mixts. and below 820°C with 34:66 mixts. with coke or charcoal, resp., solid carbon did not enter into reaction. Water-gas equil. were approached; with charcoal, equil. was reached at 750°C.

9787. Cobb, J.W. **Reactivity of pulverized fuels.** *Chaleur & ind.* **15**, No. 167, 377-86(1934).—*C.A.* **28**, 6547^5.

A plot of exptl. data for the reactivity of cokes (10 g) with CO_2 at 900°C and with steam at 1000°C was presented. It was decompd. in a column of 0.875 in. diam. in a gas stream of 20% of CO_2 flowing at 5 liter per hr. For the steam expts. the column was the same and the standard of decompn. was taken as 50% of steam at 10 liter per hr carrying 50% by vol. of N_2. The reactivity at low temps. was obtained and curves for cokes from various raw materials showed a relation between reactivity (percentage of O_2 burned) and temp.

9788. GRODZOVSKIĬ, M.K. AND CHUKHANOV, Z.F. **Gasification process for solid fuels.** *Compt. rend. acad. sci. U.R.S.S.* 3, 356-9 (in German 359) (1934); *J. Applied Chem. (U.S.S.R.)* 7, 1398-1421 (in German 1421-2) (1934).—*C.A.* 29, 320^9, 5625^9.

The gasification processes of activated carbon and coke were studied with normal and O_2-enriched air. Primary reactions were the formation of CO_2 and CO from the solid fuel. Formation of primary CO depended on the temp., the velocity and amt. of O_2 passing over the solid and upon the activity of the fuel. For complete gasification the primary CO must be rapidly enough removed to prevent further oxidation. This limiting velocity for charcoal was 1.2 m per sec. With coke large velocities repressed the reaction of carbon with CO_2 to form CO. With activated charcoal this reaction proceeded appreciably only under 0.26 m per sec.

9789. MAYERS, MARTIN A. **Mechanism of combustion of coal.** *Am. Inst. Mining Met. Engrs. Tech. Pub.* No. 575, 17 pp. (1934).—*C.A.* **28**, 7473^2.

The ultimate limit to the attainable rating in both pulverized-coal firing and grate firing was set by the reactivity of the fuel in its coked form. With pulverized fuel this limit seldom was reached; a practical limit was set by the speed of the active burning process, which was practically independent of the characteristics of the fuel and depended only on the mech. arrangements for firing.

9790.. TERRES, E.; PATSCHEKE, G.; HOFMANN, H.; KOVACS, ST., AND LÖHR, O. **The formation of water gas and the behavior of brown coal and bituminous coal cokes and semicokes in water-gas generation.** *Gas u. Wasserfach* 77, 585-7, 628-36, 650-5, 666-9, 681-4, 703-6(1934).—*C.A.* 29, 577^7.

Cokes and semicokes from the bituminous coal and from several brown coals were prepd. at various temps. between 300° and 1200°C and gasified at slightly lower temps. in N_2-contg. H_2O vapor. Merck wood charcoal also was gasified. The water-gas analyses were used to calc. the extent of steam decompn., CO-CO_2 ratios and the water gas and Boudouard equil.; similar calcns. were made for the theoretical steam-carbon equil. at 400-1200°C with the N_2O-100% satd. with H_2O. At 1200°C the bituminous coal coke gave a steam decomp., CO-CO_2 ratios, and carbon gasification distinctly lower than the corresponding equil. values, and lower than wood charcoal.

9791. WEISS, CLARENCE B. AND WHITE, ALFRED H. **Influence of sodium carbonate upon the producer-gas reaction.** *Ind. Eng. Chem.* **26**, 83-7(1934).—*C.A.* **28**, 1506^5.

The reaction $Na_2CO_3 + 2C = 2Na + 3CO$ which proceeded to the right above 800°C was reversed when the reaction products were cooled slowly in the range 900°-750°C. The reaction was studied in a miniature gas producer consisting of a Ni tube heated in an elec. furnace. When using untreated Acheson graphite and dry air at 900°C and a time of contact of 2 secs., the exit gases contained 6.8% CO; but when the graphite contained 1% Na_2CO_3, they contained 33% CO. As little as 0.1% Na_2CO_3 gave these results. Similar results were obtained with steam-air mixts.

9792. SIHVONEN, V. **True activation energy of the desorption of the ketonic group from graphites.** *Suomen Kemistilehti* **8B**, 28 (1935).—*C.A.* 30, 2822^5.

9793. GRODZOVSKIĬ, M.K. AND CHUKHANOV, Z.F. **Gasification of solid fuel with air.** *J. Applied Chem.* (U.S.S.R.) 9, 73-81 (in German) (1936).—*C.A.* 30, 6163^7.

Charcoal, activated charcoal, coke, electrode carbon and graphite were investigated. Linear velocity of blown air was the most important variable. With high velocities the major portion of CO produced was the primary product of the reaction.

9794. CASSAN, M.H. **Experimental study of the reactivity of different varieties of carbon to water vapor and carbon dioxide.** *J. usines gaz.* 61, 275-7 (1937).

Coke, wood charcoal, or graphite was heated in a quartz tube in a dil. gas mixt. of H_2O or CO_2 in N_2. Max. deviation in the reactivity among the different carbons was observed at about 950°C. The diagram of the apparatus was given.

9795. MAYERS, MARTIN A. **Some factors affecting combustion in fuel beds.** *Am. Inst. Mining Met. Engrs. Tech. Pub.* No. 771, 18 pp. (1937).—*C.A.* 31, 2388^9.

The available data concerning the values of various phys. and chem. consts. required for the calcn. of temps. in a burning fuel bed were discussed. The only property characteristic of a particular fuel that was important in combustion calcns. was its ignition temp. The coeff. of heat transfer between the solids of the fuel bed and the air or gas stream, the thermal cond. of the fuel bed, and the sp. rate of the combustion reaction appeared to depend almost entirely on the phys. characteristics of the fuel bed and will be affected more by the size, size distribution and porosity of the fuel in bulk than by its chem. characteristics.

9796. SEBASTIAN, J.J.S. AND MAYERS, M.A. **Coke reactivity. Determination by a modified ignition point method.** *Ind. Eng. Chem.* 29, 1118-24 (1937).—*C.A.* 31, 8888^7.

The abs. reaction rates were detd. between coke and O_2 from measurements of the time rate of temp. rise of the coke at the ignition pt. The relations between reaction rate and temp. calcd. from the results were characteristic of the cokes. The reactivity of each coke may be specified either by a line on a plot of the Arrhenius equation, or by the 2 parameters, *b* and *F*, appearing in the equation, whose values usually decrease with increasing activity. The reactivity was found to increase with decreasing temp. of carbonization of the coal.

9797. BAUKLOH, W. AND JAEGER, F. **The reduction of tungsten oxide with solid carbon and hydrogen.** *Z. anorg. allgem. Chem.* 239, 365-8 (1938).—*C.A.* 33, 934^5.

By action of solid carbon and H_2 upon W_4O_{11}, it was found that the reduction began at about 800°C with carbon and at about 450°C with H_2. In the presence of Fe the reduction began about 50°-100°C lower.

9798. CHUKHANOV, Z.F. **Combustion of carbon. I. Sequence of the processes in the combustion of aerosols of solid fuels.** *J. Tech. Phys. (U.S.S.R.)* 8, 147-61 (1938).—*C.A.* 32, 5599^9.

The oxidation of an aerosol of activated wood charcoal began at 300-500°C and the products were CO and CO_2. The oxidation proceeded normally up to 700-750°C, at which point there occurred a sharp change in the kinetics of the process, the carbon broke into flame and the formation of CO and CO_2 was greatly accelerated.

9799. CHUKHANOV, Z.F. **Combustion of carbon. II. Oxidation.** *J. Tech. Phys. (U.S.S.R.)* 8, 621-32 (1938).—*C.A.* 32, 6838^2.

The oxidation of an aerosol of activated wood charcoal, proceeding with the formation of equal amts. of CO and CO_2, was the predominant reaction up to 750°-800°C (at high O_2 concns). Above this temp. range, combustion with the formation of CO predominated. The oxidation, which at atm. pressure was but slightly dependent on the O_2 concn., proceeded within the carbon particles at a rate proportional to the wt of the particles (wt concn. of the aerosol).

9800. CHUKHANOV, Z.F. **A large-scale gas generator IGI-2.** *Novosti Tekhniki* **1938**, No. 14-15, 30-1; *Khim. Referat. Zhur.* **1**, No. 11-12, 164(1938).—*C.A.* 33, 8958^7.

The generator design was based on the fact of the primary formation of CO, and the possibility of its removal by blowing with a velocity of not less than 0.3-0.5 m/sec. The fuel was peat and sub-Moscow coal. The continuous process of gas generation was described.

9801. FISHER, C.H. **Relation between volatile matter and hydrogen-carbon ratio of coal and its banded constituents.** *Ind. Eng. Chem., Anal. Ed.* **10**, 374-8(1938).—*C.A.* 32, 7699^9.

The relation between volatile matter and the C-H ratio in coals was studied with particular attention to the petrography. Plotting the H-C ratio against volatile matter gave 2 curves; vitrains and clarains fell in one curve and fusains, durains and spores on the other. The equations representing these lines could be used to relate the C-H ratio to the volatile matter.

9802. GEER, M.R. AND YANCEY, H.F. **Expression and interpretation of the size composition of coal.** *Am. Inst. Mining Met. Engrs. Tech. Pub. No.* **948**, 20 pp.(1938).—*C.A.* 32, 6430^4.

When cumulative wt percentage was plotted *vs.* screen size, straight-line curves resulted. The slope and intercept of these lines were the consts. n and k in the equation, $R = 100 \exp(-x/k)^n$, in which R = wt percentage retained on a screen with opening of size x. Products of the standard shatter and tumbler tests of coal and coke did not conform.

9803. LAUPICHLER, F.G. **Catalytic water-gas reaction—mass transfer and catalyst activity.** *Ind. Eng. Chem.* 30, 578-86(1938).—*C.A.* 32, 4866^1.

Equations were derived for mass transfer and reaction velocity in the catalytic water-gas reaction at const. temp., which permitted calcn. of conversion rate for any given amt. of catalyst, or the amt. of catalyst required to obtain a given conversion. The effect of varying initial temp., steam-CO ratio, and flow rate were detd. The equations were useful in detg. the optimum conditions for operating catalytic converters.

9804. SCOTT, G.S. AND JONES, G.W. **Oxidation of anthracite; effect of time of contact on the concentration of oxygen in the effluent gases.** *U. S. Bur. Mines, Rept. Investigations No.* 3405, 7 pp. (1938).—*C.A.* 32, 7700^1.

When air was passed through heated anthracite, the percentage of O_2 in the effluent gases were inversely proportional to the time of contact with the heated coal at any given temp. and the oxidation was equiv. to a first-order chem. reaction. Thus, percentage of O_2 in effluent gases from a mine-fire area was of little value in predicting temp. or activity of the fire.

9805. SINKINSON, ERIC. **A new theory concerning the combustion of anthracite.** *Trans. First Annual Anthracite Conf. of Lehigh Univ. April 29-30,* **1938**, 45-52.—*C.A.* 32, 6838^4.

Anthracite ash at bright incandescence performed the role of a catalytic agent toward gases (chiefly H_2) distg. in an anthracite fire.

9806. FRANK-KAMENETSKII, D.A. **Carbon dioxide reduction.** *Compt. rend. acad. sci. U.R.S.S.* **23**, 663-5(1939).—*C.A.* 34, 4648.

The kinetics of the reduction of CO_2 by activated ash-free sugar charcoal were measured under static conditions at 600-900°C and at pressures of 50-200 mm Hg. The course of the reaction was followed by measuring the thermal cond. of the gas mixt. With a surface-cleaned carbon a measurable reaction took place at not lessthan 600°C, and between 600° and 750°C the reaction was $CO_2 + C = CO + (CO)$, where (CO) denoted a surface oxide which could be regarded as chemisorbed CO. In this temp. range the total pressure, after an initial drop, remained approx. const. From 750° to 900°C a steady increase in pressure was found which in the initial stages was not equiv. to the CO formed. No CO was formed between 400° and 600°C, and the only sign of action was an initial fall in pressure owing to activated adsorption of CO_2.

9807. HERRLIN, P. ADOLF. **Catalysis of the reaction velocity of mercury (I) ions. The equilibrium $Fe^{+++}/Fe^{++}/Hg^{++}/Hg_2^{+}/Hg$ as perchlorate**

in water solution. *Nord. Kemikermøde, Forh.* 5, 194-5(1939).—*C.A.* 38, 2872^5.

Kieselguhr and various active carbons catalyzed the attainment of equil. from either side in the reaction $2Fe(ClO_4)_2 + Hg_2(ClO_4)_2 = 2Fe(ClO_4)_3 + 2Hg$. The velocity increased with the sp. surface of the catalyzer and the initial concn. of the Fe^{++} and diminished with increasing initial concn. of Hg^+ (probably owing to adsorption). Traces of active carbon brough about equil. conditions in 1 min.

9808. KOELSCH, H. **The reaction equation for the formation of producer gas.** *Feuerungstech.* 27, 195-201, 282-8(1939).—*C.A.* 33, 8958^7; 34, 5271^9.

9809. BANGHAM, D H. AND BENNETT, J. G. **The chemistry of gasification with reference to small producers.** *Fuel* 19, 95-101(1940).—*C.A.* 34, 7581^2.

Present knowledge of steam-carbon and water-gas reactions was summarized and applied to several theories of gasification.

9810. CHUKHANOV, Z. **The burning of carbon. II.** *Fuel* 19, No. 3, 17-20, 49-50, 64-67(1940).

The oxidation of carbon with equiv. formation of CO and CO_2 preponderated at 750° to 800°C. The process of oxidation took place within the vol. of the charcoal particles. The rate of oxidation was proportional to the wt of the particles (to the concn. of the air suspension by wt) within the ranges of sizes of particles studied. The energy of activation of the oxidation of carbon in the form of activated wood charcoal under atm. conditions was 20,000 to 25,000 cal. Oxidation of CO to CO_2 distorted the primary compn. of gas.

9811. CHUKHANOV, Z. F. **Observations on the temperature regime of a coal layer in a state of gasification.** *Compt. rend. acad. sci. U.R.S.S.* 26, 346-51(1940)(in French).—*C.A.* 34, 7577^7.

The real temp. of a surface of coal and of gas below the O_2 zone was the closer to the theoretical temp. the smaller the heat flow in the layer. An increase in the velocity of the air current reduced the velocity of the upward movement of the combustion zone and at a given point reversed it into a downward movement. The combustion velocity of a coal fuel may be fairly accurately calcd. for various velocities of the air current by means of the bireactionary theory.

9812. CHUKHANOV, Z. F. **Oxidation of carbon.** *Compt. rend. acad. sci. U.R.S.S.* 28, 32-6 (1940)(in French).—*C.A.* 35, 2400^3.

At temps. below ignition the oxidation of carbon was believed to proceed according to the mechanism $C_3O_4 + C + O_2\ (gas) = 2CO + 2CO_2$. C_3O_4, a surface compd., was assumed to be the only oxide of C with a sufficiently rapid rate of production and decompn. to enter into the reaction. Corroborative exptl. evidence was given relating to the rate of oxidation of graphite and activated carbon as a function of the O_2 concn.

9813. GWOSDZ, J. **The expansion of the combustion zone in the gas producer in relation to fuel and to gas velocity.** *Brennstoff-Chem.* 21, 145-51(1940).—*C.A.* 35, 3062^8.

Gas rate, fuel reactivity, thermal cond., formation of gas in the fuel bed, progression of temp. in the combustion zone, influence of charging height, low-temp. coke, wood charcoal, and high-temp. gasification were discussed with reference data. The upper part of the reaction or combustion zone, in comparison with the lowest hot layer which constituted only a few cm of the gas path, was subject to extension depending principally upon air rate and carbon reactivity and upon steam addn.

9814. GWOSDZ, J. **Formation of an intermediate zone between the oxidizing and reducing zones in the gas producer and the behavior of steam at very high gas velocities.** *Brennstoff-Chem.* 21, 269-73(1940).—*C.A.* 36, 2117^3.

The restriction of the dimensions of the gasification zone in the small cross-draught type of producer using high gas velocities was explained by the assumption of an intermediate zone between the oxidizing and reducing zones. The greater part of the CO was formed in this intermediate zone, in which there was a gradual transition from oxidizing to reducing conditions, whereas the conversion of steam into H_2 occurred principally in the subsequent reducing zone.

9815. HOTTEL, H. C. AND STEWART, I. McC. **Space requirement for the combustion of pulverized coal.** *Ind. Eng. Chem.* 32, 719-30(1940).—*C.A.* 34, 4253^4.

The problem was attacked by combining a suitable particle-size distribution law applicable to samples of pulverized coal, the laws of burning of individual particles, and reasonable assumptions concerning the mechanism of burning particles in a cloud. The resulting relationship, expressed graphically in dimensionless terms, predicted the percentage of the original unburned carbon in the coal which passes out unburned, as a function of chamber size, firing rate, fineness of grinding, excess air, approx. flame temp., and a so-called combustion const. to be detd. experimentally.

9816. KANTOROVICH, B. **Hydrodynamic problems relative to the process of the combustion and gasification of a combustible solid.** *Comp. rend, acad. sci. U.R.S.S.* 28, 244-9(1940)(in French).—*C.A.* 35, 3059^8.

The combustion of charcoal was studied and a theoretical procedure devised for the calcn. of the effect on the total velocity of the reaction of the conditions (hydrodynamic) for bringing the O_2 to the reacting surface.

9817. KURIN, N. P. AND NOVGORODOVA, E. M. **The catalytic oxidation of nitrogen. III. Investigation of the catalytic activity of activated carbon.** *Izvest. Tomsk. Ind. Inst.* 60, No. 3, 61-78(1940); *Khim. Referat. Zhur.* 1940, No. 9, 62.–*C.A.* 37, 2144^6.

Catalytic oxidation of NO was investigated in the presence of activated carbon at 25°, 50°, 100° and 150°C at velocities of 200, 400, 800, 1200 and 1600 (vol. of gas per unit vol. of catalyst per hr) and at initial concns. of NO (in the dry gas mixt.) equal to 1.5, 3.6 and 10 vol. %. With the initial concn. of NO equal to 15 vol. % and a temp. of 25°C, increasing the vol. velocity from 200 to 1600 decreased the degree of oxidation from 37.6 to 27.9. A further increase in the initial concn. of NO resulted in a slower increase in α total. A kinetic equation, $-dC_{NO}/dt = KC^2_{NO}/(1 + bC_{NO_2})$, was derived for the oxidation process of NO into NO_2 under the condition mentioned with a large excess of O_2 (as compared with NO).

9818. Leye, Alexander R. **Gasification with steam and oxygen. A method for calculating results and extent of reforming.** *Gas- u. Wasserfach* **83**, 669-72, 688-91(1940).—*C.A.* 35, 3062^6.

A method was developed for calcg. the volumetric compn. of a generator or reformed gas, based on the knowledge of the fuel compn. and the gasification media, such as steam or air; with the help of dimensionless factors for the fuel, gasification media, etc. Examples were given for coke water gas, continuous gasification with steam and O_2 and the reforming of methane and hydrogenation gas as well as the production of gas for synthetic purposes. Calcd. values agreed with those found in practice.

9819. Mayers, M. A. and Landau, H. G. **Ignition in beds of solid fuel.** *Ind. Eng. Chem.* **32**, 563-8(1940).—*C.A.* 34, 3901^7.

A nomograph was designed for calcn. of the rate at which fuel could be ignited in pure underfeed burning when the characteristics of the fuel bed are known. Better values were obtained for the relation between the air flow rate and the rate of the combustion reaction, and between air flow rate and the rate of heat transfer between the gases and solids of the fuel bed than had heretofore been available.

9820. Predvoditelev, A. S. **Combustion of a carbon particle in a current of gas.** *J. Tech. Phys.* (U.S.S.R.) **10**, 1311-23(1940).—*C.A.* 35, 3059^8.

The combustion of a carbon particle in a current of gas was examd. analytically with the following assumptions: (1) the gas flow could be described by a potential function, (2) O_2 reached the surface of carbon particle through the process of forced diffusion, (3) combustion on the surface occurred in such a way that the diffusional flow always remained equal to the specific speed of combustion, (4) the combustion reaction was of the first order, (5) on the equipotential surface, passing through the intersection point of gas flow with carbon particle the concn. of O_2, was equal to the outside concn.

9821. Schwab, Georg-Maria and Lober, Friedrich. **The halogen-transporting action of carbon.** *Z. physik. Chem.* **A186**, 321-47(1940).—*C.A.* 35, 1691^5.

The action of Br_2 on $CHCl_3$ and on H_2 with activated carbon (Carbotox ACS) as the catalyst was studied in the gaseous phase in a dynamic app. The bromination of $CHCl_3$ began at approx. 180°C, reached thermodynamic equil. at approx. 350°C, and at 500°C was again immeasurably slow. The bromination of H_2 in an empty tube of Supremax glass was homogeneous above 500°C. With carbon as catalyst the velocity was measurable at 120°C and rose as a monotone function of the temp. to 220°C.

9822. Strickland-Constable, R. F. **The oxidation of carbon.** *Fuel* **19**, 89-93(1940).—*C.A.* 34, 7574.

The process of combustion on grates was discussed from present knowledge of the equil. conditions obtained at grate temps. The mechanism and theory of the carbon oxidation process were reviewed.

9823. Balandin, A. A. and Patrikeev, V. V. **Activated carbon as a catalyst in the hydrogenation of halogen derivatives by means of hydrogen.** *J. Gen. Chem.* (U.S.S.R.) **11**, 225-31 (1941).—*C.A.* 35, 7937^9.

Pure activated carbon was a catalyst at 200-500°C for the reaction $RHal + H_2 = RH + HHal$. The amt. of halogen substituted by H_2 in the presence of activated carbon at 400°C was as follows for the compds. investigated: PhBr, 3.0%; $CHCl_3$, 18.2%; BuBr, 42.0%; Me_3CCl, 51.0%; and $CH_2{:}CHCH_2Cl$, 58.0%. Addn. of H_2 or HCl to the double bond did not occur.

9824. Balandin, A. A. and Patrikeev, V. A. **Catalytic capacity of activated charcoal. Reactions between hydrogen and organic halides.** *Acta Physiochim. U.R.S.S.* **15**, 281-92(1941)(in German).—*C.A.* 37, 4959^1.

Several aliphatic and aromatic halides were passed at about 400°C over activated charcoal contg. 1-2% KOH. The extent of dehalogenation of org. halide was detd. from the amt. of AgCl formed: for PhBr at 350°C, 0.8%, at 475°, 18.2%; for $CHCl_3$, 1.6 at 350°, 42.2 at 425°; BuBr, 0.6 at 325°, 64.0 at 425°, 66.9 at 450°; allyl chloride, 21 at 375°, 58 at 400°; tert-BuCl, 19.8 at 375°, 51 at 400°. These data gave const. energies of activation. The desorption of HCl from the charcoal in a H_2 stream at 425°C was a 1st-order reaction, 93% complete in 2 hrs, 99 in 3 hrs, $k = 1.44$ min.$^{-1}$.

9825. Budnikov, P. P. and Krech, E. I. **Calcium sulfate as the source for preparation of chloro derivatives of sulfur. I. Chlorination of calcium sulfate in the presence of reducing agents. II. Chlorination of calcium sulfate under optimal conditions.** *J. Applied Chem.* (U.S.S.R.) 14, 747-54, 755-65(1941).—*C.A.* 37, 2893^3.

$CaSO_4$ + 4C (charcoal) was chlorinated at 225-850°C. $CaSO_4$ began to decompose at 345°C with evolution of Cl derivatives of S. Optimum temperature was 725°C, at which there was obtained a 96.2% yield. At 850°C the yield was 97.5% under the same condition. At 740-50°C the best mixture was $CaSO_4$-3C. At this composition the maximum yields were from carbon black or charcoal. Calculation showed that reduction of $CaSO_4$ by C to CaS and reaction of Cl_2 with $CaSO_4$ were endothermic.

9826. Danulat, F. **Pressure-gasification of solid fuels with oxygen.** *Gas- u. Wasserfach* 84, 549-52(1941).—*C.A.* 36, 4315^6.

Predried lump or briquetted brown coal was gasified with O_2 and steam under a pressure of 20-30 atm. Cooling the crude gas and recovering CO_2 by scrubbing with H_2O under pressure yielded a town gas contg. 23% of CH_4. Typical operating data were tabulated.

9827. MARKOVSKII, L. YA. **Catalytic agents for the production of carbon disulfide from the elements.** *Compt. rend. acad. sci. U.R.S.S.* 31, 350-1(1941)(in English).—*C.A.* 37, 821^7.

Sulfates and carbonates of Na, K, Ca, Fe, Ni, Mn, and Cu were tested for their catalytic activity in the production of CS_2 by passing S vapor through charcoal. Only Na and K proved very effective. Optima were 3-4% of Na or K as carbonates or sulfates. The formation of CS_2 passed through intermediate stages consisting of the formation and decomposition of fairly stable surface sulfides.

9828. SCOTT, G. S. AND JONES, G. W. **Effect of particle size on the rate of oxidation of anthracite.** *U. S. Bur. Mines, Rept. Investigations* 3546, 15 pp.(1941).—*C.A.* 35, 3060^8.

For sizes larger than 20-mesh, the initial rate of oxidation was directly proportional to the superficial surface area (150-350°C). For smaller sizes, the initial rate increased more slowly than increase in the surface area and appeared to reach a max. beyond which further subdivision of the particles had no effect. For temps. of 150, 200 and 250°, the rate of oxidation decreased regularly with time (or with increase in the amt. of O_2 consumed) for all sizes tested. At 300° and 350°C, for sizes under 20 mesh, the rate of oxidation decreased regularly with increase in amt. of O_2 consumed.

9829. TRAUSTEL, SERGEI. **Combustion [of coal-dust fuel] in suspension.** *Feuerungstech.* **29**, 1-6, 25-31, 49-60(1941).—*C.A.* 36, 1463^5.

The exchange of heat and material was analyzed mathematically and the results of theoretical investigations on the ignition and combustion time were given. The theoretical considerations were extended to high-speed combustion and to the effect of limited reactivity of the fuel.

9830. TRAUSTEL, SERGEI. **Practical calculation of gasification equilibria.** *Feuerungstech.* 29, 105-14(1941).—*C.A.* 36, 3932^5.

Even when the dimensions of the fuel bed, the phys. and chem. properties of the fuel, and the temp., compn. and rate of flow of the gasification medium were known, it was not possible to calc. in advance to what extent equil. would be attained. Two missing factors were: (*a*) the reactivity of the fuel, expressed as a purely physicochem. quantity, e.g., $kg/m^2/sec$; and (*b*) the material transfer figures between gas and solid material in a static fuel bed.

9831. TRAUSTEL, SERGEI. **Combustion of solid fuels.** *Feuerungstech.* 29, 225-9(1941).—*C.A.* 37, 2160^2.

The phys. phenomena in combustion, primary reactions of the combination of carbon with O_2, gasification, and rate of disintegration of the solid phase by the combustion reaction were discussed.

9832. TRAUSTEL, SERGEI. **Minimum contact time in externally heated reaction tubes.** *Gas- u. Wasserfach* **84**, 389-91(1941).—*C.A.* 37, 6841^6.

Reaction velocity in an externally heated tube contg. finely divided solid fuel was fixed by chem. and phys. "resistances". For the limiting case a min. contact time could be calcd. on a purely phys. basis. Chem. influences made themselves felt in a longer reaction period. The use of the temp. at the center of the charge as the reaction temp. might frequently lead to erroneous conclusions.

9833. TRAUSTEL, SERGEI AND REUTER, A. **Conversion of gases in the reduction zone of a gas producer.** *Feuerungstech* 29, 159-61(1941).—*C.A.* 36, 3932^9.

Equations derived for calcg. the gasification products at various degrees of conversion were applied to the case of the gasification of carbon with O_2 and steam under pressure. A calcn. was made for gasification under pressure with simultaneous washing out of CO_2.

9834. VULIS, L. A. AND VITMAN, L. A. **Reduction of carbon dioxide in a carbon channel.** *J. Tech. Phys.* (U.S.S.R.) **11**, 509-18(1941).—*C.A.* 35, 6502^7.

Preheated CO_2 flowed through a cylinder of electrode carbon of uniform temp. (900° to 1150°C), varying in length (34, 52, 57, 85 and 95 mm) and inner diam. (4-6 mm); standard condition of the canal surface was attained by preliminary heating in N_2 for 1.5 to 2 hrs. The compn. of the gas leaving the canal plotted against the gas output showed the reaction $C + CO_2 = 2CO$ to be of the first order, with an activation energy $E = 59$ kcal/mole and $k_o = 3 \times 10^9$ cm/sec. Comparison with the reaction between carbon and O_2 led to the conclusion that the carbon + CO_2 reaction had a negligible velocity below 900°C.

9835. ANON. **Sulfur removal.** *Report of the Institution of Gas Engineers' Committee of Inquiry. Gas World* **117**, 435-8(1942).—*C.A.* 37, 249^5.

The 3 available processes for reducing the organic-S to 10 grains per 100 ft^3 were the active carbon process, the oil-washing process, and the catalytic process of the Gas Light & Coke Co. With a suitable catalyst under proper temp. conditions it was possible to reduce the S-content of gas from 25 to 1 grain per 100 ft^3. The organic-S compounds in all supplies of town gas should be reduced to 10 grains per 100 ft^3 before distributing.

9836. FUCHS, WALTER AND SANDHOFF, A. G. **Theory of coal pyrolysis.** *Ind. Eng. Chem.* 34, 567-71(1942).—*C.A.* 36, 3026^7.

Aliphatic C—C linkages were first to break, C—H linkages were severed next as the temp. of 600°C was approached and exceeded; aromatic C—C linkages did not break readily in the temp. range of coal carbonization. In the range, 400-700°C, O-contg. complexes and other heterocyclic structures broke away from the coal (or semicoke) mols.

9837. GUILLIER, RENNE. **Some by-products of the saltpeter industry.** *Anales 1° congr. panamer.*

ing., minas y geol. 5, 2033-9(1942).—*C.A.* 45, 9815*g*.

The I_2 was recovered by elimination with vegetable carbon forming iodinated carbon, which after washing and drying at 100°C was distd., liberating the I_2 at 200°C. This shortened the storage and eliminated the H_3BO_3 in the washings. Decompn. of $NaNO_3$ now only utilized to 17% as fertilizer was suggested according to $6NaNO_3 + Al_2(SO_4)_3 = 3Na_2SO_3 + Al_2O_3 + 6NO_2 + 1\ 1/2\ O_2$.

9838. Hamai, Senzo; Hayashi, Shiro; Shimamura, Kiyoshi, and Igarashi, Hiroshi. **Physico-chemical investigation of catalytic mechanisms. IV. The Fischer-Tropsch synthesis of hydrocarbons. (Experimental series I.)** *Bull. Chem. Soc. Japan* 17, 166-71(1942).—*C.A.* 41, 4366*g*.

The reaction vessel of Terex glass was made double-walled, so that the gas mixt. ($CO + 2H_2$) led in could be preheated. The catalyst was made of Co, CeO_2, ThO_2, B_2O_3, and diatomaceous earth. The reaction was run at 200°C at the rate of flow 4 liters/hr. The reaction products were collected in two traps, condensed by water and solid CO_2-C_2H_5OH mixt., resp. In the initial stage CH_4 formation predominated, cutting down the oil formation, but as time proceeded side reactions other than oil formation were inhibited.

9839. Kobayashi, Ichiro. **Catalytic decomposition of coal light oil.** *Bull. Inst. Phys. Chem. Research* (Tokyo) 21, 311-20(1942).—*C.A.* 43, 7664*e*.

The decompn. of light oil (150°-300°C) obtained by liquefaction of Kawakami coal was studied in the presence of active charcoal catalysts. With increasing temp. the yield decreased, and the low-boiling fractions and quantity of gas increased. When the catalyst (contg. 5% K_2CO_3 + 1% KCl) was added, the quantity of H_2 in the gas increased with increasing temp., and the yield of acid oil decreased.

9840. Ogura, Toyojiro and Nagai, Horoyuki. **Reaction between methane and carbon dioxide.** *J. Soc. Chem. Ind. Japan* 45, 170-3(1942).—*C.A.* 43, 1944*h*.

The reaction of CH_4 and CO_2 in various proportions at 500-1200°C under ordinary pressure in the presence of Co or Ni catalysts was studied on exptl. and semi-industrial scales. The reaction was accelerated by using good catalysts and also by raising the temp. When there was insufficient CO_2, deposition of carbon was noticed. This was prevented by the addn. of steam to the mixed gas.

9841. Ota, Nobuto. **Water gas by the reaction of methane and carbon dioxide. II. Methods of preventing carbon formation on the catalyst.** *J. Soc. Chem. Ind. Japan* 45, 284-90 (1942).—*C.A.* 43, 1944*g*.

The formation of carbon on catalysts was prevented by selecting a suitable catalyst, and also by (a) elevating the reaction temp., (b) taking excess CO_2, or (c) adding H_2O to the reacting gas. When 30% excess CO_2 was used with the CH_4, the reaction proceeded smoothly at 800°C with a Ni-kieselguhr catalyst without any other admixture. Similar results were obtained with a gas having 30% H_2O (based on CH_4) at 700°C or 10% H_2O at 800°C.

9842. Pearl, Irwin A. and Benson, Henry K. **Catalytic oxidation of sulfite waste liquor by atmospheric oxygen.** *Ind. Eng. Chem.* 34, 436-8(1942).—*C.A.* 36, 2718^2.

When sulfite waste liquor was discharged into sea water, the immediate chem. O_2 demand was the only O_2 demand of consequence. At room temp. the aeration of 10% waste liquor in a tower by introduction of the air through a Carborundum block at the base of the tower had no effect upon its sulfite content; small quantities of $CuSO_4$, $FeSO_4$, $Co_2(SO_4)_3$, $Mn_2(SO_4)_3$ and $NiSO_4$ had no effect. Aeration in the presence of Pt, Fe_2O_3, Cr_2O_3, CuO or MnO_2 could materially reduce the O_2 demand, but the acid soln. dissolved the oxides and the catalysts soon disappeared from the porous pellets acting as carriers. Activated carbon was an effective catalyst for the oxidation of the chem. oxidizable compds. in the waste liquor.

9843. Schunck, Rezsö. **The production of benzene from coal gas.** *Magyar Mernök-es Epitesz-Egylet Közlönye* 76, 161-6(1942).—*C.A.* 39, 1281^9.

An Hungarian plant for the recovery and purification of benzene was described. The benzene was adsorbed from the coal gas (illuminating gas) on activated carbon. The plant capacity was 275,000 m^3 of the coal gas daily. Methods of testing both the crude and the purified benzene were described.

9844. Bente, Paul F. and Walton, James H. **The catalytic activity of activated nitrogenous carbons.** *J. Phys. Chem.* 47, 133-48(1943).—*C.A.* 37, 3911^3.

The catalytic activities of several nitrogenous carbons and one sugar carbon were compared by measuring their effects on the rate of decompn. of H_2O_2, the rate of oxidation of hydroquinone in various solvents, and the rate of oxidation of alk. potassium urate. The optimum temp. of activation was found to be 875°C. The carbons could be arranged in the same order of decreasing activity for all 3 reactions. The carbon prepd. from hexamethylenetetramine showed exceptional catalytic activity. KCN (0.001 N) inhibited all 3 reactions on the nitrogenous carbon but not on the sugar carbon. B.E.T. surface areas of the carbons ranged from 2000 to 600 m^2/g, but did not give a direct correlation with the catalytic activities.

9845. Bente, Paul F. and Walton, James H. **Effect of active nitrogen and of certain nitrogen compounds on catalytic properties of carbon.** *J. Phys. Chem.* 47, 329-37(1943).—*C.A.* 37, 5641^1.

The catalytic activities of carbons prepd. from lactose and from naturally occurring org.-N compds. were tested on the decompn. of H_2O_2 and on the oxidation of hydroquinone and K urate. Lactose carbon treated with active N_2 and NO showed a decreased activity. NH_3 caused a promotion which equaled that of carbon from org.-N compds. This effect was not due to retention of NH_3. Treatment at high temps. with N_2O caused a large promotion without any N-fixation.

9846. Bray, J. L., and Howard, R. E. **Hydrogenation of coal at high temperatures.** *Purdue Univ., Eng. Expt. Sta. Bull., Research Ser. No.* **90**, 55 pp. (1943).—*C.A.* **38**, 3448^5.

The hydrogenation of Indiana fourth-seam coal was investigated without the use of vehicles or catalysts in the range from 750° to 1060°F and at pressures up to 4500 lbs/in^2. The reaction bomb was constructed of a pearlitic Mn steel and was operated as a const.-vol. batch system. Data were given for the variation of gas compn. with time for various temps., and the equil. values of gas compn. were detd. The presence of H_2 appeared to modify tremendously the ordinary destructive distn. of coal, and the volatile matter distd. from the coal was ultimately reduced to CH_4 by a combination of cracking and hydrogenation.

9847. Fong, T. C. and Ragatz, R. A. **The action of carbonate catalysts in the carburization of steel.** *Trans. Am. Soc. Metals*, preprint No. 17, 25 pp. (1943).—*C.A.* **37**, 6620^4.

The evolution of CO_2 from plain charcoal and from charcoal mixts. with carbonates of Na, Ba or Ca was studied. The catalytic activity induced by Na_2CO_3 or $BaCO_3$ was sustained even after the percentage evolution of CO_2 had leveled off to a const. value. Effective functioning of a carbonate catalyst required a carbonate which reacted directly with carbon and which had a low dissocn. pressure.

9848. Imada, Fumio and Ono, Teisuke. **Studies on carbon. VII. Sulfonation.** *Technol Repts. Kyushu Imp. Univ.* **18**, 76-80 (1943).—*C.A.* **43**, 5572*d*.

By passing vaporized CS_2 and S with a stream of N_2 over active charcoal at 800-1100°C for 1 to 3.5 hrs, the equil. $CS_2 \rightleftarrows C + S_2$ was studied. The reaction proceeded mainly from left to right up to 1000°C for 1.5 hrs and reversed its direction after this point.

9849. Jäppelt, A. and Klaus, J. **The distillation of tar and tar fractions in the presence of surface-active coke.** *Oel u. Kohle* **39**, 569-74 (1943).—*C.A.* **38**, 2187^8.

The tar obtained by low-temp. carbonization of Upper Silesian gas coke and fractions from this tar were distd. in the presence of different grades of coke dust with varying surface activity; the coke had been activated by steam in the course of its production by low-temp. carbonization. The surface activity of the coke dusts was measured by detg. the heat of wetting with C_6H_6. Tar and coke dust, both anhyd., were mixed in a kneading machine and the briquets were distd. without cracking, with steam as heating medium. The yield and quality of the distillate depended on the magnitude of the internal surface of the coke dust used.

9850. Oza, Trambaklal Mohanlal and Shah, M. S. **The mechanism of the action of charcoal on KNO_3. II. Study of the reactions.** *J. Indian Chem. Soc.* **20**, 261-70 (1943).—*C.A.* **38**, 2258^7.

Charcoal reacted in different stages: (*1*) $4KNO_3 + 2C \rightarrow 4KNO_2 + 2CO_2$, (*2*) $4KNO_2 + 3C \rightarrow 2K_2CO_3 + CO_2 + 2N_2$ and (*3*) the flash reaction $KNO_3 + KNO_2 + 2C \rightarrow K_2CO_3 + CO_2 + N_2$. (*2*) was the major reaction and proceeded through the dissocn. of the KNO_2 produced in reaction (*1*) into K_2O, NO and N_2O_4. This was followed by a chain of vigorous reactions between the NO and N_2O_4 with charcoal, and the union of the CO_2 produced with the K_2O. In the flash stage, reaction (*3*), KNO_2 was produced from KNO_3 by reduction with charcoal, or by direct rupture into KNO_2 and O_2. The reaction chain, initiated by KNO_2, proceeded rapidly and charcoal burned with a flash in the mixt. of NO and O_2.

9851. Rideal, Eric K. **The mechanism of catalytic hydrogenation.** *Chemistry & Industry* **1943**, 335-8.—*C.A.* **38**, 15^7.

A metallic catalyst was covered with a monolayer of chemisorbed H_2 which was adsorbed without appreciable energy of activation. Further changes in H_2 retention with temp. were due to soln. of H_2 in the metal, or "activated diffusion". The methods of photoelec. thresholds and the change in contract potential caused by the presence of a monolayer were used to study the chemisorbed layer. The ortho-para H_2 conversion at a metallic surface was due to interaction between a chemisorbed and a van der Waals adsorbed species, and thus could be used as an indicator for chemisorbed H atoms. The theory of intermediate compd. formation best explained such hydrocarbon catalysis reactions as the exchange of H and D in C_2H_4 and C_3H_6, and the migration of the double bond in higher olefins under conditions when exchange occurred.

9852. Traustel, Sergei. **The calculation of gasification equilibra.** *Feuerungstech.* **31**, 111-14 (1943).—*C.A.* **40**, 5902^4.

It had been found that the calcn. of the equil. in advance was not possible, as the reactivity of the fuel and the transfer coeff. between gas and solid material in a static fuel bed were not known, and had to be estimated. A new calcn. method was developed by which systematic estimations were made. No graphic methods were required and volatile constituents of the fuel could be taken into account. The equil. consts. were detd. as a function of temp. from $\log k_p = (a/T) + b$, and the consts. a and b were given in the range from 600 to 1500°K.

9853. Chukhanov, Z. F. **Thermal regime of burning and gasification of a layer of solid fuel.** *Compt. rend. acad. sci. U.R.S.S.* **44**, 269-73 (1944).—*C.A.* **39**, 3650^2.

The heat transfer through a layer of burning fuel was studied. The flow of heat through the bed was primarily by radiation. The rate of heat flow increased with decrease in the particle size of the fuel.

9854. Funasaka, Wataru and Horikawa, Kihachiro. **Catalytic decomposition of hydrocarbon oil. I. Decomposition of cetane by alumina and silica gels.** *J. Soc. Chem. Ind. Japan*, **47**, 160-2 (1944).—*C.A.* **42**, 7010*i*.

For the catalytic decompn. of cetane the optimum reaction temp. was found at 525°C. The flow velocity of oil had no remarkable influence. The Al_2O_3 gel was more effective than silica gel and had greater ability to produce aromatic compds. The yield of cracked gasoline was approx. 20%. The gasoline contained olefins but no naphthenes. The gaseous decompn. products were also olefins. The decompg. power of active charcoal was extremely high and aromatic compds. also were formed.

9855. Griffith, R. H. and Plant, J. H. G. **Catalytic removal of organic sulfur compounds from coal gas. Recent development work of the Gas Light and Coke Company.** *Gas. J.* 244, 48-50, 54-4(1944).—*C. A.* 38, 5063^5.

A plant for the catalytic removal of org. S compds. from coal gas contained 3600 lbs of Ni subsulfide catalyst on china clay pellets in 4 vessels, each with a cubical content of 15 ft^3. The horizontal-retort gas from the oxide boxes and $C_{10}H_8$ washer was preheated to about 220°C and then passed through the catalyst vessels, usually 3, in parallel. The purified gas leaving the vessels at about 350°C was cooled in the heat exchanger and in a washer-cooler. A 2% soln. of Na_2CO_3, which was circulated through the latter, also dissolved the oxides of S. The NO was reduced at the same time from an av. concn. of 1 p.p.m. to less than 0.1.

9856. Hofmann, U. and Höper, W. **Active spots in catalysis.** *Naturwissenschaften* 32, 225-6 (1944).—*C. A.* 40, 2377^9.

The carbon Thermax was heated to 1300°C and was then shown to be of spherical grains 3500 A. in diam. Each grain had 10^6 graphite crystals of 30 A. each. After 24 hrs graphitizing at 3000°C the grain size was the same, but only 1 to 3 graphite crystals were found. The adsorption of methylene blue was the same with the 2 products. The activity of the 2 types of catalyst in the formation of HBr was detd. at 150°C. The no. of active spots on individual crystals did not seem to be related to the no. of graphite crystals present.

9857. Hulburt, Hugh M. **Chemical processes in continuous-flow systems. Reaction kinetics.** *Ind. Eng. Chem.*, 36, 1012-17(1944).

Data on flow systems furnished kinetic information as reliable as that from static expts. The analysis was applicable rigorously only for homogeneous reactions in long tubes. It failed if the mechanism of reaction changed with the pattern or velocity of flow, as when surface reactions controlled the rate. If adsorption reached equil., it was possible to express the reaction velocity as a function of the bulk phase concns. through the adsorption isotherm. At fast flow rates, however, diffusion radially to the reactor or catalyst surface will be rate controlling and the analysis must then be revised.

9858. Ramat, Auguste. **Use of adsorption in the purification and dehydration of gases.** *Chimie & industrie* 52, 64-7(1944).—*C. A.* 40, 2701^2.

The principles of the purification and dehydration of gases by adsorption was explained. The more important industrial applications (debenzolation and desulfuration of illuminating gas, drying of air, dehydration, and purification of CO_2) were discussed.

9859. Areshidze, Kh. I. **Investigation of hydroaromatic hydrocarbons in Mirzaan gasoline, 95°-122°C fraction by dehydrogenation catalysis.** *Doklady Akad. Nauk S.S.S.R.* 50, 193-6 (1945).—*C. A.* 43, 4838*i*.

The petroleum fraction was freed of aromatic hydrocarbons by 99% H_2SO_4 and the fraction b. 95°-122°C was subjected to catalytic dehydrogenation over Pt-carbon at 300-5°C. The aromatic content of the product (detd. by 30 min. shaking with 99% H_2SO_4) was 26.6 vol. %. The resulting sulfonates were hydrolyzed and the hydrocarbons identified as: trace of C_6H_6, toluene, EtPh, *m*-xylene and *o*- and *p*-xylenes.

9860. Bailar, John C. Jr. and Work, J. B. **The role of catalysis in the preparation and reactions of some Co(III) and Cr(III) amines.** *J. Am. Chem. Soc.* 67, 176-9(1945).—*C. A.* 39, 1366^5.

Many reactions in which N was coordinated to Co or Cr were particularly susceptible to catalysis by charcoal. It seemed to be immaterial whether the N was NO_2, a primary amine, or NH_3. SiO_2 and Raney Ni also were effective, but charcoal seemed to be most suitable for practical purposes. In the presence of charcoal, aq. NH_3 displaced both Cl from cis-$[Co(en)_2Cl_2]^+$, giving preponderantly the trans product, $[Co(en)_2(NH_3)_2]^{+++}$. $[Cr(en)_3]Cl_3$ was readily prepd. by the reaction of hydrated $CrCl_3$ and hydrated $C_2H_4(NH_2)_2$ in the presence of charcoal. In the presence of charcoal, $NaNO_2$ reacted with $[Cr(NH_3)_6]^{+++}$ and aq. NH_3 reacted with $[Co(NO_2)_6]^{---}$ to give $[Co(NO_2)_3(NH_3)_3]$.

9861. Chukhanov, Z. F. **Thermal regime of semicoking, burning, and gasification of particles in a solid fuel. II.** *Compt. rend. acad. sci. U.R.S.S.* 47, 185-9; *Doklady Akad. Nauk S.S.S.R.* 47, 190-4(1945).—*C. A.* 40, 4863^7.

Criteria were proposed for assessing the relative importance of heat exchange in a fuel bed due to conduction, convection, and radiation. The dependence of these functions on temp., gas velocity and compn., particle size and particle cond. was shown. Thermal control of the system by means of the most favorable method, usually convection, may be effected by the adoption of appropriate conditions.

9862. Dulou, R. **Catalysis by nonmetallic adsorbents.** *Chimie & industrie* 54, 396-403 (1945).—*C. A.* 40, 5985^9.

9863. Pshezhetskiĭ, S. Ya. **Theory of the diffusion retardation of heterogeneous catalytic reactions.** *J. Phys. Chem.* (U.S.S.R.) 19, 376-81(1945).—*C. A.* 40, 1726^1.

When a gas mixt. traversed a bed of catalyst, the concn. of the reaction product in the outgoing gas depended on the rate of diffusion of the reaction product from the interior of the catalyst grain to its surface and on the rate of diffusion of this product from the grain surface into the gas current. A formal theory was given for both these rates. The difference between the apparent and the true reaction consts. was proportional to the velocity of gas flow and to the square of the grain diam.

9864. Roginskiĭ, S. Z. **Poisoning of catalysts.** *Compt. rend. acad. sci. U.R.S.S.* 47, 478-81; *Doklady Akad. Nauk S.S.S.R.* 47, 497-500(1945). —*C.A.* 40, 4942^{6}.

Basic peculiarities of the isotherms of catalyst poisoning of broad nonuniform surfaces were discussed.

9865. Roĭter, V. A.; Gaukhman, S. S.; Pisarzhevskaya, N. P., and Gvaliya, T. M. **Kinetics and mechanism of catalytic conversion of carbon monoxide.** *J. Applied Chem.* (U.S.S.R.) 18, 439-49(1945)(English summary). —*C.A.* 40, 4593^{6}.

The dependence of yield of CO conversion to H_2 and CO_2 in the presence of H_2O was studied with the following factors: space velocity, total and partial pressures of the components, between 400° and 500°C over K-carbon catalyst and Fe oxide catalyst of "nitrogen" type. A new theory for the K-carbon catalyst proposed the following scheme: $2KOH + CO = K_2CO_3 + H_2$; $K_2CO_3 + H_2O = 2KOH + CO_2$, with summary result: $CO + H_2O = H_2 + CO_2$. In case of the Fe catalysts there was evidence for considerable effect of the following reaction sequence; $2CO = CO_2 + C$; $C + 2H_2O = CO_2 + 2H_2$.

9866. Anon. **Removal of organic sulfur compounds from gases.** *Gas Research Board*, No. 24; *Gas J.* **248**, 1102, 1107, 1154, 1159(1946). —*C.A.* **41**, 4292*b*.

Use of active charcoal as a support for the Cu-Cr catalyst rendered it more active for removal of org. S from gas at high space velocities than did alumina. The optimum temp. for use of the activated carbon was 270°C, although the variation in performance over the range 250°-300°C was not great. Nickel hydroxide, pptd. without carrier or binder and contg. 1-2% S as sulfate to inhibit the synthesis of CH_4, was effective in completely adsorbing traces of H_2S from gas at 150°C, until it had adsorbed 9.9% of its wt of S. The addn. of 1% to the reagent allowed the temp. to be raised to 200°C, but then only 7.5% of S was adsorbed. The amt. of Ni hydroxide required to adsorb the org. S compds. remaining after the first conversion stage would be only 3-4 lb per million ft^3 of water gas treated. In preliminary expts. on the removal of org. S before the removal of H_2S, a Cu-Cr catalyst was used.

9867. Arthur, J. R. **The combustion of carbon monoxide.** *Bull. Brit. Coal Utilisation Research Assoc.* **10**, 129-34(1946).—*C.A.* 40, 6282^{4}.

The more important factors in the high-temp. oxidation of CO were reviewed.

9868. Avramenko, L. I. **The reaction between hydrogen atoms and carbon.** *J. Phys. Chem.* (U.S.S.R.) 20, 1299(1946)(in Russian).—*C.A.* 41, 2998*f*.

H atoms produced in a glowing discharge reacted at 100°C with soot. The reaction product showed a band at 4317A. indicating CH radicals.

9869. Frost, A. V. and Lapin, Yu. P. **Dehydrogenation of cyclohexane and the structure of the active centers of dehydrogenating catalysts.** *Vestnik Moxkov. Univ.* 1946, 95-103.—*C.A.* 42, 6630*a*.

Catalysts were prepd. by impregnating the carrier with $PdCl_2$ until colorless, filtering, drying at 120°C and reducing 2 hrs in a stream of H_2 at 400°C. Dehydrogenation was carried out at 320°C, rate of flow 0.1 ml cyclohexane/min. On active charcoal (3 g) with an ash content 1.4%, Pd 0.0119, 0.0042, 0.0015, 0.0006, 0.00017 g/g charcoal the conversion was 41, 65, 16, 5, 2.5%, resp. Pd (0.0002 to 0.12 g/g cryst. MgO) had a surface of 58.5 m^2/g by adsorption of stearic acid in CCl_4 and only one kind of active center.

9870. Grekhnev, M. A. **Dehydrogenation of isoborneol with a copper catalyst made without reduction in hydrogen.** *J. Applied Chem.* (U.S.S.R.) 19, 1271-6(1946)(in Russian).—*C.A.* 41, 7214*i*.

With a catalyst prepd. by impregnating charcoal with a 50% soln. of $Cu(NO_3)_2$, drying and heating at 550°C, the amt. of H_2 liberated from isoborneol in 2.5 hrs at 200°C was about 98% of theory; catalysts heated to 500 and 400°C gave only about 92 and 86%, resp. Heating the catalyst on charcoal resulted in partial reduction to Cu which progressed further in the course of the reaction. Addn. of KOH was more effective than NaOH, the latter more effective than CaO. Addn. of 0.1% $Ba(NO_3)_2$ to the $Cu(NO_3)_2$ soln. promoted the reaction particularly in the initial stages and shortened its completion.

9871. Key, A. and Eastwood, A. H. **45th report of the Joint Research Committee of the Gas Research Board and the University of Leeds. The removal of sulfur compounds from coal gas and synthesis gas at atmospheric pressure.** *Gas Research Board, Copyright Pub. No.* 14/4, 42 pp.(1946).—*C.A.* 43, 3169*i*.

A catalyst composed of Cu sulfide and Cr oxide supported on active carbon or activated Al_2O_3 would effect a 98% reduction in the org. S content of a water gas contg. 15 grains per 100 ft^3 when the gas was passed over it at a high space velocity and at 250°C. A total of 3 treatments was required to reduce the S concn. to 0.002 grains per 100 ft^3 with removal of the H_2S, which was formed after each treatment. The catalyst was inactive when used for the treatment of coal gas below 400°C, owing to the presence in the gas of certain unsatd. compds., particularly those of the C_2H_2 type. By treatment of the coal gas with a Ni sulfide or Mo sulfide catalyst at 300°C and at a space velocity of 6000 vol. of gas per vol. of catalyst space per hr, the C_2H_2 was removed.

9872. Kobozev, N. I. **Catalase action of various catalysts. The catalytic activity and**

structure. *Acta Physicochim. U.R.S.S.* 21, 469-518(1946)(in English).—*C.A.* 41, 2309*h*.

The action of catalase and of other catalysts capable of speeding up the evolution of O_2 from H_2O_2 was analyzed on the basis of 3 reactions. The deduced true activities per active center at 0°C in relative units for the various catalysts were: MoO_4^-, CrO_4^-, WO_4^- and I^-, 0.1; Fe^{+++}, 1.0; $Cr_2O_7^-$, 11.0; Fe^{+++} on charcoal, 100; hemin, 50 to 650; hemin on charcoal, 800; catalase, 5×10^8; Fe_3O_4 and MnO_2, 10^4; and Pt-black sol, 10^6. The model of an intermediate complex holding the 2 O atoms was deduced in which thermodynamic repulsion between the O atoms decreased as the total amt. of supporting material to which the active centers were attached increased.

9873. Kobozev, N. I. **The ensemble and aggravation principles in catalysis. II. The aggravation principle and structural classification of catalysts.** *Acta Physicochim. U.R.S.S.* 21, 943-57(1946)(in English).—*C.A.* 41, 2308*h*.

The smallest cluster of atoms still possessing catalytic properties was termed the "active element" and was denoted by Φ. Φ frequently coincided with some chem. element. "Aggravation" of active element-formation might involve attachment of any mol. groups that were catalytically non-specific. "Association" of active elements might involve: $n\,\Phi \rightarrow (\Phi)_n$, $\Phi_1 + \Phi_2 \rightarrow (\Phi_1\Phi_2)$, or $\Phi + a \rightarrow \Phi\,[a]$. Specific examples included ensembles of chromate ions, phytin, fructose diphosphate, and thyroxine. Activators and promotors might serve as true activators of ensembles, and also as stabilizers of $(\Phi)_n$ without altering their structure and activity. The adsorption of hemin on charcoal was not merely its fixation on the surface, but also a further aggravation of Φ by the surface.

9874. Kobozev, N. I. and Zubovich, I. A. **Specific effects of micro amounts of heavy metals on the rate of oxidation catalysis.** *Compt. rend. acad. sci. U.R.S.S.* 52, 131-4 (1946).—*C.A.* 41, 1540*d*.

Various catalysts were prepd. by simultaneous or successive adsorption on sugar charcoal (surface area approx. 200 m^2/g) from soln. of the salts. In each case the concn. of the first metal was held at 0.1% of the final catalyst, and that of the 2nd metal was varied: Fe^{+++}, Cu^{++}; Cu^{++}, Fe^{+++}; Fe^{+++}, Ag^+. The activity of the resulting catalyst was measured by detg. the no. of g mol. of substrate transformed per min. The activity of one metal was strongly affected by the addn. of micro amts. of another, and this effect was about the same for catalase (decompn. of H_2O_2) or oxidase (oxidation of Na_2SO_3) except that catalase was inhibited whereas oxidase was enhanced.

9875. Lapin, Yu. P. and Frost, A. V. **Investigation of the active centers of dehydrogenating catalysts in the reaction of dehydrogenation of cyclohexane.** *Compt. rend. acad. sci. U.R.S.S.* 53, 801-3(1946)(in English).—*C.A.* 41, 4027*i*.

Charcoal (a porous carrier) and cryst. MgO (nonporous) with Pd and Ni were used. The catalysts were prepd. by the adsorption of $PdCl_2$ from a soln. with subsequent reduction to Pd at 400°C. The curve of specific activity in the dehydrogenation of cyclohexane with a Pd catalyst on charcoal showed a decline, then a rise to max., with subsequent decline as the ratio of the catalyst-covered area to total area of the carrier was increased. The max. of specific activity corresponded to 2 atoms of Pd in an active center.

9876. Liberman, A. L. and Kazanskiĭ, B. A. **Hydrogenation of dimedon.** *Bull. acad. sci. U.R.S.S., Classe sci. chim.* 1946, 77-82(in Russian).—*C.A.* 42, 5861*c*.

Dimedon in aq. suspension of Pt black did not adsorb H_2 at any significant rate and addn. of HCl did not improve it; a somewhat greater hydrogenation rate was observed in AcOH, but this rapidly dwindled to 0. Dimedon and an aq. suspension of platinized carbon also did not adsorb H_2; addn. of a little H_2PtCl_6, however, led to theoretical adsorption of H_2.

9877. Mozingo, Ralph. **Palladium catalysts.** *Org. Syntheses* 26, 77-82(1946).—*C.A.* 41, 644*h*.

Details were given of the prepn. of Pd on $BaSO_4$, of 5 or 10% Pd on carbon (Darco G-60), and of $PdCl_2$ on carbon.

9878. Pshezhetskiĭ, S. Ya. and Rubinshteĭn, R. N. **Progress of heterogeneous catalytic reactions in a stream. I. General equations. A heat-insulated** system. *J. Phys. Chem.* (U.S.S.R.) 20, 1421-34(1946)(in Russian).—*C.A.* 41, 2972*e*.

A general quant. theory was given for the steady state of heterogeneous reactions taking place when a gas streamed through a bed of catalyst. The rate of the over-all reaction could be detd. by the rate of the actual reaction process, by the rate of diffusion toward the catalyst, or by that within the grains of the catalyst.

9879. Reznik, Delia. **Production of pulverulent solid fuels from vegetable matter.** *Industria y quim. (Argentina)* 8, 328-42(1946).—*C.A.* 41, 3599*c*.

Com. powd. charcoal was made suitable for use as fuel by impregnating with 10-20% asphalt as an aq. emulsion and heating to 250-300°C in air to granulate and to oxidize the asphalt. This improved combustibility, ignition temp., flame length, calorific value, and bulk d.

9880. Szczeniowski, Boleslaw. **Theoretical analysis of combustion gases.** *Rev. trimestr. can.* 32, 196-223, 294-327(1946).—*C.A.* 42, 1720*c*.

Under certain conditions, and with a no. of arbitrary assumptions, general equations were set up which related the wt % of the constituents of various fuels to the amt. of O_2 required for combustion. Equations were derived for combustion of gases, liquids, and solids, with O_2 and N_2 in various proportions to each other and to the fuel, and by taking into account dissocn. Combustion diagrams for various cases were shown.

9881. TODES, O. M. **The kinetics of exothermal catalytic reactions in a current. I. Theory of reaction on a long contact layer.** *Acta Physicochim. U.R.S.S.* 21, 689-704(1946)(in English).—*C.A.* 41, 1537*c*.

Two types of thermal regimes in flowing systems of exothermal reactions on a long catalyst layer were possible, analogous to the "quiet reaction" and "combustion" regimes for homogeneous reactions. At low concns. with first-order reactions, the reaction occurred with a small heating effect over a considerable distance along the reaction vessel. Above the crit. concn., defined as a function of activation energies and catalyst properties, there were two sharply different reaction zones: (1) a narrow zone of steady combustion, where the reaction proceeded at a high velocity and heating up, (2) beyond this zone the combustion went to completion with a small heating effect.

9882. WINN, HUGH; SHELTON, J. REID, AND TURNBULL, DAVID. **Role of carbon in oxidation of GR-S vulcanizates.** *Ind. Eng. Chem.* 38, 1052-6(1946).—*C.A.* 40, 7690^4.

Carbon black was a catalyst of this oxidation, but the increased rate of absorption of O_2 with increase in the proportion of carbon black was a function of surface area. The particular furnace-process carbon blacks studied were only 55% as active as channel carbon black in promoting oxidation. The linear stage of O_2 absorption involved 2 types of reaction with the remaining oxidizable centers: (1) a reaction with centers not under catalytic influence, and (2) a reaction catalyzed by carbon black.

9883. BOGATSKII, D. P. **Reduction of nickel oxides with solid carbon in connection with their dissociation.** *Bull. acad. sci.* (U.R.S.S.), *Classe sci. tech.* 1947, 105-12(in Russian).—*C.A.* 41, 5367*d*.

Thermograms of NiO_2 heated with carbon black (pure soot from CO) showed a first endothermal min. at 115-20°C corresponding to dissocn. of NiO_2, occurring at a somewhat lower temp. than in the absence of carbon; dissocn. of NiO began at 320-90°C, with formation of a solid soln. with Ni_2O and oxidation of carbon. With a mixt. of NiO and carbon, dissocn. of NiO with simultaneous oxidation of carbon occurred at about 200-20°C; reduction of NiO by CO formed from carbon took place to some extent at 450-500°C. With a mixt. of Ni_2O and carbon, strongly endothermal reduction became noticeable at 585-600°C, going over into exothermal reduction by CO; above 700°C reduction of Ni_2O by solid carbon, with regeneration of CO, again became predominant owing to scarcity of CO; at still higher temp., reduction by CO set in once more. The metal obtained at high temp. by reduction with carbon was coarsely cryst. and much less reactive than the powdery Ni obtained by reduction with H_2 at low temp.

9884. BORESKOV, G. K. **Effect of heat and material transfer on the rate of contact reactions.** *Khim. Prom.* 1947, No. 8, 1-6, No. 9, 5-11.—*C.A.* 43, 3698*g*.

The phys. reactions were divided into 3 main groups: (1) exchange reaction between the gas flowing in channels formed by the granular catalyst and the surfaces of these granules; (2) material and heat transfer within the granules of the catalyst, and (3) heat transfer between the granules of the catalyst in a direction normal to the plane of the internal heat transfer. For slow catalytic reactions where the rate of reaction on the inner surfaces did not vary materially from the rate of reaction on the outer surface, the most favorable was a fine-pore structure. For medium-rate reactions where the rate on the inner surfaces was noticeably slower than on the outer, but where the transfer to the outer surface did not materially affect the overall rate, the preferred structure of the granules was capillary, in which the diam. of the capillaries equaled the length of the mean free path. For high-rate reactions, the preferred structure of the catalyst was the same as for medium-rate, but the capillaries need not extend too deep inward.

9885. CHARTROU. **Processes for the hydrogenation and treatment of hydrocarbons of I. G. Farbenindustrie.** *Bull. assoc. franc. techniciens petrole.* No. 61, 23-59(1947).—*C.A.* 41, 6689*c*.

The I. G. Farbenind. industrial-scale processes were reviewed relating to two-stage catalytic hydrogenation of coal and lignite, aromatization of the hydrogenated product, dehydrogenation, hydroforming, manuf. of isoöctane, alkylation, catalytic cracking, and refining of paraffin wax, etc.

9886. EVANS, ALWYN G. AND MEADOWS, G. W. **Catalytic oxidation of sulfur dichloride by oxygen.** *Trans. Faraday Soc.* 43, 667-74(1947).—*C.A.* 42, 4082*i*.

The oxidation of SCl_2 by dry air was detd. with activated charcoal as a catalyst. The catalyst was prepd. by shaking 1300 g of charcoal in a soln. contg. 200 g of $CaCl_2.8H_2O$ in 2 liters of water. The mixt. was filtered, washed with 250 ml alc., followed by 200 ml ether, and dried at 100°C in an oven. The oxidation was investigated at 193°, 238°, and 320°C, and the equil. const. detd. for each temp. The max. yield of $SOCl_2$ was obtained by using a SCl_2/O_2 ratio of 2. SO_2Cl_2 did not react with I_2 or KI, but under the conditions used, it underwent hydrolysis; i.e., 1 mol. of SO_2Cl_2 liberated four equivs. of acid.

9887. FANO, UGO. **A possible contributing mechanism of catalysis.** *J. Chem. Phys.* 15, 845 (1947).—*C.A.* 42, 1112*b*.

Types of catalytic mechanism were considered in which the mass of the catalyst was important. The mechanism suggested was probably not the main factor in catalysis, but it might be one of several concurrent factors of comparable importance.

9888. FOSTER, JOHN F. AND VORUM, DONALD A. **The mechanism of water-gas reaction. Report on experimental work done for the A.G.A.** *Gas World* 127, 259-64(1947).—*C.A.* 41, 6692*h*.

Exptl. work was started on a cylindrical generator with a cross-sectional area of 1 ft^2 and an internal height of 46 in. The primary objective was to characterize the fuel bed of the generator as completely as possible with respect to temps., gas compn. occurring at fixed times, locations, and rates of material flow. Plots of CO/CO_2 ratios against either time or distance above grates failed to show regularity, and were not subject to interpretation until more data were available. Rapid and accurate detn. of the steam content of the gases in the fuel bed was necessary for the study of the progress of gasification in the generator.

9889. Ghosh, J. C.; Bhattacharyya, S. K.; Muthanna, M. S., and Mitra, C. R. **Electrolytic reactions on porous carbon anodes. I. Preparation of *p*-benzoquinone by the oxidation of benzene.** *Current Sci.* **16**, 87(1947).—*C.A.* **41**, 4725*c*.

Thick-walled porous carbon tubes closed at the bottom were soaked in a soln. of $K_3Fe(CN)_6$. After being dried in an oven they were used as anodes in 2% H_2SO_4 contg. $K_3Fe(CN)_6$ as a catalyst. Diffusion of benzene through the tube under certain but undefined conditions gave 51% current efficiency in conversion to *p*-benzoquinone.

9890. Ghosh, J. C.; Bhattacharyya, S. K.; Rao, M. R. A.; Muthanna, M. S., and Patnaik, R. B. **Electrolytic reactions on porous carbon anodes. II. Preparation of chlorobenzene from benzene.** *Current Sci.* **16**, 87-8(1947).—*C.A.* **41**, 4725*d*.

C_6H_6 was recycled through a porous carbon anode into a bath of monochloracetic acid in concd. HCl. At c.d. 0.026 amp./cm^2 and 38°C current efficiencies were 33, 68, and 89% with I_2, $FeCl_3$, and cyanuric acid as catalysts, resp.

9891. Ghosh, J. C.; Bhattacharyya, S. K.; Muthanna, M. S., and Patankar, A. D. **Electrolytic reactions on porous carbon anodes. III. Preparation of ethylene chlorohydrin and ethylene glycol from ethylene.** *Current Sci.* **16**, 88(1947).—*C.A.* **41**, 4725*e*.

Ethylene was fed to a porous carbon tube anode at a rate of 57 ml/hr/cm^2 of anode surface. With a c.d. of 0.023 amp./cm^2 and in 10% NaCl soln. both ethylene chlorohydrin and ethylene glycol were formed. The current efficiency on chlorohydrin was 91% at 1°C and 1.1% at 91°C, while the efficiency on glycol was 5.4% at 1°C and 16.5% at 91°C.

9892. Ghosh, J. C.; Bhattacharyya, S. K.; Muthanna, M. S., and Parikh, R. K. **Electrolytic reactions on porous carbon anodes. IV. Preparation of chloral from alcohol.** *Current Sci.* **16**, 88(1947).—*C.A.* **41**, 4725*f*.

Alc. was introduced through a porous carbon anode into a bath of satd. NaCl soln. at 100°C to yield chloral, which distd. off. At a c.d. of 0.04 amp./cm^2 and with an anode impregnated with 6.5% by wt of cyanuric acid, the current efficiency on chloral was 33.4%. Besides chloral and chloral alcoholate, monochloracetic acid and aldehyde and ethyl acetate were obtained as by-products in yields depending on conditions.

9893. Glushnev, V. E. and Vasil'ev, S. F. **Catalytic desulfurization of reforming gasoline with phosphoric acid and zinc chloride.** *Izvest. Acad. Nauk S.S.S.R., Otdel. Tekh. Nauk* **1947**, 829-33.—*C.A.* **43**, 8125*d*.

Catalytic desulfurization of distillate from a high-S petroleum was investigated by using H_3PO_4 on activated carbon, $ZnCl_2$ on activated carbon, H_2SO_4, and activated carbon. The distillate used in the expts. had S-content 0.42% before washing, 0.40% after washing with alkali soln., and octane no. 64.5. After catalytic treatment, percentage of S, octane no., and yield of gasoline (wt %) were, resp.: H_3PO_4 on activated carbon, 0.15, 74, 91; $ZnCl_2$ on activated carbon, 0.17, 71, 89.3; H_2SO_4, 0.19, 65.5, 85; activated carbon, 0.40, 65, 94.

9894. Iley, R. and Riley, H. L. **Preparation of colorless Carborundum.** *Nature* **160**, 468(1947).—*C.A.* **42**, 434*b*.

Carbon was deposited on fused Si in electrically heated concentric Vitreosil tubes (0.4 in. internal diam.). C_2H_4 satd. with H_2O was passed through the tube at 1200°C (measured by a Pt/PtRh thermocouple) at a rate of 25 liter/hr. In 1 expt., which lasted several hrs, in addn. to the carbon deposit a white fluffy moldlike growth formed on the center part of the outer surface of the inner tube. X-ray powder photographs showed this to be a microcryst. cubic Carborundum.

9895. Kinney, Corliss R. **Sources of acetic acid obtained by oxidation of coal.** *J. Am. Chem. Soc.* **69**, 284-9(1947).—*C.A.* **41**, 3275*g*.

The coal (1 g) was oxidized with 25 ml concd. HNO_3 and 20 g $Na_2Cr_2O_7$ or $K_2Cr_2O_7$ by refluxing 0.5 hr and then distg. as long as acid was formed. Data were given for a large no. of coals, sucrose, cotton and wood cellulose, a variety of lignins, humus, and various phenols. The structures in coal which yield AcOH on oxidation were largely decompd. by carbonizing at 500°C. The yield of AcOH from bituminous coals had a direct relation to the amount of CH_4 produced on carbonization.

9896. Kitaĭgorodskiĭ, I. I.; Sentyurin, G. G., and Rishina, V. A. **Reduction of sodium sulfate in glass manufacture.** *Glass Ind.* **28**, 636(1947).—*C.A.* **43**, 7203*e*.

Addn. of several times the quantity of wood charcoal theoretically required to reduce the Na_2SO_4 in the glass batch contg. sand 72.35, Al_2O_3 1.89, chalk 10.50, MgO 3.50, borax 2.46, Na_2SO_4 37.82 parts, when heated to 1100°C, left much sulfate unreduced. Further test-melts were made at 1100°C, 1200°C, 1300°C, and 1350°C, with wood charcoal, electrode carbon, anthracite, coke, and SiC. The 1:1 mixt. of wood charcoal and coke gave the best reduction.

9897. Lewis, Warren K. **Kinetics of the reactions of steam and carbon dioxide with carbon.** *Chem. Eng. News* **25**, 2815-18(1947).—*C.A.* **41**, 7212*e*.

The advantages of the powder-bed technique for the producer-gas and water-gas reactions were described.

9898. MUSAEV, I. A. AND GAL'PERN, G. D. **Platinized carbon in hydrogenation and dehydrogenation of hydrocarbons.** *Bull. acad. sci. U.R.S.S., Classe sci. tech.* 1947, 805-8(in Russian).—*C.A.* 42, 1484*h*.

The catalyst was prepd. by impregnating 70 g active carbon with a satd. soln. contg. 65 g $H_2PtCl_6.6H_2O$, drying the next day on a water bath, and reducing in a stream of electrolytic H_2 6 hrs at 150°C then 6 hrs at 200°-210°C, and finally heating to 310°C. It was effective in practically complete hydrogenation of C_6H_6 to cyclohexane at any temp. between 50° and 180°C at rates of feeding of 3.6 and 7.2 ml/hr, H_2 3.51 liter/hr.

9899. NADZIAKIEWICZ, JULIAN. **The influence of mild hydrogenation on the coking properties of some coals of the Polish coal basin.** *Biul. Inst. Nauk.-Badawczego Przemyslu Weglow.* (Katowice) No. 2, Komun. No. 20, 1-42(1947) (English summary).—*C.A.* 46, 4769*f*.

Eight kinds of noncoking and poorly coking coal were hydrogenated in a rotary autoclave at 400°C under an initial H_2 pressure of 80-100 atm., in the absence of oil and catalysts. The hydrogenated coal had good coking properties, agglutinating power, and a wide plasticity range (up to 263°C). The H_2 consumption reached 1.67%, based on dry coal. The material balance and yield of reaction products were tabulated.

9900. ODELL, WILLIAM W. **Gasification of solid fuels in Germany by the Lurgi, Winkler, and Leuna slagging-type gas-producer processes.** *U. S. Bur. Mines, Inform. Circ.* No. 7415, 46 pp.(1947).—*C.A.* 42, 1040*a*.

Operating data relative to 3 processes employing free O_2 as a gasmaking fluid were discussed. The Winkler and Lurgi processes were adapted for use in gasifying fuels at temps. below their ash-softening points and required a highly reactive fuel.

9901. SHUIKIN, N. I.; NOVIKOV, S. S., AND TULUPOVA, E. D. **Effect of unsaturated hydrocarbons on the dehydrogenating properties of platinum catalysts.** *Bull. acad. sci. U.R.S.S., Classe sci. chim.* 1947, 89-95(in Russian).—*C.A.* 42, 4437*a*.

Mixts. of a de-aromatized gasoline fraction were subjected to prolonged dehydrogenations at 300-305°C on a 5% Pt catalyst on activated charcoal, 50 cm high, 48 g, rate of flow 1 ml/min. The activity of the catalyst before, during, and after the runs was tested by the yields of dehydrogenation of cyclohexane. Marked inactivation was brought about by 1-ethyl-1-cyclopentene. Cyclohexene alone, in a slow H_2 stream, left the activity of the catalyst unchanged.

9902. TOTZEK, FRIEDRICH. **Gasification of coal by the Koppers-Totzek process.** *Stahl u. Eisen* 66/67, 363(1947).—*C.A.* 43, 5923*g*.

The most satisfactory results were obtained with an air-steam or an O_2-steam mixt. at about 1200°C, by using the fuels in dust form and in suspension. Fuels used in the exptl. generator included lignite dust, lignite-coke dust, anthracite dust, and coke dust. Up to 95% gasification was obtained with a high concn. of CO and H_2 in the gas. It was suggested that the gas be used instead of coke in metallurgical processes.

9903. VICKERY, R. C. AND EDWARDS, R. W. **Reduction of arsenic trioxide by carbon and carbon monoxide.** *Metallurgia* 36, 3-6(1947).—*C.A.* 41, 5367*b*.

The prepn. of elemental As by sublimation from a mixt. of As_2O_3 and charcoal rarely yielded more than 65% of the theoretical: $2\ As_2O_3 + 3\ C \rightarrow 4\ As + 3\ CO_2$. Replacement of As_2O_3 by As compds. of lower vapor pressure is being studied. The use of CO as a reducing agent indicated that As_2O_3 was reduced by CO at about 60°C. At such low temps., however, a protective coating of As appeared to be formed on the As_2O_3 particle surfaces; on removal of this protection by volatilization at higher temps., reduction appeared to be almost instantaneous and complete.

9904. VOORTHUIJSEN, J. J. B. VAN EIJK VAN. **The isomerization equilibriums of the butanes, pentanes, hexanes, and heptanes.** *Rec. trav. chim.* 66, 322-34(1947).—*C.A.* 42, 439*f*.

The isomerization equil. for the butanes were detd. by passing butane and HCl over $AlCl_3$ (on "Norit CC") at 100, 150, and 200°C. For the higher alkanes the detn. was made in an autoclave: 100 g hydrocarbon, 5-10 g $AlCl_3$ (sublimed through active carbon at 250°C), HCl and H_2 were heated for 24 hrs as high as 80°C. The products were analyzed by fractionation. Neopentane was not produced under these conditions, and neoheptane failed to isomerize. The results for the heptanes deviated considerably from the thermodynamic predictions.

9905. WICKE, E. **Importance of surface diffusion for the effectiveness of porous catalysts. I. Surface diffusion at normal pressures.** *Angew. Chem.* B19, 57-61(1947).—*C.A.* 42, 442*d*.

The ratio of actual reaction velocity to the max. possible one was evaluated numerically for values obtained on commercially active carbons. Conclusions applied to ammonia synthesis brought out the fact that the effectiveness of a catalyst could be improved by the choice of catalyst carriers that possessed particularly good surface diffusion and in this way acted somewhat like promoters.

9906. BARGONE, A. AND RINALDI, F. **The equilibrium of the decarburization reaction from the point of view of the thermodynamics of real systems.** *Ann. triestini cura univ. Trieste*, Ser. 2, 18, 125-38(1948-49).—*C.A.* 46, 6908*d*.

Calcns. of the reaction FeO + C = Fe + CO took into account the variation of heat capacity and of entropy with temp. The reaction was endothermic throughout the temp. range used in steel-making.

9907. CSUROS, ZOLTAN. **New principles in catalysis. Selectivity.** *Magyar Kem. Lapja* 3, 29-37(1948).—*C.A.* 43, 8832*a*.

Selective hydrogenation of cinnamic aldehyde was investigated with colloidal Pd as catalyst and of BzH and *o*-, *p*-, and *m*-hydroxybenzaldehyde in the presence of Pd catalyst pptd. on animal charcoal. The amt. of catalyst could det. the compds. obtained in hydrogenation.

9908. Dubrisay, René and Favart, Michel. **Catalytic action of carbon impregnated with silver in oxidation reactions.** *Compt. rend.* 226, 900-1(1948).—*C.A.* 42, 4436*h*.
Active carbon was metallized by adsorption of the nitrates of Ag, Cu, Pb, and the hydroxides of Ag and Cu in the ratio of 0.035 g of metal to 10 g carbon. Each of these mixts. was heated for 12 hrs at 100°C before use. None of the catalysts was active in the oxidation of MeOH or EtOH. Air satd. with toluene was passed over 50 g of catalyst at a rate of 5 liter per hr. At 250°C, only the Ag catalyst was more active than the carbon alone, and yields of 15-18.3% benzoic acid were obtained. When the toluene was carefully freed of S by means of $AlCl_3$, the yield dropped to 0.35%, but if CS_2 was added to the extent of 2% the yield increased to 26%.

9909. Foster, John F. **Production of water gas from pulverized coal. A continuous process.** *Ind. Eng. Chem.* 40, 586-92(1948).—*C.A.* 42, 4328*d*.
The rate of production of water gas by reaction between pulverized coal and steam, flowing continuously through a vertical, externally heated alloy tube, depended upon the chem. activity of the fuel, the rate of fuel feed, the rate of steam supply, the temp., and the dimensions of the tube. An empirical equation was presented, indicating the effect of these variables on gas production. This equation was used to est. the capacity of continuous water-gas equipment of com. size.

9910. Gordon, E. **Catalytic isomerization of vegetable oils.** *Bull. mens. ITERG* 1948, No. 11, 38-40.—*C.A.* 43, 2791*i*.
Conjugated double bonds were created in linseed oil by heating it at temps. between 180° and 200°C with Ni catalysts on a support of active carbon.

9911. Guerin, Henri and Bastick, Jack. **The catalytic oxidation of arsine.** *Compt. rend.* 226, 1732-3(1948).—*C.A.* 42, 7647f.
Mixts. of AsH_3 and O_2 were allowed to reach equil. in the presence of a porous catalyst at 0°C. With coconut charcoal as catalyst, the products were As_2H_2, and As_4H_2 (if the original O_2 to AsH_3 ratio by vol. was less than 0.2), As (if the ratio was between 0.4 and 1), and As_2O_3 (if ratio was between 1 and 2). Oxidation of As_2O_3 to As_2O_5 was not complete, even with excess O_2. With activated Al_2O_3 as catalyst, As and As_2O_3 were produced, but no lower hydrides. With silica gel only As_2O_3 was formed.

9912. Hottel, H. C.; Williams, G. C., and Satterfield, C. N. **Generalized thermodynamics of high-temperature combustion.** *Trans. Am. Soc. Mech. Engrs.* 70, 667-76(1948).—*C.A.* 42, 7152*e*.
A method of expressing the thermodynamic properties of the four-component system in a dimensionless form was given that permitted putting the whole system onto a simple set of charts for easy engineering use. The present data had particular value in calcg. flame temps. and in solving the performance of liquid-fuel rocket power plants. An example of the latter application was given.

9913. Iley, R. and Riley, H. L. **Deposition of carbon on vitreous silica.** *J. Chem. Soc.* 1948, 1362-6.—*C.A.* 43, 2833*a*.
Deposition of carbon from CH_4, C_3H_8, C_4H_{10}, C_2H_4, and C_6H_6 at 800-1300°C was studied by aspirating the gases through the annular opening between 2 vitreosil tubes. Three types of carbon, vitreous and columnar, soft black pulverulent, and filamentous, were found arranged zonally from hotter to cooler ends. Crystallite size, as detd. by x-ray diffraction, ranges from about 15 × 30 to 25 × 40A. At temps. of 1200-1300°C a soft fine-grained white carborundum was observed, of sufficiently perfect crystn. to afford sharp back-reflections.

9914. Joshi, M. L.; Gulati, K. C., and Bhushan, Bharat. **Production of synthetic liquid fuel (petroleum) from molasses.** *Indian Minerals* 2, 112-19(1948).—*C.A.* 43, 9422*e*.
Molasses was pyrolyzed to give liquid fuel. The best ratio of molasses and lime (34.7% available CaO) was 100:44 parts; the optimum temp. for the reaction was 450-480°C. The crude oil contained 32.5% gasoline and 27.5% kerosene; the recovery was 11-12% of the wt of the molasses. The gasoline was unstable and a gum formed. NH_3, pitch, K_2CO_3, K_2SO_4, and coke were obtained as by-products.

9915. Leidheiser, Henry Jr. and Gwathmey, Allan T. **The selective deposition of carbon on the (111) face of a nickel crystal in the catalytic decomposition of carbon monoxide.** *J. Am. Chem. Soc.* 70, 1206(1948).—*C.A.* 42, 4435*i*.
An electrolytically polished monocryst. sphere of Ni was exposed to CO at 550°C for 10 hrs. The carbon deposited selectively on the (111) faces as the catalytic reaction occurred. Similar results were obtained in CO-H_2 mixts. when the CO was in excess, but when the CO was present in only low concns., rearrangement of the surface occurred selectively on some faces.

9916. Mizuno, Shigeru. **Activated carbon electrodes for the electrolytic synthesis of hydrogen peroxide. I. Conditions necessary for the electrode production.** *Bull. Tokyo Inst. Technol.* 13, 102-7(1948).—*C.A.* 44, 10549*f*.
The electrodes were 50 mm diam. and 80 mm high with a conical hole in center. The wall thickness of the electrode were thinner at the lower than upper part. The material was made by electrolytic synthesis from activated carbon, wood charcoal, and pitch coke in the proportions 3:5:2, baked at 950°C. The flow resistance of the electrode to gas should be 15-100 cm H_2O at 10 liter/min.

9917. Mizuno, Shigeru. **Activated carbon electrodes for the electrolytic synthesis of hydrogen peroxide. II. Physicochemical properties of the electrodes.** *Bull. Tokyo Inst. Technol.* 13, 108-11(1948).—*C.A.* 44, 10549*h*.

The half-cell potential of the activated carbon electrode in 20% KOH was higher than the calcd. value of the 1 atm. O_2 reversible potential. It dropped with time but did not reach an equil. value in 96 hrs. The potential was directly connected with the activity and the results of electrolysis. The adsorption of O_2 was measured on degassed electrodes and was represented by the equation $x = a \log t + b$, where x was the amt. adsorbed, t the time, and a and b consts.

9918. Newman, L. L. **Oxygen in the production of hydrogen or synthesis gas.** *Ind. Eng. Chem.* 40, 559-582(1948).

Low-cost synthesis gas required the use of lower priced generator fuels, which could best be gasified in continuous internally heated processes using O_2. Part, if not all, of the energy requirements for O_2 production could be obtained from the heat evolved in the synthesis reactors. The principal processes included: Winkler, gasifying fines in a fixed fluidized bed; Koppers, gasifying pulverized coal in suspension; Lurgi, gasifying fines in a fixed bed under pressure; Thyssen-Galocsy and Leuna, gasifying lump fuel and disposing of the ash as a molten slag. American requirements may best be satisfied by gasification processes using pulverized fuel in suspension.

9919. Novikov, S. S.; Rubinshteĭn, A. M., and Shuĭkin, N. I. **Stability of the catalytic properties and of the structure of platinized carbon in heat-treatment.** *Doklady Akad. Nauk S.S.S.R.* 62, 345-8(1948).—*C.A.* 43, 1249*e*.

Constancy of the catalytic activity of a 20% Pt catalyst on active carbon, independently of the length of heat-treatment at 300°C, up to 639 hrs, was ascertained by dehydrogenation of cyclohexane to C_6H_6 at 300°C, space velocity 0.41/liter catalyst/hr. Under the same conditions, both the crystal lattice const. and the grain size of the Pt (~56A.) remained practically unchanged. Regeneration of a catalyst, heat-treated over 300°C, restored the original activity and left the crystal size unchanged, i.e., no recrystn. took place even at red glow.

9920. Parry, V. F.; Wagner, E. O.; Koth, A. W., and Goodman, J. B. **Gasification of subbituminous coal and lignite in externally heated retorts.** *Ind. Eng. Chem.* 40, 627-41 (1948).

The theory of the annular retort and mechanism of gasification therein were presented. CO and H_2 could be made at rates of 65 to 70 $ft^3/hr/ft^2$ of heated surface in retorts heated to 1900°F. Internally heated processes make 1000 to 8600 ft^3 of CO and H_2/ft^2, while the externally heated processes make 1000 to 2300 ft^3. Various grades of water gas having ratios of H_2 to CO ranging from 1.9 to 10 were made in the pilot plants, but lowest-cost gases and highest efficiency and capacity were attained in making gases of 2.0 to 2.5 ratio.

9921. Patrikeev, V. V. and Liberman, A. L. **Causes of the high catalytic activity of one platinum catalyst preparation.** *Doklady Akad. Nauk S.S.S.R.* 62, 87-90(1948).—*C.A.* 43, 475*c*.

The hydrogenation of ketones was carried out in glacial AcOH soln. (100 ml per 2.8 g dimedone), at 22-4°C, with 5 different catalyst prepns.: (I) Platinized carbon (1 g with 20% Pt), activated with 2 ml aq. soln. of H_2PtCl_6 (0.3 g Pt/ml) introduced after flushing with H_2; (II) With activated (non-platinized) carbon, and H_2PtCl_6 introduced as above, no reaction with H_2 took place during the 1st 21-22 min., whereupon the reaction started suddenly and was complete in 8-8 1/2 hrs; (III) With 0.2 g Pt black and H_2PtCl_6 introduced as above, absorption of H_2 began immediately but slowed down rapidly, in 3 hrs about 740 ml H_2 were absorbed; (IV) With only 2 ml of the H_2PtCl_6 soln. (without solid catalyst), there was an induction period of about 18 min., whereafter the reaction did proceed, but at a substantially slower rate; (V) With platinized carbon alone, no reaction occurred for 5 hrs, but got under way immediately at any stage on addn. of H_2PtCl_6.

9922. Pelipetz, M.; Kuhn, E. M.; Friedman, S., and Storch, H. H. **Effect of catalysts on the hydrogenolysis of coal.** *Ind. Eng. Chem.* 40, 1259-64(1948).—*C.A.* 42, 6079*d*.

The effect of various catalysts on the production of liquid products during the hydrogenation of coal was investigated with regard to increasing the "oil" fraction. Tin was found to be the best catalyst in the primary cracking of coal and Zn-Sb alloy the best in the hydrogenolysis of asphaltenes. A 3-component catalyst consisting of 0.5% Sn and 0.5% Zn-Sb gave good results. Increasing the amt. of Sn and Zn-Sb to 2.0% did not improve the degree of liquefaction materially.

9923. Roginskii, S. Z. **Poisoning of a catalyst by blocking.** *J. Phys. Chem.* (U.S.S.R.), 22, 655-67(1948).—*C.A.* 42, 7608*d*.

Adsorption of a poison on an inhomogeneous catalyst surface could have various effects on the activity of the catalyst: (1) equal adsorption on spots of different activities; in this case the surface appeared homogeneous; (2) preferential adsorption on the most active spots; and (3) preferential adsorption on the least active spots; small adsorbed amts. affected the activity little but great amts. suppressed it.

9924. Roginskii, S. Z. **Blocking of catalysts at a correlated distribution of the catalyst poison.** *J. Phys. Chem.* (U.S.S.R.) 22, 669-82 (1948).—*C.A.* 42, 7608*f*.

If the adsorption of the poison on a given surface spot depended on the catalytic activity of this spot, the effect of the poison was a function of this dependence. Various instances were treated mathematically.

9925. Rubinshteĭn, A. M.; Minachev, Kh. M., and Shuikin, N. I. **Hydrogenation of benzene on platinized carbon of low platinum content.** *Doklady Akad. Nauk S.S.S.R.* 62, 497-9(1948).—*C.A.* 43, 1249*g*.

X-ray studies were made of a series of catalysts prepd. under identical conditions but with the Pt content decreasing from 20% to 0.1%. With increasing diln. of Pt the (222) plane reflection disappeared first, followed in order by (022), (113), and (002); the reflection on the (111) plane persisted throughout, and was only weakened at the lowest Pt content. The activities of this series of catalysts, expressed in percentage of conversion in hydrogenation of C_6H_6, remain const. = 100% with 4-1% Pt and decrease only slightly (to about 90%) with 0.5-0.1% Pt.

9926. STEEGMULLER, E. **Catalysis and polymerization.** *Monde ind.* 74, 11-19(1948).—*C.A.* 44, 6712*e*.

The phenomena of catalysis and polymerization and the relation between the two were outlined briefly. The effect of temp. and pressure on the polymerization of C_2H_2, C_2H_4, iso-C_4H_8, and styrene were discussed, and the catalytic action of active carbon, Pt, Co, Fe, Ni, Cu, $AlCl_3$, CuCl, and $ZnCl_2$ on C_2H_2, of $AlCl_3$, BF_3, H_2SO_4, and H_3PO_4, on C_2H_4, and of Floridin (an activated silicate), $AlCl_3$, H_2SO_4, and BF_3 on iso-C_4H_8 were described.

9927. SZÁDECZKY-KARDOSS, ELEMÉR. **Cokability of black coals and lignites.** *Univ. Tech. Sci., Sopron, Pubs. Dept. Mining Met.* 17, 170-5 (1948-49)(in German).—*C.A.* 46, 2269*f*.

Investigation of various Hungarian lignites (originating from Borsod and Várpalota) showed that xylites and periblinites affected melting and smelting qualities of coal favorably and induced the formation of coke of good quality. Cokability was a typical peculiarity of coals derived from a thick wood and bark tissue woven closely and thickly together. When this tissue became loose and mixed up with oxidized org. particles, the cokability of the coal was gradually lessened. Excess of resinites decreased the cokability even in the case of xylites, xylovitrites, and periblinites. Coked brown coals resulted in a coarse, compact coke with metallic luster showing no baking ability.

9928. WRIGHT, C. C.; BARCLAY, K. M., AND MITCHELL, R. F. **Production of hydrogen and synthesis gas by the oxygen gasification of solid fuel.** *Ind. Eng. Chem.* 40, 592-600 (1948).—*C.A.* 42, 4329*d*.

Test data were presented on the gasification of rice and barley sizes of anthracite and of lump coke in a com. producer gas plant, slightly modified to blast the bed continuously with O_2-steam mixts. instead of the usual air-steam mixt. These results for over-all C, O, and steam consumption for synthesis-gas production compared favorably with any fixed-bed, fluid-bed, or coal-suspension process thus far developed to com. operation. The economics of the O_2 gasification of solid fuels in fixed beds hinged largely upon the cost of the solid fuel suitable for the process and upon the cost of O_2, the relative efficiency as compared with other processes, and the capital charges.

9929. ANDREEV, E. A. AND KAVTARADZE, N. N. **Catalytic oxidation of phosphine in the adsorbed layer on active carbon with addition of copper compounds.** *Problemy Kinetiki i Kataliza, Akad. Nauk S.S.S.R.* 6, 293-305 (1949).—*C.A.* 47, 5776*i*.

On plain active carbon (grain size 1.5-2.5 mm, ash content 8%, area 410 m^2/g), outgassed at 320°C, adsorption of PH_3 at 18°C, under 109 mm Hg, was rapid, and the desorption complete and extremely fast. In contrast, on carbon impregnated with $CuSO_4$ (4% Cu), adsorption of PH_3 was slower, and desorption only partial; a fraction of the PH_3 was chemisorbed. The difference between the total adsorption of PH_3 on carbon with Cu and without Cu corresponded to the irreversibly adsorbed amt. On carbon with Cu, moistened with 0.43% H_2O, the adsorption of PH_3 was decreased by an amt. equiv. to the amt. of H_2O. Pretreatment of the C/Cu with H_2 (at 280°C) suppressed the activated adsorption of PH_3 at room temp. completely; subsequent treatment with O_2 regenerated the activated-adsorption capacity.

9930. BOGATSKIĬ, D. P. **Calcination and reduction of nickel hydrosilicates by carbon.** *Izvest. Akad. Nauk S.S.S.R., Otdel Tekh. Nauk* **1949**, 1512-25.—*C.A.* 45, 9435*c*.

The reduction of silicate minerals of Ni by carbon was studied experimentally. The heating and calcination tests showed that: (1) The process of reduction of Ni from its silicate-oxide minerals was highly endothermic and proceeded to a marked degree in the high-temp. region, in contrast to the reduction of nickelous oxide. (2) Reduction by carbon began in the higher-temp. region in contrast to processes with H_2 or CO. Hygroscopic and constitutional water was removed completely at the beginning of the reduction process. (3) Reduction of the Ni hydrosilicates by carbon was much slower than that of nickelous oxide. (4) Reduction of the Ni silicate-oxides was not complete up to their sintering temp.

9931. BREITENBACH, J. W. AND PREUSSLER, H. **Influence of activated carbon on styrene polymerization.** *J. Polymer Sci.* 4, 751-4(1949).—*C.A.* 44, 6193*e*.

Eight different active-charcoal prepns. (air-dried at 200°C) were placed into reaction bottles contg. styrene at room temp. under N_2; the reaction bottles were freed of gases and sealed *in vacuo*. The samples were polymerized by heating in a const. temp. bath for 3 hrs at 90°C with continuous shaking. Al-charcoal decreased the rate of polymerization. Those having much retarding effect also decreased the intrinsic viscosity of the polymers. Expts. were carried out with a charcoal sample which was heated for a considerable time at 600°C under H_2 before introducing it into the reaction bottles. The results of these tests indicated that charcoal had only a limited retarding effect.

9932. BRINKLEY, STUART R. JR. AND LEWIS, BERNARD. **Combustion gases—equilibrium composition and thermodynamic properties.** *Chem. Eng. News* 27, 2540-1(1949).—*C.A.* 43, 8119*f*.

A table of equil. compn. and thermodynamic properties at equil. of the 4-component system, C, H, O, and N was described. Application of the table to combustion problems was sought.

9933. BRINKMAN, G. **Chemical character and catalytic behavior of activated carbon.** *Angew. Chem.* 61, 378-83(1949).—*C.A.* 44, 418*i*.

The chem. nature of activated carbon was detd. by the presence of surface groups that exhibited basic or acid behavior. The groups were detd. by measurements of sorption of strong acids or alkalies. The catalytic activity of active carbon in the decompn. of H_2O_2 depended on the chem. nature of the surface. By detg. the half-time value of catalytic activity under definite exptl. conditions, small changes in surface conditions of active carbons were evaluated. Several other catalytic reactions were discussed.

9934. CREMER, E. **Forces of adsorption and heterogeneous catalysis.** *J. chim. phys.* 46, 411-19 (1949).—*C. A.* 44, 1778*a*.

Deviations from the Langmuir adsorption formula were explained on the hypothesis that a surface had centers with different heats and adsorption (λ_i). Adsorption began at centers with high energy. The no. of centers, z_i having a given λ_i was $z_i = Cc^{-\lambda_i/R\beta a}$, where R was the gas const., γ a quantity characteristic of the disorder of the surface with the dimensions of temp., and β the degree of adsorbability of the substance adsorbed and c is its concn. The no. of active catalytic centers increased exponentially with λ_i.

9935. CSUROS, ZOLTÁN AND GERGELY, EDITH (NEE POPPER). **Catalysts. III. Effect of the amount of palladium and platinum catalysts on the rate of hydrogenation of ethylene carboxylic acids.** *Hung. Acta Chim.* 1, No. 4/5, 1-26(1949).—*C. A.* 44, 4764*h*.

Semimicro hydrogenation expts. were made on (1) Pd catalyst pptd. on bone char, (2) colloidal Pd catalyst, (3) Pt catalyst pptd. on bone char, (4) colloidal Pt catalyst; *trans*-Cinnamic acid, *cis*-citraconic anhydride, *trans*-mesaconic acid, *cis*-maleic anhydride, *trans*-fumaric acid, *cis*-angelic acid, and *trans*-tiglic acid dissolved in EtOH served as standard solns. for catalysts pptd. on bone char. The relative adsorption of H_2 by Pd catalysts pptd. on bone char and the hydrogenation-time graphs of ethylene derivs. with *trans* configuration showed min. and max. at identical amts. of catalysts.

9936. CSUROS, ZOLTÁN AND SELLO, ISTVÁN. **Catalysts. IV. Catalytic hydrogenation of compounds containing a carbonyl group.** *Hung. Acta Chim.* 1, No. 4/5, 27-44(1949).—*C. A.* 44, 4765*e*.

Methylhexenone, crotonaldehyde, BzH, benzal acetone, and phenylacetaldehyde were hydrogenated in the presence of colloidal Pd or Pt and also of Pd on bone char. At ordinary pressure and room temp. the CO group of aliphatic aldehydes and ketones could not by hydrogenated by the above catalysts in EtOH nor in glacial AcOH. Phenylacetaldehyde could be hydrogenated with Pd on bone char or with colloidal Pd at ordinary pressure. Although the hydrogenation velocity was larger with Pd on bone char than with colloidal Pd, those compds. that could not be satd. with colloidal Pd could not be hydrogenated with Pd on bone char.

9937. CSUROS, ZOLTÁN; GÉCZY, ISTVÁN, AND LENGYEL, AGNES (NEÉ FARAGO). **Catalysts. V. Heterogeneous catalytic autoxidation of benzaldehyde.** *Hung. Acta Chim.* 1, No. 4/5, 1-26 (1949).—*C. A.* 44, 4766*a*.

The catalysts were Pt black, Pt on bone char, Pd on bone char, Pd on $BaSO_4$, and Pt on $BaSO_4$; the strongest catalytic effects were observed with Pt black and Pd on $BaSO_4$. Bone char exerted a strong antioxygen effect on the autoxidation of BzH. The changes of the velocity of autoxidation with changing amts. of Pt black and Pd on $BaSO_4$ followed a max.-min. curve, the latter catalyst seemed to be better than the former. The activity of the catalyst Pd on $BaSO_4$ seemed to increase with Pd content even if prepd. identically.

9938. DUNOYER, JEAN MICHEL. **Experimental study of the kinetics of a gas-solid reaction.** *Compt. rend.* 229, 205-7(1949).—*C. A.* 43, 8820*b*.

The reaction $MoO_3 + H_2 \rightarrow MoO_2 + H_2O$ was studied with good contact between gas and solid in the range 375°-450°C. The reaction rate was slow and further reduction did not occur. At const. temp. the reaction obeyed the expression $N = N_0 \exp(-H't)$, where N represented the no. of moles at time t, N_0 original no. of moles, and H' a const.

9939. GLENN, RICHARD A. **Effects of temperature on the hydrogenation of certain bituminous coals.** *Fuel* 28, No. 2, 32-40(1949).—*C. A.* 43, 2404*d*.

The following bituminous coals were hydrogenated with Adkins Ca-Cu-chromite catalyst, Pocahontas No. 3 and High Splint Seams Coals at 400°C and High Splint and Illinois No. 6 Seam Coals at 325°C. The gases produced were measured and analyzed. The liquid products were rehydrogenated 3 times with Raney Ni and distd. The production of petr.-ether-sol. products with Adkins catalyst was quite sensitive to temp. with a max. at or near 350°C, and was greatest for medium-rank coals.

9940. GREENSFELDER, B. S.; VOGE, H. H., AND GOOD, G. M. **Catalytic and thermal cracking of pure hydrocarbons. Mechanisms of reaction.** *Ind. Eng. Chem.* 41, 2573-84(1949).—*C. A.* 44, 2211*c*.

New data on cracking over pure silica gel, pure alumina, and activated carbon showed that there were 2 broad classes of cracking reactions, namely, a free-radical, thermal type, and a carbonium ion, acid-activated type. Activated carbon caused *n*-hexadecane to crack at over 50 times the thermal rate to more satd. products of higher av. mol. wt. This was explained by thermal cracking on the surface followed by quenching of large radicals by addn. of H atoms to form large paraffins.

9941. IMADA, FUSAO. **Carbons. XIX and XX. The active center and electromotive force.** *Kogaku Iho, Kyushu Univ.* 20, 48-60(1949).—*C. A.* 47, 5820*a*.

The catalytic activity of active carbon which was the main component of anode mixts., was responsible for the e.m.f. of the dry air-cell. This e.m.f. was measured on dry air-cells with various kinds of active carbon as depolarizer. The e.m.f. was almost proportional to the no. of active centers in the carbon and was also affected by the rate of O_2 supply.

9942. Kiperman, S. L. and Temkin, M. I. **Magnetic properties of iron-carbon catalysts.** *Problemy Kinetiki i Kataliza* 6, 206-9(1949).—*C.A.* 47, 5744*g*.

Carbon (from sucrose, burned at 700-800°C) of surface area 94 m^2/g, was impregnated with ether solns. of $Fe(CO)_5$ and decompd. The catalyst had approx. the same catalytic activity for decompn. of NH_3. The magnetic susceptibility x per 1 g Fe was measured on catalysts with different Fe contents (different surface coverages α). If the Fe were present in the form of isolated atoms, the susceptibility should be $x = NBn(n + 2)/3kTA$, where N = Avogadro's no., B = Bohr's magneton, $n = 4$ = no. of unpaired electrons, A = at. wt., i.e. $x = 1.78 \times 10^{-4}$. Actually measured values, even at high α (up to 0.104) were considerably higher than the max. possible x for paramagnetic Fe.

9943. Kitaĭgorodskiĭ, I. I.; Sentyurin, G. G., and Rishina, V. A. **Glass forming in a sulfate charge.** *Steklo i Keram.* 6, No. 1, 3-4(1949). —*C.A.* 43, 5913*i*.

Mixts. of Na_2SO_4 and SiO_2 with mol. ratios of SiO_2/Na_2O ranging from 1 to 4 were heated for 1 hr at 600°, 700°, 800°, 900°, 1000°, and 1100°C in presence of graphitized electrode carbon, coke, coal, activated carbon, charcoal, and $Si(C_6H_5)_4$. Electrode carbon proved the most resistant against combustion.

9944. Kobozev, N. I. and Lebedev, V. P. **Structure of disperse supports of catalysts from the viewpoint of the theory of active ensembles.** *Zhur. Fiz. Khim.* 23, 1483-94(1949).—*C.A.* 44, 2835*i*.

The "migration area" Δ of a catalyst support was identified with that fraction of the area of a face of a microcrystal which was not in contact with another crystal, i.e. available for adsorption. If l was the edge of the microcrystal (supposed to be a cube), S the available surface per g, and d the d. of the support, $l = (6\Delta/Sd)^{1/3}$. The fraction of surface which was unavailable was $k = (6 - Sld)/6$. If S_1 was the available surface of 1 ml of support, for all these samples $S_1 = 1350(1-k)$ m^2; apparently, the total surface of all samples was about 1350 m^2/cc. The energy F of formation of disperse support was connected with k by the equation $F = RT\ln[(1-k)/k]$; F was - 1000 to + 800 cal for the supports studied.

9945. Kobozev, N. I. and Reshetovskaya, N. A. **Active ensembles of platinum in oxidation-reduction and hydrogenation processes.** *Zhur. Fiz. Khim.* 23, 388-405(1949).—*C.A.* 43, 6062*b*.

A chloroplatinate was deposited on active carbon or Al_2O_3 and used as catalyst. From the variation of the catalytic activity A with the degree of coverage α, the no. n of Pt atoms in the active "ensemble" and the area S of the "migration cell" were calcd. In decompn. of H_2O_2 n was 1 and 4 + 6(on carbon and Al_2O_3); in oxidation of H_2 1(on carbon and Al_2O_3) and 6(on Al_2O_3); in hydrogenation of maleic acid and PhOH 2 and 6 (on carbon); and in reduction of *p*-nitrophenol and picric acid 1 and 5 (on carbon).

9946. Mayland, B. J. and Hays, George E. **Thermodynamic study of synthesis-gas production from methane.** *Chem. Eng. Progress* 45, 452-8 (1949).—*C.A.* 43, 7200*a*.

The general thermodynamic equations were presented. With these equations, a chart was prepd. for detg. an equil. mixt., outside the carbon-deposition boundary, at pressures from 1 to 21.4 atms., temps. from 1200 to 2500°F, and H_2 to CO ratios from 1.75 to 2.25. The equil. calcns. for the adiabatic reaction of methane and O_2 and of CH_4 and air to give synthesis gas were also presented. In order to obtain final equil. temps. in the region of 2350°F, which were necessary to attain equil. without the use of a catalyst, a considerable excess of O_2 was required.

9947. Mizuno, Shigeru. **The electrolytic synthesis of hydrogen peroxide. II. On the electrolysis conditions.** *J. Electrochem. Soc. Japan* 17, 288-90(1949).—*C.A.* 44, 6305*d*.

H_2O_2, prepd. by the electrolytic reduction of O_2 flowing over an activated carbon cathode immersed in NaOH soln., was prevented from decompn. by keeping the soln. at temps. below 20°C. Higher c.d. and uniformity of O_2 flow gave higher elec. efficiency for the prepn. of H_2O_2.

9948. Novikov, S. S.; Rubinshteĭn, A. M.; Shuĭkin, N. I., and Mel'nikova, Z. Ya. **Causes of the instability of palladium catalysts in dehydrogenation catalysis.** *Doklady Akad. Nauk S.S.S.R.* 68, 1049-51(1949).—*C.A.* 44, 916*f*.

Identical samples of Pd on carbon and of Pd on silica gel were (a) subjected to prolonged heat-treatment in H_2, (b) used in dehydrogenation of cyclohexane at 300°C, 0.3 liter/hr/liter, (c) used in dehydrogenation of a mixt. of 90% cyclohexane with 10% 1-ethyl-1-cyclopentene, under the same conditions. The Pd-carbon catalyst had an initial activity by about 35% lower than the corresponding Pt-carbon catalyst; in (a), the activity of Pd-carbon fell faster than that of Pt-carbon, but became stabilized at about 2/3 of the initial activity. The activity of Pd on silica gel was still lower than that of Pd-carbon, but it did not change in treatment (a). Immediately after deposition on carbon, Pd showed the lattice const. of the hydride, 4.04A., which did not change on prolonged treatment (a). Pd on SiO_2 had a normal lattice.

9949. Orchin, Milton and Wender, Irving. **Apparatus for measuring gas absorption or evolution during organic reactions.** *Anal. Chem.* 21, 875-6(1949).—*C.A.* 43, 8749*h*.

Magnetic stirring and the use of a serum stopper for the injection of liquids were features of this new design. A sample of *p*-cyclohexylanisole was quantitatively dehydrogenated in this app. It was recommended for detg. the amt. of O_2 absorbed by coal, for the detn. of $LiAlH_4$, and the extent of its reducing action.

9950. Roy, A. N. and Howard, H. C. **Molecular size and shape of some primary degradation products of a bituminous coal.** *J. Phys. & Colloid Chem.* 53, 1033-42(1949).—*C.A.* 44, 816*c*.

Degradation by hydrogenation of a Pittsburgh Seam bituminous coal in the presence of a Cu-Cr oxide catalyst was studied in the range 300°-350°C, at 1800 p.s.i.g. cold H_2 pressure and a 24-hr reaction period. The min. temp. found for obtaining satisfactory yields of benzene-sol. material was 325°C. Fractionation of the degradation products was investigated by fractional pptn. and fractional soln.

9951. RUBINSHTEĬN, A. M.; MINACHEV, KH. M., AND SHUĬKIN, N. I. **Blocking of the active centers of platinized carbon by products of deep decomposition of hydrocarbons.** *Doklady Akad. Nauk S.S.S.R.* 67, 287-90(1949).—*C.A.* 43, 7802*a*.

In the hydrogenation of C_6H_6 in excess H_2 at 170-2°C at the space velocity 0.06 liter/liter catalyst/hr, on catalysts contg. from 4.0 down to 0.03% Pt, some reaction took place even at the smallest Pt content. The fall of the initial rate during the run was in inverse ratio to the Pt content. Similarly, in the dehydrogenation of cyclohexane, in a weak stream of H_2, at 300-2°C and 0.3 liter cyclohexane/liter catalyst/hr, the activity of catalysts with 4.0-0.25% Pt showed no marked differences; from 0.25% Pt down, the activity fell sharply. The stability of the catalysts fell sharply from Pt $< 0.5\%$ down. X-ray diagrams showed that the cryst. structure of the Pt was preserved down to 0.03%, but that lattice defects increased with decreasing Pt content.

9952. RUDAKOV, G. A.; BORISOVA, N. P.; EMEL'YANOVA, O. A.; EROSHEVSKII, I. G.; KOMSHILOV, N. F.; MAKAROVA, A. N.; MERLIS, N. M., AND KHOMENKO, Z. S. **Irreversible catalysis and catalytic dehydrogenation of some hydrocarbons on activated carbon.** *Zhur. Priklad. Khim.* (J. Applied Chem.) 22, 180-98 (1949).—*C.A.* 43, 5656*h*.

Pure dipentene, passed at 410-50°C over water-vapor activated charcoal, reacted according to: $3C_{10}H_{16} \rightarrow C_{10}H_{20}$ (*p*-menthane) + $2C_{10}H_{14}$ (*p*-cymene). The reaction occurred at a considerably higher temp. than on Pd (130°C) and on Ni (280°C). No reaction occurs on crushed quartz at 420°C. Δ_3-Carene, on activated charcoal at 410-30°C, reacted as above with the same products. α-Pinene at 350° and 420°C on activated charcoal was completely isomerized into alloöcimen which, in turn, was cyclized into a mixt. of α- and β-pyronene. On crushed quartz, at 550-600°C, *p*-menthane also under went pyrolysis, but considerably more slowly than on activated charcoal, and the yield of aromatic hydrocarbons was much lower.

9953. SBORGI, U. AND GIOVANNINI, E. **Carbon disulfide from methane and sulfur.** *Chimica e industria* (Milan) 31, 391(1949).—*C.A.* 46, 9811*g*.

An industrial method for prepg. CS_2 employed the reactions $CH_4 + 4S = CS_2 + 2H_2S$ and $CH_4 + 2S = CS_2 + 2H_2$. The first reaction occurred at 600°-900°C with W, Mo, or Cr catalysts. Yields with different catalysts and compn. of resultant gases was reported; CS_2 yields of 20-30% were obtained.

9954. SHERWOOD, PETER W. **High-pressure hydrogenation of carbonaceous matter. I. Introduction.** *Petroleum Refiner* 28, No. 12, 97-101(1949).—*C.A.* 44, 4223*g*.

The status of the high-pressure hydrogenation of coal, including its history, and flow diagrams for two basic processes were presented.

9955. TOPPER, YALE J. **Note on the synthesis of succinic acid labeled in the carboxyl position with radioactive carbon.** *J. Biol. Chem.* 177, 303-4(1949).—*C.A.* 43, 2861*i*.

Succinic acid was prepd. by hydrogenation with Pt-charcoal of acetylenedicarboxylic acid which had been labeled with C^{14} at one carboxyl by reaction of $C^{14}O_2$ with dilithium acetylide soln. The yield of C^{14} succinic acid relative to the original $BaC^{14}O_3$ was 11%.

9956. WELLER, SOL; PELIPETZ, MICHAEL G.; KUHN, M.; FRIEDMAN, SAM, AND CLARK, E. L. **Hydrogenation of coal in batch autoclaves with coke-oven gas.** *Ind. Eng. Chem.* 41, 972-3 (1949).—*C.A.* 43, 5171*d*.

The cost of H_2 was a major item in coal hydrogenation. Therefore, substitution of coke-oven gas for hydrogen was tried. The coal used was Pittsburgh-seam, high-volatile A bituminous coal. Fifty g powd. coal was placed in a 1.2-liter rotating autoclave with glass liner together with 0.5 g powd. tin and 0.275 g NH_4Cl. When a vehicle was employed, 70 g heavy oil from coal hydrogenation was added. Hydrogenation was carried out at 450-465°C and at 660-2120 lbs/in^2 total initial pressure for at least 1 hr.

9957. BASU, A.N. AND GLENN, R.A. **Restricted hydrogenolysis of high-sulfur coal from Assam, India.** *J. Sci. Ind. Research* 9B, No. 3, 64-7 (1950).—*C.A.* 44, 9135*a*.

A very high S-coal (C 75.1, H 5.5, N 1.1, S 7.5, O 9.1, and ash 1.7%) was hydrogenated in the presence of Ca-Cu-chromite catalyst. H_2 at 1800 p.s.i. increased to 3300 p.s.i. at 375°C. While essentially complete conversion of the coal to sol. products was observed and 80% of C and N originally present was recovered in the hydrogenation oils, only 15% of the O and S was converted.

9958. BATCHELDER, H.R. AND STERNBERG, J.C. **Thermodynamic study of coal gasification—applicable to suspension gasification of pulverized coal.** *Ind. Eng. Chem.* 42, 877-82 (1950).—*C.A.* 44, 6602*h*.

Equations were developed for the continuous gasification of coal with O_2 and superheated steam under the conditions of thermal balance, reaction equil. according to the equation $CO + H_2O = CO_2 + H_2$, and other simplifying assumptions. Graphical presentation of the soln. of these equations for two different coals under various operating conditions showed certain trends which were expected to hold in practice.

9959. BROWN, CALLAWAY. **Equilibrium at low pressure in the reduction of barium oxide by carbon.** *J. Chem. Phys.* 18, 1311-13(1950).—*C.A.* 45, 933*h*.

The reduction of BaO by carbon was described and analyzed critically. Exploratory results at 950°C indicated equil. at CO pressures below 100 μ with Ba vapor pressures in the range 0.1 to 0.3 μ. The resulting value for the free energy of formation of BaO was −114,000 cal per mole.

9960. CHENEY, HARRY A.; MCALLISTER, S.H.; FOUNTAIN, E.B.; ANDERSON, JOHN, AND PETERSON, W.H. **Butylene from ethylene. Cobalt-carbon catalyst.** *Ind. Eng. Chem.* 42, 2580-6 (1950).—*C.A.* 45, 3794*d*.

C_2H_4 was polymerized to C_4H_8 over a Co-charcoal catalyst at temps. below 150 C and pressures at 1-100 atm. The polymer consisted of olefins with an even no. of C atoms and was mostly straight-chain. The catalyst was poisoned by CO, O, COS, H_2S, and C_2H_2; other normal C_2H_4 contaminants had no effect on the activity.

9961. FALKUM, E. AND GLENN, R.A. **Coal-hydrogenation-process studies. II. Effects of temperature on the restricted hydrogenolysis of a Spitsbergen coal with Adkins catalyst.** *Fuel* 29, No. 8, 178,84(1950).—*C.A.* 44, 8619*d*.

The effect of temp. on the hydrogenation of a Spitsbergen coal with Adkins catalyst in the absence of a vehicle was studied. This coal was an Arctic coal contg. 5% ash and about 44% volatile matter and a H-content of 6.3% based on ash- and moisture-free coal. The hydrogenations were made in a specially designed rocking-type autoclave equipped with a cold-head receiver for 72 hrs with a cold H_2 pressure of 1750-1800 p.s.i. The effects of temp. on the primary hydrogenation products were presented graphically. Three different temp. effects were distinguishable.

9962. GARCIA-CONDE, J.R. **The effect of partial hydrogenation, and of mixtures, on the coking properties of coal.** *Combustibles* (Zavagoza) 10, No. 51, 10-14(1950).—*C.A.* 45, 5909*e*.

Coals of poor coking quality were improved by mixt. with products of their partial hydrogenation. This reaction was effected by heating with 1,2,3, 4-tetrahydronaphthalene in an autoclave at 400°C, max. pressure being 25.5 atm. Coals from Barnsley and Parkgate seams of the Thurcroft Mine (England) were used. The quality of the cokes was measured as "microhardness" by rotating 16-25-mesh material in tubes with steel balls under standard conditions (125 revolutions at 25 r.p.m.) and measuring the amt. retained on 25 and 72 mesh.

9963. GAULT, HENRY; MARCU, LIVIU, AND RITTER, ROGER. **The catalytic cracking (reforming) of gaseous hydrocarbon mixtures.** *Bull. soc. chim. France* 1950, 596-7.—*C.A.* 45, 3151*f*.

The cracking (reforming) of com. propane over activated alumina was studied by using two methods of combustion, viz. with and without an open flame. The propane and enough air to burn a fraction of the hydrocarbon were introduced into a tube contg. alumina. In the first case the combustion was aided by means of a heated spiral thus causing open combustion. In the second case, the surface of the catalyst was cooled sufficiently to prevent the appearance of an open flame. The "open-flame" method favored production of CO_2 and in the presence of excess propane, caused the formation of carbon deposits.

9964. GLENN, R.A.; BASU, A.N.; WOLFARTH, J.S., AND KATZ, M. **Coal-hydrogenation-process studies. I. The role of coal sulfur in the hydrogenation of coal.** *Fuel* 29, No. 7, 149-59 (1950).—*C.A.* 44, 7510*d*.

Three coal samples ranging in S content from 0.83 to 4.37% selected from a single mine in the Pittsburgh Seam were subjected to a restricted hydrogenolysis at 375° and 350°C with the Adkins catalyst, a cold H_2 pressure of 1800 p.s.i., and no vehicle in a specially designed autoclave provided with a cold-head receiver. The initial products were measured and analyzed and the distillate oils were resolved further through C_5H_{12} extn. followed by chromatography on alumina. The greatest conversion of coal to C_6H_6-sol. products was observed for the low-S coal instead of the high-S coals as expected, the conversion of the low-S coal to C_6H_6-sol. products being complete at both 350° and 375°C.

9965. GUNTHARD, HS. H.; KOHLER, M.; PFISTER, H.R.; AUERSWALD, H., AND MESSIKOMMER, B. **The calculation of adsorbers.** *Helv. Chim. Acta* 33, 1118-26(1950).—*C.A.* 44, 10442*d*.

Linear differential equations and their solutions were used to describe heterogeneous catalytic reactions occurring in reaction tubes on adsorbent surfaces: (1) adsorption equil. instantaneously with no chem. reaction (2) adsorption equil. instantaneously with the sorbate undergoing a heterogeneous first-order reaction; (3) adsorption equil. as a reversible moderate-rate reaction; (4) adsorption equil. as a rate process simultaneous with a first-order chem. reaction.

9966. HANSCH, CORWIN; SCOTT, CARLETON, AND KELLER, HOWARD. **Catalytic synthesis of benzofurans. Chromium catalysts for cyclodehydrogenation of *o*-alkylphenols.** *Ind. Eng. Chem.* 42, 2114-17 (1950).—*C.A.* 45, 1991*i*.

The vapor-phase catalytic dehydrocyclization was studied at 550°C with *o*-EtC_6H_4OH, *o*-$Me_2CHC_6H_4OH$, *o*-allylphenol, and thymol with Pd on charcoal, Cr on charcoal, Cr-Cu on charcoal, Cr-Zr on charcoal, and Cr-Cu on silica gel. The liquid reaction products were condensed and the phenolic constituents sepd. and fractionally distd.

9967. HANSEN, CHRISTIAN J. **Low-temperature tar from bituminous coal and its further treatment.** *Brennstoff-Chem.* 31, 308-17(1950).—*C.A.* 45, 846*h*.

Five conditions that must be met by a satisfactory low-temp. carbonization process were: (1) applicability to all kinds and sorts of coal, suitable for low-temp. carbonization, (2) manuf. of strong semicoke in suitable size, (3) maintenance of suitable cracking conditions throughout the system and uniform temp. conditions to give the highest possible tar uniformity, (4) a satisfactory throughput at the desired temp., (5) smooth and trouble-free oven operation.

9968. HEINEMANN, HENRY. **Petroleum-type hydrocarbons from sugar cane.** *Petroleum Refiner* 29, No. 2, 111-14 (1950).—*C.A.* 44, 5571*e*.

Sugar cane in the form of 1-in. cubes was converted to bituminous materials, CO_2, CH_4, H_2O, phenols, phenol carboxylic acids, and coal by heating in a closed Aminco-type bomb for 5 hrs at 250°F and then for 5 hrs at 625°F in the presence of 750 ml 1 *N* NaOH per 100 g. The yield of bituminous material varied directly with the quantity of alkali used. The bituminous matter can be repeatedly hydrogenated in the bomb at 750°F with an initial H_2 pressure of 1000 p.s.i.g. with a molybdenum oxide or sulfide catalyst, the product extd. with CCl_4, and the ext. distd. to produce gasoline 3, middle oil 16, and lubricating oil 6% based on sugar cane. Analytical data indicated that the hydrocarbons were formed from the sucrose, hemicellulose, and cellulose content of sugar cane, while the asphalt was derived from the lignin.

9969. KING, R.O.; DURAND, E.J., AND ALLAN, A.B. **The oxidation, ignition, and detonation of fuel vapors and gasses. XV. The concentration of finely divided carbon in town gas-air mixtures required to induce severe knocking combustion.** *Can. J. Research* **28F**, 177-88(1950).—*C.A.* **44**, 8615*h*.

Engine expts. at 800 r.p.m. and 9:1 C.R. were made with Toronto town gas as the fuel, with and without added graphite dust. The engine remained substantially free of carbon with town gas fuel after 50 hrs' running. When graphite dust was injected at the rate of 1.5 mg per stroke, equiv. to 180 grains per 100 ft^3, severe knocking occurred, with a reduction in brake horse power (B.H.P.) from 1.54 to 1.32 (14%). The extent of knocking corresponding to this decrease in power was indicated by a graph of C.F.R. engine results which gave audible knock at C.R. of 4.6, "standard knock" at C.R. of 5.27 and severe knock at C.R. of 6.8 with a 9% decrease in power.

9970. KING, R.O.; DURAND, E.J., AND ALLAN, A.B. **The oxidation, decomposition, ignition, and detonation of fuel vapors and gases. XVI. Benzene as a knocking fuel in conditions promoting the formation of finely divided carbon.** *Can. J. Research* **28F**, 308-14(1950).—*C.A.* **45**, 1331*e*.

Benzene, a non-knocking fuel in ordinary engine operation, became a knocking fuel in a modified CFR engine under operating conditions such that the vapor-air mixt. became impregnated with finely divided carbon. Carburation was such that liquid drops of C_6H_6 were in the vapor-air mixt., and carbon was formed by impingement of burning C_6H_6 on relatively cool surfaces. The engine was run abnormally cool to avoid surface ignition. The audibility of knock varied over a wide range while intensity as measured by the knock meter was "standard."

9971. KODAMA, SHINJIRO; TARAMA, KIMIO; KATO, SHIICHIRO, AND HAYAKAWA, SHUICHI. **The rate of the thermal decomposition of methane. III. Mechanism of the thermal decomposition of methane.** *J. Chem. Soc. Japan, Pure Chem. Sect.* **71**, 89-93(1950).—*C.A.* **45**, 4538*b*.

The activation and deactivation of CH_4, the effect of the surface of the reaction vessel and the chain reaction mechanism were studied. The initial rate consts. at the various conditions were calcd. The agreement between the calcd. and exptl. results concerning the effect of the initial pressure of CH_4, reaction temp., the surface/vol. ratio of the reaction vessel, the carbon produced by the CH_4 decompn. and the addn. of H_2 was satisfactory.

9972. KRAUSE, A. **Catalytic properties of coal and charcoals.** *Przemysl Chem.* **29**, 377-83 (1950).—*C.A.* **46**, 6916*e*.

The catalytic properties of coal, coke, lampblack, animal and other charcoals, and graphite in the reactions of decompn. of H_2O_2 and peroxidative oxidation of formic acid and of indigo carmine were compared. Graphite was inactive, and the activity of the other substances appeared to depend on their Fe, Ca, and Mg contents, and on their adsorptive power.

9973. KUKHARENKO, T.A. **An investigation of the composition and properties of bituminous coals by hydrogenating them below their decomposition temperatures.** *J. Applied Chem. U.S.S.R.* **23**, 655-63(1950)(Engl. translation); *Zhur. Priklad. Khim.* **23**, 620-30(1950).—*C.A.* **46**, 11634*a*.

A 0.5-kg sample of coal ground to 0.25 mm was hydrogenated in a 2-liter revolving autoclave for 2 hrs below the decompn. temps. (320-380°C) and at 72-105 atms. Long-flaming coal acquired clinkering capacity with loss of O as H_2O from functional groups. The methoxyl no. dropped from 6.84% for the original coal to 3.47% for the 1st stage of hydrogenation and 3.28% for the 2nd. Gas coal improved in coking properties with little change in ultimate analysis and a slight decrease in volatiles. Coking, medium lean, and lean coals underwent simplification of the complex org. compds. with the addn. of H.

9974. KUKHARENKO, T.A. AND MATVEEVA, I.I. **Investigating the nature of noncoking coals by hydrogenating them below their decomposition temperatures.** *J. Applied Chem. U.S.S.R.* **23**, 773-9(1950)(Engl. translation).—*C.A.* **46**, 11634*c*.

Coal, lying between brown and bituminous coal, was hydrogenated to acquire the coking capacity of good coking coal at 60-100 atm. and 350-380°C. The C increased 3% without change in the H. The total volatile and functional groups decreased. The compn. of the humic acids was unchanged, but the amt. decreased. The yield of primary tar was doubled (from 7-10 to 14-20%); the semicoke increased (74-78%), but the gas + losses decreased (6.69 to 1.77%).

9975. MEAD, JAMES F. AND HOWTON, DAVID R. **Quantitative hydrogenation of unsaturated fatty acid derivatives.** *Anal. Chem.* **22**, 1204-5(1950).—*C.A.* **45**, 983*f*.

Hydrogenation of less than mg amts. in the Barcroft-Warburg app. with 10% Pt on charcoal catalyst, and dissolving the sample in 96% alc. gave precision adequate for detg. the no. of C=C double bonds and distinguished between small amts. of Me oleate, linoleate, and linolenate. The slight soly. of H_2 in 96% alc. probably introduced no great error.

9976. MINACHEV, KH. M. AND SCHUĬKIN, N.I. **Hydrogenation of cyclenes and alkenes on low-percent platinized carbon.** *Doklady Akad. Nauk S.S.S.R.* **72**, 61-3(1950).—*C.A.* **44**, 7785*i*.

Charcoal platinized with as little as 0.5% Pt hydrogenated very effectively 1-methylcyclopentene, 1-ethylcyclopentene, 1-octene, and $Me_3CCMe{:}CH_2$.

9977. Mizuno, Shigeru. **Studies on the electrolytic synthesis of hydrogen peroxide. III. The mechanism of the electrolytic synthesis.** *J. Electrochem. Soc. Japan* 18, 48-50(1950).—*C.A.* 45, 3259*a*.

The rate of decompn. of H_2O_2 by activated carbon electrodes was measured. In the prepn. of H_2O_2 by the electrolytic reduction of O_2 flowing over an activated carbon cathode immersed in NaOH or KOH soln. the observed deviation from the theoretical efficiency was explained by taking into consideration the measured rate of decompn. of the product (H_2O_2).

9978. Mizuno, Shigeru; Yamada, Daiju, and Yasukawa, Saburo. **Electrolytic synthesis of hydrogen peroxide. IV. V. VI.** *J. Electrochem. Soc. Japan* 18, 80-1, 116-17, 167-9 (1950). —*C.A.* 45, 7451*a*.

H_2O_2, produced in NaOH or KOH soln. by the electrolytic reduction of O_2 flowing over an activated carbon cathode immersed in the soln., was detd. Powd. $Ba(OH)_2.8H_2O$ crystals (200-250 mesh) were added to the soln. (after the electrolysis), and the ppt. thus obtained, $BaO_2.8H_2O$, was added slowly to H_2O (contg. metaphosphoric acid or solium silicate as a stabilizer of H_2O_2) through which CO_2 gas was bubbling, whereby the BaO_2 was decompd. and H_2O_2 reproduced. The temp. of the liquid was kept at 15-20°C, and the $BaO_2.8H_2O$ added at such a rate that the liquid was always weakly alk.

9979. Mizutani, Kyuichi and Yamashita, Kasane. **Manufacture of vinyl chloride resins. I. Synthesis of vinyl chloride in the vapor phase in the presence of hydrogen.** *Repts. Govt. Chem. Ind. Research Inst. Tokyo* 45, 41-8(1950) (English summary).—*C.A.* 46, 2332*i*.

Into a tube contg. 80 ml $HgCl_2$ adsorbed on activated charcoal (50 g/liter) were passed at 190-200°C C_2H_2 and HCl gases (in a ratio of 1.0-1.2 to 1.0) mixed with 20% H_2(which did not affect the reaction) at 75-100 ml/min. In 2 hrs CH_2:CHCl was obtained in 98.7% yield. The catalyst, however, aged rather rapidly; the $HgCl_2$ was reduced to HgCl (or even to Hg) and a resinous substance was formed on the charcoal.

9980. Mizutani, Kyuichi and Yamashita, Kasane. **Manufacture of vinyl chloride resins. VI. Adsorption of the catalyst for the synthesis of vinyl chloride. VII. Effect of various metallic chlorides added to the catalyst of mercuric chloride and active charcoal. VIII. Catalytic action with silica gel and alumina as carriers.** *Repts. Govt. Chem. Ind. Research Inst. Tokyo* 45, 235-45, 246-51, 271-80 (1950). —*C.A.* 46, 2333*e*.

The best catalyst was prepd. by dipping activated carbon in 4-12% $HgCl_2$ at 70°C for 2 hrs (adsorption 80-95%). The catalyst adsorbed HCl less as the temp. was raised from 50° to 175°C, at which temp. the $HgCl_2$ tended to sublime. The adsorption of C_2H_2 decreased up to 140°C and thereafter increased. With the addn. of $AlCl_3$ ($MgCl_2$ or $BaCl_2$ less effectively) to the $HgCl_2$-C catalyst the adsorption of $HgCl_2$ on carbon was increased, prolonging the life of the catalyst. Catalyzed by $HgCl_2$ loaded on silica gel, CH_2:CHCl was produced at 80°C in 80-90% yield, but the catalyst did not last long because of violet sublimation of $HgCl_2$ occurring locally.

9981. Norris, T.H. and Ruben, S. **Kinetics of the isotopic exchange reaction between carbon monoxide and carbon dioxide.** *J. Chem. Phys.* 18, 1595-1600 (1950).—*C.A.* 45, 6029*f*.

The rate of the exchange reaction between CO and CO_2 was studied, with C^{14} as a tracer. The reaction, whose velocity in a quartz vessel was convenient for study between 800° and 900°C, appeared to follow the rate law: Rate = $k(pCO)^{0.73}(pCO_2)^{0.85}$. The apparent activation energy was 77 kcal. The reaction was accelerated by added N_2 but not A. Packing increased the rate only slightly, giving no indication of a primarily heterogeneous reaction. A probable mechanism was a bimol. exchange between the two reactants adsorbed on the catalyst surface.

9982. Novikov, S.S.; Lapshina, Z. Ya., and Shuikin, N.I. **Hydrogenation of benzene and dehydrogenation of cyclohexane on nickel catalysts on activated carbon.** *Doklady Akad. Nauk S.S.S.R.* 74, 77-9 (1950).—*C.A.* 45, 29*d*.

Hydrogenation of C_6H_6 at a space velocity of 0.06 liter /liter catalyst/hr, at 180°C, and dehydrogenation of cyclohexane at 0.3, 300°C, were investigated with catalysts prepd. by impregnation of active carbon with a soln. of 47 g $(HCO_2)_2Ni$/liter, and decompn. from 250° to 670°C. Catalysts heated at 350°C were also tested after repeated impregnation with $(HCO_2)_2Ni$, and repeated decompn. at 350°C. At low space velocities hydrogenation was practically complete with all catalysts; highest activity was found with catalysts with Ni crystallities of the size of about 40A. In contrast, the activity in dehydrogenation was found to increase with the Ni crystallite size up to 80A. The activity in dehydrogenation was highest with catalysts decompd. at 450°C; higher decompn. temp. lowered the activity, whereas sintering in vacuo at 800°C increased it considerably owing to a 1.5-fold increase of the Ni grain size.

9983. Roĭter, V.A. **Role of transfer phenomena in catalysis on porous contacts.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* 1950, 576-81. —*C.A.* 45, 6030*c*.

Conditions on a porous catalyst grain were approximated by a model, wherein the catalyst was carried on a diaphragm sepg. the reaction space into 2 compartments. The reacting gas mixt. was first allowed to flow on both sides of the diaphragm, then the flow was stopped on one side, but continued on the other; the 1st side thus became a closed space. The stationary concn. c_h in that closed space, different from the stationary c_o on the flow side, corresponded to the concn. in the center of a catalyst granule of a radius equal to the thickness of the diaphragm. In the general case of N spherical granules of radius r and vol. v, in a gas stream of mean concn. c_o and rate of flow V, the rate of reaction was $W = -dx/dt = kNvVf(c)$. Along an infinitely thin layer of thickness dr, where the concn. could be considered const. $dW = -kNS_oV/f(c)dr$, where S_o = external surface area of each granule, $dv = NS_odr$. The amt. reacted was compensated by diffusion, which gave $d^2c/dr^2 = (kV/D)f(c)$, where D = effective diffusion coeff.

9984. RUBINSHTEĬN, A.M.; MINACHEV, KH. M., AND SHUĬKIN, N.I. **Distribution of platinum in a platinized carbon catalyst.** *Doklady Akad. Nauk S.S.S.R.* 71, 1073-5 (1950).—*C.A.* 44, 6249*i*.

The Pt content was detd. by transmittance to x-rays of sections, taken at different depths, of cubes of platinized charcoal of 10.2-3.2 mm side. Although the amt. of Pt was highest in the outermost layer of each grain, it was also found in deeper layers; e.g., in a cube of 10.2 mm side, the ratio of the amts. of Pt found in layers 0-1.2, 1.2-2.4, 2.4-3.7, and 3.7-4.9 mm deep, was 6.7:3.6:1.1:1, and in a 4.1 mm cube, at 0-0.85, 0.85-1.6, and 1.6-2.4 mm below the surface, the ratio was 2.4:1.2:1.

9985. SAKIKAWA, NORIYUKI. **Organic geochemical reactions. II. Catalytic actions of minerals on the dehydration and polymerization of humic acid.** *J. Chem. Soc. Japan, Pure Chem. Sect.* 71, 298-300(1950).—*C.A.* 45, 4424*f*.

Some minerals contained in the ashes of coals, such as Fe oxides, Fe sulfide, silica, Al_2O_3 or some clays acted as effective catalyzers in the dehydration of humic acid and polymerization of humin. Humic acid was easily dehydrated to humin by heating at 200°C and it then changed to humus coal at 300°C. Humic acid and humin were not only contained in young coals, but also in bituminous coals. It was, therefore, concluded that coals could be formed by the catalytic actions of minerals without high temp. as hitherto supposed.

9986. SAKIKAWA, NORIYUKI. **Organic geochemical reactions. III. Effects of ash on the properties of coal.** *J. Chem. Soc. Japan, Pure Chem. Sect.* 71, 300-3 (1950).—*C.A.* 45, 4424*g*.

Coals having high caking properties contained much S and this caking property was attributed to the bitumens contained in the coal formed by the natural hydrogenation of coal with H_2S or other hydrogen compds. in the presence of iron sulfide as a catalyst. Catalytic action of pyrite in the hydrogenation of coal was tested and found to be effective as MoS_3 or $ZnCl_2$. Effect of pyrite on the caking property of coal during coke formation was found to be rather effective.

9987. SCHWABE, K. **The electrolytic chlorination of spent sulfite liquor.** *Monatsh.* 81, 609-12 (1950).—*C.A.* 45, 1884*i*.

Spent sulfite liquor, purified over a cationic resin, lowered the anode (Pt) potential to about 500 mv. (*vs.* sat. calomel electrode) in pure NaCl soln., and to 250 mv. in *N* HCl. The depolarization amounted to almost 1000 mv. in *N* KOH plus 2 *N* KCl soln. Graphite and Pt anodes behaved alike. The spent sulfite liquor (S 8.01, OCH_3 9.10, NH_3 4.29, ash 0.84% on a dry basis), decalcified with $(NH_4)_2CO_3$, was chlorinated in a diaphragm cell with graphite anodes at a discharge potential below that of Cl. In alk. electrolytes(*N* KOH, 2 *N* KCl) two fractions resulted.

9988. SHIODA, RIICHI. **The carbonization of lignite.** *J. Fuel Soc. Japan.* 29, 7-15(1950).—*C.A.* 46, 3236*g*.

A new plant with an internal heating system was constructed, in which the hot gas, prepd. in a sep. furnace, was supplied for heating. In this system, besides the sensible heat of the gas some heat of combustion was also utilizable, which was liberated from the partial combustion of the charged lignite with O_2 included in the heating gas. The results obtained from actual operation, however, showed that the charges were not uniformly carbonized and the system of self-coking without a heating gas was also tried during the whole period except starting.

9989. SHUĬKIN, N.I.; MINACHEV, KH. M., AND ROZHDESTVENSKAYA, I.D. **Hydrogenation and dehydrogenation of hydrocarbons with low-percent nickel catalysts.** *Doklady Akad. Nauk S.S.S.R.* 72, 911-13 (1950).—*C.A.* 44, 8332*h*.

Catalysts (Ni = 0.125 to 4%) were prepd. by a 40-45 min. impregnation at 30-35°C of 1 g activated charcoal with 2 ml soln. of $Ni(NO_3)_2$, drying at 125°C, and reduction in H_2 at 330°C. Hydrogenation of C_6H_6 was carried out in a stream of excess H_2 at 115-176°C, space velocity 0.025-0.2 liter/liter catalyst/hr; dehydrogenation of cyclohexane at 300-302°C, space velocity 0.2. The first proceeded to a significant extent with catalysts contg. 1% Ni or more; the reaction was just barely noticeable with 0.5% Ni. The degree of hydrogenation was practically const. between 120° and 176°C.

9990. STANIER, H. AND MCKEAN, J.B. **The production of town gas by the catalytic gasification of petroleum oils.** *Inst. Gas Engrs., Copyright Pub.* No. 375, 36 pp.; *Gas World* 132, 550-3(1950).—*C.A.* 45, 2177*h*.

With catalysts based on Na_2CO_3 or CaO and under suitable conditions, gas oil was gasified with almost the complete absence of carbon deposition or tar formation, to produce a gas low in unsatd. hydrocarbons and rich in H_2, with a d. of about 0.45, and a heating value of 400-480 B.t.u./$ft.^3$ For application to a full-scale process a suitable catalyst was prepd. from a mixt. of bauxite, $CaCO_3$, and bentonite combined in the proportions of 63:34:3, molded in hollow, cylindrical shapes, and fired for 16 hrs at 1350°C. The expts. showed that equally good results could be obtained when one of the heaviest types of petroleum fuel oils was gasified.

9991. STOCKMAN, C.H. AND BRAY, J.L. **The hydrogenation of coal at high temperatures.** *Purdue Univ. Engl. Expt. Sta., Research Ser.* No. 111, 44 pp.(1950).—*C.A.* 45, 6819*g*.

The hydrogenation of Indiana 4th seam bituminous coal in a batch autoclave was investigated at 1200-1450°F and up to 6000 p.s.i. Gases with higher CH_4 content and heating values were produced at lower pressures provided the equil. point was satisfactory. The fraction of the coal gasified and the no. of moles of CH_4 produced were greater at higher pressures. Increasing the temp. increased the rate of CH_4 production.

Finely divided coal was not markedly more reactive than coarse coal.

9992. Weller, Sol; Clark, E.L., and Pelipetz, M.G. **Mechanism of coal hydrogenation.** *Ind. Eng. Chem.* 42, 334-6(1950).—*C.A.* 44, 5563*d*.

It was postulated that coal (or asphalt) was thermally split into reactive fragments (splitting being catalyzed by halogen acids). These fragments then either polymerized to form benzene-insol. materials, or were stabilized by addn. of H_2 to form sol. products (stabilization being catalyzed by Sn).

9993. Weller, Sol; Pelipetz, M.G.; Friedman, Sam, and Storch, H.H. **Coal-hydrogenation catalysts batch autoclave tests.** *Ind. Eng. Chem.* 42, 330-4(1950).—*C.A.* 44, 5563*e*.

Comparative catalyst tests were reported for hydrogenation at 450°C for 1 hr in absence of whole Bruceton coal (Pittsburgh bed), Bruceton anthraxylon and Rock Springs coal (Wyoming subbituminous). Initial cold H_2 pressures of 1000 p.s.i. were used. NH_4Cl alone was not an effective catalyst, but was an effective promoter for Sn (itself a moderate catalyst). HCl, CCl_4, chloroacetic acids were equiv. as promoters for Sn catalysts; NaCl was inert, free Cl_2 was harmful. MoO_3, Ni on kieselguhr, and Cu chromite were relatively ineffective. Zn showed appreciable activity and when promoted with NH_4Cl could replace 90% of the Sn normally used. Proper phys. distribution of Sn catalyst on coal was found to be quite important.

9994. Brinkley, Stuart R. Jr. **Evaluation of performance factors of fuel-oxidant mixtures.** *Ind. Eng. Chem.* 43, 2471-5(1951).

Generally applicable methods appropriate for application to automatic equipment were described for the computation of the thermodynamic properties of combustion gases. The results of such computations were the equivalent, in numerical form, of a Mollier chart for each fuel-oxidant mixt. The application of these results, employing automatic computational equipment, to the calcn. of flame temp. and fuel performance parameters was described.

9995. Brinkmann, G. **Catalytic reactions of active carbon.** *Kolloid-Z.* 123, 116-29(1951).—*C.A.* 46, 8787*h*.

Reactions comparable to those exerted by enzymes, such as catalase, oxidase, and hydrolase, were treated in more detail. The surface-active groups of active carbon which detd. its chem. behavior in various reactions were discussed. Also studied was the role played by those groups in the inhibition of catalysis. More completely treated reactions were the catalytic decompn. of H_2O_2 on active carbon compared with the analogous reaction of catalase, the question of the nature of surface-active groups in this case being especially discussed, the autoöxidation of active carbon, and the catalytic oxidation of formic acid and of hydrazine.

9996. Browning, L.C. and Emmett, P.H. **Equilibrium measurements in the system carbon-methane-hydrogen.** *J. Am. Chem. Soc.* 73, 581-3(1951).—*C.A.* 45, 4534*f*.

Equil. consts. for the reaction $CH_4 = C + 2H_2$ were measured in the range 380-838°C, the carbon present being formed from the decompn. of Fe_3C. The values obtained were close to those for the reaction in which the carbon form was β-graphite.

9997. Chaigneau, Marcel. **The sulfo-chromic oxidation of carbon.** *Compt. rend.* 232, 1112-14(1951).—*C.A.* 46, 4897*h*.

Oxidation of graphite by chromic acid without a catalyst at room temp. yielded no more gas after 130 hrs. The gas was about 75% CO_2, < 1% CO, and O_2. The oxides accounted for at least 99.75% of the sample. With a 10% chromic acid soln. in H_2SO_4 of d. 1.140, the oxidation at 100°C was complete in 5 hrs.

9998. Csuros, Zoltán; Géczy, István, and Keipert, Miklós. **Investigations on catalysts. VI. Mechanism and kinetics of hydrogenation of stereoisomeric ethylenecarboxylic acids.** *Acta Chim. Hung.* 1, 22-45(1951)(in German).—*C.A.* 45, 10022*i*.

Pd-animal charcoal prepd. according to Gattermann-Wieland was used as the catalyst with *maleic*, *fumaric*, and *cinnamic acids*. The curves of hydrogenation velocity showed a max. and a min. with increased amounts of catalyst. The product of the reaction had an inhibiting effect on the hydrogenation process, and its presence apparently changed the mechanism of the reaction. It was observed that the product of reaction repressed both the adsorption of the substance and the adsorption of H_2. The differences observed in the hydrogenation velocities of maleic and fumaric acid were caused by differences in their adsorptions.

9999. Dryden, I.G.C. **Action of solvents on coals at lower temperatures. III. Behavior of a typical range of British coals towards specific solvents.** *Fuel* 30, 217-33 (1951).—*C.A.* 45, 10542*g*.

The action of specific solvents (ethylenediamine proved the best for the purpose) on 23 bright coals covering a wide range of rank and on specimens of gray and black durain, fusain, and cannel coal, was described. When plotted against rank (C content) the extn. yield, quantity of solvent imbibed, and heat of wetting in ethylenediamine of the bright coals formed well-defined bands, each with a moderate degree of scatter. Coals were divided into 3 classes; the first comprised free-burning and caking coals (chemically reactive towards the solvent), the second both strongly coking and dry steam coals, and the third anthracites.

10000. Dubrisay, René and Favart, Michel. **Catalytic action of metallized carbons in certain oxidation reactions.** *Compt. rend.* 232, 2099-2100(1951).—*C.A.* 46, 1855*d*.

Carbon metallized by $AgNO_3$ or AgOH catalyzed the air oxidation of EtOH to a greater extent than did carbon alone. Cu exerted a similar, but much smaller, catalytic effect.

10001. Dunlop, E.C. **Quantitative analysis by means of catalytic hydrogenation reactions.** *Ann. N.Y. Acad. Sci*, 53, 1087-92 (1951).—*C.A.* 46, 3895*g*.

Maleic acid, methyl vinyl ketone, styrene, and cyclooctatetraene were detd. by hydrogenation in 95% EtOH, AcOH, or dioxane with PtO_2, Pd on charcoal, or Ni W-6 catalysts. Flasks with sealed side arms to hold the sample permitted working in a closed system.

10002. Funasaka, Wataru; Yokokawa, Chikao; Suga, Sôhei; Kito, Yoshiyuki, and Awaya, Tetsuro. **Caking properties of coal. II.** *Bull. Inst. Chem. Research, Kyoto Univ.* 25, 18-23(1951).—*C.A.* 46, 3237*b*.

The properties of caking and noncaking coals were compared. Each coal was extd. under N_2 with pyridine, benzene, and cyclohexanone in a Soxhlet app. and with benzene for 3 2-hr periods in an autoclave at 230-60°C. The amt. of the extd. matter, except that by pyridine, was parallel to the caking power. The extd. residues were oxidized with *N* $KMnO_4$ and the oxidation coeffs. were detd. with oxalic acid. They revealed the difference of carbonization degree between the caking (34.6-42.7) and the noncaking (51.7-70.6) coals.

10003. Funasaka, Wataru; Yokokawa, Chikao; Ueno, Shoji; Matsumiya, Saburo, and Miyazaki, Yoshiaki. **The chemistry of coal. VII. Oxidation of artificial coal containing nitrogen by means of alkaline potassium permanganate.** *J. Chem. Soc. Japan*, Ind. Chem. Sect. 54, 579-81(1951).—*C.A.* 47, 6633*f*.

Five different artificial coals contg. N and several natural coals were oxidized with alk. $KMnO_4$ soln. N in each coal was converted to NH_3 or NO_3^-. The value of NH_3/NO_3^- was large in the initial stage of oxidation, and became smaller with the progress of reaction. The final values of NH_3/NO_3^- for cellulose coals were greater than those of lignin coals.

10004. Gel'd, P.V.; Vlasov, V.G., and Serebrennikov, N.N. **Reduction of metal oxides by solid carbon.** *Doklady Akad. Nauk S.S.S.R.* 78, 693-6(1951).—*C.A.* 45, 8421*c*.

The reduction proceeded: (I) $MO + CO \rightarrow M + CO_2$ and (II) $CO_2 + C \rightarrow 2CO$. Proof was supplied by trapping and detg. the amt. of CO_2 evolved on heating *in vacuo* pressed pellets of finely ground Cr_2O_3 or MnO mixed with finely divided graphite, outgassed under 10^{-5} mm Hg. and by detg. the loss of wt of the pellets. The proportions used were $1Cr_2O_3$: 5C and 1 MnO: 4C, resp. The components were ignited to 1200°C prior to mixing and pelleting. The amt. of CO_2 produced was practically the same in all expts.

10005. Grothe, Hans. **Physical-chemical problems in thermal zinc recovery and their significance for practice.** *Z. Erzbergbau u. Metallhüttenw.* 4, 133-7(1951).—*C.A.* 45, 6135*g*.

The gas content of the coal used had no accelerating effect except that the introduction of CO was more advantageous than an inert gas. Briquetting was of no particular advantage.

10006. Hallonquist, Earl G. **Catalytic hydrogenolysis of wood.** *Ind. Eng. Chem.* 43, 1427-30(1951).—*C.A.* 45, 8243*g*.

Simultaneous hydrogenation and hydrolysis of wood was carried out at 250-290°C, and pressures of 4-6000 p.s.i. Nickel catalysts were found most effective. Optimum yields of about 50% of the wt of the wood were obtained as nonaq. distillable liquids.

10007. Hansen, Christian J. **Low-temperature carbonization of bituminous coal.** *Brennstoff-Chem.* 32, 97-104(1951).—*C.A.* 45, 5907*a*.

High-volatile noncoking coals should be subjected to low-temp. carbonization before use, as a satisfactory smokeless coke can be made from these coals, with the recovery of large vols. of tar and considerable gas. Where a lower-volatile but free-burning coke is required, the semicoke may be subjected to a second heating stage. Such coke was much less graphitized and freer burning than high-temp. coke. Various proposals for combining low-temp. carbonization with gas manuf. were suggested.

10008. Herbo, Cl.; Lefebvre, C., and Muylle, R. **Adsorption in heterogeneous catalysis.** *Ind. chim. belge* 16, 82-5(1951).—*C.A.* 45, 6029*e*.

A flow method was used to det. isotherms for the hydrogenation of Me_2CO and C_6H_6 with a Ni-ZnO-Cr_2O_3 catalyst at 130°-140°C and for the reaction of H_2 with Br_2 on activated charcoal at 295°C. If p_x stood for the equil. pressure of H_2 or Br_2 when the adsorbing surface was x% covered, the ratios p_{75}/p_{50} and p_{75}/p_{25} were 1.5 and 3.0, resp., in all 3 cases. Since values of 3 and 9 were predicted from a Langmuir isotherm, the low values indicated that mols. already adsorbed favor further adsorption on the free surface with a corresponding increase in heat of adsorption.

10009. Hopkins, D.W. and Adlington, A.G. **Factors affecting the reduction of zinc oxide by carbon.** *Bull. Inst. Mining Met. No.* 530, 101-16 (1951).—*C.A.* 45, 2833*e*.

Nut charcoal, carbon black, and electrode carbon, of particle size less than 5 μ, were mixed with powd. ZnO and caused to react at temps. between 980° and 1100°C in small fused silica retorts especially fitted with means for the rapid removal and shock-cooling of the effluent gases. The rate of reduction increased rapidly above 1000°C and at any temp. was related to the compn. of the retort amt. irrespective of the type of carbon used.

10010. Inouye, Yoshiyuki and Mitani, Shiro. **Vacuum distillation of turpentine with active carbon and sulfur.** *Mokuzai Kenkyu* (Wood Research) No. 6, 1-6 (1951).—*C.A.* 45, 9890*c*.

To increase the yield of retene, a decarboxylating agent for abietic acid, such as active carbon or S, was employed in the distn. of turpentine from *Pinus thunbergii*, estd. to contain 45.89% abietic acid. The max. yield of retene was 3.4% based on turpentine when 33.3% active carbon was employed, and 9.1% when 29.6% S was employed.

10011. Ishiwara, Torajirô; Niwa, Kichizô, and Itô, Toshio. **Utilization of pyrrhotite principally composed of iron and sulfur. III. Making sulfur by the catalytic reduction of roasting gases with blast-furnace gases. IV. Direct reduction of roasting gases with coke** *Science Repts. Research Insts., Tohoku Univ.*, Ser. A, 3, 397-406, 407-12(1951).—*C.A.* 47, 2441*i*.

SO_2 was catalytically reduced with CO with 3 kinds of catalysts. Roasting gases, from which O_2 was removed, gave better results than pure SO_2. The S yields were detd. at different reaction temps. where the roasting gases, contg. equal weights of SO_2 and O_2, were introduced into the direct reducing furnace contg. coke. At 850°C, even if the S yields were only 70%, the ratio of CO to SO_2 was about 2 to 1. Residual SO_2 could be reduced almost completely through the use of a catalyst.

10012. Jeanprost, Charles. **The Kubierschky principle and reactions between pulverized solids and gases or vapors.** *Chimie & industrie* 65, 191-9, 339-47(1951).—*C.A.* 45, 5502*g*.

A vertical column was divided into a no. of compartments by perforated plates or screens. The pulverized solid was fed into the top and, passing through the screens, fell by gravity from one compartment to the next. The reacting gas entered the bottom of the column, moved through vertical passageways to the top of the 1st compartment and then, in contact with the falling solids, passed downward to the bottom of the compartment, where the gas entered another passageway, moved to the next upper compartment and, thence, through the entire column. The application of the principle was the displacement of heavier gases or vapors from the bottom of each compartment by lighter gases entering at the top. Production of sponge iron, metallurgical coke and lime, SO_3, hydrocarbons by the Fischer-Tropsch process, P_2O_5 from phosphorite, activated carbon, and $2Na_2O.3SiO_2$ from SiO_2, NaCl, and carbon were discussed.

10013. Kiuchi, Shumji. **Reactivity and mechanism of formation of metallurgical coke.** *Tetsu to Hagane* (J. Iron & Steel Inst. Japan) 37, 140-4 (1951).—*C.A.* 46, 7742*i*.

Expts. on cokes and anthracites with a thermobalance showed remarkable differences in combustion velocities which were thought to be caused by different activation energies, but the activation energies actually detd. were of almost equal value. The contradiction may be explained by considering the frequency factor of burning carbon aggregates in the Arrhenius equation. The essential step was considered to be a growth of carbon grains. Coke grains were considered to have a larger degree of growth than the anthracite grains.

10014. Kobozev, N.I. **Some remarks concerning the paper of Sokol'skiĭ and Stender.** *Zhur. Fiz. Khim.* 25, 375-9(1951).—*C.A.* 46, 2894*a*.

The published data gave a value of *n* equal to 2, very exactly when the formulas of Kobozev were correctly applied.

10015. Kordesch, Karl and Marko, Adolf. **A new carbon oxygen-electrode process.** *Österr. Chem. Ztg.* 52, 125-31 (1951).—*C.A.* 46, 839*b*.

The electrodes were impregnated with various heavy metal salts to serve as catalysts. The porous carbon-O electrode made possible the formation of higher compds. through electrolytic action with the primary atm. elements. Cathodic oxidation proceeded through the formation of H_2O_2 by the electrochem. reduction of O or by essentially chem. oxidation of oxidizable materials. The special catalytic property of the carbon electrode would be gradually used up by the oxidizing reactions.

10016. Lewis, W.K.; Gilliland, E.R., and Sweeney, M.P. **Gasification of carbon. Metal oxides in a fluidized powder bed.** *Chem. Eng. Progress* 47, 251-6(1951).—*C.A.* 45, 5906*g*.

The exptl. procedure, equil. results, interpretation of data, and engineering significance were described. CuO on silica gel was not a suitable O_2 carrier. Fe_2O_3 appeared worthy of further study.

10017. Loison, R. **Underground gasification.** *Rév. ind. minerale* 32, 330-46(1951).—*C.A.* 46, 2779*b*.

The present status of transforming solid combustible minerals into a combustible gas by gasification on the site of the deposit was surveyed.

10018. Minachev, Kh. M.; Shuĭkin, N.I., and Rozhdestvenskaya, I.D. **Hydrogenation and dehydrogenation of hydrocarbons in the presence of cobalt catalysts with a low metal content.** *Doklady Akad. Nauk S.S.S.R.* 76, 543-6(1951).—*C.A.* 45, 3698*d*.

In the flow hydrogenation of C_6H_6 at 180°C at a space velocity of 0.04 liter/liter catalyst/hr, on active charcoal with 4,2,1,0.5, 0.25% Co the degrees of conversions were 100,100, 100, 72.8, 20.2%. In the dehydrogenation of cyclohexane at 300°C, 0.2 liter/liter catalyst/hr, on the same catalysts, degrees of conversion were 26.6, 27.6, 25.0, 13.2, 5.0%. At const. space velocity, 0.076, with 4 and 2% Co, the conversion remained at the 100% level for 100 and 66 hrs, resp.; with the 1% Co catalyst, at a space velocity of 0.045, the activity was still at the 85% level after 266 hrs of service. With the 0.5% Co catalyst, at space velocity 0.035, at 180°C, the activity fell to 36.8% in 285 min., and with 0.25% Co, to 5.6% in 128 min.

10019. Orchin, M.; Golumbic, C.; Anderson, J.E., and Storch, H.H. **Studies of the extraction and coking of coal and their significance in relation to its structure.** *U.S. Bur. Mines, Bull.* No. 505, 15 pp. (1951).—*C.A.* 46, 4768*i*.

Removal of the binding material led to complete disintegration of the colloidal structure of the coal and peptization of the micelles in the solvent. Inexpensive solvents obtained directly from coal, could be substituted for phenanthrene for various purposes. Catalytic hydrogenation of a noncoking subbituminous coal under comparatively mild conditions coverted it to a coal with good coking properties, the conversion requiring the consumption of 0.6% H. Coking properties of bituminous coal lost upon air oxidation were restored by mild hydrogenation. The oxidative attack probably resulted from the formation of a hydroperoxide or a peroxide that started an autoxidative chain reaction.

10020. Papp, Elemer; Antonescu, Hadrian, and Holló, Mária Gy. **Study on the oxidizability of coals with special reference to anode carbons. I.** *Aluminium* 3, 13-17(1951).—*C.A.* 45, 8737*e*.

Coke residues (obtained by C_6H_6 extn. of raw anode masses) were screened, and material of grain size 1.5-0.06 mm and below was used for test. One g was treated with 15 ml 40% CrO_3 30 mins. on the water bath, then 300 ml cool distd. water was added. The soln. was filtered, the filtrate dild. to 500 ml, and an aliquot portion titrated iodometrically. The oxidation diagrams obtained by this method showed that coke of finer grain size was more oxidizable than was coarse coke. The rate of oxidation depended to a high degree on the amt. of bonding material adhering to the surface of coke grains, which was not sol. in C_6H_6. Ignited petroleum coke consumed much less CrO_3.

10021. PAPP, ELEMÉR; ROMWALTER, ALFRÉD, AND ANTONESCU, HADRIAN. **Study on the oxidizability of coals with special reference to anode carbons. II.** *Aluminium* 3, 28-32(1951).—*C.A.* 45, 8737*e*.

The amt. of CO_2 as a function of time was used as the basis of oxidizability. The coal or carbon sample was treated with H_2SO_4 contg. chromic acid at 100°C. The CO_2 was removed by a stream of N_2 at a velocity of 6 liters/hr and absorbed by 2% $Ba(OH)_2$. The oxidizability had an approx. linear relation to surface. The degree of oxidizability of the same coal or carbon varied according to the heat treatment. When subjected to heat treatment the oxidizability of petroleum coke heated up to 800°C decreased and then again increased when the heating temp. was above 800°C. Acheson graphite was most readily oxidized and anthracite least readily.

10022. PATAI, SAUL AND HOFFMANN, ELIAHU. **Catalysis of the air oxidation of carbon black.** *Bull. Research Council Israel* 1, No. 1/2, 131 (1951).—*C.A.* 46, 5414*b*.

At an air pressure of 200 mm, a slow reaction occurred between carbon black and atm. O_2 at 367°C, in the presence of $KClO_4$, during 1-2 hrs, almost all of the O_2 being consumed in the oxidation to CO_2. The following reaction occurred concurrently: $KClO_4 + 2C = KCl + 2CO_2$. KCl had the same effect. Plotting log $(a - x)/(b - x)$ vs. t, where $a - x$ = amt. of carbon black and $b - x$ = amt. of O_2 present at time t, gave straight lines up to 65% reacted.

10023. PAUSHKIN, YA. M. AND LIPATOV. YU. S. **Inhibition and activation of cracking on carbon and on aluminosilicates.** *Doklady Akad. Nauk S.S.S.R.* 76, 547-50 (1951).—*C.A.* 45, 6371*f*.

In cracking on activated carbon as catalyst, addn. of BF_3 lowered the yield of gasoline almost by a factor of 2, lowered its Br_2 no. considerably, and lowered the yield of gas and the content of unsatd. compds. At 350-450°C, in the presence of BF_3, a distillate heavier than the original oil was obtained. The same proportion of BF_3 introduced into cracking runs on an aluminosilicate cracking catalyst increased the yield of gasoline by 10-15%, and yielded a lighter gasoline than aluminosilicate alone.

10024. POTTER, CHARLES AND BARON, SEYMOUR. **Kinetics of the catalytic formation of phosgene.** *Chem. Eng. Progress* 47, 473-80 (1951).—*C.A.* 45, 10018*f*.

The kinetics of the catalytic formation of phosgene from CO and Cl_2 with activated carbon was studied in a flow system by means of the differential bed technique. An analytical method was developed to measure small changes in compn. of CO, Cl_2, and $CO+Cl_2$ mixts. Measurement of the reaction rate in the temp. range from 31° to 99°C showed that surface reaction between adsorbed Cl_2CO was the controlling mechanism. Introduction of N_2 into the reaction mixt. increased the adsorption coeff.of Cl_2 and $COCl_2$. The effective enthalpy of adsorption of Cl_2 and $COCl_2$, however, remained unchanged.

10025. RAUSCHENBACH, P.. **Directions for the use of artificial coal as bearing material.** *Die Technik* 6, 330-1 (1951).—*C.A.* 46, 4146*b*.

The raw materials were bituminous coke, lignite-tar coke, petroleum coke, soot, natural graphite, charcoal, and Cu, Pb, Sn, and Zn powder, with pitches or tars as binders, or less often synthetic or natural resins. The ground, mixed, and pressed masses were fired at up to 1450°C. The finished artificial coal had less that 1% ash, sp. gr. 2.20-2.23, apparent d 1.55-1.7 g/ml, and vol. of pores 15-30%. Oxidation became noticeable above 450°C.

10026. ROMWALTER, ALFRED. **The stability of coke.** *Acta Tech. Acad. Sci. Hung.* 1, No. 2, 75-82 (1951)(in German).—*C.A.* 46, 238*h*.

The stability of coke and the clinkering capacity of coking coal were examd. in the light of the most recent knowledge of crystal structure. The stability of the coke could be deduced from the stability of the microcryst. units. The stability of the coke increased with increasing av. size of the graphitic crystallites, and this apparently was confirmed by practice.

10027. SHUĬKIN, N.I.; MINACHEV, KH. M., AND RUBINSHTEIN, A.M. **Dehydrogenating and hydrogenating properties of low-content palladium catalysts.** *Doklady Akad. Nauk S.S.S.R.* 79, 89-92 (1951).—*C.A.* 45, 10020*e*.

Catalysts with 2.0, 1.0, 0.25, 0.10, and 0.05% Pd on active carbon were tested in dehydrogenation of cyclohexane in a weak stream of H_2, and in hydrogenation of C_6H_6, in excess H_2. The activity of all catalysts in the dehydrogenation of cyclohexane fell very slowly with time with the 2.0, 1.0, and 0.25% Pd catalysts, faster with 0.10 and 0.05% Pd: however, even the 0.05% Pd catalyst had still at least 5% of its initial activity left after about 12 hrs. The measured differences of activity were, apparently, due not only to the different contents of Pd but to differences of structure of the Pd.

10028. SOKOL'SKIĬ, D.V. AND STENDER, K.I. **The role of the carrier in heterogeneous catalysis.** *Zhur. Fiz. Khim.* 25, 369-74(1951).—*C.A.* 46, 2894*a*.

The rate of hydrogenation of dimethylethynyl carbinol was studied on charcoal covered with various amts. of Pd($7.75 \times 10^{-4} < \theta < 1.16 \times 10^{-2}$). The no. n of Pd atoms in the active ensemble may be approx. 2 but it also may be 9; in fact, it did not seem to have any precise meaning.

10029. Tamaru, Kenji. **The action of carriers in the hydrogenation of acetylene by palladium catalyst.** *Bull. Chem. Soc. Japan* 24, 177-80 (1951) (in English).—*C.A.* 46, 8944*i*.

C_2H_2 was hydrogenated by Pd deposited on such carriers as carbon black, active carbon (Merck), Japanese acid clay, French chalk, silica gel, granular active carbon, quartz sand, Al_2O_3, and kieselguhr. The ratio of Pd to carrier was 1:100 in each instance. The expts. were made by the static method at 30°C. The catalysts deposited on the 1st four carriers catalyzed the hydrogenation in 2 distinct steps at 30° in the same manner as Al_2O_3 and kieselguhr. When the granular active carbon was used as a carrier, the hydrogenation of C_2H_2 and C_2H_4 proceeded not in two steps, but simultaneously. When the quartz sand was used as a carrier, the hydrogenation of the two hydrocarbons occurred at the same time.

10030. Terbeck, W. **A water-gas diagram.** *Brennstoff-Chem.* 32, 65-9(1951).—*C.A.* 45, 5908*c*.

Diagrams based on the water-gas reactions and the water-gas equil. were presented which made it possible to calc. the O_2 requirements to gasify 1 kg carbon. These calcd. values were compared with values measured in O_2-gasification operation at Leuna, showing fair agreement. Diagrams were also presented for the equil. gas compn.

10031. Thiele, Heinrich and Weise, Eberhard. **Graphite as anode.** *Z. Elektrochem.* 55, 193-9 (1951).—*C.A.* 45, 7896*c*.

In the anodic polarization of graphite, 3 different reactions occurred: (1) evolution of O_2; (2) an attack perpendicular to the surface, which attacked the honeycomb plane of the graphite lattice and oxidized it to CO_2 and CO; (3) a swelling, an attack parallel to the plane of the C_6-ring which remained intact. The type of attack depended on the kind and concn. of acid or of anion.

10032. Watanabe, Jun and Shiramoto, Tomizo. **Activated carbon electrodes for air-depolarized wet cells. I. The decomposition of hydrogen peroxide on account of activated charcoals.** *J. Electrochem. Soc. Japan* 19, 274-9(1951).—*C.A.* 46, 1891*e*.

The activity of charcoals activated by many inorg. reagents was studied by measuring the decompn. velocity of aq. H_2O_2 in the presence of the sample charcoal. The charcoals activated with NaOH, KOH, $KMnO_4$, H_2SO_4, H_3PO_4, and other metallic sulfates gave the lowest decompn. velocity values; while $HClO_4$, HNO_3, NH_4Cl, $(NH_4)_2SO_4$, $MgCl_2$, $FeCl_2$, $Co(NO_3)_2$, $SnCl_2$, etc., gave medium values; and $MnCl_2$, $CoCl_2$, $PdCl_2$, H_2PtCl_6, etc., gave considerably higher values.

10033. Weller, Sol and Pelipetz, M.G. **Coal hydrogenation catalysts. Studies of catalyst distribution.** *Ind. Eng. Chem.* 43, 1243-6 (1951).—*C.A.* 45, 5907*e*.

The activity of a no. of catalysts was found to be much greater when they were impregnated on the coal from aq. soln. than when they were added as powders to the powd. coal. The ball-milling of coal and catalysts together was of intermediate effectiveness. With a Wyoming coal, the activity of $SnCl_2$ was equaled by impregnated $NiCl_2$ and surpassed by impregnated $(NH_4)_2MoO_4$ + H_2SO_4.

10034. Yagishita, Hideharu and Araki, Harumi. **Coking. I. Thermochemical properties of coal and oil coke.** *Misc. Repts. Research Inst. Natl. Resources* No. 23, 23-38(1951).—*C.A.* 47, 289*f*.

From the thermoanalysis of hard to soft coals from 9 different mines heated at 100-1000°C and their x-ray diffraction patterns (the swelling tested at 300-500°C), the coking property seemed to depend upon the development of a 2-dimensional lattice of unit C chains which changed into a 3-dimensional graphite structure by heating, releasing hydrocarbon mols. loosely linked with the main C chains as gases.

10035. Zelinskiĭ, N.D. and Levi, G.I. **Irreversible catalysis of cyclohexene on activated carbon of high purity.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* 1951, 819-20.—*C.A.* 46, 3839*c*.

Cyclohexene passed at the rate of 0.6 ml/ml catalyst/hr over high-purity carbon (from sucrose, ash ~ 0.01%), in the absence of H_2, disproportionated to the extent of 12.5, 29.5 (max.), 26.1%, at 400, 450, 475°C, resp. The reaction was $3C_5H_{10} \rightarrow 2C_5H_{12} + C_6H_6$. In an excess of H_2, neither disproportionation nor hydrogenation took place, and the reaction for C_6H_6 in the catalyzate was neg.

10036. Ahlers, Walter. **Water-gas generation in large horizontal chamber ovens.** *Gas- u. Wasserfach* 93, 5-15, 69-70(1952).—*C.A.* 46, 4198*f*.

Advantages of steaming were the use of the sensible heat in the coke, and the increased flexibility of operation of the plant. Disadvantages were addnl. gas losses due to leakage through the walls on account of the gasification of carbon deposited in the walls; steam losses due to leaks in the steam conduits, and a slight deterioration of the coke quality. With short steaming periods the coke deterioration will be very slight, but this must be considered with respect to the coke use.

10037. Andreev, E.A. and Kavtaradze, N.N. **Catalytic oxidation of phosphine in a broad temperature range.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* 1952, 1021-32.—*C.A.* 47, 5777*f*.

On an active carbon (without Cu), if PH_3 was first adsorbed at 315°C, under a pressure of 110 mm, the amt. desorbed was 3 times (by wt) the amt. adsorbed; consequently, this 1st portion of PH_3 had been oxidized by O_2 which was chemisorbed in the carbon. On C/Cu (4%) the total adsorption (reversible + irreversible) of PH_3 (under 100 mm) decreased with the temp. rising from 130 to 264°, and then increased somewhat with further rising temp. On powd. CuO and Cu_2O without carbon carrier, adsorption of PH_3 was 2 mg/g at room temp.; at 130°C, it was of the order of 9-10% of the wt of the oxide. Expts. of oxidation of gaseous mixts. $PH_3 + 2O_2$ on carbon/Cu (treated with NH_3) were made at 21°C under 0.4 mm Hg (higher pressures result in ignition). Chemisorption of PH_3 was evidently a necessary but not a sufficient condition for oxidation.

10038. Archibald, R.C.; May, N.C., and Greensfelder, B.S. **Experimental catalytic and thermal cracking at high temperature and high**

space velocity. *Ind. Eng. Chem.* 44, 1811-17 (1952).—*C.A.* 46, 10593*i*.

Three feed stocks were used: isopropylbenzene, *n*-hexadecane, and a heavy West Texas gas oil. Special induction-heated equipment was used and runs were made both with and without catalysts (silica-alumina). Coke formation during catalytic cracking was found to decrease with rise in temp. for the whole range studied. Coke reduction resulted from the higher volatility of the reactants and products, which diminished their retention on the catalyst, and from min. thermal and metal-catalyzed coking because of the short contact time.

10039. **Barkley, L.W.; Corrigan, T.E.; Wainwright, H.W., and Sands, A.E.** **Catalytic reverse shift reaction. A kinetic study.** *Ind. Eng. Chem.* 44, 1066-71(1952).—*C.A.* 46, 7733*f*.

A study was made of the feasibility of adjusting the ratio of H_2 to CO in synthesis gas by the use of the reverse shift reaction CO_2 (g) + H_2(g) $\rightleftarrows$ CO(g) + H_2O (g) by using the standard shift reaction catalyst. The kinetics of the reaction were studied, and a probable mechanism for the reaction was postulated. This method of adjusting the synthesis gas compn. was feasible, but that its use would depend upon the economic advantage of employing a large excess of superheated steam in the coal-gasification step.

10040. **Baron, Seymour.** **The kinetics of the catalytic formation of phosgene.** *Univ. Microfilms* (Ann Arbor, Mich.), *Pub.* No. 3319, 129 pp. (microfilm $1.61, paper enlargements $12.90);—*Dissertation Abstracts* 12, 10(1952).—*C.A.* 46, 7415*e*.

10041. **Bellini, G.** **Theoretical conditions to avoid carbon black formation in reforming of methane.** *Riv. combustibili* 5, 694-700(1952).—*C.A.* 46, 5292*c*.

The thermodynamics in reforming CH_4 and the equil. consts. at various temps. involving the Components CH_4, H_2O, H_2, CO, and CO_2 were discussed. From the consts. and temp. and pressure conditions (based on C_{gas}) the min. steam/CH_4 ratio for avoiding carbon black formation was calcd.

10042. **Colclough, R.O.** **Study of the mechanism of ionic polymerization using radioactive tracers.** *J. Polymer Sci.* 8, 467-75(1952).—*C.A.* 47, 5163*i*.

Styrene was polymerized in cyclohexane for 15 min.at 25°C by using $SbCl_5$ catalyst having radioactive Sb. The polymer soln. was brought into contact with activated char. All of the Sb was adsorbed by the char; none remained in the effluent polymer soln. Suggested polymerization mechanisms which required that catalyst remain attached to polymer chains were incorrect.

10043. **Dryden, I.G.C.** **Action of solvents on coals at lower temperatures. IV. Characteristics of extracts and residues from the treatment of coal with amine solvents.** *Fuel* 31, 176-99(1952).—*C.A.* 46, 4764*f*.

The application of pptn. by nonsolvents and by ions, dialysis and electrodialysis, chromatography, electrophoresis, chlorination, condensation with amines, and heats of wetting was reported. There was evidence that the coal particles in soln. had a wide size distribution, perhaps 90% being too large to pass through a Cellophane membrane and a small proportion probably being very small; the mean size of the colloidal portion may be independent of rank, at least up to 86% C content.

10044. **Falkum, E. and Glenn, R.A.** **Coal-hydrogenation-process studies. III. Effects of time on restricted hydrogenolysis of Spitsbergen coal with Adkins catalyst.** *Fuel* 31, 133-52 (1952).—*C.A.* 46, 4765*g*.

The effects of a no. of variables on the restricted hydrogenolysis of a Spitsbergen coal for the range 375-388°C for 72 hrs by using Adkins catalyst with no vehicle and a cold H_2 pressure of 1800 p.s.i. were studied, including the effects of time at the temps. 325°, 350°, 375°, and 400°C and also the effects of temp. for zero time over the range 325-470°C. The restricted hydrogenolysis of Spitsbergen coal occurred in two distinct stages which were influenced greatly by changes in temp. over the range studied.

10045. **Ghosh, J.C.; Bhattacharyya, S.K.; Muthanna, M.S., and Mitra, C.R.** **Electrolytic reactions on porous carbon anodes. I. The preparation of *p*-benzoquinone by the oxidation of benzene.** *J. Sci. Ind. Research* (India) 11B, 356-61(1952).—*C.A.* 47, 2064*e*.

The prepn. of *p*-benzoquinone by electrochem. oxidation of benzene in a special cell was studied for optimum conditions. The cell utilized a thick-walled carbon anode and Pb cathodes with an unglazed porcelain diaphragm between chambers. The anode was made of extruded wood charcoal and baked at 1300°C in a reducing atm. Its apparent porosity was 50.7%.

10046. **Ghosh, J.C.; Bhattacharyya, S.K.; Rao, M.R.A.; Muthanna, M.S., and Patnaik, R.B.** **Electrolytic reactions on porous carbon anodes. II. The preparation of chlorobenzene from benzene.** *J. Sci. Ind. Research* 11B, 361-64 (1952).—*C.A.* 47, 2064*g*.

Chlorobenzene was prepd. by electrolytic chlorination of benzene. Eighteen % HCl was used as the catholyte. The best current efficiency of 89% was obtained with cyanuric acid (1.34% of wt of the carbon anode), an anolyte of 100% soln. of monochloroacetic acid in concd. HCl, a temp of 38°C, and a c.d. of 4.3 amp./sq dm. for 2 hrs.

10047. **Gordon, Alvin S.** **The reaction between methane and steam in the temperature region 1000° to 1100°.** *Ind. Eng. Chem.* 44, 1857-9 (1952).—*C.A.* 46, 11637*a*.

Between 1000° and 1100°C at 1 atm. abs., the reaction of CH_4 with steam was probably a combination of CH_4 decompn. followed by the steam-carbon reaction. Until carbon was formed as a result of the decompn., steam behaved as an inert gas.

10048. **Hecker, Eberhard.** **Carbonization of American coals.** *Gas- u. Wasserfach* 93, 118-23(1952). —*C.A.* 46, 5294*b*.

The first American coal received in 1948 had a high S content, and the volatile matter content was so high that the resultant coke was weak even when only 10% was used in admixt. with German coals. More suitable coal was later bought on the basis of specifications and this gave excellent results. Carbonization results were reported for American coals for two periods. Under present conditions the American coal was as cheap delivered at the gas plants as suitable European coal.

10049. Khundkar, M.H. **Reduction of borax and boric oxide melts by carbon.** *J. Indian Chem. Soc.* **29**, 477-83(1952).—*C.A.* 47, 3743*i*.

The reducibility of B_2O_3 and $Na_2B_4O_7$ melts with various forms of carbon was studied between 900° and 1000°C. Appreciable reduction of $Na_4B_2O_7$ commenced at 900°C, and of B_2O_3 at 950°C. The rate of reduction was highest with active carbon, as compared to graphite and coke. With increasing amts. of carbon, the reduction reached a max. of 87.33% at a ratio of 3.75 carbon per 1.043 $Na_2B_4O_7$; further increases in carbon resulted in lower conversion rates. The rate of oxidation of carbon depended directly on the fluidity of the mass.

10050. Kotelkov, N.Z. **Catalytic properties of some activated carbons.** *Zhur. Priklad. Khim.* **25**, 337-41(1952).—*C.A.* 47, 5044*g*.

Rates of dehydrogenation of iso-PrOH, fed at the rate of 0.05 ml/min., were measured between 300° and 400°C on tech. active carbon reclaimed from wastes of furfural production, and on dendrite carbon formed in the decompn. of org. compds. The carbons, in amts. of 0.1-0.85 g, were supported on nichrome wire spirals. Activation energies (calcd. from 1st-order rate consts.) varied from 15.6-16.9 kcal on the dendritic and one industrial carbon, to 10 kcal on activated furfural waste carbon; on the latter, the conversion was 90.5% at 400° and it showed the highest heat of wetting with C_6H_6 and the fastest bleaching action on methylene blue.

10051. Long, F.J. and Sykes, K.W. **The effect of specific catalysts on the reactions of the steam-carbon system.** *Proc. Roy. Soc.* (London) **215A**, 100-10 (1952).—*C.A.* 47, 4180*f*.

The reactions of the steam-carbon system were studied by the static method at 750°C with extd. coconut charcoal to which Fe, Na, Ca, and Al were added separately. The steam-carbon reaction was catalyzed chiefly by Na, the CO_2-carbon reaction by Fe and Na, whereas the heterogeneous oxidation of CO by steam was enhanced by all the addns. except Al. The gasification of the carbon was unaltered. The general course of the gasification was not altered by the impurities in 2 main types of catalyst, the transition metals and the alkali metals. The added substances interacted with the gases to a much greater extent than did the natural impurities, though both were efficient catalysts.

10052. Long, F.J. and Sykes, K.W. **The catalysis of the carbon monixide-steam reaction.** *Proc. Roy. Soc.* (London) **215A**, 111-19(1952).—*C.A.* 47, 4581*f*.

The kinetics of the CO-steam reaction occurring heterogeneously at the surface of coconut charcoal were detd. before and after the extn. of the metallic impurities. The impurities catalyzed the reaction. The results were attributed to active sites consisting of surface C atoms more firmly bound to the rest of the lattice than those attacked during gasification of the C by steam or CO_2.

10053. Minachev, Kh. M.; Shuĭkin, N.I., and Rozhdestvenskaya, I.D. **Poisoning of platinum catalysts with low contents of the active metal on a carrier, in dehydrogenation catalysis.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* **1952**, 603-15.—*C.A.* 46, 10823*g*.

Dehydrogenation of cyclohexane was run, without externally fed H_2, on 2.5 g of catalysts contg. 3.21, 1.41, 0.62, and 0.37% Pt on activated carbon, reduced in H_2 4 hrs at up to 310°C; the feed rate of cyclohexane in all expts. was 0.5 ml/5 min. Poisoning was done at 280°C as long as there was no H_2S in the outgoing gas. The different poisons had about the same action, except than on 3.21% Pt, PrSH, iso-AmSH, and thiophene, lowered the activity more rapidly than did the other poisons. Pt on silica gel was poisoned more easily than Pt on carbon, and Pt on ultraporous glass even more easily. The relatively low susceptibility of Pt on carbon to poisoning was attributed to its large sp surface area.

10054. Mulford, Robert N.R. and Russell, W. Walker. **Catalytic hydrogenation of the oxides of carbon to higher hydrocarbons.** *J. Am. Chem. Soc.* 74, 1969-74(1952).—*C.A.* 46, 7738*h*.

The synthesis of hydrocarbons from H_2, CO, and CO_2 at atm. pressure was studied upon ceria-promoted, Cu-contg. Co catalysts to which was added CO_3^{2-}, Cl^-, SO_4^{2-}, $S_2O_3^{2-}$, or S^{2-} as Na or K salts prior to catalyst pptn. All catalysts produced oil when the initial CO_2-H_2 mixt. was first passed over a supported Fe, water-gas catalyst; with no water-gas catalyst present only the Co catalysts contg. K_2CO_3 or K_2SO_4 produced oil. Catalyst additives altered the distribution between liquid and gaseous synthesis products.

10055. Nistler, Friedrich. **New methods for producer-gas generation from bituminous coal.** *Glückauf* **88**, 346-9(1952).—*C.A.* 46, 7736*e*.

Preheated air and coal dust were admitted tangentially through nozzles to the cyclone-shaped producer. The turbulent gas flow caused the liquefied slag to be thrown to the walls of the chamber; the liquid slag then drained down into a water bath where it was granulated. The producer gas was freed from the larger suspended particles in a cyclone, and flowed through an air preheater and a waste-heat boiler. The gas was then further purified by means of a multiclone, a washer, and an elec. precipitator. The resulting gas was similar to blast-furnace gas, with a gross heating value of about 1051 kcal/m³.

10056. Padovani, C. **The chemical utilization of natural gas.** *Riv. combustibili* 6, 84-104(1952). —*C.A.* 46, 8350*d*.

Natural gas was decomposed to obtain carbon black or higher hydrocarbons depending on conditions used. CH_4 at 1 atm. began to dissoc. at 400°C, and the dissocn. was practically complete at 900°C. To attain a higher reaction rate, temps. higher than 1000°C were employed. The use of metallic catalysts to increase the rate caused difficulties as they form carbides which set up secondary equil. with CH_4 and products of decompn. The reaction was essentially a surface type and was influenced by inert material placed in tubes. Addn. of H_2 retarded cracking and gave better yields of higher hydrocarbons. Addn. of N_2 retarded it to some degree. Temp. of 1000°-1200°C and times of 0.1 sec were employed.

10057. Patai, Saul; Hoffmann, E. and Rajbenbach, L. **The oxidation of carbon by air. I. Catalysis in the oxidation of carbon black by air.** *J. Applied Chem.* (London) 2, 306-10(1952).—*C.A.* 46, 10817*c*.

The influence of K salts of various anions and that of the chlorides of alk. earth and alkali metals on the oxidation by air was investigated. Tablets were pressed from ground mixts. of carbon black and various amts. of the salts. A part of the sample was weighted and degassed in the reaction chamber of the evacuated app. at about 250°C, then withdrawn. The reaction chamber was heated to the desired temp., air admitted till the initial pressure (generally 200 mm) was established and the sample reintroduced. The pressure drop was measured manometrically and at the end of the reaction the residual gas analyzed for CO and O_2. CO_2 was absorbed by ascarite. Most of the measurements were carried out at 367°C. Strong basicity of the salt-catalyst seemed to be a sufficient condition for high activity.

10058. Patai, Saul; Rajbenbach, L., and Hoffmann, E. **The oxidation of carbon by air. II. Catalytic effects in the oxidation of graphite, Nuchar, and sugar charcoal by air.** *J. Applied Chem.* 2, 311-14(1952).—*C.A.* 46, 10817*g*.

The rate of oxidation of graphite by air was measured at 453°C, for Nuchar at 306°C, and of sugar charcoal at 273°C. The exptl. curves obtained in the kinetic measurements could be presented by a second-order kinetic equation. Salts of strongly basic reaction, such as K_2CO_3 and K_3PO_4, which had a very marked effect as catalyst, enhanced the breakdown of the surface oxides. Other active salts, e.g. KI and LiCl. work as O_2 carrier.

10059. Patry, Marcel. **Manufacture of hydrogen from natural gas.** *Chimie & Industrie* 67, 399-409(1952).—*C.A.* 46, 6808*e*.

The natural-gas-reforming plant, built by Chem. Construction Corp. in Toulouse, France, for Onia, and the BASF plants at Oppau, Ludwigshafen, Germany, and Pierrefittes, Pyrenees, France, were described. The last one used natural gas to react with steam and O_2 in the presence of a catalyst.

10060. Powell, Alfred R. **Relation of coal gasification to the production of chemicals.** *Gasification and Liquefaction of Coal Symposium, Ann. Meeting AIME, New York, N.Y.*, Feb. 20-1, 1952, 196-296.—*C.A.* 47, 4580*h*.

The possible production of a mixt. of H_2 and CO by direct gasification of coal was discussed. The largest potential use of synthesis gas made from coal was an as intermediate in the Fischer-Tropsch type of process for manuf. of synthetic liquid fuel. Many oxygenated products could be recovered and marketed, including alcs., aldehydes, ketones, and aliphatic acids.

10061. Rao, M.N. and Hougen, O.A. **Catalytic oxidation of nitric oxide on activated carbon.** *Chem. Eng. Progress Symposium Ser.* 48, No. 4, *Reaction Kinetics and Transfer Processes*, 110-24(1952).—*C.A.* 47, 2025*e*.

The oxidation of NO to NO_2 using activated carbon as a catalyst was studied in a series-type flow reactor. The catalytic reaction using activated carbon followed the same apparent mechanism as that using silica gel as the catalyst. This mechanism consisted of the formation of the NO complex $(NO)_2$, equil. adsorption of the complex on single sites of the catalyst, surface reaction between the O_2 in the gas phase and the adsorbed complex, and finally desorption of the NO_2. The surface reaction was the rate-controlling step.

10062. Rayner, J.W.R. **Gasification by the moving-burden technique.** *J. Inst. Fuel* 25, 50-9; *Gas Times* 70, 30, 32, 37, 39(1952).—*C.A.* 46, 4197*i*.

Coke was blown from the carbonizing chamber into the combustion tube; cyclones at the top of this tube caught the larger part of the ash and partly burned coke and returned this to the carbonizing chamber, while the combustion products passed through a secondary combustion chamber to which was also led dust purged from the bottom of the carbonizing chamber. The gases from this secondary combustion chamber were passed through a boiler, heat exchanger for heating air for the combustion chamber, through dedusting equipment, and to the stack. Gas from the carbonizing and steaming chamber was passed through a waste heat boiler, heat exchanger (for heating steam used in carbonizing and steaming chamber), an economizer, cyclone for removing dust, scrubber, and disintegrater.

10063. Rayner, J.W.R. **Gasification by the moving-burden technique. II.** *Gas Times* 70, No. 757, 103, 106, 109(1952).—*C.A.* 47, 290*f*.

The problem of dust losses from the coke gasification process was discussed. Operating data were given for a 400-kg hr coal-gasification process. Both a coking coal and a slightly caking coal (minus 1/8 in.) were satisfactorily carbonized at 930°-950°C in a bed fluidized with steam. The plant operated smoothly with no build-up of deposits in the units. Temps. could be controlled within ±5°.

10064. Savich, T.R. and Howard, H.C. **Oxidation of bituminous coal to organic acids by nitric acid and oxygen.** *Ind. Eng. Chem.* 44, 1409-11 (1952).—*C.A.* 46, 8347*g*.

Twenty-g samples of —200 mesh Pocahontas No. 3 coal were slurried in a rocking autoclave with 200 ml of HNO_3 of specified concn. and O_2 at 400 p.s.i.g. At 110°C, the reaction was too slow, except with 16 *M* acid. With 0-4.5 *M* acid, oxidation proceeded at a satisfactory rate at nearly 200°C, optimum conditions being 1-2 *M* acid at 190°C. With 4.5 *M* acid, the max. yield of sol. acids was obtained at 170°C for 4-8 hrs. Increase of O_2 pressure in the range 400-600 p.s.i.g. was without significant effect. Considerable corrosion of the stainless steel reactor was observed above 120°C.

10065. Schuster, Fritz. **Coke and gas production of gas works, with special attention to the**

use of noncaking or poorly caking coals. *Gas- u. Wasserfach* 93, 57-67(1952).—*C.A.* 46, 4198*i*.

The practical upper limit for coke production was reached for a const. heating value gas composed of coal and water gas, when the oven was heated with coal gas and light oil was removed as completely as possible. Complete gasification of coal in a gas plant had the advantage that a wide range of coals could be used without paying the premium for scarce high-volatile coals, and that the gas plant operation became more flexible.

10066. Swann, Sherlock Jr.; Chen, C.Y., and Kerfman, H.D. **Electrolytic reduction of organic compounds at carbon cathodes.** *J. Electrochem. Soc.* 99, 460-6(1952).— *C.A.* 47, 53*f*.

Cathodes of graphite, gas-baked coke, and lampblack were compared in relative activity against each other in the reduction of maleic acid, pyridine, acetophenone oxime, benzophenone oxime, diethyl ketoxime, K benzenediazotate, azobenzene, *N*-benzohydrylideneaniline, and K glyoxylate in alk. soln. in diaphragm divided cells. Lactic acid was tested in a cell without diaphragm. Generally, graphite electrodes were most effective in reductions.

10067. Tesner, P.A. and Rafal'kes, I.S. **Formation of carbon on the surface in the thermal decomposition of hydrocarbons.** *Doklady Akad. Nauk S.S.S.R.* 87, 821-4(1952).—*C.A.* 47, 3671*e*.

Mixts. of CH_4, C_2H_2, and C_6H_6, with N_2, were passed at temps. from 700° to 1000°C over lampblack or Pt, and the amts. of carbon deposited as a result of the decompn. were detd. by weighing. With the rate of carbon deposition from pure CH_4 taken as unity, the relative rates in the mixts. were proportional to the hydrocarbon content; the N_2 acted only as a diluent. Exptl. points for the 3 hydrocarbons lie on the same straight line. On Pt, porcelain, quartz, Al_2O_3, and aluminosilicate the rate was slower than on a carbon surface and increased gradually as the surface became coated with carbon. The amt. of H_2 collected corresponds stoichiometrically to the amt. of carbon deposited.

10068. Watanabe, Jun and Shiramoto, Tomizo. **Activated-carbon electrodes for air-depolarized wet cells. II. The decomposition of hydrogen peroxide by activated charcoal (2).** *J. Electrochem. Soc. Japan* 20, 135-7(1952).—*C.A.* 47, 52*e*.

The relation between the temp. and the logarithm of the velocity const. k_1 of primary decompn. of H_2O_2 by activated charcoal was almost linear, and the tangent of the line was nearly 0.024. The relation between the wt of charcoal M and k_1 was not linear: $k_1/k_1' = (M/M^n)^n$, where n was 1.2-1.3. The effect of pH on k_1 and the type of decompn. was large. With α-type charcoal activated by NH_4Cl the values of k_1 dropped steeply at about pH 3, but with the β-type charcoal activated by $MgCl_2$, k_1 dropped at about pH 7.

10069. Watanabe, Jun and Shiramoto, Tomizo. **Activated carbon electrodes for air-depolarized wet cells. III. The decomposition of hydrogen peroxide by activated charcoal.** *J. Electrochem. Soc. Japan* 20, 386-90(1952).—*C.A.* 47, 2060*d*.

When wood charcoal was heated in a current of NH_3 gas, the N-content of the charcoal increased and the charcoal was activated to a very high degree. The degree of activity was correlated to the decompn. velocity of H_2O_2. The catalytic activity of the charcoal depended on the temp., the NH_3 gas rate, and the reaction time but not upon the N-content.

10070. Whittingham, G. **Production of sulfur trioxide during the combustion of carbon in air containing small quantities of sulfur dioxide.** *Nature* 169, 155-6(1952).—*C.A.* 46, 5293*i*.

SO_2 was oxidized to SO_3, but if the latter passed over carbon in an O_2-depleted atm., it was again reduced to SO_2.

10071. Musaev, I.A. and Gal'pern, G.D. **Catalyst for analytic hydrogenation and dehydrogenation of hydrocarbons.** *Doklady Akad. Nauk S.S.S.R.* 88, 71-2(1953).—*C.A.* 47, 5233*h*.

Active carbon impregnated overnight with a mixt. of solns. of H_2PtCl_6 and of $FeCl_3$, evapd. to dryness, and reduced in a stream of H_2 for 6-8 hrs at a temp. gradually raised from 150° to 180°C, provided a catalyst on which C_6H_6, passed at 180°C in a stream of H_2, was hydrogenated to cyclohexane in a single pass, and cyclohexane passed at 300°-305°C in a weak stream of H_2 was dehydrogenated to C_6H_6. On the other hand, this catalyst failed to act on methylcyclopentane in a stream of H_2 at 300°, or on indane, whereas platinized carbon without Fe did open the cyclopentane ring, and converted indane to *o*-methylethylbenzene.

10072. Pelipetz, M.G.; Salmon, J.R.; Bayer, James, and Clark, E.L. **Catalyst-pressure relationship in the hydrogenolysis of coal.** *Ind. Eng. Chem.* 45, 806-9(1953).—*C.A.* 47, 5661*h*.

In order to det. the interchangeability of catalyst activity and H_2 pressure, tests were made on specific reaction rates for the hydrogenolysis of Rock Springs coal in the presence of Sn and Mo catalysts at several H_2 pressures. Because the conversion was a 1st-order reaction, a plot of the specific reaction rates as a function of pressure resulted in a numerical dependence between H_2 pressure and catalyst activity.

10073. Robinovich, E. Ya.; Snegireva, T.D., and Tesner, P.A. **Specific catalytic activity of carbon.** *Doklady Akad. Nauk S.S.S.R.* 88, 95-7 (1953).—*C.A.* 47, 5233*i*.

Channel carbon black of 100 m^2/g proved to have a definite cracking catalytic capacity, as the degree of decompn. of paraffins at 500-20°C, on the carbon, was 3-4.5 times as great as in an empty tube at the same temp. For an acetylene carbon of 65 m^2/g, the sp cracking activity was of the same order. At the end of the 135 hrs, 4-5 new at. layers of carbon were added to the original carbon black, and, consequently, the cracking was taking place most of the time on new carbon formed through the very cracking; consequently the newly deposited carbon has the same activity as the original carbon black. In cracking on an aluminosilicate catalyst, in which carbon is deposited in the course of the process, the B.E.T. surface area of the catalyst was found to remain very nearly const. as long as the amt. of carbon deposited did not exceed 3%.

V-14. Catalytic Processes on Non-Carbons

10074. Bodenstein, M. and Fink, C. G. **Heterogeneous catalytic reactions. IV. Kinetics of contact sulphuric acid.** *Z. physik. Chem.* **60,** 1-45 (1907).—*C.A.* **1,** 2849^5.

The velocity of the reaction on the immediate surface of the Pt was assumed to be very great. The surface was protected by a layer of adsorbed SO_3 thru which the SO_2 and O_2 must diffuse. The velocity of the reaction ordinarily depended only on the rate at which the more slowly diffusing gas (SO_2) passed thru this layer of SO_3. When the concn. of the O_2 was relatively small, its rate of diffusion thru the SO_3 layer was the detg. factor in the reaction.

10075. Sabatier, Paul. **Action of metallic oxides on primary alcohols (reducible oxides).** *Compt. rend.* **147,** 16-8 (1908).—*C.A.* **2,** 3057.

Sb_2O_5, Sb_2O_3 and Bi_2O_3 were reduced to the metals when heated with EtOH vapor at 360°C. The metallic powders did not have appreciable catalytic influence. NiO, CoO, PbO_2, Pb_3O_4, PbO, Cu_2O, CuO were reduced to the metals when heated with EtOH vapor at 350°C, and the metals acted catalytically on the alc., giving aldehyde and H_2. WO_3 and EtOH at 350°C gave a blue oxide intermediate between WO_2 and WO_3.

10076. Sabatier, Paul and Mailhe, A. **New applications of hydrogenation by divided metals.** *Ann. chim. phys.* **16,** 70-107 (1909).—*C.A.* 3, 1274.

Hydrogenation of various compds. was accomplished by passing the vapors with an excess of H_2 over finely-divided Ni at various temps.

10077. Hartley, H. **Electrical condition of a gold surface during the adsorption of gases and their catalytic combustion.** *Proc. Roy. Soc.*(London)**A90,** 61-8 (1914).—*C.A.* **8,** 2102..

A Au surface acquired a negative charge during the catalytic combustion of gases in contact with it. The metal became negatively charged during the occlusion of combustible gases (H_2 or CO) and positively charged during the occlusion of O_2.

10078. Reichinstein, D. **Relationship between electrolytic and purely chemical processes. III.** *Z. Elektrochem.* **20,** 406-17 (1914).—*C.A.* 8, 3760.

The soln. of Ni in $H_2O_2 + H_2SO_4$ soln. took place in steps: (1) Adsorption of H_2O_2; (2) $H_2O_2 \rightarrow O + H_2O$; (3) $2O \rightarrow O_2$; (4) $Ni + O + 2H^+ \rightarrow Ni^{++} + H_2O$. In a soln. 0.970 *N* H_2O_2 and 0.045 *N* H_2SO_4, the passivity of Ni lasted about 90 min.; in a soln. 0.423 *N* H_2O_2 and 0.057 *N* H_2SO_3, the passivity lasted about 170 min.

10079. Reichinstein, D. **Relationship between electrolytic and purely chemical processes. IV.** *Z. Elektrochem.* **21,** 359-72 (1915).—*C.A.* 9, 3019.

The slow passivation of Ni in CrO_3 was explained by the slow O_2 formation in the electrode surface. The reaction proceeded in 4 stages: (1) adsorption of a part of the liquid phase (H^+ and oxidizing agent) by the Ni; (2) $H_2O_2 = H_2O + O$, or $2CrO_4^{--} + 10\ H^+ = 2\ Cr^{+++} + 5\ H_2O + 3\ O$; (3) assocn. of a part of the atomic O in the electrode surface vol.; (4) the soln. process $Ni + O + 2\ H^+ = Ni^{++} + H_2O$.

10080. Lemoine, G. **Catalysis of hydrogen peroxide in heterogeneous media. II. Experiments with platinum.** *Compt. rend.* **162,** 657-63 (1916).—*C.A.* **10,** 1959.

The time required for 50% decompn. of H_2O_2 (8.6% soln.) alone and in the presence of Pt black and Pt sponge was measured. With Pt black the decompn. was very regular, but extraordinarily rapid. The time of half-decompn. decreased rapidly with increasing quantities of catalyzer and increased with decreasing concn. of H_2O_2.

10081. Lemoine, G. **Catalysis of hydrogen peroxide in heterogeneous media. III. Experiments with oxides.** *Compt. rend.* **162,** 702-8 (1916).—*C.A.* **10,** 1959.

Fe_2O_3 (pptd. and dried at 180°C) caused a rapid decompn. of H_2O_2, increasing the speed of decompn. 5790 times for 21°C and 770 times for 70°C. Expts. were also made with CeO_2, SiO_2 and ThO_2; in each case an increase was found.

10082. Tschischewski, N. **The occurrence and influence of nitrogen in iron and steel.** *Engineering* **101,** 171-3, 217-19 (1916).—*C.A.* **10,** 1321.

When Fe, Mn or Al was heated and exposed to the action of NH_3, considerable N was adsorbed with the formation of nitrides. With Fe the temp. optimum was about 600°C and about 8.9% N taken up. In the case of Fe nitride, the N was obtained almost entirely as NH_4Cl when the metal was dissolved in HCl. Mechanical tests proved that the presence of N had a considerable effect especially with regard to the elongation. The hardness of the metal was increased and the elasticity reduced.

10083. Maxted, E. B. **The influence of lead on the catalytic activity of platinum.** *J. Chem. Soc.* **117,** 1501-6 (1920).—*C.A.* **15,** 1646.

The poison effect for a given quantity of Pt catalyst was a linear function of the quantity of Pb. One mg of Pb appeared to inhibit completely the catalytic activity of 8.8 mg of Pt as shown by the velocity of adsorption of H_2 by oleic acid induced by catalytic Pt. This velocity of adsorption varied directly with the wt of Pt. These results were analogous to those observed on the inhibition of occlusion of H_2 by Pd due to H_2S.

10084. Iredale, Thomas. **The role of protective colloids in catalysis.** *J. Chem. Soc.* **119,** 109-15 (1921).—*C.A.* **16,** 189.

The inhibitive effect of protective colloids on the catalytic decompn. of H_2O_2 by colloidal Pt was found to be in the following order: gelatin and glue, egg albumin, gum arabic, sucrose (the last having no effect). The stronger the substance as a protective colloid, the greater its inhibition of catalytic activity; in the case of gelatin inhibition was noticeable at dilutions of 0.000005%.

10085. LANGMUIR, I. **The mechanism of catalytic action of platinum in the reactions $2CO + O_2 \rightarrow 2CO_2$ and $2H_2 + O_2 \rightarrow 2H_2O$.** *Trans. Faraday Soc.* **17**, 4 (Advance Proof) (1921).—*C.A.* **16**, 864.

Pt wires were heated in mixts. of CO and O_2 or H_2 and O_2 at pressures below 1000 dynes per cm^2, the products of the reaction being condensed by liquid air. The rate of decrease in pressure served as a measure of the reaction velocity. With the Pt at 750° to 1050°K the velocity was practically independent of the temp., being limited largely by the rate at which the gases came in contact with the surface. With an excess of O_2, the velocity was proportional to the pressure of CO, while with an excess of CO the rate was proportional to the pressure of O_2. Every O_2 mol. which hit a clean Pt surface condensed on the surface in the form of single atoms combined with sep. Pt atoms. The adsorbed O atoms were very active in their ability to react with CO.

10086. MAXTED, EDWARD BRADFORD. **Influence of mercury, sulfur, arsenic and zinc on the catalytic activity of platinum.** *J. Chem. Soc.* **119**, 225-33 (1921).—*C.A.* **15**, 1646.

The rate of absorption of H_2 by 3 ml of oleic acid dissolved in 9 ml of acetic acid in the presence of 5 mg of active Pt was const. almost to the satn. point both with and without poisons. The inhibitive effect of Hg was a linear function of the Hg present in the reacting mixt. almost down to complete extinction of activity. The residual catalytic activity decreased less rapidly with increasing Hg content. With S this point was somewhat lower than with Hg, while As and Zn deviated from the linear course at a slightly higher point.

10087. ADKINS, H. **The selective activity of alumina for decarboxylation or for dehydration.** *J. Am. Chem. Soc.* **44**, 2175-86 (1922).—*C.A.* **16**, 4116^6.

The catalytic effect of Al_2O_3 from different sources was tested on the decompn. of AcOEt to Me_2CO, CO_2 and C_2H_4. The catalysts were prepd. by ignition of $Al(OH)_3$ that had been prepd. both by pptn. in aq. soln. and by slow decompn. of Al alkoxides with H_2O vapor. The size and shape of the alkyl group replaced detd. the size of the interstices left in the catalyst when the OH was later eliminated as H_2O. The reaction was carried out at 465°C. The highest yields of C_2H_4 were obtained with Al_2O_3 from $Al(OH)_3$ which had been prepd. by pptn. in aq. soln.

10088. ARMSTRONG, E. F. AND HILDITCH, T. P. **Discussion on heterogeneous reactions.** *Trans. Faraday Soc.* **17**, 669-70 (1922).

From expts. on hydrogenation of unsat. org. liquids in presence of Ni, the primary action was thought to be between Ni and the org. compd., and the resulting unstable intermediate complex. H_2 must react either by collision with the Ni-ethylenic compd. complex or by preliminary assoc. of H_2 with Ni.

10089. LENHER, V. **Some properties of selenium oxychloride. II.** *J. Am. Chem. Soc.* **44**, 1664-7 (1922).—*C.A.* **16**, 3277.

A small amt. of moisture materially modified the behavior of $SeOCl_2$ and a high degree of purity was essential that its behavior be not confused with reactions not due to $SeOCl_2$ itself. $CoCO_3$ formed a sensitive detector of moisture. Reactions of $SeOCl_2$ with 16 additional substances were described.

10090. RUFF, O. **Reactions at metal boundary surfaces.** *Z. physik. Chem.* **100**, 419-24 (1922).—*C.A.* **16**, 2058.

Ca, alloyed with more positive metals or with Ca_3M_2, took up N_2 more readily than pure Ca.

10091. ADKINS, H. AND NISSEN, B. H. **Selective activation of alumina. II. Reactions of formic acid at the surface of alumina.** *J. Am. Chem. Soc.* **45**, 809-15 (1923).—*C.A.* **17**, 2104.

The effect of H_2O and temp. was studied on the decompn. of HCOOH passed over (1) Al_2O_3 prepd. from Al-Hg and H_2O, (2) Al_2O_3 from $(Me_2CHO)_3Al$ on pumice (3) Al_2O_3 from $(Me_2CHO)_3Al$ in pills, (4) Al_2O_3 from $(BuO)_3Al$ on pumice, (5) glass wool, and (6) pumice. The amts. of H_2 and CO_2 formed agreed with the reactions $HCOOH = CO_2 + H_2$ and $HCOOH = CO + H_2O$. The results indicated that Al_2O_3 may be selectively activated towards the 2 reactions by modifying the distance between the Al atoms.

10092. ALMQUIST, J. A. AND BRAY, W. C. **Catalytic oxidation of carbon monoxide. I. Efficiency of the catalysts, manganese dioxide, cupric oxide and mixtures of these oxides.** *J. Am. Chem. Soc.* **45**, 2305-22 (1923).—*C.A.* **17**, 3824.

Temp. efficiency curves were obtained for 3 series of partially hydrated porous catalysts of MnO_2 and CuO. Pronounced improvement in activity was caused by the addn. of small amts. of either oxide to the other. Partial dehydration was necessary to bring a catalyst to the region of max. activity, but with little change in the efficiency. Continued dehydration however finally lowered the efficiency and caused loss of O_2 (except in the case of CuO).

10093. BOSWELL, M. C. AND MC LAUGHLIN, R. R. **The mechanism of catalysis by platinum.** *Trans. Roy. Soc. Can.* (3) **17**, 1-20 (1923).—*C.A.* **18**, 1077.

The prepn. of Pt black was minutely described. H_2, O_2 and mixts. of H_2, O_2 and N_2 of known compn. were passed over and the changes in vol. of the gases and the H_2O formed were detd. Charged O and H atoms and OH groups in the adsorption films reacted stoichiometrically with H_2 and O_2.

10094. KINGDON, K. H. AND LANGMUIR, I. **The removal of thorium from the surface of a thoriated tungsten filament by positive-ion bombardment.** *Phys. Rev.* 22. 148-60 (1923).—*C.A.* **18.** 17.

The removal of Th by positive-ions of A, Cs, He, H, Ne and Hg as a function of voltage and time was studied. A, Cs, Hg, and Ne ions all started to sputter the Th at about 50 v. To explain the fact that the amt. of Th sputtered did not increase linearly with the time at the beginning, it was suggested that some Th atoms were driven into the filament by the first impacts; if one of these depressed atoms was struck again the ion was reflected and knocked off one of the surrounding Th atoms.

10095. PEASE, R. N. **Catalytic combination of ethylene and hydrogen in the presence of metallic copper. II. Measurements of reaction velocity at 150°, 200° and 250°C.** *J. Am. Chem. Soc.* **45**, 2235-42 (1923).—*C.A.* **17**, 3823.

The reaction was more nearly bimol. in the region 150-250°C than at 0°C where it was approx. monomol. with respect to H_2 and partially inhibited by excess of C_2H_4. Non-adsorption of the gases by the catalyst probably accounted for the more nearly normal character of the reaction at the higher temps.

10096. SANDONNINI, C. **The behavior of some metals as catalysts. II.** *Gazz. chim. ital.* **53**, 453-61 (1923).—*C.A.* **18**, 190⁹.

Temps. ranging from 250° to 720°C were used. The results showed that carbon may not be considered a catalyst for detonating gas. At temps. from 300° to 500°C, carbon adsorbed O_2, which it gave off at higher temps. as CO and CO_2. Finely divided Ni, besides being an active catalyst for the detonating mixt., was also a catalyst for the reaction that led to the oxidation of carbon.

10097. SCHLENK, W. AND WEICHSELFELDER, T. **Nickel hydride and the mechanism of hydrogenation with nickel catalyzers.** *Ber.* **56B**, 2230-4 (1923).—*C.A.* **18**, 207.

A Ni ethersol, prepd. by action of Ph-Mg bromide in Et_2O soln. on anhyd. $NiCl_2$ under N_2, absorbed H_2 avidly, the dark-brown soln. being decolorized with formation of a black finely flocculent ppt. The vol. of H_2 absorbed corresponded closely to NiH_4 but after drying in a current of H_2 the solid corresponded to NiH_2. The hydride was stable in Et_2O. Contact with atm. O_2 rendered it inactive at ordinary temp. Catalytic action of Ni in hydrogenation may be due to formation of hydride.

10098. WHITESELL, W. A. AND FRAZER, J. C. W. **Manganese dioxide in the catalytic oxidation of carbon monoxide.** *J. Am. Chem. Soc.* **45**, 2841-51 (1923).—*C.A.* **18**, 613.

The prepn. of MnO_2 by methods which gave a product little contaminated by adsorbed alkali resulted in a material which was catalytic in the oxidation of CO as low as -20°C. It was rapidly poisoned by H_2O, but resumed its activity when the H_2O was removed by heating. CO_2 had no poisoning effect. The CO adsorbed by the oxide was desorbed as CO_2. Since this material was more active than Hopcalite, it was suggested that the function of the promoters in the latter was merely to neutralize the deleterious effects of the impurities present.

10099. ADKINS, H. AND LAZIER, W. A. **Organic reactions at the surfaces of dehydrogenating catalysts.** *J. Am. Chem. Soc.* **46**, 2291-305 (1924).—*C.A.* **18**, 3357.

Two distinct types of Ni were produced thru reduction by EtOH and by H_2. The catalysts were different in their ability to promote hydrogenation of C_2H_4, considerably different in their power to dehydrogenate EtOH, and very different in their ability to break C-C linkages in AcH and other compds. The proportion of reactions taking place at the surface of ZnO and Fe_2O_3 may be modified by prepg. these oxides from the hydrates or hydroxides and from different metallic alkoxides. The spacing of the active points of a Ni catalyst was a matter of fundamental importance.

10100. ADKINS, H. AND NISSEN, B. H. **Causation of organic reactions by alumina and theories of catalysis.** *J. Am. Chem. Soc.* **46**, 130-45 (1924).—*C.A.* **18**, 1982³.

The nature of the rearrangement and subsequent reaction on a catalyst was detd. by the spatial configuration of the catalyst. The formation of ketones from acids, of nitriles from amides and of olefins from alkyl halides was not affected by modifications in the spatial configuration of the Al catalysts. The reactions of esters and alcs. were quite sensitive.

10101. BROWN, A. B. AND REID, E. E. **The catalytic alkylation of ammonia.** *J. Phys. Chem.* **28**, 1067-76 (1924).—*C.A.* **19**, 35.

The alkylation of NH_3 by MeOH, EtOH, PrOH and BuOH was measured by passing the alc. vapors with NH_3 over catalysts at 300°-500°C. The order of effectiveness was: special silica gel; silica gel impregnated with thoria, ZrO_2; silica gel impregnated with NiO, alumina, com. silica gel, blue oxide of W. Silica gel showed wide variations in its activity with seemingly slight variations in its prepn.

10102. FORESTI, B. **Catalysis through the action of subdivided metals. II. The thermal effect of the hydrogenation of ethylene on the surface of finely divided nickel.** *Gazz. chim. ital.* **54**, 132-46 (1924).—*C.A.* **18**, 2634.

The hydrogenation of C_2H_4 occurred in 3 phases: (1) adsorption of C_2H_4 and of H_2 by the Ni; (2) combination of adsorbed mols. to give adsorbed C_2H_6; (3) evapn. of adsorbed C_2H_6 from the surface of the Ni. The mol. heat of adsorption by Ni at const. vol. for C_2H_4 was 5845.6 cal. and for C_2H_6 5004.7 cal.

10103. GAUGER, A. W. **Critical potentials of hydrogen in the presence of nickel catalyst.** *J. Am. Chem. Soc.* **46**, 674-80 (1924).—*C.A.* **18**, 1226.

A Ni grid activated by dipping it in HNO_3 and $Ni(NO_3)_2$ soln. and subsequent reduction with H_2 at 300°C after drying in air at 400°C was subjected to electronic bombardment in a vacuum tube, The breaks obtained in the photoelectric current-grid voltage curves were 10.4, 120.0, 13.6, 16.4, 18.2, 20.5, and 22.6 v., four of these being attributed to the atom, two to the mol. and one to the Ni-H complex.

10104. HURST, W. W. AND RIDEAL, E. K. **Promoting action of palladium on copper. I. Catalytic combustion.** *J. Chem. Soc.* **125**, 685-94 (1924).—*C.A.* **18**, 1775.

The ratio of CO to H_2 burned in a mixt. of gases containing O_2 at the surface of Cu and at surfaces of Cu + Pd was measured. A specific promoting effect was observed and the addition of Pd to Cu definitely increased the ratio CO: H_2.

10105. PALMER, W. G. AND CONSTABLE, F. A. **The catalytic action of copper. IV. The periodic variation of the activity with temperature of reduction.** *Proc. Roy. Soc.* (London) **106A**, 250-68 (1924).—*C.A.* **19**, 204.

Expts. were made with Cu catalysts reduced from 220° to 420°C. A curve showing 3 max. was obtained for the reaction velocity at any const. temp. plotted against temp. of reduction. With a temp. of reduction of 420°C a profound change took place in the structure of the Cu film. Its activity was permanently raised and the periodic curve showed much less sharp max. and min.

10106. ARMSTRONG, E. F. AND HILDITCH, T. P. **A study of catalytic actions at solid surfaces. XII. Some observations relative to those particles of a catalyst which participate in chemical change.** *Proc. Roy. Soc.* (London) **108A**, 111-20 (1925).—*C.A.* **19**, 2443.

Expts. on the hydrogenation of whale oil in the presence of Ni catalysts and the toxic action of impurities were in accordance with the earlier concept of "active patches or particles" in the surface of the catalyst. Taylor's concept of isolated or semi-isolated Ni atoms was not completely satisfactory.

10107. BONE, W. A. AND ANDREW, G. W. **Studies upon catalytic combustion. I. The union of carbon monoxide and oxygen in contact with a gold surface.** *Proc. Roy. Soc.* (London) **A109**, 459-76 (1925).—*C.A.* **20**, 537.

The catalytic combn. of CO and O_2 on a Au wire gauze at about 300°C and pressures below 1 atm. was studied by a static method. The gas mixts. contained CO and O_2 in the proportions $2CO/O_2$, CO/O_2, and $4CO/O_2$. The final const. rate of reaction attained with the $2CO/O_2$ mixt. after prolonged operation was regarded as the "normal" activity and was used as the reference state. The normal catalytic activity of the catalyst could be greatly reduced by cooling the catalyst down to room temp. or by evacuating it at the reaction temp., and could be increased by previous exposure to CO or O_2 at 300°C.

10108. KAUTSKY, H. **Chemiluminescence.** *Trans. Faraday Soc.* **1925** (Advance Proof).—*C.A.* **20**, 551.

The chemiluminescent spectrum emitted by either rhodamine B or rhodamine sulfonate adsorbed on colorless oxidation products of $Si_6O_3H_6$, when the latter were oxidized either in soln. by permanganate or dry by O_3, was the same as the fluorescent spectrum of the adsorption compd. These dyes adsorbed on silicic acid may be oxidized by $KMnO_4$ but no chemiluminescence appeared.

10109. KUBOTA, B. AND YOSHIKAWA, K. **The toxicity of thiphene for nickel catalyzer; a new action of copper catalyzer.** *Japan J. Chem.* 2, 45-62 (1925) (in French).—*C.A.* **20**, 860.

The toxicity of C_4H_4S was studied by detg. the amt. required to inhibit completely the action of the catalyst. Contrary to catalysis with Cu, variations in the rate of H_2 had but very little effect. Differences in toxicity of various compds. were attributed to the fact that some reacted with all the forms of active Ni while others acted selectively only on the most active forms.

10110. KUBOTA, B. AND YOSHIKAWA, K. **The toxicity of thiophene for catalytic nickel and another action of catalytic copper.** *Sci. Papers Inst. Phys. Chem. Research Japan* 3, 33-50 (1925).—*C.A.* **19**, 2771.

The decrease in activity of catalytic Ni for the hydrogenation of benzene, containing 1% of thiophene, was studied at 300°C. Though rapidly poisoned as a result of the formation of NiS, it maintained its activity for the hydrogenation of phorone giving undiminished yields of valerone. Reduced Cu was not affected by thiophene as regards its ability to hydrogenate either C_6H_6 or phorone.

10111. KUBOTA, B. AND YOSHIKAWA, K. **The composition of reduced nickel catalysts.** *Sci. Papers Inst. Phys. Chem. Research Japan* 3, 223-31 (1925).—*C.A.* **20**, 138.

A reduced Ni catalyst was composed of many active unstable hydrides coexisting in the catalyst. The hydrides were sepd. into 3 classes: those poisoned by thiophene, by Et_2S and by H_2S. The relative amts. of each class of hydrides were detd. by measuring the S-content of the Ni catalyst when it became completely and successively poisoned for each of the 3 hydrogenation reactions.

10112. PEASE, R. N. AND STEWART, L. **The catalytic combination of ethylene and hydrogen in the presence of metallic copper. III. Carbon monoxide as a catalyst poison.** *J. Am. Chem. Soc.* 47, 1235-40 (1925).—*C.A.* **19**, 1981.

The velocity of combination of C_2H_4 and H_2 in the presence of a metallic catalyst at 0°C was measured by a static method; 0.05 ml CO reduced by 88% the activity of the Cu catalyst. The Cu catalyst could adsorb at 1 mm pressure 5 ml of CO. The reaction velocity measurements were compared with adsorption measurements; adsorption at pressures even as low as 1 mm was not a trustworthy index of catalytic activity for hydrogenation catalysts.

10113. RUSSELL, W. W. AND TAYLOR, H. S. **The promoter action of thoria on nickel catalysts.** *J. Phys. Chem.* **29**, 1325-41 (1925).—*C.A.* **20**, 325.

The reaction $CO_2 + 4\ H_2 = CH_4 + 2H_2O$, a surface reaction was strongly affected by the adsorbing power of the catalyst surface for the reactants. The activity of Ni alone as catalyst, either supported or unsupported, was greater the lower the temp. at which the Ni was reduced. The primary function of ThO_2 as promoter with supported Ni catalysts was to make possible the existence of a greater no. of Ni atoms of a highly unsatd. character per unit of catalyst, through the creation of ThO_2-Ni interfaces.

10114. SCHMIDT, OTTO. **The catalytic hydrogenation of organic substances.** *Z. physik. Chem.* **118**, 193-239 (1925).—*C.A.* **20**, 1017.

Expts. were described on powdered Fe, Co, Ni, Cu, Ag, Au, Zn and Pb as catalyzers for the $C_2H_4 + H_2 \rightarrow C_2H_6$ reaction. The actual hydrogenation process took place in the metal between dissolved ionized H_2 and dissolved C_2H_4. Results of expts. on the surface and H_2 adsorption of Ni powders were given. The surface was detd. from the decrease in wt on subjecting the powder to HCl (2.5%) for a short interval (11 sec). Only part of the H_2 could be pumped off.

10115. WELO, L. A. AND BAUDISCH, O. **The catalytically active and unactive forms of ferric oxide.** *J. Biol. Chem.* **65**, 215-27 (1925).—*C.A.* **19**, 3197.

Several forms of iron oxides were prepd. and compared for their activity in accelerating the oxidation of benzidine by H_2O_2, in accelerating the growth of *Bacillus leptisepticum* and in increasing the O_2-absorption of broth or H_2O-cultures thereof. The activity depended upon the intramol. arrangement and not upon the presence of Fe^{++} nor on the adsorptive capacity.

10116. ALMQUIST, J. A. **The nature of the catalyst surface and the effect of promoters.** *J. Am. Chem. Soc.* **48**, 2820-6 (1926).—*C.A.* **21**, 2593.

The inhibiting effect of small concns. of O_2 or H_2O (0.008%-0.04%) upon Fe catalysts for NH_3 synthesis at 444°C and 1 atm. was studied. Calcns. based on the reaction of $3/4\ Fe + H_2O = 1/4\ Fe_3O_4 + H_2$ showed that both the catalytic activity for NH_3 synthesis and the ability to form oxide in the presence of low concns. of H_2O were properties of Fe atoms in the same range of unsatn. The ratio of active atoms to the total Fe in the catalyst was estd. at about 1 atom in 2000 for pure Fe and about 1 in 200 for Fe promoted with Al_2O_3.

10117. ALMQUIST, J. A. AND BLACK, C. A. **The poisoning action of oxygen on iron catalysts for ammonia synthesis.** *J. Am. Chem. Soc.* **48**, 2814-20 (1926).—*C.A.* **21**, 691.

The catalysts and their activity at 1 atm. and 444°C were recorded. With varying concns. of O_2 there was a lowering of the NH_3 concn. produced to a const. value. This concn. was lower at the higher O_2 concn. for a given catalyst; for equal concns. of O_2 it was lower for the less active catalyst. Some iron oxide formed, the quantity being greatest for the most active promoted catalyst. Water vapor produced idential results for corresponding equiv. concn. of free O_2 and water vapor.

10118. ALMQUIST, J. A. AND CRITTENDEN, E. D. **A study of pure-iron and promoted-iron catalysts for ammonia synthesis.** *Ind. Eng. Chem.* **18**, 1307-9 (1926).—*C.A.* **21**, 802.

A direct comparison of several pure and promoted Fe catalysts was made. The activity of pure Fe depended upon the state of oxidation of the fused oxide from which it was obtained by reduction; Fe_3O_4 gave the best results. The addition of K_2O alone lowered the activity of pure Fe, but when SiO_2 was also added there was a promoting action. K_2O had a marked promoting action in the presence of difficulty reducible oxides of an acidic nature, e.g., those of Mn, W, Si and Al.

10119. BONE, W. A. AND ANDREW, G. W. **Studies in catalytic combustion. II. The union of carbon monoxide and oxygen in contact with nickel, copper and their oxides.** *Proc. Roy. Soc.* (London) **A110**, 16-34 (1926).—*C.A.* **20**, 2443.

Enhanced activity of Ni (by preliminary exposure to CO or O_2) was attributed to the formation of a highly reactive surface film of Ni carbonyl or oxy-carbonyl. Granular NiO catalyzed very considerably the oxidation of CO without any appreciable reduction of the NiO, the catalytic action involved the formation of a film of active O at the surface as the effective oxidizing agent. CuO was rapidly reduced by CO in the presence of O_2, and the rate of CO oxidation in the presence of O_2 was considerably slower. The catalyzing process did not consist of rapidly alternating reductions and re-oxidations of the surface.

10120. BONE, W. A. **Studies upon catalytic combustion. III. The influence of steam upon the catalytic combustion of carbonic oxide.** *Proc. Roy. Soc.* (London) **A112**, 474-99 (1926).—*C.A.* **21**, 522.

The catalytic combustion of CO over catalysts of porous porcelain, granular CuO, granular Ni-, Au gauze and Ag foil, in the presence and absence of H_2O vapor was exhaustively studied. The facts were difficult to reconcile with the Langmuir adsorption theory of catalysis, or any of its modifications.

10121. BRAY, W. C. AND DOSS, G. J. **The catalytic oxidation of carbon monoxide. III. Catalytic efficiency of mixtures of dry manganese dioxide and cupric oxide.** *J. Am. Chem. Soc.* **48**, 2060-6 (1926).—*C.A.* **20**, 3260.

Catalysts for the oxidation of CO by air were prepd. by grinding together certain samples of dry powd. $MnO_{1.83}$ and CuO. The efficiencies of these mixts. were compared with the efficiencies of the constituent oxides alone. In every case the mixts. were more efficient in catalyzing the reaction then the single oxides.

10122. NORRISH, R. G. W. AND JONES, G. G. **Studies of valency. VII. Surface polarity and the reaction of ethylene and chlorine. The effect of the adsorbed water layer.** *J. Chem. Soc.* **1926**, 55-62.—*C.A.* **20**, 1744.

A study was made of the reaction between C_2H_4 and Cl_2, each at an initial partial pressure of 200 mm, at the surface of glass, paraffin wax and stearic acid. By taking special precautions, a paraffin-wax surface was prepd., showing a reactivity some 1200 times smaller than that of glass. H_2O vapor, present at a partial pressure of 6 mm, increased the reactivity of the glass surface by 30%, while it had no effect on the paraffin-wax surface. The adsorbed H_2O layer was the polar catalyst with glass surfaces.

10123. TAYLOR, HUGH S. **The colloid particle is revealed by catalytic studies.** *Coll. Symposium Mon.* 4, 19-28 (1926).—*C.A.* **21**, 1390.

The catalyst surface contained atoms more loosely bound than in the crystal surface. An oxide catalyst surface was regarded as composed, not of a single catalyst, but of 2 catalysts, metal ions and oxide ions; the nature of the changes induced in the adsorbed reactant was detd. by the charge of the ion on which the reactant mol. was adsorbed.

10124. BENTON, A. F. **Kinetics of catalyzed gas reactions in flow systems.** *Ind. Eng. Chem.* **19**, 494-7 (1927).—*C.A.* **21**, 1744.

The yield in catalyzed gas reactions carried out by flow processes was expressed in terms of the quantity of catalyst, the rate of passage, the total pressure, and the compn. of the gas mixt. These equations represented satisfactorily the available data for (1) the combination of H_2 and O_2 over a Ag catalyst, (2) the synthesis of NH_3 over Mo and promoted Fe catalysts, and (3) the contact H_2SO_4 reaction over Pt.

10125. BILLMANN, EINAR AND KLIT, ANDREAS. **Colloidal palladium as catalyst in the hydrogen electrode.** *Z. physik. Chem.* **130**, 566-71 (1927).—*C.A.* **22**, 528.

H_2 electrodes of sheet Pt or Au in solns. sufficiently catalyzed by colloidal Pd (with lysalbinic acid or protalbinic acid as protective colloid) gave the same potentials as Pt or Au with Pt-black or Pd-black surfaces. As little as 2 mg of colloidal Pd per liter catalyzed the conversion of H_2 to H^+ so that polarization did not occur and well-defined potentials were obtained.

10126. CONSTABLE, F. H. **Nature of the sintering of active copper catalysts.** *J. Chem. Soc.* **1927**, 1578-84.—*C.A.* 21, 3531.

Sintering of an active Cu surface produced a reduction of the area of the exposed surface, and collapse of some of the active centers on the surface. The course of oxidation of Cu was followed by measurements of the elec. cond of the Cu-oxide mixt. and by estn. of the thickness of the surface film of oxide by means of its color in normally reflected light. The surface area was reduced to about 1/3 while the catalytic activity was reduced to about 1/7.

10127. HESSENBRUCH, W. AND OBERHOFFER, P. **An improved rapid method for the determination of gases in metals, especially of oxygen in steel.** *Arch. Eisenhuttenw.* **1**, 583-603 (1927); *Stahl u. Eisen* **48**, 486-7 (1938).—*C.A.* **22**, 2525.

At 1600°C the max. amt. of oxygen was obtained. The presence of metals whose oxides had a higher heat of formation than FeO caused errors unless very high vacuum was used. The formation of H_2O occurred only below 1000°C. A normal S-content was without any effect; with 0.050% S the error was 0.0003% oxygen. At higher S-content H_2S and CS_2 were formed. The graphite crucible used must be degasified and kept in a vacuum.

10128. HOOVER, G. I. AND RIDEAL, E. K. **The decomposition of ethyl alcohol at the surface of thoria. I.** *J. Am. Chem. Soc.* **49**, 104-15 (1927).—*C.A.* **21**, 690.

The reaction velocities of the ethylene and aldehyde decompns. were measured and the energy activation and temp. coeff. of each reaction calcd. At 300°C the value for the temp. coeff. of the velocity const. was 1.43 for H_2 and 1.58 for C_2H_4. The corresponding energies of activation were 24,000 and 30,000 cal.

10129. ADHIKARI, G. AND FELMAN, J. **Experimental contribution to the theory of hetergeneous reactions.** *Z. physik. Chem.* **131**, 347-62 (1928).—*C.A.* **22**, 1715.

The reaction between Hg and I_2 served as an example of the Ostwald-Langmuir three-phase theory of catalytic behavior. A stream of I_2 vapor was sent against Hg drops, the excess of I_2 being removed by a Ag foil. The expts. showed that the reaction went very rapidly when a HgI_2 crystal was touching the Hg surface. The mechanism of heterogeneous reactions was discussed on the basis of Volmer's theories of adsorption and supersatn.

10130. ALLEN, P. C. AND HINSHELWOOD, C. N. **The catalytic decomposition of gaseous acetaldehyde at the surface of various metals.** *Proc. Roy. Soc.* (London) **121A**, 141-55 (1928).—*C.A.* **23**, 755.

The decompn. of acetaldehyde was studied at the surface of elec. heated wires of Au, Pt, W and Pt-10% Rh alloy. The surface reaction involved two mols., but at pressures above 150 mm, the surface became satd. with adsorbed mols. and the reaction appeared unimol. The relation between reaction rate and pressure, the heat of activation and the abs. rate of reaction were markedly similar with all the metals.

10131. BAHR, H. A. AND BAHR, TH. **Decomposition of carbon monoxide on nickel.** *Ber.* **61B**, 2177-83 (1928).—*C.A.* 23, 756.

Metallic Ni or NiO catalyzed the reaction $2CO = C + CO_2 + 38.9$ cal. by first forming Ni_3C. Below 270°C the decompn. of CO continued until the Ni was completely transformed into Ni_3C; then the reaction stopped. Between 270° and 380-420°C, the CO decompn. continued after this point was reached, the catalyst being Ni_3C free from metallic Ni. The amt. of C bound chemically by the catalyst corresponds to Ni_3C, excess C being present as the free element.

10132. CONSTABLE, F. H. **Reichinstein's displacement principle.** *Proc. Cambridge Phil. Soc.* **24**, 56-64 (1928).—*C.A.* 22, 1261.

Surface action was assumed to take place only on particular spots on the surface, called "centers of activity" and these centers of activity occupied by one mol. at a time. In a bimol. reaction at a catalyst surface, the total no. of mols. of all substances adsorbed by a given surface was const. and independent of their concns. in the space around the surface layer.

10133. FROLICH, PER K.; SPALDING, H. B., AND BACON, T. S. **Destructive distillation of wood and cellulose under pressure.** *Ind. Eng. Chem.* **20**, 36-40 (1928).—*C.A.* **22**, 1035.

Distn. of wood under autogenous pressure increased the MeOH yield up to 280-370°C; beyond this temp. decompn. set in and the yield decreased. Substitution of H_2 for the autogenous pressure further increased the MeOH yield. With Ni as a catalyst and H_2 under 200 atms., cellulose was almost completely converted to gaseous and liquid products, the latter consisting of phenols and hydrocarbons.

10134. SCHMIDT, OTTO. **Theory of sorption. II. Mechanism of heterogeneous catalysts.** *Z. physik. Chem.* **133**, 263-303 (1928).

The sorption at 1 atm. pressure and at const. temp. between 0° and 150°C of gases for which the mol. diam. was less than the mean diam. of the pores of the adsorbent, was expressed by log $c = a(\lambda)^{1/2} - b$, where c was the quantity of gas adsorbed per unit weight of adsorbent, λ the latent heat of evapn., and a and b consts. which for a given adsorbent were independent of the nature of the gas, but varied with temp. and pressure. Deviations were found when chem. reaction took place readily.

10135. Wright, W. M. **The thermal decomposition of hydrogen peroxide.** *Trans. Faraday Soc.* **24**, 539-42 (1928).—*C.A.* **23**, 2639.

Pure silica gel had only a slight catalytic activity for the decompn. of H_2O_2, but this activity was greatly increased in the presence of $AgNO_3$. The addn. of a trace of alkali increased the activity of the Ag salt several hundred times. Clean sheet Ag was a very feeble catalyst.

10136. Balandin, A. A. **Splitting of organic compounds by catalytic hydrogenation over nickel. The role of the catalyst in heterogenous catalysis.** *Z. physik. Chem.* **B3**, 167-94 (1929).—*C.A.* **23**, 5090.

On the basis of available data on the hydrogenation of org. compds. over Ni, the groups which split off could be arranged in definite series. The ease of splitting of the groups from the mol. was greater, the greater the affinity of the group for the catalyst, and the less their affinity for one another in the mol.

10137. Cremer, E. **Catalytic behavior of rare-earth oxides.** *Z. physik. Chem.* **144A**, 231-42 (1929).—*C.A.* **1930A**, 44.

The decompn. of EtOH was studied from 350° to 470°C when catalyzed by oxides of the rare-earths and of other elements of group III. The heats of activation increased in the order: Al, In, Sc, Yt, La, while those of Ce, Pr, Nd, Sm, Gd, and Dy did not differ appreciably from one another. The relationship, $c = A\exp(q/a)$, between the heat of activation (q) and the activity of the catalyst (c) was established.

10138. Cremer, E. and Schwab, Georg-Maria. **A possible connection between heat of activation and activity in contact catalysis. II.** *Z. physik. Chem.* **A144**, 243; **B5**, 406-12 (1929).—*C.A.* **24**, 544.

The fraction of active centers on a surface may be proportional to $\exp(q/R\theta)$, where θ was an arbitrary temp. obtained by equating the relations $c = K\exp(q/RT)$ and $c = A\exp(q/a)$, where c was the activity of the catalyst.

10139. Donnelly, R. P. and Hinshelwood, C. N. **Combination of hydrogen and oxygen on the surface of platinum.** *J. Chem. Soc*, **1929**, 1727-33.—*C.A.* **23**, 5398.

The reaction was studied on a Pt wire heated below the temps. at which explosion takes place. The reaction at ordinary pressures followed a different law from that found by Langmuir at low pressures. The reaction was independent of the pressure of H_2 and dependent on the pressure of O_2, indicating no appreciable displacement of O_2 by H_2 on the wire. The max. rate of combination found possible without explosion was 4% per min. at 200 mm H_2 and 100 mm O_2.

10140. Emmett, P. H. and Love, Katherine S. **Comparison of the catalytic and chemical characteristics of cubic and rhombohedral ferric oxide.** *J. Phys. Chem.* **34**, 41-62 (1929).—*C.A.* **24**, 1016.

Cubic and rhombohedral Fe_2O_3 were prepd. Oxidation of benzidine and guaiac resin by H_2O_2 gave approx. the same results with both forms. Heating to 550°C for several hrs destroyed this catalytic activity. At 250°C the catalytic activity of both forms toward the combination of H_2 and O_2 was the same and heating to 550°C did not affect their activity. H_2O sorption on cubic Fe_2O_3 was 10-60% less than on the rhombohedral form and heating to 550°C lowered the sorption rate by 75-80% as compared with samples dried at 300°C.

10141. Pietsch, Erich; Kotowski, Alfons, and Berend, Gertrud. **The topochemistry of contact catalysis. IV. Experimental proof of adlineation in topochemical reactions.** *Z. physik. Chem.*, **Abt. B**, 5, 1-13 (1929).—*C.A.* **24**, 290.

The reactions studied were K_2CrO_4 and concd. H_2SO_4 to give CrO_3; $CuSO_4.5H_2O$ and H_2S in alc. or ether; $NiSO_4.7H_2O$ and H_2S in alc. or ether; $K_2Cr_2O_7$ and H_2O_2 in ether-water solns. to give violet KH_2CrO_7; $CuSO_4.5H_2O$ and KCNS in alc.; $CuSO_4.5H_2O$ and KCN in alc.-water mixts.; $Bi(NO_3)_3$ and an ether soln. of alc.; $Na_2S_2O_3.H_2O$ and $FeCl_2$ in dil. ether; decompn. of $Na_2S_2O_3.H_2O$ crystals; dehydration of $CuSO_4.5H_2O$ with concd. H_2SO_4; NaOAc crystals and $FeCl_3$ in dil. ether soln.; $NiSO_4.7H_2O$ and dimethylglyoxime in alc.; and $K_4Fe(CN)_6$ and $FeCl_3$ in ether solns. of HCl.

10142. Schenck, Rudolf and Wesselkock, H. **The activation of metals by addition of foreign substances.** *Z. anorg. allgem. Chem.* **184**, 39-57 (1929).—*C.A.* 24, 2035.

The effect was studied of CaO, MgO, MnO and Al_2O_3 separately and Al_2O_3 and MgO jointly on the oxidation of Ni and Co at 900°C in an atm. of CO_2. The activities of both Ni and Co were increased by the presence of the oxides in the order CaO, MgO, MnO. These oxides had the same crystal lattice as NiO and CoO. The activity was not closely related to the similarity of crystal lattice consts. of these oxides with those of Ni and Co.

10143. Smekal, A. **Crystal faults and active centers in heterogeneous catalysts.** *Z. Elektrochem.* 35, 567-73 (1929).—*C.A.* 23, 5395.

Optical data gave the active fraction of faults on a surface as 10^{-5} to 10^{-3} of the total surface. This agreed well with the results of expts. with catalyst poisons of surfaces.

10144. Balandin, A. A. **Osmium as a dehydrogenation catalyst for decahydronaphthalene.** *Z. physik. Chem.* **B9**, 49-72 (1930).—*C.A.* 24, 4984.

The rate of dehydrogenation of decahydronaphthalene in the presence of Os increased with temp. over the range studied, 228-277°C. The reaction products, naphthalene and H_2, exerted no influence on the speed of reaction. The catalyst was slowly poisoned by further decompn. of the naphthalene. After considerable use of the catalyst a sudden increase of activity was observed, due to a decrease in poisoning, and the energy of activation increased from 10,000 to 16,500 cal. per mol.

10145. Bowden, F. P. and O'Connor, E. A. **The change in the area and catalytic activity of metallic surfaces on passing from the solid to the liquid state.** *Proc. Roy. Soc.* (London) **A128**, 317-29 (1930).—*C.A.* 24, 5585.

"Accessible" area was measured by the quantity of electricity necessary to cause a given increase in the electrode potential in evolving H_2 from dil. acid. The relative accessible area of a fusible alloy (Wood's metal) under different conditions was: liquid, 1; solidified from liquid 1.4; solid rubbed with glass paper, 6.3; etched with HNO_3, 800-1000. The relative catalytic activities were 1, 2, 2.4 and 1200, resp. For liquid and solid Ga, the values were 1 and 1.7 for both area and activity.

10146. Dankoff, R. **Preparation of catalysts.** *Nature* **126**, 860 (1930).

Ni, Pt and Fe catalysts for hydrogenation of ethylene were prepd. by depositing metals from the vapor on cold surfaces. In case of Ni, a dependence of catalytic activity on the thickness of the deposit was found, indicating the porous nature of the surface.

10147. Mittasch, A. **Complex catalysts.** *Z. Elektrochem.* **36**, 569-80 (1930).—*C.A.* **25**, 21.

The development of complex or mixed catalysts was reviewed. The oxidation of NH_3 and the reaction of CO with H_2 to give MeOH were discussed.

10148. Porter, Alfred W. **Catalysis.** *Nature* **126**, 349 (1930).—*C.A.* 24, 5583.

The energy of activation which makes effective collisions between reacting mols., had its normal value in catalysis.

10149. Rupp, E. and Schmid, E. **Electron reflection by passive iron. I.** *Naturwissenschaften* **18**, 459-61 (1930).—*C.A.* 24, 4690.

For a study of the nature of the surface film of passive Fe the electron-reflection method was employed on (1) Fe single crystals (001 and 011 faces), (2) the same made passive by HNO_3 or (3) oxidized with H_2O vapor, (4) hematite and magnetite in large crystals. Addnl. maxima in the curves of passive Fe, which appeared at the same voltage regardless of the orientation of the underlying Fe crystal face, indicated the presence of a passive film. The maxima of passive Fe could not be identified with those of surface oxide, or with those of hematite or magnetite.

10150. Srikantan, B. S. **Reactions at the surface of hot metallic filaments. V. Thermionic emission and catalytic activity at the surface of hot metallic wires: $H_2 + CO_2 \rightarrow CO + H_2O$ at the surface of Pt, Pt coated with BaO and thoriated W.** *Indian J. Physics* **5**, 685-98 (1930).—*C.A.* **25**, 2908.

The min. temp. at which thermionic emission from a Pt wire was perceptible was obtained by extrapolation at 975°C. Interaction of CO_2 and H_2 started at 979°C. Hence, emission of electrons from a surface had an important influence on activation of gases.

10151. Suhrmann, R. **The change in the electrical condition of the surface of a metal after charging with hydrogen ions and bombarding with electrons.** *Z. Elektrochem.* **35**, 681-6 (1930).—*C.A.* 24, 1285.

Au and Ag when charged with H ions were more sensitive to light and gave off photoelectrons at longer wave lengths than normal. After electron bombardment the reverse was true; the max. wave length necessary for the emission of photoelectrons was lowered. The significance of this for the theory of catalytic action was considered.

10152. Taylor, Guy B.; Kistiakowsky, George B., and Perry, John H. **Platinum black catalysts. I. Physical properties and catalytic activity.** *J. Phys. Chem.* 34, 748-52 (1930).—*C.A.* 24, 2663.

The particle size of Pt catalysts prepd. in 3 different ways was examined by x-ray powder photographs, by photomicrographs, by rate of sedimentation in castor oil, and by analysis with an ultracentrifuge. The smaller ultimate particle size of 2 prepns. showed the greater catalytic activity, the one being better for oxidation reactions, the other for hydrogenation.

10153. Bonhoeffer, K. F. and Farkas, A. **The para hydrogen transformation on platinum: A relation between catalysis and accommodation.** *Z. physik. Chem.* B12, 231-46 (1931).—*C.A.* **25**, 3908.

The transformation of para H_2 into ordinary H_2 between 135° and 620°C was catalyzed by a hot Pt wire. The transformation reaction on pure Pt caused an abnormal increase in the accommodation coeff., while on poisoned Pt the coeff. were normal. The velocity of the transformation was increased by O_2. The heat of activation of 14,500 cal calcd. from the temp. coeff. of the reaction was approx. equal to the heat of adsorption of H_2 on Pt.

10154. Ingersoll, L. R. **Synthesis of gas-metal compounds by sputtering.** *J. Am. Chem. Soc.* **53**, 2008-9 (1931).—*C.A.* 25, 2931.

Ni sputtered in N_2 under special conditions gave a nitride film, decompd. by heating at 350°C; on heating to 150°C in H_2, NH_3 and Ni were formed. Compds. of Co and Fe with N_2 and of Ni and H_2 were also prepd.

10155. Travers, Morris W.; Hockin, Leslie E., and Pearce, Thomas J. P. **Influence of hydrogen on chemical changes in silica vessels.** *Nature* **128**, 66 (1931).—*C.A.* 25, 5075.

Reproducible results in the condensation of ethane in silica vessels at 600°C were obtained only when the exptl. conditions insured satn. of the silica with H_2. A sudden change in the rate of formation of the condensate was observed always 2-1/2 hours after the beginning of the expt.

10156. Balandin, A. A. **Logarithmic relation between the constants of the Arrhenius equation. Activation energy of dehydrogenation of cyclohexane in the presence of nickel catalysts prepared in various ways.** *Z. physik. Chem.* **B19**, 451-61 (1932).—*C.A.* 27, 1262.

The consts. in the equation, $k = k_0 \exp(-Q/RT)$, were related as follows: $\ln k_0 = aQ + b$. In the dehydrogenation of cyclohexane catalyzed by Ni supported in Al_2O_3, $Q = 16,230$ kcal per mol.; $Q = 9850$ kcal for ordinary Ni catalysts. Similar observations were made with TiO_2 as the support, and neither catalyst was able to effect the decompn. of CH_4. The $Ni-Al_2O_3$ approximated Pd supported on asbestos.

10157. Brewer, A. K. **Effect of adsorbed gases on the photoelectric emissivity of iron and platinum.** *J. Am. Chem. Soc.* **54**, 1888-900 (1932).—*C.A.* **26**, 3435.

The photoelectric properties of Fe and Pt in the presence of N_2, H_2 and NH_3 were characteristic of composite surfaces. The degree of dissocn. of the various gases was estd. from curves of known ion density as a standard. Threshold measurements on surfaces of known ion density showed that the field of influence about an ion extended to many times its normal radius. Catalysis was discussed in the light of this phenomenon.

10158. Brill, Rudolf. **Röntgenographic studies on iron catalysts for synthesis of ammonia.** *Z. Elektrochem.* 38, 669-73 (1932).—*C.A.* 26, 5707.

An x-ray examn. of the catalysts was made both before and after reduction in H_2. Added Al_2O_3 acted as a promoter only when Fe oxide-Al mixt. was treated so as to form homogeneously distributed, easily reducible, mixed crystals.

10159. Nyrop, J. E. **The surface electrons [of metals].** *Phys. Rev.* 39, 967-76 (1932).—*C.A.* 26, 2644.

The photoelec. effect, thermionic emission, adsorption of gases on metals, and catalysis were interpreted in terms of the surface electrons; particular emphasis was laid on the "maximum velocity" of the electrons in a particular metal.

10160. Schenck, Rudolf; Kurzen, Fritz, and Wesselkock, H. **Activation of metals by foreign substances. II.** *Z. anorg. allgem. Chem.* **206**, 273-88 (1932).—*C.A.* 26, 4549.

Fe and W in MgO made it difficult to form carbide by action of CH_4, if in the carbides of these metals 1 C atom was attached to several metallic atoms as in Fe_3C or W_5C_2. Carbide formation was not hindered by the addn. of inert oxides if the carbide consisted of an equal no. of metal and C atoms, as WC.

10161. Krczil, Franz. **The application of glass filters to the determination of the adsorptive or catalytic activity of technical adsorbents.** *Chem.-Ztg.* 57, 803-5 (1933).—*C.A.* 28, 18^5.

Fritted-glass diaphragms were described for filtering gas, for bubbling gas through liquids, and for supports for solids over which gases flow.

10162. Maxted, E. B. and Lewis, G. J. **The energies of catalysis. I. The energetic homogeneity of a platinum surface.** *J. Chem. Soc.* **1933**, 502-4.—*C.A.* 27, 4472.

The temp. coeff. of the decompn. of H_2O_2 by Pt black was independent of the percentage poisoning by Hg^{++} ions between 0° to 25°C and up to about 0.03 mg of Hg per mg of Pt. The apparent energy of activation for the decompn. was about 12,000 cal.

10163. Schmidt, Otto. **Reaction mechanisms. V. The active places of typical hydrogenation catalysts.** *Z. physik. Chem.* **A165**, 133-46 (1933).—*C.A.* 27, 4472.

Activation of H_2 and hydrogenation on the usual catalysts occurred on active places situated within the catalyst rather than on the surface. The catalysts discussed included elements of the Fe and Pt groups as well as Cu. Hydrogenation involved the satn. of a double-bonded C compd. with H_2.

10164. Schmidt, Otto. **Different classes of hydrogenation catalysts.** *Naturwissenschaften* **21**, 351 (1933).—*C.A.* 27, 4997.

Different metals were tested in finely porous condition for their catalytic activity in C_2H_2 hydrogenation at 0-200°C and atm. pressure. There were 2 groups: (1) Cs, Ca, Sr, Ba of large at. vol., low electron exit work, weak ion field, stable hydrides, H functioning as neg. ion and (2) Cu, Cr, Mn, Re, Fe, Co, Ni, Pd, Pt of small at. vol., etc., H acting as pos. ion.

10165. Balandin, A. A. and Bork, A. Kh. **The relative life periods of ethyl alcohol and acetaldehyde molecules on the surface of a copper catalyst.** *Uchenui Zapiski* (Moscow State Univ.) 2, 217-20 (1934).—*C.A.* **30**, 6276^5.

The dehydrogenation velocity of EtOH was detd. in the presence of MeCHO on a Cu catalyst. Under the conditions of the expts. the MeCHO mol. remained on the surface of the catalyst 5 times as long at 270°C and 3 times as long at 240°C as the EtOH mol.

10166. Farkas, A.; Farkas, L., and Rideal, E. K. **Experiments with heavy hydrogen. IV. Hydrogenation and exchange reaction of ethylene with heavy hydrogen.** *Proc. Roy. Soc.* (London) **A146**, 630-9 (1934).—*C.A.* 29, 41^5.

The reaction of C_2H_4 with H_2 contg. D_2 on an active Ni catalyst took place according to the equations: $C_2H_4 + HD \rightleftharpoons C_2H_3D + H_2$ and $C_2H_4 + HD \rightarrow C_2H_5D$. The catalytic surface was originally covered with C_2H_4 and hydrogenation occurred when this mol. evapd. from the Ni thus admitting H_2 which reacted. At low temp., H_2 and D_2 reacted at nearly the same rate, but at higher temp. some of the C_2H_4 left the surface with a consequent loosening of the C-H bond and the exchange reaction took place.

10167. Finch, G. I. and Bradford, B. W. **The electrical condition of hot surfaces during the adsorption of gases. VI. A gold surface catalyzing the combustion of carbon monoxide.** *Proc. Roy. Soc.* (London) **A144**, 320-39 (1934).—*C.A.* 28, 4285^2.

The effect of H_2O on the catalytic activity of Au toward the combustion of CO and on the elec. activities of the metal were observed simultaneously. The reaction velocities were invariably higher in the moist than in the dry reaction system; with increasing temp., however, the differences diminished.

10168. Horiuchi, J.; Ogden, G., and Polanyi, M. **Catalytic replacement of protium by deuterium in benzene.** *Trans. Faraday Soc.* **30**, 663-5 (1934).—*C.A.* 28, 6627^3.

While the hydrogenation of benzene with Pt-black catalyst was almost imperceptible at ordinary temps. a rapid reaction occurred when the

H_2 used had a high content of D. The D replaced H in benzene in the presence of Pt or Ni catalyst.

10169. LONG, J. H.; FRAZER, J. C. W., AND OTT, E. **Activity and crystal structure of mixed metal catalysts.** *J. Am. Chem. Soc.* **56**, 1101-6 (1934).—*C.A.* **28**, 3976^2.

Hydrogenation of C_6H_6 to C_6H_{12} was used to study the efficiency of pure metal and mixed pure metal catalysts. Fe, Co, Ni and Cu and compds. of Fe and Ni, Co and Ni, Ni and Cu, and Fe and Co were tested for activity. The crystal structure of these various catalysts was detd.; face-centered cubic lattices were especially active for this reaction.

10170. MAXTED, EDWARD B. AND STONE, VICTOR. **The energetics of catalysts. II. The poisoning coefficients and energies of activation in hydrogenation.** *J. Chem. Soc.* **1934**, 26-9.—*C.A.* **28**, 2254^7.

The fractional decreases in activity of a Pt catalyst caused by poisoning with a given concn. of $HgCl_2$ were the same for the hydrogenation of crotonic, oleic and benzoic acids. The energies of activation were 3100, 4600 and 9700 cals per mol., resp., for the three acids between 20° and 60°C. The sp rates at 40°C were 11.3, 7.25 and 0.65, resp.

10171. MAXTED, EDWARD B. AND STONE, VICTOR. **The energetics of catalysis. III. Further studies of the poisoning coefficients of hydrogenation processes.** *J. Chem. Soc.* **1934**, 672-4.—*C.A.* **28**, 5322^7.

The fractional decrease in activity of a Pt catalyst per unit concn. of poison was the same for nitrobenzene, acetophenone, benzene and oleic acid when Hg ions were used as poison, and for C_6H_6 and acetophenone when CS_2 was employed as a poison.

10172. WHITE, ERNEST C. AND SHULTZ, J. F. **Fused cobalt oxide as a water gas catalyst.** *Ind. Eng. Chem.* **26**, 95-97 (1934).

Catalysts made by the fusion of cobalt oxide, when properly reduced in H_2, effectively catalyzed the water-gas reaction to equilibrium at temps. as low as 283°C and space velocities as high as 1800. The addition of various promoters largely repressed the simultaneous formation of CH_4. Fe in quantities as high as 3% inhibited the formation of CH_4 without cutting down appreciably the activity toward the water gas reaction. Cu as a promoter gave promising results. A Co catalyst containing 38% Cu was active as a water-gas catalyst without synthesizing significant quantities of CH_4.

10173. ANDRUSSOW, LEONID. **The catalytic oxidation of ammonia-methane mixtures to hydrocyanic acid.** *Angew. Chem.* **48**, 593-5 (1935); *Ber.* **71B**, 776-8 (1938).—*C.A.* **29**, 8244^3; **32**, 4416^6.

It was essential that NH_3, CH_4 and O_2 (air) enter the reaction chamber containing Pt gauze in stoichiometric proportions according to the equation: $2NH_3 + 3O_2$ (or 14.4 air) $+ 2CH_4 = 2HCN + 6H_2O + 229{,}800$ cal. In the period of a few hundred thousandths sec. all of the O_2 disappeared and CH_4 was transformed to HCN, and partially to CO and H_2. At 1000°C 58-63% of the NH_3 was converted to HCN, about 8-12% to N_2 and about 26-30% remained undecompd. A small excess of either NH_3 or CH_4 was not harmful, but with increasing amts. of CH_4 most of the O_2 was used for the formation of $CO + 2H_2$, with decreasing yields of HCN.

10174. CHARACHORIN, F.; ELOVITZ, S., AND ROGINSKII, S. **The mechanism of the catalytic oxidation of carbon monoxide on manganese dioxide. III. Existence of a critical lower pressure limit in heterogeneous catalysis.** *Acta Physicochim. U.R.S.S.* **3**, 503-8 (1935) (in German).—*C.A.* **30**, 7987^3.

At pressures from 1 atm. to 10 mm the oxidation of CO by O_2 on a MnO_2 surface was approx. a first-order reaction with an E value of 6000 cal. At pressures below 0.525 mm the reaction was almost of zero order and almost independent of temp. The high-pressure reaction was related to activated adsorption, but the low-pressure reaction was not.

10175. GRIFFITH, R. H. AND PLANT, J. H. G. **Catalysis in hydrocarbon. II. Decomposition of low-boiling hydrocarbons.** *Proc. Roy. Soc.* (London) **A148**, 186-90 (1935).—*C.A.* **29**, 2335^2.

The effect of Mo catalysts on the decompn. of hexane and cyclohexane was measured at ordinary pressures. The activity of the catalyst was influenced by the addn. of silica. The peak of activity at 4.4 atoms Si to 100 atoms Mo coincided with the position of least activity observed at high pressure with low-temp. tar.

10176. HEDVALL, J. ARVID AND SANDFORD, FOLKE. **The effect of ferromagnetic transformation on the catalytic power of nickel in the reaction** $2CO = CO_2 + C$. *Z. physik. Chem.* **B29**, 455-63 (1935).—*C.A.* **30**, 369^6.

Four kinds of Ni catalysts were prepd. and the reaction $2CO = CO_2 + C$, catalyzed with Ni, was then studied. As with other reactions, the rate increased sharply at the Curie point. The effect of impurities on the reaction was also studied as well as the condition of formation of Ni carbide and its effect on the reaction.

10177. MORIKAWA, K.; BENEDICT, W. S., AND TAYLOR, H. S. **Catalytic exchange of deuterium and methane.** *J. Am. Chem. Soc.* **57**, 592-3 (1935).—*C.A.* **29**, 2842^4.

The exchange at reduced Ni catalyst surfaces between D_2 and CH_4 formed heavy methanes in the range 184° to 305°C. At the upper temp. equil. on the heavy-methane side was established within 20 hrs. At 218°C the equil. position was established in 50 hrs. The conversions were still slower at 184°C. Curves of reaction velocity indicated very low rates of exchange below 170°C.

10178. TAYLOR, H. S. AND JUNGERS, J. C. **Exchange between ammonia and deuterium on catalytic iron surfaces.** *J. Am. Chem. Soc.* **57**, 660-1 (1935).—*C.A.* **29**, 3893^4.

The exchange reactions of dry. D_2 and dry NH_3 in the presence of $Fe\text{-}K_2O\text{-}Al_2O_3$, catalyst at room temp. in a quartz vessel were studied. At the end of one month the absorption spectra revealed the presence of all the ammonias. No reaction occurred at 300°C on quartz surface. The rate-detg. reaction in NH_3 synthesis was given as: N_2 (gas) $\rightleftharpoons$ 2N (absorbed).

10179. Temkin, M. and Puizhov, V. **Heterogeneous oxidation of nitric acide at liquid-air temperature.** *Acta Physicochim. U.R.S.S.* **2**, 473-86 (1935).—*C.A.* **29**, 6522^{9}.

At liquid-air temps. by the heterogeneous oxidation of NO on glass surfaces, O_2 and NO reacted in the ratio 1:3 to give a brown liquid, N_3O_5 condensing out on the walls. The homogeneous reaction was very small. At $p = 5 \times 10^{-3}$ to 8×10^{-2} mm and $T =$ 83° to 88°K, the reaction mechanism was assumed to be: $2NO + O_2 = N_2O_4$; $N_2O_4 + NO = N_3O_5$. NO was first adsorbed on the walls and reacted with gas phase O_2.

10180. Toyama, Osamu. **Hydrogenation of ethylene with nickel as a catalyst at low temperatures.** *Proc. Imp. Acad.* (Tokyo) **11**, 319-21 (1935).—*C.A.* **30**, 2091^{4}.

The reaction was studied between 0° to −78°C and the rate measured at const. vol. and const. partial pressure of H_2 and C_2H_4. H_2 favored the initial rate of reaction, C_2H_4 retarded it and C_2H_6 had scarcely any effect. The reaction velocity increased with increase of H_2 pressure, but decreased gradually with increase of C_2H_4 pressure. At const. H_2 pressure, the rate of reaction increased and reached a max. near the end of the reaction; at const. C_2H_4 pressure the rate decreased rapidly and, when const. pressure of C_2H_4 was high, almost in proportion to the H_2 pressure. The concn. of C_2H_6 in the gas phase had little effect.

10181. Adadurov, I. E. **Andrussov's theory of the catalytic preparation of hydrocyanic acid.** *Ukraïn. Khem. Zhur.* **11**, 237-48 (in German 248-9) (1936).—*C.A.* **31**, 1688^{5}.

Andrussov's theory is thermodynamically untenable. NH_3 and CH_4 cannot exist at 1473°K at which the HCN was formed on the Pt gauze. The catalytic formation of HCN could be suitably explained by the oxidation of NH_3 to NO and the Angelucci reaction.

10182. Erofeev, B. and Mochalov, K. **New method for investigation of catalyst surfaces.** *Acta Physicochim. U.R.S.S.* **4**, 859-60 (1936).—*C.A.* **30**, 7986^{9}.

After pure Fe filings in a glass tube were reduced in H_2 at 450°C to remove surface oxide films, the resistance of the filings at room temp. fell from an immeasurably high value to a few ohms and did not change under the action of electromagnetic radiation sent by a Hertz vibrator. The admission of air to the tube increased the resistance up to some thousand ohms and the tube recovered its lost capacity of acting as a coherer. The expt. was repeated; and Fe NH_3-catalyst with 1% Al_2O_3 as a promoter was used. In spite of prolonged reduction at 450°C, this catalyst retained its capacity of acting as a coherer.

10183. Farkas, Adalbert. **The catalytic interaction of ammonia with deuterium.** *Trans. Faraday Soc.* **32**, 416-27 (1936).—*C.A.* **30**, 2836^{7}.

The exchange of H atoms between D_2 and NH_3 on an Fe catalyst was studied at 30-400 mm and 160-230°C. The abs. rate of exchange was independent of the concn. of NH_3 and increased approx. according to the square root of D_2. The apparent energy of activation was 15 cal. The relative rates of *ortho-para* conversion of H and D and of the reaction $H_2 + D_2 = 2HD$ were 5:2:1, resp., but all these reactions were much faster than the exchange reaction having energies of activation of 8-9 cal. The *ortho-para* conversion of H_2 was inhibited by NH_3, possibly owing to nitride formation on the catalyst.

10184. Morikawa, K.; Benedict, W. S., and Taylor, H. S. **Activity of specific bonds in complex molecules at catalytic surfaces. I. The carbon-hydrogen bond in methane and methane-d_4.** *J. Am. Chem. Soc.* **58**, 1445-9 (1936).—*C.A.* **30**, 6632^{9}.

CH_4 exchanged with D_2, CD_4 and D_2O on active Ni catalysts at 138°C and above. At 184°C the rate of reaction decreased in the order CD_4, D_2 and D_2O. The activation energy of reaction for CD_4 was approx. 19 kg-cals, and for D_2 approx. 28 kg-cals. The reaction was explained by an activated, dissociative adsorption of CH_4 on surface areas not occupied by H-D or D_2O.

10185. Schmidt, Otto. **The mechanism of reaction. VII. The velocity of the catalytic hydrogenation of double bonds in dissolved straight-chain molecules.** *Z. physik. Chem.* **A176**, 237-59 (1936).—*C.A.* **30**, 6633^{3}.

The times required for consumption of half the H_2 were detd. for 25 different aliphatic and aliphatic-aromatic hydrocarbons, alcs., acids and esters with an olefine double bond and straight chains as well as branched chains on contact Ni, Pt and Co catalysts in a series of solns. in alcs., o-methylcyclohexanol, cyclohexane and MeOH. The velocity const. k corresponded to that of a diffusion process through the solvent into the metallic phase. All factors affecting diffusion affected the reaction velocity.

10186. Schwab, Georg-Maria and Naicker, Kannappan. **The water-gas reaction on a platinum surface at low pressures.** *Z. Elektrochem.* **42**, 670-3(1936).—*C.A.* **30**, 7979^{2}.

The kinetics of the reaction $H_2 + CO_2 = CO + H_2O$ was studied on a Pt filament between 700° and 1200°C and at pressures up to 0.3 mm. The reaction was autocatalytic in the absence, but not in the presence, of an initial partial pressure of CO. If P_2O_5 was used to remove the H_2O formed, the time of half conversion was proportional to pressure; the rate was independent of the H_2 pressure. If a cold bath (-90°C) was placed around the reaction vessel to remove the H_2O formed, the character of the reaction changed completely. No reaction occurred below 730°C.

10187. Farkas, A. and Farkas, L. **Mechanism of some catalytic exchange reactions of heavy hydrogen.** *Trans. Faraday Soc.* **33**, 678-90(1937).—*C.A.* **31**, 7322^{8}.

Catalyst exchange of H atoms between gaseous D_2 and H_2O and some alcs. was investigated with a platinized Pt foil. The following processes were assumed in the adsorption layer: ($R = C_2H_5O$, or OH, etc.) (1) $RH \rightarrow R + H$, (2) $D_2 \rightarrow D + D$, (3) $R + D \rightarrow RD$ and (4) $H + D \rightarrow HD$. With low concn. of H_2O or alc., equation (1) was the rate-governing step; at higher concn. equation (2) was.

10188. FARKAS, A. AND FARKAS, L. **The catalytic interaction of heavy hydrogen and benzene on platinum.** *Trans. Faraday Soc.* 33, 827-37 (1937).—*C.A.* 31, 6542^5.

The rate of interaction on Pt foil placed in the gas phase was measured by the thermal-cond. method at room temp. and at partial pressures of C_6H_6 and H_2 ranging from 3 to 150 mm Hg. Hydrogenation and exchange occurred simultaneously and independently. The abs. rate of hydrogenation was proportional to the H_2 pressure and independent of the C_6H_6 pressure; the abs. rate of exchange was independent of the H_2 pressure and approx. proportional to the 0.4th power of the C_6H_6 pressure. The catalyst was mainly covered with H_2, and the C_6H_6 mols. were adsorbed very strongly on a few places.

10189. GRIFFITH, R. H. **Catalysis in hydrocarbon chemistry. V. Promoter concentrations.** *Trans. Faraday Soc.* 33, 407-9 (1937).—*C.A.* 31, 3773^6.

When a Mo oxide catalyst was promoted by the addn. of another oxide, the promoter concn. for greatest activity was the same for Na, Cr, Fe, Cu, Ce, Al, Ba, Pb, B and Th. When present as a metal, the promoter concn. was half that necessary when present as an oxide.

10190. GRIFFITH, R. H. AND HILL, S. G. **Catalysis in hydrocarbon chemistry. VI. Conversion of phenol to benzene.** *Trans. Faraday Soc.* 33, 409-12 (1937).—*C.A.* 31, 3773^6.

A Mo oxide catalyst promoted with SiO_2 and Al_2O_3 was used to study the reduction of PhOH by H_2. The promoter concn. for max. reactivity differed from that in the case of hexane decompn. Compd. formation occurred in certain cases between the promoter and catalyst.

10191. GRIFFITH, R. H. AND HILL, S. G. **Catalysis in hydrocarbon chemistry. VII. Carrier action and molecule size.** *Trans. Faraday Soc.* 33, 412-16 (1937).—*C.A.* 31, 3773^6.

The decompn. of dekalin, decane, hexane and cyclohexane over CuO, TiO_2, Cr_2O_3 promoted with MgO as a carrier, and Cr_2O_3 with lead silica as a promoter was studied. Most active catalysts did not necessarily have the largest no. of active centers. The lowering effect of carriers was not due to compn. formation with the catalyst, and for a catalyst with many active centers a carrier will lower the activity at a concn. depending on the size of the reacting mol.

10192. JULIARD, A. **Heterogeneous catalysis. I. Study of promotion in the conversion of cyclohexane to benzene and methane.** *Bull. soc. chim. Belg.* 46, 549-618 (1937).—*C.A.* 32, 3244^4.

Promoters of easily reducible oxides (Fe, Cu, Cd, Pb) decreased the activity as well as 1% of $CaCO_3$ or $BaCO_3$. The oxides of Mn, Zn, Cr, Ce, Th, Al and Be increased the activity of Ni catalysts. Ni-ZnO mixts. showed a dehydrogenation proportional to the ZnO content, but other mixts. simultaneously caused dehydrogenation and conversion to CH_4.

10193. KUBOKAWA, MASAO, **A note on "The decomposition of methane on the surface of platinum".** *Rev. Phys. Chem. Japan* 11, 217-19 (1937) (in English).—*C.A.* 32, 2817^7.

Retardation was treated as a diminution in the active centers during the reaction, the adsorption equil. being always established. The energy distribution of the active centers of a catalyst was studied.

10194. LEL'CHUK, S. L. AND VELTISTOVA, M. V. **Catalytic production of esters from alcohols.** *Org. Chem. Ind.* (U.S.S.R.) 4, 147-52 (1937).—*C.A.* 32, 2085^4.

95-6% EtOH was passed over Cu with and without the addn. of Cr_2O_3, Al_2O_3, MnO, MgO and TiO_2. At 275°C and a circulation rate of 15 ml/hr over 25 ml catalyst, Cu gave in the 1st run 28.4% AcOEt, 4.92% AcOH, 15.27% AcH and a gas contg. 85% H_2. The stability of the Cu catalyst was improved and the AcOEt yield somewhat increased by adding 2% Cr_2O_3. An equally good yield was obtained with the contact mixt. contg. 20% Al_2O_3, though it is mechanically unstable. Results, superior to Cu-Ce and equal to Cu-Zr, were obtained with the contact mixt. of Cu with 10% Al_2O_3 and 2% Cr_2O_3, giving a condensate contg. 45% AcOEt, 6.4% AcOH and 7% AcH with 50% utilization of the alc. in the first run and 75% in 3 recirculations.

10195. LEL'CHUK, S. L. AND VELTISTOVA, M. V. **Combined production of acetic acid and ethyl acetate by catalytic decomposition of ethyl alcohol at ordinary pressure.** *Org. Chem. Ind.* (U.S.S.R.) 4, 245-53 (1937).—*C.A.* 32, 2085^7.

In the catalytic esterification of alc. with a Cu catalyst, the AcOH yield was considerably increased by raising the temp. to 300°C and introducing water vapors for the hydration of the AcH formed in the catalysis: $AcH + H_2O = AcOH + H_2$. The AcH and uncondensed gaseous portion was passed through a 2nd reaction chamber over the Cu catalyst; 47.7% AcH contg. 8% H_2O was converted into AcOH at 300-25°C.

10196. MORIKAWA, K.; TRENNER, N. R., AND TAYLOR, H. S. **Activation of specific bonds in complex molecules at catalytic surfaces. III. Carbon-hydrogen and carbon-carbon bonds in propane and ethylene.** *J. Am. Chem. Soc.* 59, 1103-11 (1937).—*C.A.* 31, 8340^7.

The exchange reaction between propane and D_2 on a Ni catalyst occurred about 90°C lower than the hydrogenation-decompn. forming ethane and methane. Both reactions were inhibited by H_2 adsorbed on the catalyst. Not only the H_2 adsorbed upon the catalyst, but also the H in the bound water in the kieselguhr support, was available for exchange reactions. Cu catalysts favored the exchange reaction, but not the decompn.

10197. PAVELKA, FRITZ. **Significance of the boundary surface as participant in reaction.** *Mikrochemie* 23, 202-16 (1937).—*C.A.* 32, 2010^2.

Examples were cited in which so-called "catalysis" was merely adsorption, whereby the reaction was stabilized. Thus, a neg. catalyst was often made ineffective as a result of its adsorption by a colloid. In electrochem. reactions (corrosion) the protection afforded by a colloid might be the result of the adsorption of microquantities of more noble ions; in this way the formation of electrolytic couples was avoided.

10198. Schenck, Rudolf and Kurzen, Fritz. **The activation of oxides by foreign oxides. II. The activation of the oxides of copper.** *Z. anorg. allgem. Chem.* 235, 97-109 (1937).—*C.A.* 32, 2818^{1}.

The O_2 tension of CuO was increased by the addn. of Fe_2O_3, Al_2O_3, Mn_2O_3, and especially by Cr_2O_3, because the Cu_2O formed compds. with the sesquioxides. With Mn_2O_3 was formed a cupricupromanganite, $CuO.(Cu_2O.Mn_2O_3)_2$, partly miscible with cupromanganite, $Cu_2O.Mn_2O_3$. The mixt. 3CuO + Cr_2O_3 gave excellent results in the micro-elementary analysis of very difficultly combustible org. substances.

10199. Taylor, H. S. and Joris, G. G. **The characteristics of a copper catalyst activated by magnesia.** *Bull. soc. chim. Belg.* 45, 241-52 (1937).—*C.A.* 31, 8341^{4}.

The catalyst was prepd. by co-pptn. of the hydroxides of Cu and of Mg in the mol. proportions of 1 $Cu(OH)_2$ to 4 $Mg(OH)_2$, washing, drying and reducing in H_2. C_2H_4 was hydrogenated at 0 °C and C_6H_6 at 225 °C by the catalyst. Cyclohexane was dehydrogenated into C_6H_6 between 330° and 460 °C without side reactions. The energy of activation was 8.6 kcal. The catalyst was less active than Ni in breaking the C-C bond. The conversion of C_2H_4 and H_2 into CH_4 took place slowly at about 400 °C.

10200. Toyama, Osamu. **The kinetics of the catalytic hydrogenation of ethylene with nickel. I. II. Reaction at high temperatures.** *Rev. Phys. Chem. Japan* 11, 153-65 (1937)(in English); 12, 115-24 (1938)(in English).—*C.A.* 32, 2414^{4}; 33, 1580^{1}.

From the temp. coeff. of the const. k_2, the heat of adsorption of C_2H_4 was about 15 kcal/mol. The temp. independence of k_1 indicated that the true heat of activation for the reaction was roughly as large as the sum of the adsorption heats of both reactants. In the hydrogenation of C_2H_4 with Ni catalyst at 99-165 °C, as at lower temps., the rate of reaction was practically independent of C_2H_6 and the pretreatment of the catalyst with any reactant gas.

10201. Adadurov, I. E. and Prozorovskii, N. A. **Effect of support on sintering of catalysts.** *J. Phys. Chem.* (U.S.S.R.) 12, 445-50 (1938).—*C.A.* 34, 3161^{8}.

The hydrogenation of C_2H_4 catalyzed by Ni supported on sulfates of bivalent metals showed that the greater the radius of the cation of the support, the smaller was the tendency of the catalyst to sinter and the greater its activity. With an oxide of a quadrivalent metal as support, the activity was greater and the tendency to sinter smaller than with a sulfate of a bivalent metal as support.

10202. Bork, A. Kh. and Tolstopyatova, A. A. **Catalyst poisoning from the viewpoint of the specificity of active centers. VII. Kinetics of the dehydration of ethyl alcohol on aluminum oxide. VIII. Orientation of the molecules of the aliphatic alcohols $C_nH_{2n+2}O$ in the dehydration of the alcohols on aluminum oxide. IX. Influence of methyl substituents on the activation energy of the dehydration of the aliphatic alcohols $C_nH_{2n+2}O$ on aluminum oxide.** *Acta Physicochim. U.R.S.S.* 8, 577-90; 591-602; 603-16 (1938).—*C.A.* 33, 6694^{4}.

The dehydration of EtOH by Al_2O_3 behaved similarly to the dehydrogenation of EtOH. The ratio a_2/a_1 of the adsorption coeffs. of H_2O to that of EtOH at 350 °C was 0.65. The dehydration of PrOH and iso-PrOH was similar; a_2/a_1 for PrOH and iso-PrOH was identical with that for EtOH. The influence of Me substituents on the activation energy of the dehydration of 6 aliphatic alcohols was experimentally investigated.

10203. Dunbar, Ralph E. **Preparation and use of copper-chromium oxide catalysts in dehydrogenations.** *J. Org. Chem.* 3, 242-5 (1938).—*C.A.* 33, 961^{8}.

Cu-Cr oxide catalysts were pptd. upon inactive material as an adequate support where this catalyst was used in the dehydrogenation of BuOH and other similar alcs. The supporting materials studied were arranged in the increasing order of effectiveness as Al_2O_3, pumice and celite. The catalyst retained its activity well over prolonged periods.

10204. Farkas, A. and Farkas, F. **Catalytic interaction of ethylene and heavy hydrogen on platinum.** *J. Am. Chem. Soc.* 60, 22-8 (1938).—*C.A.* 32, 2414^{5}.

The interaction of D_2 and C_2H_4 was studied on platinized Pt foil at pressures of 10-100 mm in the range 0-236 °C. Two reactions occurred: hydrogenation according to $C_2H_4 + D_2 = C_2H_4D_2$ and exchange according to $C_2H_4 + D_2 = C_2H_3D + HD$. In the range 0°-150 °C the hydrogenation had a temp. coeff. higher than unity corresponding to an energy of activation of 10 kcal. Above 150 °C the temp. coeff. was smaller than unity. A comparison of the hydrogenation with the ortho-para-conversion of H_2 and D_2 and with the reaction $H_2 + D_2 \rightleftharpoons 2HD$ showed that in the lower temp. range the rate-detg. step was the activation of H_2 mols.

10205. Juliard, A. and Herbo, Cl. **Researches on heterogeneous catalysis. II. Study of promotion for the hydrogenation of benzene.** *Bull. soc. chim. Belg.* 47, 717-69 (1938).—*C.A.* 33, 3243^{4}.

Ni and Co were poor catalysts for the hydrogenation of benzene to cyclohexene; Fe, Cu and Cd from the reduction of the mixts. NiO-Fe_2O_3, NiO-CuO and NiO-CdO were inhibitors; $CaCO_3$ and $BaCO_3$ in small amts. were inhibitors; oxides of Be, Al, Cr, Ce and Zn were marked promoters.

10206. Khrizman, I. A. **The mechanism of the catalytic decomposition of ammonia.** *Ber. Inst. phys. Chem., Akad. Wiss. Ukr. S.S.R.* 8, 37-57 (1938).—*C.A.* 34, 5731^{6}.

The catalytic decompn. of NH_3 was studied: (a) fixation of the intermediate compds. and investigation of their properties, (b) nature of intermediate products obtained in the synthesis of NH_3, (c) adsorption of N_2, H_2 and NH_3 by ammonia catalysts, (d) kinetics of the catalytic decompn. and synthesis of NH_3 and the kinetics of decompn. of nitrides.

10207. Maxted, E. B. and Evans, H. C. **Catalytic toxicity and chemical structure. II. Influence of various factors on toxicity of sulfur compounds.** *J. Chem. Soc.* **1938**, 455-8.—*C.A.* 32, 5288^1.

The addn. of a second terminal S to a hydrocarbon chain decreased the toxicity. This was due to decrease of mobility, because the effect was absent if the 2 S atoms were adjacent.

10208. Pisarzhev'skii, L.; Chrelashvili, S., and Savchenko, G. **Prevention by irradiation of the poisoning of catalysts.** *Ber. Inst. physik. Chem., Akad Wiss. Ukr. S.S.R.* **8**, 9-22 (1938).—*C.A.* 34, 5731^7.

Ultraviolet irradiation of Pt during and before the decompn. of H_2O_2 greatly diminished the poisoning of the catalyst by H_2S, C_2H_5OH and I_2.

10209. Rapoport, I. B. and Lang, A. **Genesis of catalyst skeletons.** *J. Applied Chem.* (U.S.S.R.) **11**, 1056-62 (1938) (in French, 1063).—*C.A.* 33, 4115^8.

The properties were investigated of catalyst skeletons which were obtained by the treatment of alloy (Ni-Co-Al or Ni-Al) with an alkali to remove most of Al. The catalyst skeletons were more stable against poisoning with S-contg. org. compds. than the pptd. catalysts (oxides). The hydrogenation of caprylene, octyl alc., cyclopentanone and 1, 3, 4-xylenol in a current of H_2 at 190-5°C disclosed that the Ni-Co-Al catalyst skeleton was a very active hydrogenation catalyst. Above 260°C (280-320°), the surface of the catalyst was gradually covered with a carbon film and the catalyst completely lost its activity.

10210. Rusov, M. T. and Roiter, V. A. **Kinetics of the catalytic synthesis of ammonia.** *J. Phys. Chem.* (U.S.S.R.) **11**, 390-9 (1938).—*C.A.* 33, 4115^5.

Catalyst No. 340 (of the GIA) was used. The velocity of the reaction and total partial pressures of the components and the compn. of the reaction mixt. were related. In all cases the total pressure was less than 1 atm. The adsorption of NH_3 on the catalyst followed the equation: $A = abp/(1 + bp)$, where $a = 0.2$ ml and $b = 0.001$. The equation $U = K\ (p_{H_2} p_{N_2}^{0.5}/p^{0.25})$, accounting for the adsorption of NH_3 on the catalyst, represented quite well the kinetics.

10211. Tanaka, Yosio. **Nickel catalysts in chemical industries.** *Japan Nickel Rev.* **6**, 262-70 (1938).—*C.A.* 33, 3539^9.

The prepn. of Ni catalysts and their application in the hydrogenation of oils and the production of tetralin, cyclohexane, cyclohexanol and methylcyclohexanol were described.

10212. Taylor, A. and Weiss, J. **Defect lattices and catalytic activity.** *Nature* **141**, 1055 (1938).—*C.A.* 32, 6535^9.

X-ray examn. of Ni-Al alloys showed the existence of Ni_3Al, Ni_2Al_3 and $NiAl_3$, all with distinct structures. Upon treating this alloy with NaOH soln., Al atoms were removed from the lattice, leaving vacant sites. When 0.5% Al remained, the structure ultimately collapsed and formed the face-centered cubic structure of Ni.

10213. Tutumi, Shigeru. **Promoting action of promoters and carriers. VI. The relation between the dispersity of catalysts and the catalytic activity.** *J. Chem. Soc. Japan* 59, 1407-11 (1938).—*C.A.* 33, 2290^8.

In the catalytic reduction of C_6H_6 the following catalyst was most effective: To the soln. of $Co(NO_3)_2$ a slight excess of K_2CO_3 was added. The ppt. was dried at 200°C, mixed with kieselguhr and water in a mortar, and dried at 100°C. The ratio of Co to kieselguhr was 1:40. A catalyst having the compn. (4Ni + Co) + 7.5% Cr was prepd. for the synthesis of liquid hydrocarbons from CO and H_2.

10214. Baukloh, W. and Knapp, B. **The progress of the reaction between hydrogen and carbon in iron.** *Arch. Eisenhuttenw.* 12, 405-11 (1939); *Iron and Steel Inst. (London), Carnegie Schol. Mem.* 27, 149-64 (1938).—*C.A.* 33, 3732^2.

The basic reaction $Fe_3C + 2H_2 \rightleftharpoons 3\ Fe + CH_4$ was discussed. At first H_2 dissolved, independently of temp. and carbon present on the Fe surface. The Fe formed in this stage obstructed further direct access of H_2 and the reaction continued only after diffusion of H_2. Beginning at 850°C the migration velocity of carbon was higher than the reaction velocity of H_2 and carbon. The reaction became the slower process and was detd. by the equil. conditions.

10215. Beeck, O.; Wheeler, A., and Smith, A. E. **Catalytic activity and crystal orientation of metal films.** *Phys. Rev.* 55, 601-2 (1939).—*C.A.* 34, 4947^9.

10216. Buben, N. and Shekhter, A. **Chemical reactions in electric discharges. IV. Recombination of nitrogen atoms on metals.** *Acta Physicochim. U.R.S.S.* **10**, 371-8 (1939) (in German).—*C.A.* 33, 6163^4.

Considerable recomb. of N atoms occurred on Au, Cu, Fe and Ag surfaces at room temps. On Ni surfaces, the recomb. of N atoms had an activation energy of about 2500 cal/mol, between 300° and 1200°K. Above 1200°K the surface recomb. decreased rapidly. The temp. of the max. rate of recomb. was 1170°K at 0.005 mm and 1320° ± 25°K at 0.02 mm Hg. The heat of adsorption of N atoms on Ni was about 55 ± 2 kcal/mol.

10217. Canneri, G. and Cozzi, D. **The mechanism of the catalytic action of the oxides of vanadium in the conversion of methanol to formaldehyde.** *Chimica e industria* (Italy) **21**, 653-5 (1939).—*C.A.* 34, 3237^3.

The reactions considered were: (1) $6MeOH + V_2O_5 \rightarrow 2Me_3VO_4 + 3H_2O$; (2) $2Me_3VO_4 + 2H_2O \rightarrow V_2O_4 + 5MeOH + CH_2O$; (3) $2Me_3VO_4 + H_2O \rightarrow V_2O_3 + 4MeOH + 2CH_2O$. As formation of the intermediate oxides of V controlled the reaction, addn. of O_2 to the reaction mixt. up to the theoretical limit increased the yield.

10218. Chakravarty, K. M. **Hydrogenation of nickel carbonyl.** *Ind. Eng. Chem.* **31**, 1069-60 (1939).—*C.A.* **33**, 7498⁶.

The principal reactions in the hydrogenation process were $CO + H_2 = C + O_2$ and $2CO + 2H_2 = CO_2 + CH_4$.

10219. Elovich, S. Yu. and Zhabrova, G. M. **Mechanism of the catalytic hydrogenation of ethylene on nickel. I. Kinetics of the process. II. Role of the activated adsorption of ethylene and hydrogen in the hydrogenation process. General scheme of the process.** *J. Phys. Chem.* (U.S.S.R.) **13**, 1761-74, 1775-86 (1939).—*C.A.* **35**, 373⁵.

H_2 and C_2H_4 were held by activated adsorption to a Ni catalyst prepd. by reduction of NiO. The energy for the activated adsorption for H_2 was 16 ±1 kcal and for C_2H_4, 9 kcal. When the reaction was carried out stepwise, i.e., adsorption of H_2 and then of C_2H_4, or the reverse, no hydrogenation occurred. As the temp. rose, the rate of activated adsorption of C_2H_4 increased relatively more rapidly than the rate of hydrogenation until finally its abs. rate was also greater.

10220. Ipatieff, V. N.; Corson, B. B., and Kurbatov, I. D. **Copper as a catalyst for the hydrogenation of benzene.** *J. Phys. Chem.* **43**, 589-604 (1939).—*C.A.* **33**, 5269⁸.

The activities of several Cu catalysts were correlated with chem. compn., conditions of reduction, and phys. structure (studied microscopically and by the emanation method). Traces of impurities, especially Ni, greatly affect activity. Pure Cu catalyzed the hydrogenation of benzene at 100 kg/cm² pressure, but only slightly at atm. pressure. The presence of 3.5% Cr_2O_3 increased the surface and the activity.

10221. Joris, George G. and Taylor, Hugh S. **Exchange reactions of nitrogen isotopes on iron and tungsten surfaces.** *J. Chem. Phys.* **7**, 893-8 (1939).—*C.A.* **33**, 9128².

Fe synthetic-NH_3 catalysts and W filaments in promoting the reaction between N_2^{15} and N_2^{14} were studied from room temp. to 725°C with Fe and to 900°C on W. In contrast to the exchange reaction of mol. H_2 isotopes, the exchange reaction of N_2 mols. was very slow, being first measurable above 450°C. The exchange was accelerated by the presence of H_2. The temp. coeff. of exchange in a N_2:$3H_2$ mixt. was about 50 kcal. Measurements of the velocity of N_2 adsorption at about 400°C on synthetic-NH_3 catalysts involved true activated adsorption.

10222. Kawakubo, Syoitiro. **Studies on the catalytic oxido-reduction of some metallic complex salts. XII. Catalytic oxidation of pyrogallol by the complex salts of platinum group.** *J. Chem. Soc. Japan* **60**, 1031-6 (1939).—*C.A.* **34**, 1582³.

Generally, the ammine complex salts of Pt, Pd, Rh and Ru had no catalytic action; some even showed retarding action. The catalytic action of metallic complex salts depended on their constitution and on the nature of the central metal.

10223. Kazanskii, B. A. and Tatevosyan, G. T. **Influence of the substituents on the velocity of catalytic hydrogenation of certain trisubstituted ethylenes in the presence of platinum.** *J. Gen. Chem.* (U.S.S.R.) **9**, 1458-64 (1939).—*C.A.* **34**, 2783⁵.

1-Methyl-2,2-diethyl-, 1,2-dimethyl-1-phenyl-, 1-methyl-2,2-diphenyl- and triphenylethylene were hydrogenated in 96% alc. in the presence of Pt black at room temp. The velocity of hydrogenation of trisubstituted ethylenes decreased with increasing no. of aryl substituents in the mol.

10224. Kobozev, N. I. and Klyachko-Gurvich, L. L. **A theory of the formation of catalytically active "ensembles" on surfaces. II. An application of the theory to the synthesis of ammonia and to the catalytic and electrocatalytic hydrogenation of the ethylene bond.** *Acta Physicochim. U.R.S.S.* **10**, 1-24 (1939) (in English).—*C.A.* **33**, 7654⁵.

The av. no. of atoms in active ensembles was 3 Fe for the reaction $N_2 + 3H_2 = 2NH_3$; 3 Pt for $2H_2 + O_2 = 2H_2O$; 2Pd for fumaric acid hydrogenation; 4Pt or 4 Ni for $C_2H_4 + H_2 = C_2H_6$; 2 Fe or 2 Pt for the electrocatalytic hydrogenation of cinnamic acid in the presence of traces of $HgCl_2$ and K_3AsO_4 catalyst poisons as activators. For reactions of H_2 with dissocd. mols., the ensembles contained 3 atoms; for addn. to the C=C bond they probably contained 2-4 atoms.

10225. Kostelitz, O. and Hensinger, G. **Catalytic dissociation and synthesis of methanol.** *Chimie & industrie* **42**, 757-73 (1939).—*C.A.* **34**, 3572³.

ZnO prepns. were obtained by different processes from $ZnCO_3$ and treated in various ways. The catalytic action of these prepns. after they had been used for the synthesis were studied on the dissocn. of MeOH to see what changes were undergone during the high-pressure synthesis tests. In the synthesis of MeOH Smithsonite was the most active catalyst, followed by ZnO pressed under 1000 atm. and by $ZnCO_3$ pressed under 2000 atm. and subjected to preliminary treatment in MeOH vapor at 300°C. Tests on the dissocn. of MeOH with catalysts that had been used for synthesis showed a considerable decrease in the catalytic power, and the sp. activity of these catalysts also seemed to have undergone considerable modifications.

10226. Levina, R. Ya. **The contact isomerization of ethylene hydrocarbons over metallic oxides. III. Comparative action of certain contact substances in the isomerization of allylbenzene.** *J. Gen. Chem.* (U.S.S.R.) **9**, 2287-90 (1939).—*C.A.* **34**, 4730⁷.

When $PhCH_2CH{:}CH_2$ was passed at a rate of 2-3 drops/min. in a weak CO_2 current over 30-cm layers of Cr_2O_3 and Fe_2O_3 at 220°C, it was isomerized to give 72% PhCH:CHMe. The reaction at 300°C over activated clay, silica gel, and charcoal gave PhCH·CHMe in 35, 58, and 42% yields, resp.

10227. Litkenhous, E. E. **Hydrogenation of nickel carbonyl.** *Ind. Eng. Chem.* **31**, 1059-60 (1939).—*C.A.* **33**, 7498⁶.

It was assumed and established that the principal reaction was $2C + 2H_2O = CH_4 + CO_2$.

10228. Monblanova, V. V.; Koboziv, N. I., and Filippovich, P. H. **Activation process and the nature of the centers in electrocatalytic hydrogenation.** *J. Phys. Chem.* (U.S.S.R.) **13**, 326-40 (1939); *Acta Physicochim. U.R.S.S.* **11**, 317-42 (1939) (in English).—*C.A.* 34, 1256^6.

The electrocatalytic hydrogenation of cinnamic acid was studied at electrodes with large (Cu, Ag, Hg, Pb, Sn) and small (Pt, Fe) H overvoltages and in the presence of catalyst poisons such as K_3AsO_4 and $HgCl_2$. The first group of metals was poisoned and the second activated up to a certain max. concn., 1×10^{-5} mols./liter in alkali, 6×10^{-4} in acid for $HgCl_2$ on a Pt cathode and 1×10^{-4} mols./liter for K_3AsO_4 on an Fe cathode. On a clean Pt cathode the energy of activation between 0° and 51°C was 5.95 cal, on a Hg film 1.5 mol. thick 2.32, and on an amalgamated Pt cathode 1.21 cal/mol.

10229. Osame, Gohei and Hirai, Taizo. **The manufacture of sulfuric acid by means of vanadium catalyst on an intermediate scale. II. Increase of the draft-resistance in a small converter.** *J. Soc. Chem. Ind., Japan* 42, Suppl. binding 434 (1939).—*C.A.* 34, 3025^8.

Vanadium catalyst, fouled by Fe sulfate, was slightly inferior to the uncontaminated catalyst in layers at 425°C.

10230. Roginskii, S. Z. and Rozing, V. S. **The nature of the catalytic activity of platinum.** *Uchenye Zapiski Leningrad. Gosudarst. Univ., Ser. Fiz. Nauk* **1939**, No. 5 (No. 38), 67-72; *Khim. Referat. Zhur.* **1940**, No. 4, 5.—*C.A.* 36, 3092^5.

The catalytic activity of Pt increased under the influence of the mixt. of H_2 and O_2. H_2 alone inactivated Pt; O_2 increased its catalytic activity at 430°C. After removing O_2 from the surface of Pt by means of H_2 the Pt surface was inactivated, but treating it with the mixt. of the two gases rapidly restored the initial activity. The results indicated that O atoms or O_2 mols. imbedded in the porous Pt lattice were the active centers on the surface of Pt.

10231. Rubinshteĭn, A. M. **Relation of the activity and the selective action of mixed nickel-alumina catalysts to their composition and structure.** *J. Phys. Chem.* (U.S.S.R.) **13**, 1271-81 (1939).—*C.A.* 35, 374^2.

Exptl. data were obtained on the dehydration and the dehydrogenation products of iso-Am alc. on various mixed $Ni-Al_2O_3$ catalysts at 200-300°C as functions of compn., lattice consts. and dispersity of the catalyst. Although no simple relation between dispersity and compn. existed, the activity-compn. curve for dehydrogenation at all temps. passed through a max. near 30 and a min. near 70% Ni, whereas that for dehydration passed through a max. near 70% Al_2O_3. The 1 to 1 ratio Al_2O_3:Ni gave the best conditions for development of a phase boundary.

10232. Stearn, Allen E.; Johnston, H. P., and Clark, Chas. R. **The significance of activation entropy in catalytic mechanisms.** *J. Chem. Phys.* 7, 970-1 (1939).—*C.A.* 33, 9109^9.

The rate of a reaction was detd. by the heat of formation of the activated complex and its entropy of formation. The conditions under which ΔH^* or ΔS^* dominated the reaction were discussed: this detd. whether catalysis was pos. or neg. ΔH^*, ΔS^* and k' were given for: xanthogenic acid decompn.-alc., decompn. of malic acid by H_2SO_4-water, addn. of amylene to $CCl_3COOH-Me_2CO$, denaturation of egg albumin-urea, denaturation of oxyhemoglobin-alc., denaturation of oxyhemoglobin-$(NH_4)_2SO_4$.

10233. Talmud, D. L. **Organic catalysts.** *Vestnik Akad. Nauk S.S.S.R.* **1939**, No. 2-3, 119-22.—*C.A.* 34, 4083^6.

Linear adsorption at the boundary between 3 phases was discussed. The relationship between adsorption and the catalytic activities of org. adsorbents and the orientation of mols. in the surface layer of these adsorbents were studied.

10234. Teletov, I. S. and Gritsan, D. N. **The relation between the decomposition velocity of H_2O_2 and the degree of dispersion of gold sols. I. The role of alkali in the catalytic decomposition of H_2O_2 by gold.** *Zapiski Khar'kov. Sel'skokhoz. Inst.* 2, No. 1-2, 47-58 (1939); *Byull. Khim. Obshchestva im. Mendeleeva* **1940**, No. 8, 22-4; *Trudy Inst. Khim. Khar'kov Gosudarst. Univ.* 5, 235-46 (1940).—*C.A.* 37, 3659^7.

Au alone did not decomp. aq. solns. of H_2O_2. Addn. of NaOH decompd. H_2O_2 in the presence of Au plates, the velocity of the decompn. depending on the character of the surface of the plates. During the first 30-40 min. the reaction-velocity const. decreased continuously, the decrease being greater the more concd. the NaOH soln. KOH decompd. H_2O_2 more energetically than did NaOH. Au acted as a promoter and the mechanism of the decompn. of H_2O_2 was: $H_2O_2 \rightleftharpoons H^+ + HO_2^-$; $H^+ + OH^- = H_2O$; $HO_2^- = OH^- + O$.

10235. Temkin, M. and Pyzhev, V. **Kinetics of the synthesis of ammonia on promoted iron catalysts.** *J. Phys. Chem.* (U.S.S.R.) **13**, 851-67 (1939); *Acta Physicochim. U.R.S.S.* **12**, 327-56 (1940).—*C.A.* **34**, 6512^7; **35**, 7273^9.

From exptl. data on the synthesis and decompn. of NH_3 on tech. Fe catalysts promoted by Al_2O_3 and K_2O at 400-450°C and 1 atm. pressure and $H_2:N_2$ ratios of 0.5 up to 8.5, the rate consts. were $k = 1.04 \times 10^3$ at 400°C and 7.78 at 450°C. The rate of formation of NH_3 was given by $v = k_1 P_{N_2} (P^3_{H_2}/P^2_{NH_3})^{\alpha}$, with $\alpha = 0.5$. The detg. factor in the forward process was the rate of activated adsorption on the N_2-free surface. For the reverse process, the rate of NH_3 desorption was the rate-detg. factor.

10236. Tutumi, Sigeru. **Catalysts for the synthesis of liquid hydrocarbons from carbon monoxide and hydrogen. III. Catalysts prepared by the roasting method.** *Sci. Papers Inst. Phys. Chem. Research* (Tokyo) 35, 481-6 (1939).—*C.A.* 33, 6535^4.

Catalysts contg. 5% Co and 12% Cu or 5% Co and 4% Cu, activated with U_3O_8, were less active and had lower optimum reduction temps. when prepd. by roasting below 300°C than when prepd. by pptn. More kieselguhr must be added to the roasted catalysts to obtain the activity of the pptd. material.

10237. Tutumi, Sigeru. **Catalysts for the synthesis of liquid hydrocarbons from carbon monoxide and hydrogen. IV. Catalysts prepared by the roasting method.** *Sci. Papers Inst. Phys. Chem. Research* (Tokyo) 36, 47-52 (1939).—*C.A.* 33, 6535^4.

The optimum reduction temp. for Co catalysts prepd. by roasting was lower, and the decrease in activity from using high reduction temps. was greater than for pptd. Co catalysts. The amt. of kieselguhr in the roasted catalysts must be increased to raise their activity. The decrease in activity of roasted Co catalysts was greatest when Mn was a promoter, less with heavier ThO_2 and least with the heaviest U_3O_8.

10238. Tutumi, Sigeru. **Catalysts for the synthesis of liquid hydrocarbons from carbon monoxide and hydrogen. VIII. Changes on the catalyst surface caused by the addition of promoter and carrier.** *Sci. Papers Inst. Phys. Chem. Research* (Tokyo) **36**, 335-43 (1939).—*C.A.* **33**, 9103^7.

A Ni-7.5% Cr-50% kieselguhr catalyst was more active than a Ni-10% Al_2O_3-100% kieselguhr catalyst for the reaction of CO with H_2. For the hydrogenation of benzene, the activity varied in the opposite order. In the Ni-kieselguhr catalyst, the optimum ratio of kieselguhr to Ni was 1:2 for the CO-H_2 reaction and 50:1 for the hydrogenation of benzene. The action of the promoter did not differ greatly from that of the carrier, although a larger amt. of the carrier was needed to prevent sintering during reduction of the catalyst.

10239. Tutumi, Sigeru. **Catalysts for the synthesis of liquid hydrocarbons from carbon monoxide and hydrogen. IX. The relation between the surface dispersity of catalysts and the catalytic activities.** *Sci. Papers Inst. Phys. Chem. Research* (Tokyo) **36**, 344-51 (1939).—*C.A.* **33**, 9103^7.

Co-kieselguhr catalysts for the hydrogenation of benzene were prepd.: (1) $Co(NO_3)_2$ was treated with K_2CO_3 in the presence of kieselguhr; (2) $Co(NO_3)_2$ was treated with K_2CO_3 and the ppt. dried and mixed with kieselguhr in a little H_2O; (3) $Co(NO_3)_2$ and kieselguhr were mixed and roasted. The products were dried and reduced by H_2 at various temps.

10240. Twigg, George H. **Mechanism of catalytic exchange reactions between deuterium and olefins.** *Trans. Faraday Soc.* **35**, 934-45 (1939).—*C.A.* **33**, 9103^2.

The olefin mol. was adsorbed on the Ni catalyst at 2 points through the opening of the double bond; a D atom formed a Ni-alkyl radical which then decompd. to reform the adsorbed olefin mol. and released a H atom. All the H atoms in the higher olefins were exchangeable with D under conditions where no exchange took place between ethane and D; no double bond migration occurred in the absence of H.

10241. Veltistova, M. V. and Lel'chuk, S. L. **Synthesis of acetates of higher alcohols by catalytic dehydrogenation.** *Org. Chem. Ind.* (U.S.S.R.) **6**, 657-60 (1939).—*C.A.* **34**, 5414^2.

The dehydrogenation of BuOH and AmOH in the mixts. proceeded at a nearly equal rate to give complex mixts. of the corresponding Et, Bu and Am acetates, butyrates and valerates and acids and aldehydes. With increasing mol. proportion of EtOH, the yields of esters increased and those of acids and aldehydes decreased.

10242. Balandin, A. A. and Liberman, A. L. **Kinetics of dehydrogenation of *sec*-butyl alcohol and reversible poisoning of copper catalysts.** *Compt. rend. acad. sci. U. R. S. S.* **28**, 794-9 (1940) (in English).—*C.A.* **35**, 2781^8.

The mean life of mols. of secondary alcs. on the surface of Cu was detd. and their dehydrogenation products (the ketones). A considerable irreversible poisoning was noticed in the dehydrogenation of *sec*-BuOH on Cu (particulary above 240°C). The curves obtained for the equations showed that the activation heats of secondary alcs. were lower than those of primary alcs.

10243. Beeck, Otto; Smith, A. E., and Wheeler, Ahlborn. **Catalytic activity, crystal structure and adsorptive properties of evaporated metal films.** *Proc. Roy. Soc. London* **A177**, 62-90 (1940).

Metal films of high and reproducible catalytic activity were obtained by condensation of their vapors on glass at any desired temp. The catalytic activity was measured by the hydrogenation of ethylene. The crystal structure of these films was investigated by electron diffraction. By controlling the pressure of an inert gas (N_2, A, etc.) during evaporation of the metals, unoriented and oriented films could be produced at will, and their catalytic activities were compared. Oriented gas-evaporated Ni films have twice the B.E.T. surface per gram of randomly oriented high-vacuum films but ten times the activity. The most extensive studies were made on Ni films, but films of Fe, Co, Pd, Pt and Cu were also investigated, and with the exception of Cu similar results were obtained.

10244. Bhatnagar, S. S.; Prakash, Brahm, and Singh, Jarnail. **Magnetism and catalysis. I. Catalytic decomposition of potassium chlorate by manganese dioxide and ferric oxide.** *J. Indian Chem. Soc.* **17**, 125-32 (1940).—*C.A.* **34**, 4972^4.

Mixts. of $KClO_3$ and MnO_2 were heated to various temps. for 0.5-1.0 hr and the resulting products were then analyzed. The mechanism of the catalyzed decompn. of $KClO_3$ and MnO_2 involved the formation of an intermediate compd. Similar expts. on mixts. of $KClO_3$ and Fe_2O_3 gave no significant differences between the exptl. and calcd. values of the susceptibilities.

10245. Boreskov, G. K. and Pligunov, V. P. **Mechanism of the oxidation of sulfur dioxide in the presence of activated vanadium catalysts. I. Stability of vanadium compounds under the condition of sulfuric acid catalysis.** *J. Applied Chem.* (U.S.S.R.) **13**, 329-35 (in German, 336) (1940).—*C.A.* **34**, 8185^6.

KVO_3, $NaVO_3$, $Ba(VO_3)_2$ and V_2O_5 were treated with a gas contg. SO_2 5, SO_3 5 and O 17.0% at 480°C for 12-16 hrs. Except V_2O_5, all were active catalysts. V_2O_5 reacted with SO_2 very slowly, forming vanadyl sulfate. Addn. of small amts. of K_2O or K_2SO_4 increased the velocity of reaction of V_2O_5 with SO_2, yielding vanadyl sulfate and K_2SO_4 and $K_2S_2O_5$. In the presence of SiO_2, the reduction of V_2O_5 decreased with an increase of the amt. of SiO_2.

10246. Boreskov, G. K. and Pligunov, V. P. **Mechanism of oxidation of sulfur dioxide in the presence of activated vanadium catalysts. II. Influence of an admixture of salts of alkali elements and amorphous silicic acid.** *J. Applied Chem.* (U.S.S.R.) 13, 653-61 (in French, 662) (1940).—*C.A.* 35, 3396^8.

The catalytic activity of pure V_2O_5, V_2O_5 + amorphous SiO_2 (1 mol. to 8 mols., resp.), V_2O_5 + 0.1 mol. K_2SO_4 and 1 mol. V_2O_5 +8 mols. SiO_2 +0.1 mol. K_2SO_4 was investigated. Pure V_2O_5 did not change in compn. during catalysis, even at temps. below 500°C, and the apparent energy of activation of SO_2 oxidation was 38,000 cal. Addn. of 8 mols. of SiO_2 per mol. of V_2O_5 did not change the character of the relation of reaction velocity and temp., but the activity at all temps. was approx. 1/15 of that with V_2O_5 alone. Addn. of K_2SO_4 to the V_2O_5 decreased by about 90% the velocity of oxidation at temps. below 490°C.

10247. Briner, E. **The role of ozone as an oxidation catalyst. Interpretation of the favorable effect of dilution based on the laws of adsorption.** *Helv. Chim. Acta* 23, 590-6 (1940).—*C.A.* 34, 7168^9.

The catalytic action of O_3 in ozonized air for the oxidation of BzH, butyraldehyde and H_2SO_3 was assumed proportional to the amt. of O_3 adsorbed in the surface of the liquid and the adsorption obeyed the Freundlich equation. The enormous increase with diln. of the no. of O_2 mols. activated per O_3 mol. and the observed rate of oxidation as a function of concn. of O_3 were explained.

10248. Duhamel, A. **Comparison of the activities of two nickel catalysts.** *Bull. soc. chim.* 7, 358 (1940).—*C.A.* 39, 3721^9.

Exptl. data on a large no. of unsatd. compds., ketones, and unsatd. ketones showed that ethylene double bonds were reduced at the same rate by Raney-Ni and by Ni pptd. from Ni salt solns. by Zn. Carbonyl groups were reduced four times as rapidly by Raney-Ni in alk. soln. as by Ni.

10249. Eley, D. D. and Rideal, E. K. **Parahydrogen conversion on tungsten.** *Nature* 146, 401-2 (1940).—*C.A.* 34, 7710^7.

The W filament was most active catalytically when free of adsorbed O. The clean wire, exposed to gaseous H_2, took up a stable film of H, which did not evap. appreciably at room temp., and so could not give a para-H_2 conversion by Farkas' mechanism. It was more probable that the conversion occurred by a surface interchange of the type para-H_2 + WH → ortho-H_2 + HW.

10250. Eru, I. **Liquid fuel from brown coal.** *Novosti Tekhniki* 1940, No. 10, 32.—*C.A.* 34, 7087^3.

Finely ground Aleksandriisk brown coal and heavy oil and Fe catalyst were mixed with H_2 at 200 atm. and 400°C and the hydrogenated products sepd. and fractionated. About 95% of the org. mass of the coal was liquefied. In the 2nd stage of the process the middle oil obtained by hydrogenation was fed at a definite and const. rate into a chamber contg. highly active Mo-Ni catalyst. By recycling, it was possible to raise the gasoline yield to 75-80% or 45% of the org. matter.

10251. Farkas, L. and Sandler, L. **The heterogeneous ortho-para conversion on paramagnetic crystals.** *J. Chem. Phys.* 8, 248-51 (1940).—*C.A.* 34, 2686^8.

The rate of conversion of para-H_2 and ortho-D_2 was measured on paramagnetic crystals: $CuSO_4$, $NiCl_2$ and Nd oxalate. In the last case the conversion rate had a max. at 0°C. Below 0°C the desorption rate of the H_2 and the D_2 was rate-determining. The rate of desorption increased with increasing temp. and at higher temps. the rate of conversion on the surface became the slow process. The ratio of the rates for H_2 and D_2 approached 11 in this region. The heat of adsorption of H_2 on Nd oxalate was about 2.4. kcal/mol.

10252. Foresti, Bruno. **The effect of the pH on the rate of catalytic hydrogenation of olefins, benzene and some of its homologs.** *Boll. soc. Eustachiana* 38, 19-27, 29-38 (1940).—*C.A.* 36, 6400^4, 6400^6.

The rate of hydrogenation in the presence of Pt as a function of the apparent pH was detd. for the following unsatd. compds.: 1-heptene, asym. methylethylethylene, 2-pentene, tri-methylethylene, cyclopentene, cyclohexene, cyclopentadiene and dicyclopentadiene. The curve showed a slight rise with increase in the pH in acid media and a sharp drop in alk. media. Similar curves were detd. for some aromatic hydrocarbons: benzene, toluene, o-xylene, p-xylene, p-cymene and mesitylene.

10253. Frost, A. V. **Reactions of hydrocarbons on active aluminum silicates.** *J. Phys. Chem.* (U.S.S.R.) 14, 1313-18 (1940).—*C.A.* 35, 3883^2.

Polymerizations, isomerizations and cracking were discussed.

10254. Glushnev, V. E. and Gerasimov, M. M. **The effect of various factors during the refining of cracked gasolines by $ZnCl_2$.** *Vostochnaya Neft* 1940, No. 12, 29-30; *Khim. Referat. Zhur.* 4, No. 9, 120 (1941).—*C.A.* 38, 1867^1.

Gasoline obtained by vapor-phase oxidation cracking was treated at 185-365°C with $ZnCl_2$ added to pumice in an amt. equal to 52.6%. The optimum refining temp. was 220-30°C. Light gasoline could be refined at 150°C. Heating above 275°C resulted in the cracking of the product and lowered its quality.

10255. Grosse, Aristid, V.; Morrell, Jacque C., and Mavity, Julian M. **Catalytic dehydrogenation of monoölefins to diolefins. Source materials for synthetic rubber and resins.** *Ind. Eng. Chem.* 32, 309-11 (1940).—*C.A.* 34, 2646^1.

The following hydrocarbons were catalytically dehydrogenated to give conjugated diolefins of the same C framework: *n*-butenes, 3-Me-1-butene, 2-Me-1-butene + 2-Me-2-butene, 2-pentene, and cyclopentane. The reaction was carried out over alumina impregnated with 4% Cr_2O_3, at 190 mm and at 600°C with 0.34 to 0.75 sec. contact time. With cyclopentane, the temp. was 500°C and contact time 1.85 sec.

10256. Hüttig, G. F. and Bischoff, V. **Decomposition of calcium sulfate by silica.** *Reichsamt Wirtschaftsausbau, Chem. Ber. Pruf-Nr.* 93, (PB52008), 171-5 (1940) (Pub. 1941).—*C.A.* **41,** 5809*a*.

When heated to 800°C, $CaSO_4.2H_2O$ lost its H_2O. Further heating at 1000°-1300°C with an equimolar amt. of SiO_2 caused decompn. of the $CaSO_4$. The heating was done in Pt in an oven controlled to ± 2.5°. Dry SO_2 allowed the least decompn. when a stream was led through the oven at 2 or 4 liters/hr; O_2, air, and N_2 allowed somewhat more decompn. A stream of steam moving at 4 liters/hr allowed 92% decompn. after 4 hrs at 1100°C.

10257. Ipatieff, V. N. **Copper catalysts for the hydrogenation of benzene.** *Bull. soc. chim.* **7,** 281-95 (1940).—*C.A.* **36,** 4014^2.

Cu prepd. by a reduction of the oxide contg. 0.1% of Ni easily hydrogenated benzene at 225°C and ordinary pressure. Cu prepd. from the pptd. hydroxide or carbonate and contg. 0.2% of O easily hydrogenated benzene at pressures above atm., but weakly at atm. pressure. Cu obtained by the reduction of copper ions by H_2 under pressure did not hydrogenate benzene even at high pressure. The presence of 3.5% of Cr oxide increased the catalytic activity and the surface as detd. by the emanation method. At 350-400°C the activity of the catalyst and the surface decreased rapidly.

10258. Ipatieff, V. N.; Corson, B. B., and Kurbatov, J. D. **Mixed copper-chromium oxide hydrogenation catalysts.** *J. Phys. Chem.* **44,** 670-9 (1940).—*C.A.* **34,** 4869^3.

Hydrogenations of C_6H_6 and isopentene at atm. and superatm. pressures were used as a method of evaluating the hydrogenating activities of Cu-Cr_2O_3 catalysts. Cr_2O_3 increased the activity of Cu up to 5% oxide, and then decreased it. Cu and Cu-Cr_2O_3 catalysts were very sensitive to activation by traces of Ni.

10259. Iwasaki, Tomokichi. **Studies of the catalytic oxido-reduction by some metallic complex salts. XV. Catalytic oxidation by copper complex salts.** *J. Chem. Soc. Japan* **61,** 400-4 (1940).—*C.A.* **34,** 5338^7.

The catalytic oxidation of polyphenols and some other inorg. salts caused by the addn. of complex salts of Cu was studied by measuring the adsorption of O_2. The polyphenols, e.g., pyrogallol, were easily oxidized. The inorg. substances, e.g., NH_4Cl, $NaNO_2$, etc., were less affected by the addn. of Cu complex salts.

10260. Kawamoto, Tokio. **Dehydrogenation catalysts (preliminary report).** *J. Chem. Soc. Japan* **61,** 521-4 (1940).—*C.A.* **36,** 7016^5.

Isobornylaniline was dehydrogenated by heating at 300-400°C for 1-1.5 hrs in the presence of a metallic catalyzer to obtain an oily product from which, upon hydrolysis with dil. H_2SO_4 and distn. under 30 mm pressure, camphor was sepd.

10261. Kiyoura, Raisaku. **Activity center of a catalyst.** *Science* (Japan) **10,** 126 (1940).—*C.A.* **34,** 7169^4.

The catalyst of V_2O_5 type in the reaction, $SO_2 + \frac{1}{2}\ O_2 \rightleftarrows SO_3$, was investigated and the mols. of molten catalyst existing on the surface of the carrier were very active. The co-catalysts such as K_2SO_4, Na_2SO_4 or Li_2SO_4 caused the acceleration of the reaction catalyzed by V_2O_5 because such co-catalysts lowered the m.p. of the chief catalyst.

10262. Kobozev, N. I. **Theory of the formation of catalytically active ensembles on surfaces. IV. Application of the theory to the poisoning of catalysts.** *Acta Physicochim. U.R.S.S.* **13,** 469-504 (1940) (in German).—*C.A.* **35,** 2401^7.

The mols. of a catalyst poison were assumed to act only on the activity of a single ensemble independently of processes occurring in neighboring ensembles. The theory was able to explain many exptly. observed catalysis-poisoning phenomena. Calcns. were given for the NH_3 reaction on Fe, hydrogenation of the ethylenic bond on Pt, Pd. etc.

10263. Kurin, N. P. **Investigations of the activities of the ZnS-CuS methanol catalysts.** *Nauch. Tekh. Konferentsiya v Svyazi s Sorokaletnim Yubileem Uchebno-Nauch. Deyatel'-nosti Tomsk. Ind. Inst., Tezisy Dokladov* **1940,** 108-10; *Khim. Referat. Zhur.* **4,** No. 4, 100 (1941).—*C.A.* **37,** 5306^6.

The ZnS-CuS catalysts were obtained by the sep. pptn. of ZnS and CuS and they contained various amts. of CuS. Pure CuS and ZnS also were studied. The activities of the catalysts were detd. by the decompn. of MeOH vapors at vol. velocities from 420-2100 (vols. of vapor per unit vol. of catalyst per hr) and from 250° to 450°C. H_2S poisoned the catalysts, but their activities were restored by the passage of MeOH vapors. The decompn. process of MeOH took place into HCHO and H_2 and the decompn. of HCHO into CO and H_2.

10264. Kurin, N. P. **Investigation of the activity of ammonia catalysts reduced by pure hydrogen.** *Nauch.-Tekh. Konferentsiya v Svyazi s Sorokaletnim Yubileem Uchebno-Nauch. Deyatel'-nosti Tomsk. Ind. Inst., Tezisy Dokladov* **1940,** 112-13; *Khim. Referat. Zhur.* **4,** No. 4, 88 (1941).—*C.A.* **37,** 5560^5.

A remelted NH_3 catalyst contg. Fe_3O_4, Al_2O_3 and and K_2O was used for investigating the reduction process and the activity of the catalyst by the dynamic method at atm. pressures, at various temps. and various vol. velocities. At const. vol. velocities, the reduction velocity of the catalyst by H_2 increased with the increase in temp. The use of H_2 for the reduction (instead of the H_2 + N_2 mixt.) increased the activity of the catalyst.

10265. Kurin, N. P. and Orman, G. A. **Selective catalytic oxidation of carbon monoxide in the presence of hydrogen.** *Nauch.-Tekh. Konferentsiya v Svyazi s Sorokaletnim Yubileem Uchebno-Nauch. Deyatel'-nosti Tomsk. Ind. Inst., Tezisy Dokladov* **1940,** 113-14.—*C.A.* **37,** 5833^5.

Investigation of the com. value of Hopcalite, and other mixts. of MnO_2 and CuO to free a N_2-H_2 mixt. from CO was described. At 95°C the oxidation of CO (0.5% concn.) at high velocities was 97%. The reaction was bimol. and its velocity depended linearly on both CO and O_2. At 25-75°C the activation energy was 6500-860 cal/mol., increasing to 16,500-17,300 cal/mol. at 75-115°C.

10266. MAXTED, E. B. AND MARSDEN, A. **Catalytic toxicity and chemical structure. VI. Poisoning of platinum catalysts by metals.** *J. Chem. Soc.* 1940, 469-74.—*C.A.* 34, 4971^7.

The effect varied with the size of the atom and the valence.

10267. MEL'NIK, B. D.; LESOKHIN, I. G., AND TRABER, D. G. **Investigation of catalysts for the oxidation of nitric oxide to nitrogen dioxide.** *Trudy Leningrad. Krasnoznamen. Khim.-Tekhnol. Inst. im. Leningrad. Soveta* 9, 3-12 (1940).—*C.A.* 37, 4615^6.

Pumice as a catalyst had no effect on the oxidation of NO to NO_2 between 15° and 50°C. In the presence of iron oxide supported on pumice an insignificant acceleration occurred; Sb oxide on pumice increased the speed of reaction five-fold. MnO_2 and hopcalite (40% Cu + 60% MnO_2) increased the velocity of reaction at 20°C five-fold, at 60°C ten-fold. A Carboalum gel was most effective causing a forty-fold acceleration at 20°C.

10268. MORITA, NORIYOSI. **Catalytic isotopic exchange of gaseous oxygen. VI. Exchange of oxygen atom between oxygen and water vapor on the surface of oxides of the second, fourth and sixth groups of the periodic system. (2) Theoretical part.** *Bull. Chem. Soc. Japan* 15, 71-6 (1940).—*C.A.* 34, 4972^2.

The catalytic activities were compared of the oxides of Mg, Ca, Sr, Ba, Zn, Cd, Ti, Zr, Th, Cr, Mo and W. Elements of the 4th group had the lowest activity. Activity for those in the 2nd group increased with increasing at. no. and in the 6th group, it decreased with increasing at. no.

10269. MORITA, NORIYOSI. **Catalytic isotopic exchange of gaseous oxygen. X. Exchange reaction of gaseous oxygen between oxygen and water vapor on the surface of aluminum oxide. Influence of the composition of the gaseous reaction mixture on the degree of the exchange reaction.** *Bull. Chem. Soc. Japan* 15, 298-308 (1940).—*C.A.* 34, 7712^3.

With an O_2/H_2O ratio of 2/1, the reaction rate became measurable at 520°C; above 700°C the rate was rapid and equil. established quickly. The rate was independent of compn. Desorption of water vapor from the oxide surface detd. the rate. The activation energy was found to be 18 to 22 kcal.

10270. MURATA, YOSHIO AND MAKINO, SHÔZÔ. **The benzine synthesis from carbon monoxide and hydrogen. LII. Influence of the initial materials, the support and filler on the iron catalyst.** *J. Soc. Chem. Ind. Japan* 43, No. 7, 210-5 (1940).

The nitrate was best and the sulfate poorest for pptg. the iron catalyst. Kieselguhr was preferred to magnesia as the carrier. Alkali was a good accelerator; KOH and Rb_2CO_3 were better than K_2CO_3, but the former lost its activity very fast. In applications using Fe + 25% Cu + 125% kieselguhr and $CO/H_2 = 1$ to 1 as the initial gas, the best addn. of K_2CO_3 and KOH was 2% based on the Fe.

10271. MURATA, YOSHIO AND YAMADA, TETUZŌ. **The benzine synthesis from carbon monoxide and hydrogen under ordinary pressure. LIV. Influence of carbon dioxide in the initial gas upon the iron catalyst.** *Sci. Papers Inst. Phys. Chem. Research* (Tokyo) 38, 118-31 (1940) (in German).—*C.A.* 35, 2297^8.

A gas mixt. contg. varying CO_2 and approx. equal vols of CO and H_2 was passed over a catalyst consisting of (Fe + 25% Cu + 125% kieselguhr + 2% KOH) at 253°C at a rate of 3.8-4.3 liter/hr. Expts. with catalysts composed of Fe + 25% Cu + 2% Mn + 125% kieselguhr and 0-5% KOH at 254°C showed that the yield of liquid product and the C:H ratio of the gas resulting from the reaction increased with increase in alkali content of the catalyst. With a catalyst composed of Fe + 25% Cu + 2% Mn + 125% kieselguhr + 2% KOH at 254°C the yield of liquid product increased with a decrease of gas velocity to 2.6 liters-hr when the gas charge contained approx. 20% CO_2.

10272. PICHLER, H. AND BUFFLEB, H. **Behavior of ruthenium catalysts in synthesis of paraffin hydrocarbons of high molecular weight.** *Brennstoff-Chem.* 21, 273-80 (1940).—*C.A.* 36, 2253^6.

The activity of the catalyst was the same whether it was first reduced with H_2 or with $2H_2 + CO$ at atm. pressure, or was reduced directly with synthesis gas under pressure without pretreatment. No improvement in the catalyst was effected by addition of H_3PO_4 or phosphates.

10273. PUCHKOV, P. V. **Catalytic isomerization of monocyclic hydrocarbons in the presence of molybdenum disulfide.** *J. Phys. Chem.* (U.S.S.R.) 14, 1319-20 (1940).—*C.A.* 35, 3883^3.

Between 400 and 700°C under high H_2 pressures, destructive hydrogenation produced cracking and isomerization. Hexamethylenes gave methylpentamethylenes, ring compds. gave open-chain compds. of the normal and the iso series; unsatd. and aromatic hydrocarbons also resulted. Aromatic hydrocarbons gave methylcyclopentanes. Ethylbenzene lost its ethyl group and was then reduced.

10274. RAVICH, M. B. AND ZAKHAROV, B. A. **Influence of chemical activation of refractories on the combustion of firedamp.** *Compt. rend. acad. sci. U.R.S.S.* 26, 65-8 (1940).—*C.A.* 34, 6424^7.

Reaction rates were studied with stoichiometric mixts. of H_2 and O_2 in packed and unpacked quartz tubes at 400°, 700°, 850°, 900° and 950°C and initial pressure of approx. 1 mm Hg. The rate of reaction was increased at low temps. by the presence of commercial grog with surface coatings of Ni and Fe oxides and by Ural dunite. The activated grog and dunite yielded rates at 400°C comparable to that obtained with the unactivated refractory at 950°C.

10275. RAVICH, M. B. AND ZAKHAROV, B. A. **The catalytic effect of the oxides of rare elements on the combustion of hydrogen.** *Compt. rend. acad. sci. U.R.S.S.* 27, 473-6 (1940) (in French).—*C.A.* 34, 7711^9.

The velocity of combustion of H_2 was increased in the presence of a chamotte by applying to the latter a mixt. of ThO_2-CeO_2, or CeO_2 and a fraction of the rare earth oxides. For a temp. of 500°, these catalysts induced a reaction velocity equal to that attained in the presence of a non-activated chamotte at 950°C. The rare earth oxide fraction extd. from apatite had considerable catalytic activity and was a cheap substitute for the Th-Ce and Ce catalysts.

10276. Sano, I. **The effect of gases upon the catalytic decomposition of oxalic acid by colloidal platinum.** *Bull. Chem. Soc. Japan* 15, 204-6 (1940).—*C.A.* 34, 6512^4.

The decompn. of $H_2C_2O_4$ in aq. soln. was slight in the presence of colloidal Pt (obtained by dialysis of Pt carbonyl) in N_2 and in air under reduced pressure, but was markedly accelerated in O_2. The low rates in N_2 and under low pressure were attributed to residual dissolved O_2.

10277. Schawb, Georg-Maria and Drikos, Georg. **The combustion of carbon monoxide on Hopcalite and on its components.** *Z. physik. Chem.* **A185**, 405-25 (1940).—*C.A.* 34, 4972^8.

The velocity of the reaction between CO and O_2, catalyzed by CuO, by MnO_2 and by a 40-60 mixt. of the two, was detd. and the change in wt of the catalyst was detd. at the same time. On CuO the reduction of the catalyst by CO began at 140°C; the re-oxidation by O_2 began at room temp. The corresponding temps. for MnO_2 are 30° and 100°C; for Hopcalite, 70°C and room temp. Gas mixts. with excess CO reduced the catalysts; those with excess O_2 oxidized them, but for MnO_2 the latter reaction took place only to a slight extent.

10278. Schwab, Georg-Maria and Drikos, Georg. **Carbon monoxide combustion by a mixed catalyst, "Hopcalite," and its components.** *Praktika Akad. Athenon* (Athens) **15**, 12-23 (1940).—*C.A.* 46, 5224*h*.

In a comparison of 3 catalytic agents, where O-oxidized active Cu at any temp., CuO was reduced by means of CO at 150°C and above in proportion to the CO_2 evolved. MnO_2 required min. temps. for reduction. In the mixt. of the three (Hopcalite), CuO range and the steady reactivity of MnO_2 were combined. The latter mediated the reduction.

10279. Shurmovskaya, N. and Bruns, B. **Mechanism of the catalytic oxidation of carbon monoxide on manganese dioxide.** *J. Phys. Chem.* (U.S.S.R.) 14, 1183-94 (1940).—*C.A.* 35, 3881^8.

The mechanism of the catalytic action involved reduction of MnO_2 to Mn_2O_3 followed by reoxidation. Data were given for both chemically and electrolytically prepd. MnO_2, and the oxidation reactions carried out at 0°-70°C and up to 1 atm. on a catalyst previously heated in O_2 at 200°C and pumped out at the same temp.

10280. Tikhonov, A. V. **The mechanism of catalysis and a method for the selection of catalysts from the point of view of intermediate products.** *Trudy Vsesoyuz. Prom. Akad.* 1940, No. 2, 14-20; *Khim. Referat. Zhur.* 4, No. 9, 13 (1941).—*C.A.* 38, 910^8.

During catalytic oxidation, the catalyst was reduced in the intermediate states from the highest to the various lower degrees of oxidation. The heat effect was regarded as the activation energy of the total catalytic reaction. The most effective active catalyst possessed a min. heat of reduction. In the oxidation of SO_2, the catalyst can be reduced to V_2O_4 or V_2O_3. Activators retarded the reduction to lower degrees, which required greater amts. of energy.

10281. Agliardi, N. **Activity, structure and preparation of some nickel catalysts.** *Atti. accad. sci. Torino, Classe sci. fis. mat. nat.* 77, 82-96 (1941).—*C.A.* 37, 5560^7.

The rate of hydrogenation of C_6H_6 to cyclohexane was detd. at ordinary pressure and varying temps., over Ni-catalysts by a flow method. Some catalysts were pure Ni, others contained foreign metals (Cu, Co, Fe) in proportions so small that an examn. by x-rays showed no modification of the space lattice. Pure Ni was the most active catalyst. All catalysts showed a distinct max. at about 220°C.

10282. Babkova, M. and Mochan, I. **Adsorptive properties of promoted and inactive tungsten layers.** *Compt. rend. acad. sci. U.R.S.S.* **30**, 32-6 (1941) (in English).—*C.A.* 35, 3884^6.

The permanency of the W catalysts used in hydrogenating C_2H_4 was increased by forming the W sublimate in the presence of greases ordinarily used as cock lubricants. Contrary to the general behavior of most promoters, the activity of the catalyst actually increased with successive hydrogenations. Catalytic activity of the layers was not affected by the adsorption of inert gases (e.g., A), but was decidedly reduced by H_2 and C_2H_4.

10283. Bargagnolo, Giuseppe. **l-Ascorbic acid and oxidation catalysts (metals and carbon). I.** *Ann. chim. applicata* **31**, 250-68 (1941).—*C.A.* 39, 1588^3.

Cu, Ag, Au, Mg, Zn, Hg, Al, Si, Sn, Pb, As, Sb, Bi, Mn, Fe, Co, Ni, Cr, Te, W and C catalyzed the oxidation of 0.01 *N l*-ascorbic acid in varying degrees. The results depended on the quantity of powd. metal used, its state of division, and the duration of the reaction. Cu, Mg and Mn showed as instantaneous effect (within 1 min.), but the other metals were slower. A pos. catalytic effect was shown in descending order as follows: Cu, Mg, Mn, Si, Ni, Te (unpurified) and Fe. As made the ascorbic acid a stronger reducing agent.

10284. Bodenstein, M. **Some reactions of hydroxylamine and the catalytic oxidation of ammonia.** *Z. Elektrochem.* 47, 501-18 (1941).—*C.A.* 36, 4014^3.

The decompn. of NH_2OH was not increased by the addn. of NH_3; hence, $NH_2OH + NH_3 \rightarrow N_2 + H_2O + 2H_2$, did not take place. With at. O prepd. by a contact reaction with MnO_2, the following reaction occurred: $NH_2OH + O \rightarrow NOH + H_2O$. The following reactions for the oxidation of NH_3 were proposed: (1) Primary reaction: $NH_3 + O \rightarrow NH_2OH$. (2) Formation of NO: $NH_2OH + O_2 \rightarrow HNO_2 + H_2O$, followed by (*a*) $HNO_2 + O_2 \rightarrow HNO_4$, and (*b*) $HNO_4 \rightarrow NO + O_2 + OH$, and $2OH \rightarrow H_2O + O$. (3) Formation of N_2O: $NH_2OH + O \rightarrow HNO + H_2O$, followed by $2HNO \rightarrow H_2O + N_2O$. (4) The formation of N_2 follows in two ways: $HNO_2 + NH_3 \rightarrow 2H_2O + N_2$ (at higher temps.), and $HNO + NH_2OH \rightarrow 2H_2O + N_2$ (at lower temps.).

10285. Bogdanov, I. F. **Selective catalysis. IV. Hydrogenation of binary mixtures of acetylene derivatives.** *J. Gen. Chem.* (U.S.S.R.) 11, 979-82 (1941).—*C.A.* 36, 6882^9.

Mixts. of phenylacetylene and phenylpropiolic acid in 80% alc. soln. were shaken with H_2 and either Pt black or Pd-Ni at 20 °C. The triple bond of phenylacetylene was reduced to the double bond up to 97% before even traces of phenylpropiolic acid were reduced.

10286. BRODOVICH, K. I. **Kinetics of the oxidation of sulfur dioxide.** *J. Applied Chem.* (U.S.S.R.) **14**, 894-9 (1941) (French summary).—*C.A.* **39**, 3997⁶.

Oxidation of SO_2 on V catalyst differed from that on Pt in respect to the effect of O_2, the concn. of which to the 0.8th power was directly proportional to reaction velocity. Equations and theoretical discussion of the reaction were presented. The consts. derived from exptl. data were tabulated.

10287. DEEM, A. GARRELL AND KAVECKIS, JOSEPH E. **Catalytic poisoning in liquid-phase hydrogenation. Effect of sulfur compounds of various degrees of oxidation.** *Ind. Eng. Chem.* **33**, 1373-6 (1941).—*C.A.* **35**, 7944².

Methyl *p*-toluenesulfonate promoted the hydrogenation of PhOH at 120 °C over a Raney Ni catalyst. Na-benzenesulfonate had a slight poisoning effect. With diphenylsulfone poisoning was complete after hydrogenation of 4 C atoms of the PhOH. In the hydrogenation of quinoline the catalyst was partially poisoned by all compds., but to a lesser degree. During the first stage at 130 °C, only thiophenol was an active poison. Only during the second stage at 230 °C did the other compds. poison the catalyst. The degree of poisoning depended on the degree of oxidation of the S compd. and on the material being hydrogenated.

10288. EĬDUS, YA. T.; KAZANSKIĬ, B. A., AND ZELINSKIĬ, N. D. **The influence of the type of carrier on the synthesis of liquid hydrocarbons over Ni-MnO-Al_2O_3 catalysts at atmospheric pressure.** *Bull. acad. sci. U.R.S.S., Classe sci. chim.* **1941**, 27-33.—*C.A.* **37**, 5306⁹.

Supports of kieselguhr from different parts of Russia were studied for the (5Ni + Mn) + 10% Al_2O_3 catalyst used in prepg. hydrocarbons from CO and H_2. The degree of washing the catalyst after pptn. had great influence on its activity, and the sepn. of Fe and ignition were not always required.

10289. ELEY, D. D. AND RIDEAL, E. K. **The catalysis of the para-hydrogen conversion by tungsten.** *Proc. Roy. Soc.* (London) **178A**, 429-51 (1941).—*C.A.* **36**, 22⁴.

The para-H_2 conversion was measured on the surface of W as a function of the surface concn. of adsorbed O_2 acting as a poison. The O_2 decreased the fraction of the metal surface available for reaction and also affected the reactivity of the neighboring chemisorbed hydrogen. A part of the O adsorbed on W was removed at room temp. by reaction with H_2. Films of CO, N and ethylene also acted as poisons. The activated complex theory was more in accordance with a conversion mechanism based upon an interchange between loosely adsorbed H_2 and chemisorbed H rather than with the original idea of the recombination of chemisorbed H atoms.

10290. FEHRER, HAROLD AND TAYLOR, HUGH S. **The mechanism of reaction and of poisoning in the dehydroaromatization of heptane.** *J. Am. Chem. Soc.* **63**, 1387-92 (1941).—*C.A.* **35**, 4271².

The poisoning of Cr_2O_3 catalyst by ethylene, olefin-aromatic production with progressive poisoning, and olefin-aromatic production at various temps. were studied with the following catalysts: Cr_2O_3, Cr_2O_3 with ZrO_2, SnO_2, ZnO, MoO_3, MnO or alumina; for alumina with V_2O_5 or ThO_2; for $Al(OH)_3$ with V_2O_5; and for CeO_2 gel. The initial cyclization of 1-heptylene on Cr_2O_3 catalysts caused them to poison more rapidly. 1-Heptylene in 15% concn. in heptane reduced the over-all conversion to toluene. Methylcyclohexane was more rapidly dehydrogenated to toluene than heptane or 1-heptylene and did not poison the catalyst. Dehydrogenation of the heptane was inhibited by heptylene and was the slow process in the whole sequence.

10291. HAMAI, SENZO. **Physicochemical investigations on catalytic mechanism. II. The Fischer-Tropsch synthesis of hydrocarbons with special reference to its reaction mechanism.** *Bull. Chem. Soc. Japan* **16**, 213-28 (1941).—*C.A.* **36**, 739⁹.

CO was adsorbed or displaced H_2 adsorbed on the Co surface, forming Co—Co(—C═O)Co which was reduced first by adsorbed H_2 to Co—Co(—HCOH)Co, then to Co—Co(—CH_2)Co. The (CH_2) "mols." adsorbed on the Co surface migrated freely over the surface to interact with one another to form Co—Co(—$CH_2CH_2CH_2CH_2$......)Co which, upon desorption, yielded $(CH_2)_n$ and finally liquid products by hydrogenation. At 200 °C, Co—Co(—C═O)Co did not form CH_4 by hydrogenation, but at 300 °C CH_4 was formed; CH_4 formation probably resulted from reaction of CO and H_2 in the gas phase. Max. adsorption did not necessarily coincide with max. catalytic activity.

10292. HARTECK, P. AND JENSEN, H. **Reaction velocity with colloidal catalysts.** *Z. Physik* **118**, 416-23 (1941).—*C.A.* **37**, 2892⁵.

The diffusion relations that determined the quality of the catalyst were discussed for reactions that followed the scheme: A (gas) + B (liquid) → AB (liquid). First, a solid plane catalyst surface was treated, then a catalyst consisting of spherical particles distributed in the liquid, and finally a non-ideal catalyst.

10293. HENK, H. J. **The influence of catalysts on the decomposition of peroxides and solutions of persalts.** *Fette u. Seifen* **48**, 508-9 (1941).—*C.A.* **37**, 2524².

Metal salts and oxides, but not the pure metals, had a catalytic effect. Heavy metal salts were effective in all pH ranges by reaction with H_2O_2 to form initially unstable peroxides; with increase of H-ion concn. the decompn. of H_2O_2 decreased. Further decrease in rate of decompn. of H_2O_2 was possible by use of capillary-active materials, such as alcs., ketones, urethans, silicates, proteins and their hydrolysis products with protective colloidal activity.

10294. HERBO, CL. **The mechanism of catalytic reactions. I. Kinetic investigations of the**

catalytic hydrogenation of benzene. *Bull. Soc. chim. Belg.* 50, 257-96 (1941).—*C.A.* 37, 4614^7.

The hydrogenation of C_6H_6 was studied in the presence of Ni catalysts (catalyst *A* 98.4 g Ni, 1.6 g Cr_2O_3; catalyst *B* 2.7 g Ni, 97.3 g BeO) at atm. pressure in a flow system. With catalyst *B* the rate of hydrogenation became measurable above 60°C and increased with the temp. at const. flow rates and const. compn. of the gas up to 180°C, but decreased above this temp. and became zero at 310°C. The catalyst was used in such a thin layer that the continuous yield at higher flow rates was directly proportional to the amt. of catalyst used, and the compn. of the gas along the catalyst bed changed very slightly.

10295. Holmes, John W. and Taylor, Ellison H. **The effect of method of preparation upon the activity of co-precipitated copper hydroxide-magnesium hydroxide catalysts.** *J. Am. Chem. Soc.* 63, 2911-15 (1941).—*C.A.* 36, 322^1.

The effect of the rate of pptn. of $Cu(OH)_2$-$Mg(OH)_2$ catalysts was studied by detg. the relative effects of these catalysts toward H_2O_2. The data indicated that the activity of the catalysts was affected by changes in the rate of pptn. and the extent of washing. Similar catalysts prepd. by reverse co-pptn. (addn. of metal nitrates to base) were affected only slightly by these variables.

10296. Itterbeek, A. van and Dingenen, W. van. **Catalytic action of nickel and copper-thorium in the formation of methane and heavy gases.** *Z. physik. Chem.* B50, 341-60 (1941).—*C.A.* 37, 1917^5.

The adsorption of H_2-CO mixts. by Ni foil was detd. at low pressures (less than 2 mm Hg) and over a wide temp. range. At 167° and 329°C H_2 and CO were adsorbed in the ratio 3:1 corresponding to CH_4 formation; at 125° and 378°C, they were adsorbed in the ratio 2:1 corresponding to higher paraffin formation. The reaction rates also showed max. at these temps. Cu adsorbed H_2, and to a smaller extent CO, only if it contained traces of Th. At 250° and 325°C H_2 and CO were adsorbed in the ratio 3:1. Similar expts. with D_2 were described.

10297. Kobayashi, Kyuhei and Ishikawa, Heishichi. **The catalytic decompn. of neutral salts with Japanese acid clay and other minerals. III. Actions of activated clays, silica gel, hydrous aluminum hydroxide, and ferric hydroxide gels.** *J. Soc. Chem. Ind., Japan* 44, Suppl. binding, 238-39 (1941).—*C.A.* 44, 8214*e*.

For the catalytic decompn. of NaCl, activated clay and $Al(OH)_3$ gel were superior, especially below 500°C; silica gel and $Fe(OH)_3$ were inferior below 500°C and gradually improved above 600°C. The difference for activated clay and silica gel was caused by their permeability to NaCl soln. The superiority of $Al(OH)_3$ gel was due to chem. affinity.

10298. Kobayashi, Kyuhei and Ishikawa, Heishichi. **Catalytic decomposition of neutral salts with Japanese acid clay and the other minerals. IV-V. The catalytic decomposing action of Japanese acid clay on sodium chloride.** *J. Soc. Chem. Ind., Japan* 44, Suppl. binding, 282-3 (1941).—*C.A.* 44, 8067*f*.

The decompn. of NaCl by steam in the presence of Japanese acid clay was dependent on the steam velocity and mixing of NaCl and clay. Clay activated with HCl was more effective than raw clay, indicating that the catalytic effect was due to hydrous Al silicate.

10299. Kodama, Shinjiro; Tarama, Kimio; Oshima, Taichi, and Fujita, Koichi. **Synthesis of gaseous hydrocarbons from carbon monoxide and hydrogen. I. Effect of temperature with the iron catalyst. II. Effect of rate of flow of the starting gases with the iron catalyst.** *J. Soc. Chem. Ind., Japan* 44, Suppl. binding, 272-4, 274-5 (1941) (in German).—*C.A.* 44, 7507*i*.

In order to synthesize predominantly C_4 hydrocarbons, a synthesis gas composed of equal parts of CO and H_2 was passed at temps. varying from 242° to 299°C over an Fe catalyst contg. Cu 25, Mn 2, kieselguhr 125, H_3BO_3 20, and K_2CO_3 3%. Increase in temp. resulted in a decrease in CH_4 formation and also a decrease in reaction velocity. The max. yield of gasoline was reached at 250°C, while the yield of C_4 hydrocarbons increased up to 270°C and remained practically const. above this temp.

10300. Koyano, Tadabumi and Ito, Rihei. **Relation between the α-γ transformation of iron-nickel alloy and the velocity of catalytic decomposition of ammonia gas. I.** *J. Chem. Soc. Japan* 62, 984-9 (1941).—*C.A.* 41, 2863*h*.

With the Fe-Ni alloy (Ni 9.8%) as catalyst, the decompn. of NH_3 was studied in the range 400-610°C. The rate of decompn. of NH_3 was accelerated near 600°C, at which temp. the α-γ transformation took place; the rate of decompn. showed no hysteresis in heating and in cooling.

10301. Krauss, W. and Neuhaus, Adalbert. **Catalytic oxidation of ammonia to nitrous oxide in presence of oxides.** *Z. physik. Chem.* B50, 323-40 (1941).—*C.A.* 37, 1917^3.

NH_3-air and NH_3-O_2 mixts. were passed over heated oxides of Mn, Bi, Ba, Fe and Ni, and the yields of N_2O, NO and N_2 were detd. A reaction scheme was discussed in which NH_3 and O united to form NH_3O which then reacted with O to form HNO + H_2O or with O_2 to form HNO_2. The NH_3O also reacted with HNO to form $N_2 + H_2O$. The HNO_2 reacted with NH_3 to form N_2. N_2O was formed by the union of two HNO.

10302. Liberman, A. L. **Isotherm of heterogeneous catalytic reactions carried out under flow method conditions and a new method for determining the relative adsorption coefficients.** *Compt. rend. acad. sci. U.R.S.S.* 31, 448-52 (1941) (in English).—*C.A.* 37, 563^1.

A mathematical treatment was applied to the results of previous experiments.

10303. Love, Katherine S. and Emmett, P. H. **The catalytic decomposition of ammonia over iron synthetic-ammonia catalysts.** *J. Am. Chem. Soc.* 63, 3297-3308 (1941).—*C.A.* 36, 959^3.

Catalysts 931 (Fe-K_2O-Al_2O_3), 954 (Fe-Al_2O_3) and 973 (pure Fe) were used. The rate of the reaction over catalyst 931 was, within exptl. error, proportional to $(P_{NH_3})^{0.6}/(P_{H_2})^{0.85}$. The apparent energy of activation was 45,600 ± 2000 cal. Within a considerable range of temp. and gas compn. the rate of the reaction over catalyst 954 was directly proportional to the partial pressure of H_2, indirectly proportional to the partial pressure of NH_3; the apparent energy of activation was very small. At higher and lower temps. the kinetics of the reaction more nearly approached those of the reaction over catalyst 931. The reaction kinetics over catalyst 973 were similar to those over catalyst 954.

10304. Luytenk, L. **The kinetics of the methane synthesis on nickel.** *Natuurw. Tijdschr.* **23**, 25-6 (1941).—*C.A.* **37**, 3662³.

The poisoning effect of CO on active Ni used as catalyst in the synthesis of CH_4 from CO and H_2 was studied, including those in which D_2 was used. The higher the CO content of the gas mixt. and the smaller the activity of the catalyst, the greater was the difference between the reaction velocities of the two isotopes. The difference between the zero-point energies caused a relatively greater difference between the two isotopes.

10305. Makishima, Gen-ichiro. **Alumina catalysts.** *J. Chem. Soc. Japan* **62**, 770-9 (1941).—*C.A.* **41**, 5371g.

The most efficient alumina catalyst for the formation of acetylene by the dehydration of alc. was the monohydrate, $Al_2O_3.H_2O$.

10306. Murata, Yoshio and Yamada, Tetuzō. **The benzine synthesis from carbon monoxide and hydrogen under ordinary pressure. LV. Influence of nitrogen, methane, oxygen and ammonia in the initial gas upon the iron catalyst.** *Sci. Papers Inst. Phys. Chem. Research* (Tokyo) **38**, 218-29 (1941) (in German).—*C.A.* **35**, 5284⁶.

A mixt. of approx. mol. proportions of CO and H_2 was dild. with N_2 and passed at 253°C over a catalyst having the compn. Fe + 25% Cu + 125% kieselguhr + 2% KOH and at a gas velocity of 3.4 to 4.1 liters/hr. The yield of liquid product decreased (with respect to CO and H_2) with increasing amt. of N_2 in the initial gas mixt. The I_2 no. of the liquid product increased.

10307. Nakata, Shigeo. **Catalytic oxidation of sulfur dioxide with heavy oxygen. I. Experimental. II. Discussion of the results.** *J. Chem. Soc. Japan* **62**, 519-24; 525-8 (1941).—*C.A.* **35**, 7811¹.

The mixt. consisting of SO_2 and O_2 rich in heavy O isotope was passed over Pt-sponge heated from 300 to 600°C, and the SO_2 oxidized. The quantity of heavy O remaining was detd. and the mechanism of the oxidation estd. The exchange reaction of O atom between SO_2 and O is the exchange reaction between the reaction product SO_3 and O.

10308. Nakata, Shigeo and Morita, Noriyoshi. **Catalytic oxidation of sulfur dioxide by heavy oxygen on the surface of platinum sponge.** *Bull. Chem. Soc. Japan* **16**, 463-71 (1941).—*C.A.* **41**, 4366f.

Catalytic oxidation of SO_2 by heavy O on the surface of Pt sponge was studied. Below 400°C exchange reaction did not occur between the free O_2 phase and the O in SO_2 or SO_3. Above this temp. exchange took place between SO_3 and free O_2. The rate-detg. step of the reaction was the thermal dissocn. of SO_3.

10309. Pshezhetski, S. Ya. and Gladyshev, A. T. **Kinetics of the catalytic dimerization of ethylene.** *J. Phys. Chem.* (U.S.S.R.) **15**, 333-45 (1941).—*C.A.* **36**, 6400⁹.

Ethylene was polymerized on a Ni catalyst at temps. from 260° to 460°C. The Raman spectrum analysis of the products showed 50% α-butylene, 25% *cis*- and 25% *trans*-butylene. The rate of dimerization was directly proportional to the pressure of the ethylene in the gas phase.

10310. Rampino, Louis D. and Nord, F. F. **Preparation of palladium and platinum synthetic high-polymer catalysts and the relationship between particle size and rate of hydrogenation.** *J. Am. Chem. Soc.* **63**, 2745-9 (1941).—*C.A.* **35**, 7810⁷.

Pd and Pt catalysts were prepd. with synthetic high polymers as protective colloids. The particle size of the protective colloid and the rate of hydrogenation were related by studies of polyvinyl alc. in various degrees of polymerization as the protecting agent. Polymethyl methacrylate and polymethyl ester of polyacrylic acid were used for hydrogenations in org. solvents. The catalysts were tested for adsorption of H_2 and CO.

10311. Roginskii, S. Z. **Nature of the active surface of metallic catalysts.** *Compt. rend. acad. sci. U.R.S.S.* **30**, 29-31 (1941) (in English).—*C.A.* **35**, 3884⁴.

Gas-promoted catalysts lost their activity upon degasification at low temps., but were reactivated upon heating in O_2. The activity of the catalyst varied with the amt. of promoter entrained, following an exponential law.

10312. Roginskii, S. Z. **Active contacts, their formation and nature. I. Nature of active contacts.** *J. Phys. Chem.* (U. S. S. R.) **15**, 1-30 (1941).—*C.A.* **36**, 320⁷.

The presence of impurities and deviations from stoichiometric proportions were important factors for the appearance of catalytic activity in metals and oxides. The activation of Pt and Pd catalysts by evacuation and treatment with various gases, especially O_2, was discussed. The adsorbed O atoms were not on the surface, but just beneath the upper layer of metal atoms and decreased the work of removal of atoms from the surface. The sp surface of catalysts was practically unchanged by treatment with gases, but the rate of activated adsorption was greatly increased.

10313. Salley, Donovan J.; Fehrer, Harold, and Taylor, Hugh S. **Thermal stability, poisoning, revivification and reactivity of chromium oxide gel catalysts for dehydrocyclization.** *J. Am. Chem. Soc.* **63**, 1131-3 (1941).—*C.A.* **35**, 3513⁵.

The desorption of H_2O from Cr_2O_3 catalyst, was detd. for the period of revivification of Cr_2O_3

catalyst with N_2 and O_2 mixts. and for the effect of H_2O vapor on heptane dehydrogenation at 475°C over Cr_2O_3 catalyst. Cr_2O_3 gel was found to be stable, when properly controlled, up to temps. as high as 600°C. Dehydrogenation and aromatization of normal heptane was predominant up to 525°C. Conditions for revivification of spent Cr_2O_3 gel catalyst were defined.

10314. SERGIENKO, S. R. **The mechanism and relative rapidity of the aromatization of paraffinic hydrocarbons. I.** *Bull, acad. sci. U.R.S.S., Classe sci. chim.* **1941**, 177-90.—*C.A.* **37**, 3064[7].

Octane and 1:1 mixts. of octane and heptane were aromatized in the presence of Cr_2O_3-CoO and Al_2O_3-Cr_2O_3-CoO catalysts at 475-500°C and a throughput of 0.15-0.3 vol. % of the starting material per vol. of catalyst. By periodic regeneration (after every 2-12 hrs) of the catalyst, it will retain its original activity after 700 working hrs. Under these conditions, octane was aromatized 1.5 times more rapidly than heptane.

10315. SUITO, EIJI. **Thermal analysis of the catalytic action of colloids. II. The effect of temperature and heat-treatment of platinum sol on the catalytic decomposition of hydrogen peroxide by colloidal platinum.** *Rev. Phys. Chem. Japan* **15**, 1-16 (1941).—*C.A.* **35**, 6503[5].

The rate of decompn. of H_2O_2 catalyzed by Pt sol was detd. by a termo-analytical method at 25°, 30°, 35°,....60°C. The max. rate was attained at 45°-50°C. The surface of the Pt colloid was sintered by heating it for 2 hrs at 95°C, and its catalytic activity was reduced one-half. Oxygen adsorbed on the Pt sol reduced its activity, but was expelled by boiling for 2 hrs. Boiling the Pt sol for 7 hrs coagulated it and decreased its activity, as did also freezing the sol.

10316. TURKEVICH, JOHN; FEHRER, HAROLD, AND TAYLOR, HUGH S. **Chromium oxide gel catalysts for dehydro-cyclization of *n*-heptane.** *J. Am. Chem. Soc.* **63**, 1129-31 (1941).—*C.A.* **35**, 3513[3].

Chromium oxide catalysts were prepd. by formation from a jelly, pptn. as gel from chromic acetate, and reduction of chromic acid by alc. and other org. reducing agents. The activities of these catalysts were studied with reference to dehydrogenation-cyclization activity toward normal heptane and as to the compn. of the liquid product in olefins and aromatics. Catalysts obtained by alc. reduction of chromic acid possess high activities and are readily prepd. in bulk.

10317. TURKEVICH, JOHN AND SELWOOD, PIERCE W. **Solid free radical as catalyst for ortho-para hydrogen conversion.** *J. Am. Chem. Soc.* **63**, 1077-9 (1941).—*C.A.* **35**, 3512[8].

The magnetic characteristics were detd. of α,α-diphenyl-β-picrylhydrazyl, the corresponding hydrazine, active ZnO and ignited ZnO. H_2 adsorption at liquid-air temp. was detd. on the original compd., active ZnO, and on an intimate mixt. of the two. *Ortho-para* H_2 conversion at liquid-air temp. was slow on ZnO and slow on the free radical, but very rapid on an intimate mixt. of the two.

10318. TWIGG, G. H. **The catalytic isomerization of 1-butene.** *Proc. Roy. Soc.* (London) **A178**, 106-17 (1941).—*C.A.* **35**, 5775[9].

The double-bond migration on a Ni catalyst in the presence of H_2 was examd. simultaneously with the exchange and hydrogenation reactions. The energies of activation were found for the temp. range 76°-126°C. At the lowest temp. the rate of double-bond migration was 6 times that of exchange. The step that detd. the rate in the double-bond migration was the second fast step of the exchange reaction.

10319. VAINSHTEIN, F. M. AND POLYAKOV, M. V. **Mechanism of the catalytic oxidation of ammonia.** *J. Phys. Chem.* (U.S.S.R.) **15**, 164-73 (1941).—*C.A.* **36**, 6400[9].

Exptl. data were obtained on the oxidation of a 9.5% NH_3 stream by O_2 in a 1-cm tube at temps. from 550° to 800°C, and on the yields of NO for various temps. and distances between the 2 or 3 Pt screens used. The catalytic oxidation of ammonia was an hetero-homogeneous reaction.

10320. ZENGHELIS, C. AND STATHIS, E. **Oxidation of carbon monoxide in the presence of colloidal rhodium.** *Praktika Akad. Athenon* (Athens) **16**, 10-16 (1941).—*C.A.* **46**, 5398*a*.

Colloidal Rh was found to be considerably more active an absorbent of CO than were other Pt-group metals.

10321. BALANDIN, A. A. **Kinetics of catalytic unimolecular reactions in a flow system, taking into consideration the displacement of molecules by foreign substances.** *J. Gen. Chem.* (U.S.S.R.) **12**, 153-9 (1942).—*C.A.* **37**, 2645[2].

The general kinetic equation for the stationary process was derived and solved; several approximations were discussed. Equations were given for cases of dehydrogenation of alcs. and catalytic isomerization.

10322. BALANDIN, A. A. **Selectivity of action of nickel catalyst and the energy of chemical linkages.** *J. Gen. Chem.* (U.S.S.R.) **12**, 337-41 (1942) (English summary, 342).—*C.A.* **37**,2982[3].

Modern data on bond energies were used in calculations, based on the multiple theory, of the choice by the molecule of an organic substance of a particular direction of reaction in dehydrogenation, desulfurization, dehydration, disproportionation, dimerization, and other reactions under the influence of Ni catalyst. The calculated order of reactions agreed satisfactorily with experimental data.

10323. BALANDIN, A. A. **Preferential reaction paths in contact catalysis.** *Acta Physicochim. U.R.S.S.* **17**, 73-81 (1942).—*C.A.* **37**, 6531[1].

New data for bond energies were used to check the preferential direction of several reactions such as dehydrogenation, dehydration and reduction on Ni with those calcd. on the basis of the multiplet theory. The agreement was very good.

10324. BALANDIN, A. A. AND KOTELKOV, N. Z. **Dehydrogenation and decomposition of cyclohexane at high temperatures over metallic cata-**

lysts. *J. Applied Chem.* (U.S.S.R.) 15, 139-50 (1942).—*C.A.* 37, 2253^7.

The dehydrogenation and decompn. of cyclohexane was studied at 300-600°C over electrically heated spirals of platinized nichrome, palladized nichrome, nichrome, chromed Fe and Fe. A dendrite hypothesis of carbon deposition, based on the multiplet theory of catalysis, offered a satisfactory explanation.

10325. Balandin, A. A., and Kotelkov, N. Z. **Catalysis of dehydrogenation and decomposition of cyclohexane and the dendrite hypothesis of deposition of C.** *Bull. acad. sci. U.R.S.S., Classe sci. chim.* **1942,** 230-1.—*C.A.* **39,** 1588^1.

Cyclohexane was passed over Pt, Pd and Ni catalysts at 300-600°C. On platinized nichrome, cyclohexane was only dehydrogenated to 400°C; at 500°C complete decompn. to carbon, H_2 and CH_4 occurred. Pd-nichrome caused some dehydrogenation at 400°C, but nichrome alone was weakly active at 400°C. Fe was not active to 500°C. Deposition of carbon to a certain extent failed to diminish the dehydrogenation reaction.

10326. Berk, Bernard and Brown, Oliver W. **Catalytic activity of intermetallic compounds in the vapor-phase reduction of nitrobenzene. II.** *J. Phys. Chem.* 46, 964-8 (1942).—*C.A.* 37, 2982^2.

The vapor-phase reduction of nitrobenzene was studied using metallic catalysts of the composition indicated by the formulas Cu_2Zn_3, Cu_3Sn, and Cu_3Sb. The Cu-Zn catalyst exhibited the same general properties as pure Cu. The Cu-Sn catalyst appeared to exhibit properties of both Cu and Sn. The Cu-Sb catalyst showed maximum activity at 345°C compared with 250°-260°C for Cu and 320°C for Sb. The maximum aniline yields were in the range 92 to 99%.

10327. Bobtelsky, M. and Simchen, A. E. **Catalysts for peroxide decomposition.** *J. Am. Chem. Soc.* 64, 2492-8 (1942).—*C.A.* 36, 6882^7.

The green cobaltocitrate complex was an extremely active catalyst (the most active of all the complex citrates) for the decompn. of H_2O_2, but it could not decompose lead or manganese dioxides. During all these operations the citrates were not attacked at all, while corresponding reactions with tartrates lead to attack of the tartrate ion.

10328. Brown, Henry T. and Frazer, J. C. W. **Mixed heteropoly and catalysts for the vapor phase air oxidation of naphthalene.** *J. Am. Chem. Soc.* 64, 2917-20 (1942).

A series of catalysts were prepared from heteropoly-acid crystals containing W and Mo. The activities of these catalysts were studied for the partial oxidation of naphthalene. The catalyst from $H_4SiMo_9W_3O_{40}$ gave considerably higher conversion to phthalic anhydride than either of the parent acids, $H_4SiMo_{12}O_{40}$ or $H_4SiW_{12}O_{40}$. The addition of CO_2 to this air oxidation reaction improved the yield of phthalic and decreased the yield of maleic anhydride. The catalyst from $H_4SiMo_9W_3O_{40}$ was employed in the oxidation of phthalic anhydride, naphthoquinone-1,4 and CO.

10329. Chitani, Toshizo; Nakata, Shigeo, and Kanome, Akira. **Catalytic oxidation of carbon monoxide by heavy oxygen on the surface of copper oxide.** *Bull. Chem. Soc. Japan* 17, 288-96 (1942).—*C.A.* 41, 4366*d*.

Catalytic oxidation of CO on the surface of CuO was studied, with heavy O as tracer. The reaction proved to be an alternate reduction and oxidation of CuO by CO and O. $2CuO + CO \rightarrow Cu_2O + CO_2$; $Cu_2O + 1/2\ O \rightarrow 2CuO$. If the temp. was raised to 400°C, the catalytic oxidation became complete, and the following reaction began: $CuO + CO_2 \rightleftharpoons CuCO_3$. In this case, the exchange of O isotopes reached only 40% when heated to 600°C. From the fact that above 550°C exchange reaction of O isotopes between CO and O_2 gas took place, the following reaction was concluded to start above 550°C: $2CuCO_3 \rightleftharpoons Cu_2O + 2CO_2 + 1/2\ O_2$.

10330. Cohen, B. **Catalytic decomposition of hydrogen peroxide by basic beryllium iodide hydrosols.** *J. Am. Chem. Soc.* 64, 1340-1 (1942).—*C.A.* 36, 4014^9.

In the decompn. of H_2O_2, the catalytic effect of the I^- ion sorbed by colloidal beryllium oxide was greater than that of the free I^-.

10331. Cohn, G. and Hedvall, J. A. **Influence of the transition from ferromagnetism to paramagnetism on catalytic activity.** *J. Phys. Chem.* 46, 841-7 (1942).

The catalytic activity of ferromagnetic substances was changed by the transition from ferromagnetism to paramagnetism. The activation energy of the decomposition of HCOOH at 130° to 180°C and an initial pressure of 25 mm by a Co-Pd alloy was increased by about 30% by the transition to the paramagnetic state of the catalyst. A state of higher electronic order in a catalyst might yield an energetically stronger catalytic action.

10332. Coleman, Howard S. and Yeagley, Henry L. **The method of thin films for the study of intermetallic diffusion and chemical reactions at metallic surfaces.** *Trans. Am. Soc. Metals*, Preprint No. 17, 17 pp (1942).—*C.A.* 36, 6858^2.

Intermetallic diffusion rates of Au into Pb and Cu into Zn were studied by depositing one metal and then another from the vapor phase on a microscope slide, and observing change in reflectivity at one surface with varying temp. The method was rapid and accurate and proved the applicability of Fick's law. Diffusion of gases could be studied at sub-zero temps.

10333. Cozzi, D. **The mechanism of the catalytic action of the oxides of vanadium on the conversion of alcohols.** *Chimica e industria* (Italy) 24, 351-4 (1942).—*C.A.* 38, 4499^8.

EtOH was oxidized at 300°-50°C with 150-200 ml air-alc. vapor/min/3 ml catalyst. At 300°C and O_2/EtOH ratio of 0.6, the conversion was 48%, the selectivity of the aldehyde formation 94%. With increasing O_2/EtOH ratio the conversion increased, the aldehyde selectivity decreased; at 350°C the conversion was 63% for a ratio of 1.6;

66.4% aldehyde and 16% acid were formed. No oxidation took place below 200°C; the product was colored with ethyl orthovanadate. Ester formation was the intermediary step in the catalytic action of vanadic anhydride.

10334. Eĭdus, Ya. T. and Zelinskiĭ, N. D. **The reaction of carbon monoxide with cobalt catalysts used in the synthesis of gasoline from water gas.** *Bull, acad. sci. U.R.S.S., Classe sci. chim.* **1942**, 45-54 (English summary).—*C.A.* **37**, 2909^7.

When CO was passed over a mixt. of 100 parts Co, 18 parts ThO_2 and 100 parts kieselguhr at 192-272°C, two reactions occurred forming resp. Co_2C and carbon. At 192-212°C, carbide formation predominated, but as the temp. rose. more free carbon was formed. Poisoning of the catalyst with SO_2 also reduced Co_2C formation. Reduction of Co_2C by H_2 went faster and at a lower temp. on this catalyst than on pure Co.

10335. Eĭdus, Ya. T. and Zelinskiĭ, N. D. **Carbide formation as an intermediate stage in the catalytic synthesis of hydrocarbons from water gas.** *Bull. acad. sci. U.R.S.S., Classe sci. chim.* **1942**, 190-4 (English summary).—*C.A.* **39**, 2391^6.

The Co carbide formed by the action of CO on the Co-ThO_2-kieselguhr catalyst was neither an intermediate product nor a catalyst of the synthesis of gasoline from CO and H_2. Intermediate formation of methylene radicals during this synthesis was confirmed.

10336. Farkas, A. and Farkas, L. **The mechanism of the catalytic conversion of parahydrogen on nickel, platinum and palladium.** *J. Am. Chem. Soc.* **64**, 1594-9 (1942).—*C.A.* **36**, 5414^9.

The catalytic conversion of *para*-H_2 was investigated at room temp. and a pressure of about 0.01 mm on evapd. layers of Ni, Pd and Pt. There was a stable layer of H_2 on the catalysts which was not removed by pumping at room temp. and exchanged readily with mol. H_2 or D_2. The amt. of exchangeable H_2 in the stable layer was taken as an indication of the no. of active centers on the catalyst. This no. was 10^{14} to $10^{15}/cm^2$.

10337. Fricke, R. and Weitbrecht, G. **Active substances. LI. The equilibria of CO/CO_2 with Ni/NiO, and with (NI + γ-Al_2O_3)/$NiAl_2O_4$, and their dependence on the physical state of the solid reactants.** *Z. Elektrochem.* **48**, 87-106 (1942).—*C.A.* **37**, 559^9.

Equil. was approached from both sides and at different temps.; the effect of thermal diffusion were taken into account. The equil. const. of the system Ni/NiO, CO/CO_2 was: $\log K_p = (2348.16/T) - 0.0264$. Evaluation of the surface energy of the very small particles led to the conclusion that the equil. measured for the system (Ni + γ-Al_2O_3)/$NiAl_2O_4$ were very strongly modified by the relative total surfaces.

10338. Fricke, R. and Weitbrecht, G. **The Boudouard reaction in the system Ni/NiO and (Ni + γ-Al_2O_3)$NiAl_2O_4$.** *Z. Elektrochem.* **48**, 106-10 (1942).—*C.A.* **37**, 560^4.

The equil. between Ni/NiO and CO/CO_2 could be falsified to a considerable extent by small amts. of carbon dissolved within the nickel. By establishing the equil. between (Ni + γ-Al_2O_3)/$NiAl_2O_4$ and CO/CO_2 from the side of reduction, the correct equil. were found under the same conditions.

10339. Frost, A. V. **Catalytic action of activated silica-alumina. Action of activated clay on normal octyl alcohol and cyclohexanone.** *Compt. rend. acad. sci. U.R.S.S.* **37**, 223-5 (1942).—*C.A.* **37**, 5306^8.

Octyl alc. and cyclohexanone were refluxed with activated clay, and the distillate and residue were measured. Dehydrogenation of the carbonyl group of the ketone took place and was accompanied by polymerization and dehydrogenation. Because of the latter, satd. naphthenic hydrocarbons were formed.

10340. Gonikberg, M. G. **Method of determination of heat effects of catalytic reactions.** *Bull. acad. sci. U.R.S.S., Classe sci. tech.* **1942**, No. 1-2, 105-7.—*C.A.* **38**, 4183^8.

Changes of temp. were detd. at various points in the catalyst mass in definite periods of time. This was used as a basis for calcn. or graphical estn. of av. catalyst temp. change in the absence of heat exchange with the surroundings.

10341. Grim, Reuben Joseph. **Catalytic activity of an intermetallic compound of cadium and copper in the vapor-phase reduction of nitrobenzene.** *J. Phys. Chem.* **46**, 464-9 (1942).—*C.A.* **36**, 5415^3.

The intermetallic compd. Cd_3Cu_2 was shown to have appreciable catalytic power in the vapor-phase reduction of $PhNO_2$ to $PhNH_2$.

10342. Gwathmey, Allan T. and Benton, Arthur F. **The reaction of gases on the surface of a single crystal of copper. I. Oxygen.** *J. Phys. Chem.* **46**, 969-80 (1942).

A spherical surface of Cu was prepd. by electrolytic polishing followed by annealing in H_2 at 550°C. The relative rates of oxidation in air at 200°C and atmospheric pressure were detd. for various crystallographic faces. The (100) and (210) regions showed the greatest rates and the (311) region the least.

10343. Hamai, Senzo; Hayashi, Shiro, and Shimamura, Kiyoshi. **Physicochemical investigations on catalytic mechanisms. III. Desorption of various gases from the catalyst used in the Fischer-Tropsch synthesis.** *J. Soc. Chem. Ind. Japan* **45**, 313-18 (1942).—*C.A.* **43**, 2401*h*.

A Co catalyst with certain promoters was heated to 190°-200°C and satd. with one of the following: H_2, CO, or N_2. Another one of the 3 gases was then passed over the catalyst, and the velocity of desorption of the original gas was measured by analysis of the exhaust gas. H_2 was more quickly desorbed than CO. A comparison of the desorption of CO by H_2 and of H_2 by CO indicated that CH_4 formation predominated when there was an excess of H_2.

10344. Hamai, Senzo; Hayashi, Shiro; Shimamura, Kiyoshi, and Igarashi, Hiroshi. **Physicochemical investigations of catalytic mechanisms. IV. The Fischer-Tropsch synthesis of hydrocarbons. (Experimental series I.)** *Bull. Chem. Soc. Japan* 17, 166-71 (1942).—*C.A.* 41, 4366*h*.

The reaction vessel of Terex glass was made double-walled, so that the gas mixt. ($CO + 2H_2$) led in could be heated before entering the catalyst zone. The catalyst used was made of Co, CeO_2, ThO_2, B_2O_3, and diatomaceous earth. The reaction was run at 200°C at the rate of flow 4 liters/hr. The reaction products were collected in two traps, condensed by water and solid CO_2-C_2H_5OH mixt., resp. The gas contraction and oil yield were not parallel unless the reaction was normalized. In the initial stage CH_4 formation predominated, cutting down the oil formation, but as time proceeded side reactions other than oil formation were inhibited.

10345. Hamai, Senzo; Hayashi, Shiro, and Shimamura, Kiyoshi. **Physicochemical investigations of catalytic mechanisms. V. Fischer-Tropsch synthesis of hydrocarbons.** *Bull. Chem. Soc. Japan* 17, 252-9 (1942).—*C.A.* 41, 4367*a*.

Co with kieselguhr was used as catalyst with various amounts of ThO_2, CeO_2, and Cu promoters; gas contraction and oil formation from CO and H_2 were detd. The gas contraction was higher for 15-10% CeO_2 and for 20-30% ThO_2. When CeO_2 percentage was low, the addn. of ThO_2 lowered the activity; if CeO_2 was high, the addn. of ThO_2 did not improve the gas contraction. CeO_2 gave a relatively high yield of oil and low yield of CH_4, whereas ThO_2 gave a relatively high yield of CH_4 and low yield of oil.

10346. Hamai, Senzo. **Physicochemical investigations of catalytic mechanisms. VII. Durability and pretreatment of the catalyst used for the Fischer-Tropsch synthesis of hydrocarbons.** *J. Chem. Soc. Japan* 63, 1606-15 (1942).—*C.A.* 41, 3273*h*.

The catalyst used in the Fischer-Tropsch synthesis of hydrocarbons could be revivified by reducing with H_2.

10347. Hamai, Senzo; Hayashi, Shiro, and Shimamura, Kiyoshi. **Physicochemical investigations of catalytic mechanisms. VIII. Fischer-Tropsch synthesis of hydrocarbons with special reference to the durability of catalyst.** *Bull. Chem. Soc. Japan* 17, 451-61 (1942).—*C.A.* 41, 4367*c*.

The reaction $CH_2 \to C_2H_4$ was faster than $CH_2 \to CH_4$. In the normalized reaction $CH_2 \to C_2H_4$ predominated under various conditions of stage of reaction, temp., etc., whereas $CH_2 \to CH_4$ predominated at the initial stage and as the reaction became normalized. $CH_2 \to CH_4$ must be prohibited when the reaction mixt. $CO + H_2 = (1{:}2)$, was passed through the catalysts, Co + 15%, ThO_2 + 100% kieselguhr or Co + 12% U_3O_8 + 2.8% Cu + 100% kieselguhr, each separately at 190°-250°C.

10348. Hamai, Senzo; Hayashi, Shiro, and Shimamura, Kiyoshi. **Physicochemical investigations of catalytic mechanisms. IX. Fischer-Tropsch synthesis of hydrocarbons with special reference to factors essential to the particular catalysts.** *Bull. Chem. Soc. Japan* 17, 463-77 (1942).—*C.A.* 41, 4367*d*.

The factors studied were: the compn. of the catalysts (Co, U_3O_8, Cu, Mn, and kieselguhr), preactivation temp., and reaction mixt. $CO + H_2$. The presence of kieselguhr contributed to oil formation, but not CH_4 formation. Generally higher temp. promoted the formation of gaseous products, such as CH_4 and CO_2, and a very small amt. of oil.

10349. Hedvall, J. A. and Ahlgren, G. A. **Activation of catalysts by electric waves.** *Kolloid-Z.* 100, 137-40 (1942).—*C.A.* 38, 1678^9.

Electrolytic Ni in the form of Fe-free filings (0.3-0.6 mm long), packed in a spiral tube 22 cm long and of 5 mm bore, was used as catalyst in the decompn. of N_2O at 304°C. When the tube was exposed to waves from a 4-watt radio-transmitter or from a large induction coil the decompn. was increased by 14-38% This behavior was related to that of the "coherer" formerly used for detecting electromagnetic waves, the action of the waves being to modify the surface of the metal particles so that they became conducting.

10350. Herbo, Cl. **Research on the mechanism of catalytic reactions. II. Kinetic studies on the dehydrogenation of cylohexane.** *Bull. soc. chim. Belg.* 51, 44-62 (1942).—*C.A.* 37, 5307^1.

An equation was derived for the reaction velocity for the dehydration of cyclohexane to benzene on a Ni-BeO catalyst. It was postulated that the adsorption of the hydrocarbons on the catalyst was independent of that of H_2. Accordingly, different active centers were active. The true activation energy of the dehydration and the heat of adsorption were calcd.

10351. Herfurth, O. **Possible applications for silica gel in practical operations.** *Zellwolle, Kunstseide, Seide* 47, 67-72 (1942).—*C.A.* 37, 4536^4.

Among the possible applications discussed were the use of silica gel as a catalyst carrier, the recovery of solvents, drying air and gases, and an ingredient in salves and pastes.

10352. James, T. H. **Variation of reaction mechanism with surface conditions in the reduction of silver salts by hydroxylamine.** *J. Chem. Phys.* 10, 464-8 (1942).—*C.A.* 36, 5413^5.

AgBe oxidized $HONH_2$ at pH 10.2-10.8 to N_2 and H_2O. Under comparable conditions AgCNS yielded a mixt. of N_2 and N_2O as the gaseous products. By varying the surface conditions of the thiocyanate, the compn. of the reaction product could be varied over a wide range. Small addns. of bromide or iodide greatly influenced the N_2O yield.

10353. Kanome, Akira and Chitani, Toshizo. **Catalytic oxidation of carbon monoxide with heavy oxygen on the surface of copper oxide. I.** *J. Chem. Soc. Japan* 63, 36-40 (1942).—*C.A.* 41, 2974*f*.

The contact oxidation of CO in the presence of the catalyst CuO was studied by means of heavy O. It was found that: (1) the contact oxidation took place vigorously above 150°C and the oxidation was complete above 400°C, (2) above 400°C the reaction $CuO + CO_2 \rightleftharpoons CuCO_3$ began, and (3) above 550°C, the two reactions started: $2CuCO_3 \rightarrow Cu_2O + 2CO_2 + 1/2\ O_2$ and $Cu_2O + 1/2\ O_2 \rightarrow 2CuO$.

10354. Kawamoto, Tokio. **Dehydrogenation.** *J. Chem. Soc. Japan* **63**, 45-54 (1942).—*C.A.* **41**, 2975*f*.
The catalytic reaction of isobornylaniline and methylamine was studied in the presence of Ni chromite. The best Ni-Cr catalyst was prepd. as follows: 18.6 g $(NH_4)_2CrO_4$, 17.4 g $Ni(NO_3)_2$, and 300 ml of water were mixed. By keeping the mixt. at 30°C, the complex salt was pptd. The calcining of the ppt. at 400°C gave the best results.

10355. Kobayashi, Kyukei and Ishikawa, Heishichi. **Catalytic cracking and contact refining of low-temperature tar with Japanese acid clay. I.** *J. Soc. Chem. Ind. Japan* **45**, 1171-4 (1942).—*C.A.* **43**, 7667*h*.
To utilize low-temp. tar effectively it was distd. with the addn. of Japanese acid earth. The effect on various constituents in the tar was investigated.

10356. Kobayashi, Kyuhei; Ishikawa, Heishichi, and Isoda, Tadao. **Hydrochloric acid produced from common salts by catalytic decomposition with acid clay and colloid earth.** *Waseda Applied Chem. Soc. Bull.* **18**, 133-9 (1942).—*C.A.* **44**, 7029*d*.
NaCl mixed with acid clay and heated in a silica tube at 700°-800°C, through which steam was passed at space velocity 500, was decompd. 63% to 0.97 (initially 3.22) *N* HCl. Similarly, with colloid earth 44% was decompd. to 1.51 (initially 4.03) *N* HCl. As tested, the HCl was pure except for admixt. of SO_2. The method was industrially feasible.

10357. Kodama, Shinjiro; Tahara, Hidekazu; Fukushima, Iwao; Iwao, Masamichi; Komazawa, Seido, and Kimure, Katsue. **Hydrocarbon synthesis from carbon monoxide and hydrogen under medium pressure. II. Characteristics of hydrocarbon synthesis under medium pressure with an iron catalyst. Durability of the catalyst.** *J. Soc. Chem. Ind. Japan* **45**, 1263-71 (1942).—*C.A.* **43**, 2397*e*.
Petroleum synthesis was carried out at 230-60°C under a pressure of 10 kg/cm^2 with an equimol. mixt. of CO and H_2; 40 ml of Fe catalyst (Fe:Cu:Mn:kieselguhr: H_3BO_3: K_2CO_3 = 100:25:2:125:20:7) and a gas velocity of 6 m^3 at standard conditions per hr were used continuously for 180 days to det. the durability of the catalyst. The durability of the catalyst was very great even at higher reaction temps., and Fe catalysts presumably had greater durability than Co catalysts under high pressure. The production of CH_4 did not increase even when the activity of catalyst was increased by raising the temp.

10358. Kodama, Shinjiro; Tahara, Hidekazu; Fukushima, Iwao; Iwao, Masamichi; Komazawa, Seido, and Kimure, Katsue. **Hydrocarbon synthesis from carbon monoxide and hydrogen under medium pressure. III. Effect of adding alkali and changes in the reaction temperature on the activity of Fe-Cu-Mn-H_3BO_3 catalysts. IV. Effect of changing alkali, boric acid, and kieselguhr contents on the activity of iron catalysts.** *J. Soc. Chem. Ind. Japan* **45**, 1263-71 (1942).—*C.A.* **43**, 2397*h*.
Catalysts with 7 to 20 parts K_2CO_3 and other components were compared in medium pressure petroleum synthesis to det. the optimum compn. The catalyst contg. 7 to 10 parts K_2CO_3 gave the best yield of oil. The best reaction temp. was found to be 230-50°C. The addn. of H_3BO_3 lowered the activity of Fe catalyst. The optimum amt. of alkali was 4-5 parts when no H_3BO_3 was used. The optimum amts. of Cu and kieselguhr to be added were 25 parts and 50-125 parts, resp.

10359. Koidzumi, Masao. **Catalytic exchange reaction of hydrogen between two different hydrocarbons. I. The exchange reaction between heavy ethylene and propylene.** *J. Chem. Soc. Japan* **63**, 1516-21 (1942).—*C.A.* **41**, 2974*e*.
The exchange reaction took place between heavy ethylene and propylene in the presence of Ni catalyst. The degree of exchange was slight; after more than 10 days at room temp. two H atoms in a propylene mol. took part in the exchange reaction.

10360. Komatsu, Shigeru and Kuraku, Hideshi. **Catalytic action of nickel-magnesium on the reaction between methane and steam.** *J. Chem. Soc. Japan* **63**, 1551-4 (1942).—*C.A.* **41**, 3267*b*.
About 91-95% CH_4 was decompd. by steam at 650-700°C in the presence of Ni-Mg catalyst. The best catalyst was prepd. as follows: $Ni(NO_3)_2$ and $Mg(NO_3)_2$ were dissolved in water (Ni:Mg = 9:1). The soln. was absorbed by granules of pumice stone which were then calcined at 400°C and reduced by H_2.

10361. Kuraku, Hideshi. **Dehydrogenation of methane. I.** *J. Chem. Soc. Japan* **63**, 1147-50 (1942).—*C.A.* **41**, 3353*d*.
The catalytic activity of chromites on the dehydration of CH_4 by steam was studied. The chromites were prepd. from NH_4-chromite hydrates. The order of the catalytic activity was: $Ni(CrO_2)_2 > Fe(CrO_2)_2 > Mg(CrO_2)_2$, $Zn(CrO_2)_2$.

10362. Kuraku, Hideshi. **Dehydrogenation of methane. II. The reaction of methane with carbon dioxide.** *J. Chem. Soc. Japan* **63**, 1512-15 (1942).—*C.A.* **41**, 2974*d*.
The dehydrogenation of CH_4 with CO_2 in the presence of Fe chromite catalyst was studied. The catalyst was prepd. by calcining $(NH_4)_2CrO_4.(FeCrO_4)_3.H_2O$ at 300°C.

10363. Kuraku, Hideshi. **Dehydrogenation of methane. III. Catalytic action of iron chromite in the reaction between coal gas and steam or carbon dioxide.** *J. Chem. Soc. Japan* **63**, 1755-8 (1942).—*C.A.* **41**, 3353*e*.
Iron chromite catalyst showed good catalytic activity in the dehydrogenation of CH_4 in coal gas by CO_2; the rate was 50 to 86% at 800-900°C. The decompn. rate by steam was 62 to 94% at 800-900°C. The coal gas contained 0.2 g S per 100 m^3.

10364. Lo, Chien-Pen and Chu, Lucy Ju-Yung. **Catalytic dehydration of castor oil by normal sulfates and alums.** *J. Chem. Eng. China* **9**, 1-5 (1942).—*C.A.* **40**, 2587^7.
Castor oil (25 g) was treated with 4% of catalyst at 240-50°C for 30 min. and the I_2 no. detd.;

23 catalysts, i.e., normal sulfates, and alums were tested. The greatest increase in unsatn. was given by the following catalysts yielding in each case products with the I_2 nos. indicated: $CuSO_4$, 145.2; $Cu(NH_3)_4SO_4$, 128.8; $Fe(NH_4)_2(SO_4)_2$, 117.0; $Fe(NH_4)(SO_4)_2$, 114.7; $(NH_4)_2SO_4$, 114.6.

10365. Love, Katherine S. and Brunauer, Stephen. **The effect of alkali-promoter concentration on the decomposition of ammonia over doubly promoted iron catalysts.** *J. Am. Chem. Soc.* 64, 745-51 (1942).—*C.A.* 36, 3094^4.

A series of doubly-promoted catalysts were prepd. by treating an Al_2O_3-promoted catalyst with KOH solns. of varying strengths in order to find the optimum alkali-promoter concn. for Fe synthetic NH_3 catalysts. The total surface areas and the surface concns. of the promoters were detd. for each catalyst by adsorption measurements and the effects of temp. and gas compn. on the kinetics of NH_3 decompn. were investigated. The most active catalyst toward NH_3 decompn. was obtained when about 30% of the catalyst surface was covered by the alkali promoter.

10366. Luyten, L. and Vlieghere, R. de. **Activated adsorption and catalytic dehydration on chromic oxide.** *Natuurw. Tijdschr.* 24, 79-91 (1942).—*C.A.* 37, 5307^3.

The reduction of the catalyst, its adsorptive power for H_2, and its effectiveness in the dehydrogenation of cyclohexane and in the cyclization of heptane were studied with catalyst mixts. in various proportions of Cr_2O_3 with Al_2O_3, ZnO and ThO_2. The amt. of H_2 required for the reduction was not proportional to the amt. of Cr_2O_3; it was notably higher for the mixts. For the mixts. Cr_2O_3-ZnO and Cr_2O_3-ThO_2 the quantity of H_2 adsorbed attained a max. at each of the ratios 4:1 and 1:4 in the mixts., but for Cr_2O_3-Al_2O_3 there was only one max., at the ratio 4:1.

10367. Mikhnovskaya, A. A. and Frost, A. V. **Catalytic action of activated silica-alumina. Influence of treatment with activated clay upon unsaturated compounds contained in cracked gasoline.** *Compt. rend. acad. sci. U.R.S.S.* 37, 221-2 (1942).—*C.A.* 37, 5575^5.

The 90-122°C fraction of cracked gasoline was passed over the catalyst at 260°C at a rate of 0.25 ml of liquid per 1 ml of apparent catalyst volume per hr. Analysis showed the formation of satd. compds. from hydrogenation.

10368. Murata, Yoshio; Tatsuki, Yutaka; Yamada, Hiloemon, and Sawada, Yasuhisa. **The synthesis of gasoline from carbon monoxide and hydrogen. LVII. Effect of some added substances on iron-copper catalysts.** *J. Soc. Chem. Ind. Japan* 45, 557-60 (1942).—*C.A.* 43, 2399*g*.

With Fe catalysts the results were: (1) $K_2C_2O_4$, HCOOK, KOH, K_2CO_3, and KNO_3 accelerated the action, and the optimum amt. was about 1.5% as K; (2) Org. acids were injurious; (3) $Cr(NO_3)_3$, CrF_3, $Cr_2(CO_3)_3$, and $Cr(OAc)_3$ were injurious to the catalyst, but Cr_2O_3 was not; (4) $Zn(NO_3)_2$, ZnO, $Zn_3(PO_4)_2$, $Zn(OAc)_2$, and Zn stearate were injurious, but $Zn(OH)_2$ was not.

10369. Murata, Yoshio; Sawada, Yasuhisa, and Takezaki, Yoshizane. **The synthesis of gasoline from carbon monoxide and hydrogen. LVIII. Mutual influence of boric acid and alkali in promoting activities of iron-copper catalysts.** *J. Soc. Chem. Ind. Japan* 45, 670-5 (1942).—*C.A.* 43, 2399*h*.

The mutual influence of diatomaceous earth, H_3BO_3, and alkali on Fe-Cu catalysts was investigated. The activating action of H_3BO_3 was very weak for Fe catalysts with no alkali; it increased with the addn. of alkali. H_3BO_3 prevented the formation of high-mol. hydrocarbons, such as solid paraffins, and promoted the formation of satd. hydrocarbons. With increases in the amt. of H_3BO_3 added, the durability of the catalyst increased.

10370. Murata, Yoshio and Yasuda, Masao. **The synthesis of gasoline from carbon monoxide and hydrogen. LIX. Activation of iron-copper catalysts by boron.** *J. Soc. Chem. Ind. Japan* 45, 675-7 (1942).—*C.A.* 43, 2400*a*.

Various B compds. were added to Fe catalyst, and their influence was studied. Mn and Mg borates had the same action as H_3BO_3. The addn. of B compds. was effective even by mech. mixing, while alkali had no effect by the same treatment.

10371. Murata, Yoshio; Yashiro, Ryuichi, and Tashiro, Eiichi. **The synthesis of gasoline from carbon monoxide and hydrogen. LX. Effect of copper on iron catalysts.** *J. Chem. Soc. Ind. Japan* 45, 1117-21 (1942).—*C.A.* 43, 2400*a*.

Cu had excellent accelerating action on the activity of Fe catalyst, and the optimum amt. of Cu was different for catalysts of different compns. When H_3BO_3 and alkali were added, the optimum amt. of Cu was about 10%. Cu had no effect on the durability of Fe catalysts. The effect of alkali on the Fe catalyst was not affected by the amt. of Cu present.

10372. Murata, Yoshio; Yoshioka, Yasuo; Oji, Genichi, and Saito, Shigeru. **The synthesis of gasoline from carbon monoxide and hydrogen. LXI. Reaction temperature and durability of iron catalysts.** *J. Soc. Chem. Ind. Japan* 45, 1271-86 (1942).—*C.A.* 43, 2400*c*.

The durability of Fe catalysts was studied on the compn. $Fe:Cu:Mn:kieselguhr:H_3BO_3:K_2CO_3 = 100:25:2:125:x:y$, where $x = 0$ or 20 and $y = 1, 2, 3$ or 4 in powd. form, and $x = 20$ and $y = 4$ in tablet form, used in the Fischer synthesis with a gas mixt. $(CO:H = 1:1)$ at 200-70°C. The durability of Fe catalysts active at 230-60°C, could be greatly increased by choosing a lower reaction temp. The optimum reaction temp. was lowered more when the catalyst was in the form of tablets compared to powd. form.

10373. Murata, Yoshio; Yoshioka, Yasuo; Oji, Genichi, and Saito, Shigeru. **The synthesis of gasoline from carbon monoxide and hydrogen. LXII. Durability of iron catalyst and the composition of gas used in the synthesis.** *J. Soc. Chem. Ind. Japan* 45, 1271-86 (1942).—*C.A.* 43, 2400*e*.

The Fischer synthesis was carried out with catalysts similar in compn. with gas mixts. of compn. CO:H_2 = 1:2, 1:3, and 1:5. With increase in H_2 the most suitable reaction temp. was lowered, and the durability of Fe catalyst was remarkably increased. Thus with a mixt. of CO:H = 1:2 or 1:3 the same catalyst can be used continuously for about 1 month at a suitably fixed reaction temp. The property of H_3CO_3 in promoting the catalytic activity decreased with increases in H_2.

10374. Murata, Yoshio; Yoshioka, Yasuo; Oji, Genichi, and Saito, Shigeru. **The synthesis of gasoline from carbon monoxide and hydrogen. LXIII. Iron catalysts and the composition of gas used in the synthesis.** *J. Soc. Chem. Ind. Japan* 45, 1271-86 (1942).—*C.A.* 43, 2400*g*.

The Fischer synthesis was carried out with a gas mixt. of compn. CO:H_2 = 2:1 with an Fe catalyst of high activity contg. H_3BO_3. The yield of oil was much smaller with gas of compn. CO:H_2 = 2:1 than with compn. 1:1. The durability of the catalyst was also reduced.

10375. Nakata, Shigeo. **Catalytic oxidation of carbon monoxide with heavy oxygen on the surface of copper oxide. II,** *J. Chem. Soc. Japan* 63, 41-4 (1942).—*C.A.* 41, 2974*g*.

The contact oxidation of CO at the surface of CuO was studied by means of heavy oxygen at 120°-300°C. With the progress of the reaction, the O in CuO was gradually replaced by heavy O. Similarly, if the reaction between CO and O took place at 120-130°C on the surface of Cu oxide prepd. by using heavy O, the heavy O in the Cu oxide was gradually replaced by ordinary O.

10376. Nozaki, Kenzie. **The catalytic interchange of groups in aliphatic amines. I.** *J. Am. Chem. Soc.* 64, 2920-3 (1942).

When aliphatic amines were heated with metal halide catalysts, the groups attached to the nitrogen were redistributed. This redistribution reaction was studied with respect to the catalytic activity of several substances and the order of the reaction with respect to catalyst concentration.

10377. Ogawa, Eijior and Murata, Kenzo. **Catalytic action of nickel-iron-cobalt wire under tension on the reaction between ethylene and hydrogen.** *J. Soc. Chem. Ind. Japan* 45, Suppl. binding, 386-7 (1942).—*C.A.* 44, 7636*i*.

The activation energy of the $H_2 + C_2H_4$ reaction was raised from 16,400 to 17,800 cal by placing under tension Ni-Fe-Co alloy wire used as a catalyst. The difference was caused by the orientation of the magnetic axis of each magnetic domain from its random distribution.

10378. Ota, Nobuhito. **Preparation of hydrogen and carbon monoxide from methane and carbon dioxide. I. Catalyst. II. Prevention of carbon as a by-product.** *Rept. Tokyo Ind. Testing Lab.* 37, 59-76; 77-93 (1942).—*C.A.* 43, 4445*g*.

10379. Ota, Nobuto. **Water gas by the reaction of methane and carbon dioxide. I. Catalysts.** *J. Soc. Chem. Ind. Japan* 45, 284-90 (1942).—*C.A.* 43, 1944*f*.

An equiv. mixt. of CH_4 and CO_2 under atm. pressure was passed through a layer of catalyst at 700°-800°C to obtain CO and H_2. Catalysts composed of Ni and various oxides and carriers in different ratio were used, and among those tried one contg. Ni, MgO, and kieselguhr in the ratio 1:1:4 gave the best yield of CO + H_2 at 700°C with the least formation of carbon on the catalyst.

10380. Ri, Ki Chin. **Ferric oxide catalyst. I. Activation energy of water gas reaction with various catalysts.** *J. Soc. Chem. Ind. Japan* 45, 35-9 (1942).—*C.A.* 43, 1945*f*.

The reaction $CO + H_2O = CO_2 + H_2$ was studied at 400°, 450°, and 500°C in a chamber contg. Fe_2O_3 (or Fe_2O_3 and Cr_2O_3) prepd. in various ways in the form of small cylindrical pills, and the progress of the reaction with time was detd. by analyzing the reacting mixt. The velocity const. k calcd. from the results by the formula of the bimol. reaction was fairly const. for each temp. The catalyst Fe_2O_3 contg. 7 mol. % of Cr_2O_3 was the most powerful.

10381. Ri, Ki Chin. **Ferric oxide catalyst. II. Effect of a small quantity of hydrogen sulfide on the water gas reaction.** *J. Soc. Chem. Ind. Japan* 45, 35-9 (1942).—*C.A.* 43, 1945*g*.

When a small amt. of H_2S was added to the reaction mixt., the reaction velocity decreased and stayed at a definite value. However, when a pure gas mixt. was led through the catalytic chamber, the reactivity gradually returned to the original value.

10382. Sakai, Wataru; Hukuyama, Hiroto, and Okuno, Toshiro. **Catalytic powers of manganese oxides. I. Composition and thermal decomposition of manganese oxides.** *J. Soc. Chem. Ind. Japan* 45, 25-33 (1942).—*C.A.* 43, 1623*f*.

Several different samples of Mn oxides were prepd. from $Mn(NO_3)_2$, $MnSO_4$, $KMnO_4$, etc., and the content of available O of each sample was analytically detd. The MnO_2 and Mn_2O_3 contained in the original sample were calcd. from the sharp breaks in the decompn. curve at 500-80°C and 970-1070°C, which corresponded to the change of MnO_2 → and Mn_2O_3 and $Mn_2O_3 \rightarrow Mn_3O_4$, resp.

10383. Sakai, Wataru; Hukuyama, Hiroto, and Okuno, Toshiro. **Catalytic powers of manganese oxides. II. Adsorption equilibrium of carbon dioxide by manganese oxides.** *J. Soc. Chem. Ind. Japan* 45, 25-33 (1942).—*C.A.* 43, 1623*h*.

Preliminary to the investigation of the catalytic power of Mn oxides in oxidizing CO to CO_2, their power of adsorbing CO_2 at 25° and 50°C was measured. The adsorption occurred in 2 stages, the primary stage reaching satn. almost instantaneously, and the secondary stage taking place gradually but to a very small extent, except for one sample. The results were satisfactorily represented by the adsorption formula $a = kp^{1/n}$, where k ranged 0.10-0.88 and 0.26-0.55 at 25° and 50°C, resp.

10384. Sakai, Wataru; Hukuyama, Hiroto, and Okuno, Toshiro. **Catalytic powers of manga-**

nese oxides. III. Adsorption velocity of carbon dioxide by manganese oxides. *J. Soc. Chem. Ind. Japan* **45**, 25-33 (1942).—*C.A.* 43, 1623*i*.

With the samples of Mn oxide that showed a measurable secondary adsorption velocity, that velocity was measured at 25° and 50°C. Activation energy was obtained from the change in the adsorption velocity with temp.

10385. Schwab, Georg-Maria and Drikos, Georg. **Kinetics of the catalytic combustion of carbon monoxide on copper oxide—absolute calculation of the catalytic reaction velocity.** *Z. physik. Chem.* **B52**, 234-52 (1942).—*C.A.* 37, 6186^1.

For pressures ranging from 0.3 to 150 mm the speed of the reaction from 300° to 430°C between CO and O_2 in the presence of CuO was proportional to the concn. of CO, and independent of the concns. of CO_2 and O_2. The apparent heat of activation was 18 kcal per mol. Hence, the step which detd. the rate of reaction was the reduction of CuO by CO. The surface was moderately rough and a heat of activation of the mols. of about 21 kcal. from 3 to 4 degrees of freedom of the oscillating system CO-CuO was concd. on the crit. linkages so that the transformation occurred.

10386. Suito, Eiji. **Thermal analysis of the catalytic action of colloids. IV. Hydrogen-, oxygen-, and nitrogen-platinum sols.** *Rev. phys. Chem. Japan* **16**, 1-16 (1942).—*C.A.* **44**, 10474*c*.

Sols were prepd. by dispersing Pt into water contg. H_2, O_2, and N_2, by the use of high-frequency a.c. Catalytic actions of these sols on the decompn. of H_2O_2 were observed. The decompn. of H_2O_2 proceeded as a first-order reaction, but in the earlier stage of the process the reaction rate decreased more rapidly than in the main part when H_2-Pt sol was used as the catalyst, but less rapidly when O_2-Pt or N_2-Pt sol was used.

10387. Tamamushi, Bun-ichi. **Kinetics of the rearrangement of cis-trans isomers in the gaseous state. III. The isomerization of dichloroethylene under the influence of glass-wall and metallic catalysts.** *Bull. Chem. Soc. Japan* **17**, 321-5 (1942).—*C.A.* **41**, 4364*d*.

The isomerization of *cis*-dichloroethylene into the trans compd. and the reverse reaction were studied. Neither reaction was affected by Pt gauze or silvered wall of the vessel. Both reactions were considered practically homogeneous. However, both reactions were catalyzed by Pt black. In this case, thermal decompn. took place simultaneously.

10388. Tamura, Mikio and Shida, Syoji. **Decomposition of methanol with zinc-chromium oxide catalyst.** *Rev. Phys. Chem. Japan* **16**, 68-82 (1942) (English summary).—*C.A.* 46, 4339*e*.

The decompn. of CH_3OH by a catalyst contg. 25 at. % Cr was studied by a static method for initial pressures of 70-80 mm at 270°-300°C. The course of the pressure could be accounted for by the consecutive 1st-order reaction, $CH_3OH \rightarrow CH_2O + H_2 \rightarrow CO + H_2 + H_2$. Side reactions could be neglected. The apparent heats of activation were 43 and 30 kcal, resp., for the decompn. of CH_3OH and CH_2O. Expts. on the addn. of H_2O vapor indicated the possibility of neglecting the intermediate formation of CH_2O.

10389. Ueno, Seiichi. **Influence of the conditions of precipitation on the activity of nickel catalysts. I. Precipitation with caustic soda.** *J. Soc. Chem. Ind. Japan* **45**, 650-2 (1942).—*C.A.* 43, 5211*b*.

When the amt. of NaOH was insufficient for complete pptn. of $Ni(OH)_2$, the catalyst obtained was less active than when prepd. from $Ni(OH)_2$ completely pptd. with an equiv. amt. of NaOH soln. The catalyst prepd. from $Ni(OH)_2$ pptd. with a slight excess of NaOH soln. was most active. Temp. of pptn. had no definite effect on the catalyst.

10390. Von Elbe, Guenther and Lewis, Bernard. **Mechanism of the thermal reaction between hydrogen and oxygen.** *J. Chem. Phys.* **10**, 366-93 (1942).—*C.A.* 36, 4397^8.

Explosion limits and reaction rates of H_2 and O_2 were detd. in spherical quartz and Pyrex vessels of varying diam., clean and coated with various substances (KCl, $BaCl_2$, $K_2B_2O_4$, $K_2B_4O_7$ and Na_2WO_4) and for various temps., pressures, and mixt. compns., including addn. of inert gases. Clean and B_2O_3-coated surfaces gave rise to rapid and erratic reaction. The reaction was self-accelerating, probably because of poisoning of the surface by H_2O.

10391. Abe, Shiro. **Research on alumina-gel catalyst. VI.** *Sci. Papers Inst. Phys. Chem. Research* (Tokyo) **40**, 331-2 (1943).—*C.A.* **41**, 6122*h*.

Colloidal $Al(OH)_3$ was pptd. in a soln. of agar-agar, glue or starch, and the mixt. was dried and coagulated. By peptizing the half-gelatinized gel of agar-agar, glue, etc., with a warm aq. soln. of weak acid, Al_2O_3 gel was made porous. This catalyst was very active for the dehydration of EtOH at 180°C.

10392. Balandin, A. A. **Spatial arrangement of atoms in contact catalysis and the dehydrogenation of hydrocarbons with open chains.** *Acta Physicochim. U.R.S.S.* **18**, 69-90 (1943) (in English).—*C.A.* 37, 6530^9.

The value of $(1/a) \times 10^{-3}$ in the equation $\ln k_0 = aQ + b$ (where Q was the activation energy of the Arrhenius equation) was nearly const. for various substances on a given catalyst. It was about 2.0 for metals and about 3 for oxide catalysts. The decompn. of butane at 570°C in contact with Cr_2O_3 for 1.5 sec. produced H_2 37.5, C_2H_4 2.4, C_2H_6 3.7, C_2H_4 0.3, C_3H_8 0.1, C_4H_8 29.0 and C_4H_{10} 26.8%. The max. yield of butadiene was 75%, obtained from 2-butene at 570°C in 0.3 sec.

10393. Balandin, A. A. and Kotelkov, N. Z. **Dendrite hypothesis of carbon deposition. Chemical behavior of cyclohexane when in contact with electrically heated metallic coils.** *Acta Physicochim. U.R.S.S.* **18**, 406-19 (1943) (in English).—*C.A.* 38, 5720^1.

Both the catalytic dehydrogenation and decompn. of cyclohexane were studied in the range from 300° to 600°C on platinized nichrome, palladized nichrome, nichrome, chromized Fe and Fe. A simple and convenient app. was described and a considerable economy in Pt achieved. To explain the facts observed a dendrite hypothesis of carbon deposition was advanced.

10394. BALANDIN, A. A. AND PATRIKEEV, V. V. **Formation of carbon dendrites by catalytic decomposition of alcohols on metals.** *Doklady Akad. Nauk. S.S.S.R.* **40**, 171-4 (1943); *Compt. rend. acad. sci. U.R.S.S.* **40**, 152-4 (1943) (in English).—*C.A.* **38**, 6179^2.

Soot dendrites were formed on a constantan wire when iso-PrOH was passed over it at 450°C. The dendrites, having an empirical formula $(C_{23}H_4O)_x$, probably were cryst. layers of 6-member C rings arranged in the graphite lattice, with the H atoms attached to the C atoms of the periphery.

10395. BECKMANN, R. B.; PUFAHL, A. E., AND HOUGEN, O. A. **Catalytic hydrogenation rates-interpretation of results.** *Ind. Eng. Chem.* **35**, 558-62 (1943).—*C.A.* **37**, 4614^5.

Exptl. data indicated that the controlling step was the rate of surface reaction, that the mass-transfer step was negligible, and that adsorption equil. was maintained between the gas phase and adsorbed components. Reaction-rate equations were developed, including the effect of activated adsorption and surface reaction expressed in terms of concns. for two catalysts.

10396. BOULLÉ, ANDRÉ. **Catalysis by cathodic projection.** *Bull. soc. chim.* **10**, 361-71 (1943).—*C.A.* **38**, 4858^6.

The catalysis of $N_2 + 3H_2 \rightarrow 2NH_3$ at about 3 mm pressure by the emanations from various metallic cathodes was studied. Al, Sb, Ag, Sn, Pt, Pb and Si in various chem. and phys. forms were tested as catalysts. A Pt spring was found best as catalyst. NH_3 yields were comparable to those of a high-pressure reaction. The thermodynamic equil. of the reaction and the temp. of cathode discharge were detd.; no catalysis was found at the anode.

10397. CONSTABLE, F. H. **Distribution of catalytically active centers on surfaces.** *Nature* **152**, 135-6 (1943).—*C.A.* **37**, 6531^5.

Further studies of the auto-poisoning of catalytically active Cu in dehydrogenating EtOH above 280°C were reported. A formula was derived which agreed reasonably well with exptl. data. The more active centers poisoned less rapidly than did the less active centers.

10398. CONSTABLE, F. H. AND ÇAĞLAR, M. **Cadmium and tin as catalysts.** *Rev. faculté sci. univ. Istanbul* **8**, 328-31 (1943).—*C.A.* **40**, 2723^9.

The heats of activation for both metallic Sn and Cd as catalysts for the dehydrogenation of alc. were greater than that for an active reduced Cu catalyst. Liquid Sn was also active, and there was no great change in activity on melting.

10399. DAMKÖHLER, GERHARD. **Excess temperature in catalyst grains.** *Z. physik. Chem.* **193**, 16-28 (1943).—*C.A.* **39**, 2689^3.

The max. excess temp., θ_{max} in a stationary catalyst grain during reaction was independent of the chem. reaction velocity, as well as the radius of the grain. It was detd. solely by the heat of reaction Q, the internal diffusion coeff. D_{ji}, the internal thermal cond. λ_i, and the external concn. c of the reactants. The following equation was derived: $\theta_{max.} \approx QD_{ji}(c_{jr} - c_{jo})/\upsilon_j \lambda_i$, where c_{jo} was the equil. concn. of reactants and υ_j the stoichiometric coeff. of constituent j. $\theta_{max.}$ for SO_2 oxidation was 0.42, for NH_3 synthesis 0.20° at 200 atms. and 0.57° at 1000 atms., for MeOH synthesis 1.0°, for butane synthesis from CO and H_2 3.0°.

10400. DOLIQUE, R. AND GALINDO, J. **Oxidation of carbon monoxide by means of mixed catalysts of the hopcalite type.** *Bull. soc. chim.* **10**, 64-72 (1943).—*C.A.* **38**, 2555^1.

The velocity of oxidation of CO to CO_2 was detd. in mixts. formed of equal parts of CO and O_2 in contact with ternary (CuO, MnO_2, Co_xO_y) and binary (CuO, MnO_2 and CuO, Co_xO_y) catalysts by measuring the contractions of the gas vol. resulting from the oxidation and from a subsequent adsorption of CO_2 by the catalyst, as a function of the time of contact. A triangular diagram and the photograph of a plaster model of the surface representing the velocities as a function of the compn. of the catalysts were given. This surface was not plane but showed elevations and cavities corresponding to the different catalytic activities. The max. velocity corresponded to a very high MnO_2 content (90% MnO_2, 6% CuO, 4% Co_xO_y).

10401. EĬDUS, YA. T. AND ELAGINA, N. V. **Activity and stability of Fe-Cu-ThO_2-K_2CO_3 catalyst in the synthesis of liquid hydrocarbons from CO-H_2 mixture as influenced by composition of the catalyst and the nature of the carrier.** *Bull. acad. sci, U.R.S.S., Classe sci. chim.* **1943**, 305-11 (English summary).—*C.A.* **38**, 5648^7.

Eighteen catalysts of compn. Fe-Cu-ThO_2-K_2CO_3-carrier were examd. in the synthesis of liquid hydrocarbons from 1:1 CO-H_2 mixt. The results contradicted the view of catalyst support as an inert mass. The Fe catalysts investigated showed poor stability, which was not improved with variations of ThO_2 content.

10402. EĬDUS, YA. T.; EPIFANSKIĬ, P. F.; PETROVA, L. V.; ELAGINA, N. V., AND AL'TSHULLER, S. B. **Activating effect of certain metal oxides on Fe-Cu contacts, used in the synthesis of gasoline from water gas.** *Bull. acad. sci. U.R.S.S. Classe sci. chim.* **1943**, 145-51 (English summary).—*C.A.* **38**, 4117^2.

Of the oxides of Mg, Al, Mn and Th, the first 2 had the highest activating effect on Fe-Cu-K_2CO_3-kieselguhr catalysts prepd. by pptn. The catalysts were used in the synthesis of gasoline from water gas.

10403. EMMETT, P. H. AND KUMMER, J. T. **Kinetics of ammonia synthesis.** *Ind. Eng. Chem.* **35**, 677-83 (1943).—*C.A.* **37**, 4958^5.

The dependence of the rate NH_3 synthesis upon pressure, temp., space velocity and gas compn. were studied. The data for the synthesis and the decompn. of NH_3 over an iron catalyst, promoted with K_2O and Al_2O_3 were in satisfactory agreement with theory. On the other hand, neither the theory nor the equations appeared applicable to the decompn. of NH_3 over a singly promoted Fe-Al_2O_3 catalyst.

10404. Emmett, P. H. and Skau, Nis. **The catalytic hydrogenation of benzene over metal catalysts.** *J. Am. Chem. Soc.* **65**, 1029-35 (1943).—*C.A.* **37**, 4294[8].

The surface area of inactive Fe catalysts was as large as that of very active Co or Fe-Co alloys. Cu catalysts substantially free from Ni were inactive at 200°C, although their surface areas were several fold those of active Co catalysts. Cu contg. small addns. of Ni was slightly active at 200°C. Pd was active, Ag inactive; two Pd + Ag alloys had activities per unit Pd content that decreased markedly with a decrease in the percentage of Pd. CO was chemisorbed on both reduced Cu and reduced Ni catalysts instantly at -195°C. CO_2 was chemisorbed at -78°C on Ni catalysts prepd. by reduction of oxide formed by alkali pptn.

10405. Fricke, R. and Wessing, G. **Active substances. LXII. The catalytic behavior of diversely prepared samples of γ-Al_2O_3 and γ-Al_2O_3 + BeO.** *Z. Elektrochem.* **49**, 274-7 (1943).—*C.A.* **38**, 1166[5].

Three Al_2O_3 prepns., dehydrated at 600°C for different times and at 860°C, showing H_2O contents from 1.71% to 3.36%, two Al_2O_3-BeO mixts. with small amts. of BeO, and two equimol. mixts. of Al_2O_3 and BeO were used. The dehydration of isopropyl alc. was of zero order in the range 137° to 221°C and initial isopropyl alc. pressures between 5 and 13 mm for all of the catalysts. The activation energy increased with increasing dehydration or preheat temp. of the catalyst. The addn. of BeO decreased the velocity const.

10406. Hasegawa, Shigeo. **Formation of the reaction nuclei in the reduction of cupric oxide by hydrogen.** *Proc. Imp. Acad.* (Tokyo) **19**, 393-7 (1943) (in English).—*C.A.* **41**, 5777*h*.

The velocity of the reduction of CuO by H_2 was plotted against time. Two straight lines were obtained, the initial horizontal line being followed by one with an increase in slope. The reduction was explained by 3 assumptions: (1) a reaction between adsorbed H_2 and CuO occurred at the interface of reduced Cu, creating a reaction nucleus; (2) the nuclei on CuO were small in no. and were not initially in contact with one another; (3) the reaction progressed in proportion to the velocity of the growth and increase in number of the nuclei.

10407. Hedvall, J. Arvid and Hedin, R. **The importance of the nature of the surface for the velocity of thermal decomposition of solid materials.** *Tek. Tid.* **73**, No. 7, Uppl. A-C, *Kemi* 9-12 (1943).—*C.A.* **40**, 5625[9].

Three samples of $CaCO_3$ with edges 3-4 mm long [a column-rhombohedron, a thin section ground parallel to the base of the crystal, and a thin section ground parallel to the surface of the prism] were heated in dry N_2 first for 5 min. at increasing temps., 710-820°C and then at a const. temp. of 760°C. The loss of wt due to the reaction $CaCO_3 = CaO + CO_2$ was detd. by weighing before and after the test. Below 750°C the differences in the rates of decompn. were very small. Thin sections ground parallel to the prism surface decompd. the fatest. Two samples of FeS_2 crystals, a cube and an octahedron (3-4 mm long), were heated and cooled under the same conditions as $CaCO_3$, only that the temp. ranged from 590 to 620°C and the test periods from 5 to 10 min. The cube surface decompd. faster than that of the octahedron.

10408. Herbo, Cl. and Hauchard, V. **Mechanism of catalytic reactions. III. Study of the interaction of hydrogen with the catalyst.** *Bull. soc. chim. Belg.* **52**, 135-56 (1943).—*C.A.* **40**, 4941[5].

Nickel-thoria catalyzed the hydrogenation of benzene solely to cyclohexane giving no other hydrocarbons condensable at -80°C, similar to the results previously obtained with nickel-chromia and nickel-beryllia catalysts. This reaction was affected in the vapor phase at 50-224°C and the max. rate of reaction was attained at 185°C. The existence of these 2 types of active centers was confirmed by expt. The energy of activation for the hydrogenation of benzene was found to be 11,700 cal. and the heat of adsorption of H_2 on the Ni-thoria catalyst was 39,500.

10409. Hirai, Taizo **Regeneration of the waste vanadium catalyst for contact sulfuric acid plant and extraction of vanadium.** *J. Soc. Chem. Ind. Japan* **46**, 427-8 (1943).—*C.A.* **42**, 6496*f*.

Spent V catalyst for a contact H_2SO_4 plant was extd. with water, and then regenerated by adding V_2O_5 and K_2O. V was recovered from the extn. liquor in a yield of 95%. The catalyst thus regenerated was less effective than the original one.

10410. Ishikawa, Seiichi and Kuroda, Eiichi. **Synthesis of lubricating oil from alcohols. I. Lubricating oil from cetyl alcohol.** *Bull. Inst. Phys. Chem. Research* (Tokyo) **22**, 854-60 (1943).—*C.A.* **43**, 8125*h*.

By heating cetyl alc. with active earth, dehydration and polymerization of the olefins produced took place at 150°C. After 4 hrs, the yield of oily product was 69%. The light portion of the oil consisted of a naphtene $C_{15}H_{30}$ and a paraffin $C_{15}H_{32}$. The heavy portion was a monocyclic naphthene $C_{32}H_{64}$.

10411. Jablotchkoff, N. **The pyrolysis of propylene on silica gel at high temperature.** *Rev. universelle mines* **19**, 114-16 (1943).—*C.A.* **38**, 5719[2].

The pyrolysis of C_3H_6 on silica gel was studied at a high temp. The gas passed with different flow velocities through a quartz vessel partly filled with the gel in an elec. furnace. Repeated expts. at 660°C and different times from 0.03 to 0.005 sec. gave reproducible results and showed with increasing contact time a decrease of the total amt. of gas (CH_4 increased, C_2H_4 decreased), but an increase of the liquid products and the aromatic hydrocarbons. After a certain length of time the gel is covered with graphite. Whether the catalytic action was due to the gel itself or to the deposited graphite must yet be detd.

10412. Kazanskiĭ, B. A. and Rožengart, M. I. **Polymerization of isobutylene on hydrosilicate catalysts. III.** *J. Gen. Chem. (U.S.S.R.)* **13**, 304-8 (1943) (English summary).—*C.A.* **38**, 1207[3].

The polymerization of isobutylene was studied on pyrophosphoric acid deposited on kieselguhr and on Gayer type catalysts; also on Zn or Tl deposited on silica; finally the effect of a Th catalyst deposited on silica was studied. The first 2 catalysts gave products similar to each other in compn., which showed the similarity of the polymerizing action of these catalysts.

10413. Khrizman, I. A. and Korneiuchuk, G. **Kinetics of NH_3 decomposition on iron catalysts.** *Acta Physicochim. U.R.S.S.* **18**, 420-9 (1943) (in English).—*C.A.* **38**, 5719^6.

The kinetics of NH_3 decompn. were investigated on Fe catalysts differing in structure as well as in compn. Expts. were made in the interval 350°-500°C with an initial pressure of 50 or 100 mm, using a quasistatic method. If conditions assuring a const. catalyst surface were observed, reproducible results were obtained. The velocity const. of the NH_3 decompn. on promoted Fe free from nitride was approx. 100 times as large as the velocity const. of the same process on promoted iron nitride. The mechanism of NH_3 decompn. on pure Fe, on a promoted tech. Fe catalyst, and on the latter after the preliminary formation of nitrides was the same.

10414. Kinumaki, Jo.; Shirai, Sanji, and Ogawa, Toru. **Iron catalyst for the benzene synthesis.** *J. Soc. Chem. Ind. Japan* **46**, Suppl. binding, 80-3 (1943) (in German).—*C.A.* **46**, 1186*h*.

The prepn. of better Fe catalysts for synthesized benzene from gas mixts. of CO and H_2 was studied. It was recommended to replace the alkali carbonates with alkali nitrate. This alkali nitrate was always converted at the reduction process into the alkali carbonate, which caused a homogeneous distribution of the alkali on the surface of the diatomaceus earth. By superheating the catalyst, the synthesis of benzene was often impaired. The selective adsorption of the alkali on the catalyst metals and the diatomaceous earth was of great importance.

10415. Kodama, Shinjiro; Tarama, Kimio; Mishima, Akira; Fugita, Koichi, and Yasuda, Motomu. **Synthesis of gaseous hydrocarbons from carbon monoxide and hydrogen. III. The influence of copper, manganese, potassium carbonate, and boric acid on iron catalysts IV. The influence of the temperature of the synthesis on various promoters in the catalysts.** *J. Soc. Chem. Ind. Japan* **46**, 69-77 (1943).—*C.A.* **43**, 2398*b*.

K_2CO_3 greatly increased the mean mol. wt of the product, as did Cu to a lesser degree. The effect of adding H_3BO_3 and Mn was the reverse. However, the effect of the substances on the production of Gasol (mixt. of C_2H_6, C_3H_3, and C_4H_{10}) was not very marked. Of the various catalysts used, 100 Fe—125 kieselguhr gave the best results, yielding a product contg. 78% Gasol, although this catalyst had less power of causing CO and H_2 to react.

10416. Kodama, Shinjiro; Tarama, Kimio; Mishima, Akira; Fujita, Koichi, and Yasuda, Motomu. **Synthesis of gaseous hydrocarbons from carbon monoxide and hydrogen. V. Influence of potassium carbonate on iron catalyst. VI. Influence of boric acid on the iron catalysts.** *J. Soc. Chem. Ind. Japan* **46**, 404-8 (1943).—*C.A.* **43**, 2398*d*.

The addn. of K_2CO_3 increased the mean mol. wt of the hydrocarbons produced and decreased the formation of CH_4, while the addn. of H_3BO_3 decreased the mean mol. wt.

10417. Kondrat'ev, V. and Ziskin, M. **Reaction of water-gas conversion in quartz vessels.** *Acta Physicochim. U.R.S.S.* **18**, 197-209 (1943) (in English).—*C.A.* **38**, 5131^5.

The rate of conversion of water gas in a mixt. of CO_2 and H_2 flowing through quartz tubes of 15 and 40 mm diam. at 700° and 800°C in the absence of catalysts showed that the reaction was not purely heterogeneous. The reaction rate was not governed by the contact time. The percentage of H_2 transformed into water increased with increasing temp. according to an exponential law; even at 800°C, however, the equil. $CO_2 + H_2 \rightleftarrows H_2O + CO$ was was far from being attained. A relative increase of the surface of the reaction vessel had an inhibiting effect on the reaction.

10418. Koyano, Tadabumi. **The relation between the α-γ- transformation of iron-nickel alloy and the velocity of catalytic decomposition of ammonia gas when this alloy is used as catalyst. II. Effect of the nickel content of the alloy.** *J. Chem. Soc. Japan* **64**, 1396-8 (1943).—*C.A.* **41**, 3356*f*.

The catalytic activity of the alloy (Ni = 15%, Fe = 85%) for the decompn. of NH_3 was studied at various temps. There was a difference in the catalytic activity during the rise and fall of temp. A tentative explanation was given in the light of the lattice theory.

10419. Koyano, Tadabumi. **The relation between the α-γ- transformation of iron-nickel alloy and the velocity of catalytic decomposition of ammonia gas when this alloy is used as catalyst III. Effect of the surface treatment of the alloy.** *J. Chem. Soc. Japan* **64**, 1480-5 (1943).—*C.A.* **41**, 3356*g*.

The effect of various treatments of the Ni-Fe alloys (Ni = 10, 15%) upon the catalytic activity for the decompn. of NH_3 was studied. When the alloys were washed with 15% HNO_3 and reduced at 800°C by means of H_2, no effect of α-γ- transformation was observed in the catalytic activity. When the alloys were oxidized by O_2 and then reduced at 800°C with H_2, hysteresis of the catalytic activity was observed.

10420. McKinney, Aubrey R. **The decomposition of ethylene and carbon monoxide on metallic catalysts.** *J. Phys. Chem.* **47**, 152-63 (1943).—*C.A.* **37**, 3649^5.

The metals Fe, Co and Ni rapidly decomposed CO above 250°C; Os, Pt, Cu and Pd were comparatively inactive. The active group of metals all formed carbonyls. The order of decreasing activity for C_2H_4 decompn. by Ni, Co, Fe and Cu was compared to their resp. atomic radii, 1.24, 1.25, 1.27 and 1.28 A. Cu produced no CH_4 up to 460°C, the reaction products being H_2 and C_2H_6. With Fe large amts. of both H_2 and CH_4 were formed. From an equimol. C_2H_4-CO mixt. the decompn. of C_2H_4 reached 90% at 10° to 60°C lower than without CO.

10421. Mikai, Kiyoshi. **Velocity of reduction of cuprous chloride by hydrogen and deuterium.**

Bull. Inst. Phys. Chem. Research (Tokyo) **22**, 665-71 (1943).—*C.A.* **41**, 5778*a*.

The reduction velocity at 400-19°C was expressed by $dp/dt = kp_{H_2}(1+Bp_{HCl})$, where k was the velocity const., p_{H_2} the partial pressure of H_2, p_{HCl} the partial pressure of HCl, and B the ratio between the adsorption and desorption velocity consts. of HCl. The same equation applied to D_2. The ratio between the velocity consts. of H_2 and D_2 was about 2. From the temp. coeffs. of the consts., the apparent activating energies of H_2 and D_2 were calcd. to be 49.14 and 50.26 kcal, resp.

10422. Munro, L. A.; Dewar, D. J.; Gertsman, S., and Monteith, G. **The effect of gel water on catalytic activity. III. The decomposition of formic acid over alumina.** *Can. J. Research* **21B**, 21-33 (1943).—*C.A.* **37**, 4001[5].

The effect of gel-water content on the catalytic activity at 215° and 250°C, was studied. There were two peaks in the curves showing the relation between activity and gel water content. The ratio CO/CO_2 changed with gel water content, i.e., the course of the reaction could be altered by surface modification of the catalyst. The gel showing max. catalytic activity showed greatest sorption.

10423. Murata, Yoshio; Masayuki, Nakagawa; Tashiro, Eiichi, and Umemura, Tadashi. **The synthesis of gasoline from carbon monoxide and hydrogen. LXIV. Methods of preparing iron catalysts.** *J. Soc. Chem. Ind. Japan* **46**, 52-68 (1943).—*C.A.* **43**, 2400*h*.

The effect of the pptg. method and temp., the method of washing, the ppt., the concn. at the time of pptn., the quality and preliminary treatment of kieselguhr, the purity of reagents, the amt. of alkali used in pptn., the method of adding alkali as promotor, etc., on the activity of the catalyst was studied. The catalyst contg. Fe 100, Cu 25, kieselguhr 125, and K_2CO_3 2 parts by wt was used with a gas mixt. of $CO:H_2 = 1:1$ at 253°C.

10424. Natta, G. and Beati, E. **Kinetics of the catalytic hydrogenation of glucose to sorbitol, and of the catalytic isomerization of glucose.** *Chimica e industria* (Italy) **25**, 211-14 (1943).—*C.A.* **40**, 3046[6].

In the reaction of catalytic hydrogenation of glucose with Ni catalyzers, an anomalous behavior was observed between 120° and 135°C. The hydrogenation speed of glucose remained unchanged or even decreased. This fact was due to an isomerization of glucose, which took place with rapidity at 120°C in the presence of Ni catalyzers.

10425. Nikolaeva, A. F. and Frost, A.V. **Catalytic action of active aluminosilicates. III. Conversion of hexylene over activated clay.** *J. Gen. Chem.* (U.S.S.R.) **13**, 733-5 (1943) (English summary).—*C.A.* **39**, 662[9].

The passage of hexylene over activated clay at 260°C resulted in formation of hexane, 2-methylpentane and 3-methylpentane. Under the conditions studied, no change into benzene was observed.

10426. Osame, Gohei and Hirai, Taizo. **Manufacture of sulfuric acid by vanadium catalyst. III. Increase of the draft resistance in the large converter.** *J. Soc. Chem. Ind. Japan* **46**, 431-2 (1943).—*C.A.* **42**, 6495*i*.

The increase in draft resistance in the large converter was due to the swelling and accompanying destruction of catalyst, which was a result of absorption of water by the catalyst. When the converter operated at 20-30% of capacity, the temp. did not rise sufficiently to prevent absorption of water from gas.

10427. Plate, A. F. and Tarasova, G. A. **Mechanism of contact transformations of hydrocarbons on vanadium catalyst. I. Contact transformations of heptane.** *J. Gen. Chem.* (U.S.S.R.) **13**, 21-34 (in English, 34-5) (1943).—*C.A.* **38**, 16[1].

The reaction of dehydrogenation of heptane on V_2O_3-Al_2O_3 catalyst was investigated in the interval from 440° to 510°C, with the overall reaction being followed by detn. of H_2 evolved per 3 min. Variation of space velocity from 0.3 to 12.8 did not affect the rate of H_2 evolution. In a prolonged expt. (66 min.) it was shown that gas evolution was const., that the catalyst was not poisoned and that the evolved gas was essentially H_2, although with increased temp. there was an increased evolution of CH_4. Carbonization was important as deposited carbon coated the active points of the catalyst.

10428. Plate, A. F. and Tarasova, G. A. **Mechanism of contact transformations of hydrocarbons on vanadium catalyst. II. Kinetics of the reaction of cyclization of heptane.** *J. Gen. Chem.* (U.S.S.R.) **13**, 36-40 (1943) (in English, 41).—*C.A.* **38**, 16[4].

The overall reaction of dehydrogenation of heptane on V catalyst obeyed Arrhenius' equation, the apparent energy of activation being 41,100 cal/mol. The individual reactions also appeared to follow the same law, with the following energy values: aromatization: 50,700 cal/mol., olefin formation: 17,600 cal/mol., carbonization: 56,400 cal/mol., and CH_4 formation: 60,800 cal/mol.

10429. Plate, A. F. and Sterligov, O. D. **Mechanism of contact transformations of hydrocarbons on vanadium catalyst. III. Contact transformations of ethylcyclopentane.** *J. Gen. Chem.* (U.S.S.R.) **13**, 202-12 (1943) (English summary).—*C.A.* **38**, 1420[7].

Dehydrogenation of ethylcyclopentane on V catalyst was studied between 440° and 500°C. The reactions involved aromatization, dehydrogenation to olefins and decompn. to carbon and H_2. Apparent activation energy of the summary reaction was 31,500 cal/mol. for fresh catalyst and 34,900 for regenerated catalyst. At 500°C the 3 reactions formed a ratio 2:2:1.

10430. Rampino, Louis D,; Kavanagh, Kevin E., and Nord, F. F. **Relation between particle size and efficiency of Pdpolyvinvl alcohol (Pd-PVA) catalysts.** *Proc. Natl. Acad. Sci. U. S.* **29**, 246-56 (1943).—*C.A.* **37**, 6538[3].

Pd catalysts prepd. by the reduction of $PdCl_2$ soln. were more active toward the hydrogenation of nitrobenzene the smaller the particle size.

10431. Rao, B. Sanjiva. **Catalysis of the interaction between hydrogen sulfide and sulfur di-**

oxide by silver sulfide. *Current Sci.* **12**, 323 (1943).—*C.A.* **38**, 4858^7.

The reaction $2H_2S + SO_2 \rightarrow 2H_2O + 3S$ was highly autocatalytic in the presence of Ag. Ag_2S catalyzed this reaction in the presence of water; in the absence of water it was inactive. A glass surface had a much smaller catalytic effect than a Ag_2S surface.

10432. RAO, B. SANJIVA AND RAO, M. R. ASWATHNARAYANA. **Catalytic activity of silver sulfide.** *Current Sci.* **12**, 323-4 (1943).—*C.A.* **38**, 4858^8.

Ag_2S catalyzed the decompn. of SO (and of S_2O_2). It also catalyzed the reaction $SO + H_2S \rightarrow 2S + H_2O$, even when both gases were carefully dried over P_2O_5. SO_2, an impurity in SO, was inactive at the surface of Ag_2S when dried over P_2O_5.

10433. RIENÄCKER, G.; MÜLLER, E., AND BURMANN, R. **Catalytic investigations on alloys. XI. The properties of Cu-Pd and Cu-Pt alloys as catalysts for the hydrogenation of ethylene.** *Z. anorg. allgem. Chem.* **251**, 55-70 (1943).—*C.A.* 37, 6539^5.

Pd and Cu-Pd alloys with 47% or more of Pd as well as Pt and Cu-Pt alloys with 16% or more of Pt were about equally effective and hydrogenated at around 100°C. Cu and Cu-rich alloys had very little action and catalyzed only at high temps. Between these two groups of catalysts there exists a difference in activity of 10^6. The influence of the arrangement of the atoms on the activation energy previously observed for HCOOH decompn. was established for C_2H_4 hydrogenation on Cu-Pt alloys.

10434. ROITER, V. AND RUSOV, M. **Kinetics of the catalytic oxidation of acetylene on activated manganese dioxide.** *J. Phys. Chem.* (U.S.S.R.) **17**, 87-96 (1943).—*C.A.* **38**, 3540^4.

The catalytic oxidation of C_2H_2 by O_2 in air mixts. contg. 0.04 to 0.57% C_2H_2 passed over an active MnO_2 surface at the rate of 30-100 liter/hr per ml of catalyst proceeded as an internal kinetic reaction at temps. from 140 to 170°C, as an internal diffusion reaction from 170° to 220°C, and as an internal diffusion reaction above 220°C. The transition from one region to another was characterized by a change in the order of the reaction and in the magnitude of the energy of activation.

10435. SCHEEPERS, LÉON. **The catalytic dissociation of carbon monoxide.** *Rev. universelle mines* **19**, 121-31 (1943).—*C.A.* **38**, 5720^3.

The dissocn. of CO was investigated with natural magnetite and at the same time the reduction of the Fe_3O_4 contained therein in a semiautomatic app. under a current of gas. The crushed magnetite was sepd. into 3 fractions. The strongly magnetic material had at first a small and then increasing reaction; the formation of CO_2 tended to assume a const. value even though the reduction was not yet complete. With increasing temp. the dissocn. increased up to a max. at 550°C and then decreased again. The less magnetic material had a much stronger and almost immediate action. A first period of fast CO_2 formation gradually slowed down and became stationary. The catalyst mixt. with 15% Al had a superior effect to all others and to Fe_2O_3.

10436. SCHWAB, GEORG M. AND HOLZ, GÜNTER. **Electron concentration, lattice loosening and catalysis.** *Naturwissenschaften* **31**, 345-6 (1943).—*C.A.* **38**, 1679^5.

The catalytic effect was studied of Ag alloys on dehydration of HCOOH. The admixts. used were Cu, Zn, Ga, Pd, Cd, In, Sn, Sb, Pt, Au, Hg, Tl, Pb and Bi as α mixed crystals. The heat of activation of the reaction was detd. All elements to the right of the Ag group raised the activation heat; Pd, Pt and Au lowered it. The increases were very high (30 kcal as against 17.6 kcal for pure Ag) for Sb, Pb, Bi.

10437. SCHWAB, GEORG M. AND SCHWAB-AGALLIDIS, ELLY. **Alloys as catalysts.** *Naturwissenschaften* **31**, 322-3 (1943).—*C.A.* **38**, 1679^3.

An alloy of Al with 9.7 at. % Ag had the homogeneous δ phase above 490°C; below this temp., the hexagonal γ phase. This change of phases, however, did not affect the catalytic effect of the alloy on decompn. of EtOH above and below 490°C. The heat of activation of the reaction with the alloy was 25-26 kcal; that on the separately prepd. pure γ phase, 28 kcal. The same was true for MeOH decompn. With the decompn. of HCOOH over Cu-Ag catalysts, it appeared that the heat of activation changed from 18 kcal for pure Ag to 24 for Cu; it was 24 for 5 at. % Ag, and 20.2 for 7.5 at. % Cu.

10438. SCHWAB, GEORG M. AND SCHWAB-AGALLIDIS, ELLY. **Alloys as catalysts.** *Ber.* **76B**, 1228-50 (1943).—*C.A.* **39**, 4791^3.

In a series of metallic systems used as catalyst, no striking changes in the heat of activation were produced: (1) by the sepn., (2) by the alloy formation itself, or (3) by the tempering of the alloys. In the system Ag-Al, the gross heat of activation of cracking EtOH and MeOH did not show any systematic dependence on the previously existing alloy phases, or on the sepn. of the Ag-rich δ-solid soln. In the Cu-Ni system, neither the solid soln. approx. CuNi (23 kcal) nor the Ni (25 kcal.) differed appreciably from Cu.

10439. SEDLATSCHEK, KARL. **Catalytic effect of copper powders of different thermal treatment on the decomposition of formic acid vapor.** *Kolloid-Z.* **104**, 203-8 (1943).—*C.A.* **38**, 1420^5.

Powd. Cu was preheated at different temps. either in H_2 or in HCOOH vapor. The decompn. velocity of HCOOH at 180°C, the energy of activation and the relative no. of "active" centers were recorded as a function of the temps. of preheating. In the curves for the activation energy as a function of the temp. of preheating 2 maxima were recorded which were related to the surface structure of the powder and to the lattice deformation. Preheating in HCOOH displaced the location of these maxima and improved the catalytic effect of the Cu in the decompn. of the acid.

10440. SEMENOV, N. N. **Rupture of chains in chain reactions at the surface of solid bodies.** *Acta physicochim. U.R.S.S.* **18**, No. 2-3, 93-147 (1943) (in English).—*C.A.* **38**, 3189^2.

The general problem was solved for the special cases of a plane wall, a cylindrical, and a spherical vessel. The lower limit of inflammation and the effect of admixts. or solid particles such as metallic rods or globes or of dust particles in a glass or quartz sphere were detd.

10441. Shirai, Sanji; Kinumaki, Susumu, and Ogawa, Toru. **Iron catalyst for synthesis of gasoline.** *J. Soc. Chem. Ind. Japan* **46**, 329-31 (1943).—*C.A.* **42**, 6082*g*.

The catalyst for the hydrogenation of CO should not be heated to a temp. above that at which it was to be used in the synthesis. The alkali promoter should be evenly distributed; this was accomplished by using KNO_3 instead of K_2CO_3 to activate the catalyst.

10442. Takayasu, Masaaki. **Catalytic action of copper hydroxide. I. II.** *J. Chem. Soc. Japan* **64**, 675-83, 684-95 (1943).—*C.A.* **41**, 3353*f*, *g*.

The catalytic action of Cu oxide prepd. by various methods on butyraldehyde was studied. At 100°C under 78 atm. 17% of butyraldehyde gave 29 mol. % of Bu butyrate and 41 mol. % of butyric acid. At 150°C, 46% of butyraldehyde gave 19 mol. % Bu butyrate, 6 mol. % of butyric acid, 15 mol. % of paraldehyde, and 5 mol. % of ethylpropylacrolein. At 200°C, 66% of butyraldehyde gave 9 mol. % of Bu butyrate and 33 mol. % of ethylpropylacrolein.

10443. Takenaka, Yutaka. **Destructive hydrogenation of synthetic petroleum. I. Effect of catalyst.** *J. Soc. Chem. Ind. Japan* **46**, 658-62 (1943).—*C.A.* **43**, 2415*g*.

Kogasin oil (synthesized from CO and H_2 under pressure) was fractionated into 3 portions. Each portion was hydrogenated 5 mins. in a rocking autoclave at 480°C by using 20% of Ni_2O_3, MoO_3, MoS_3, or $Mo(PO_4)_2$ with or without kieselguhr as catalyst and H_2 under 35 atms. initial pressure to yield gasoline. The effect of using various catalysts on the compn. of the product was studied. With Ni_2O_2 on kieselguhr a gasoline fraction contg. mostly aromatic and napthene hydrocarbons was obtained.

10444. Tanida, Shigeo. **Mixed catalysts. I. The promoting action of molybdenum and tungsten on the nickel catalyst for hydrogenation.** *Bull. Chem. Soc. Japan* **18**, 30-6 (1943).—*C.A.* **41**, 4368*c*.

The influence of Mo and W upon Ni catalyst for hydrogenation of benzene into cyclohexane were studied. The mixed catalysts were prepd. by adding Ni carbonate to ammonical soln. of $MoO_2(OH)_2$ and of ammonium tungstate. Ten kinds of Ni-Mo and 8 kinds of Ni-W catalysts which had various ratios of compn. were obtained, and, after being reduced at 450°C by H_2, used for the hydrogenation. The promoting action of Mo reached its max. at the ratio of 15 Mo atoms to 100 Ni atoms, and in the case of W, the same max. was attained at the ratio of 5 W atoms to 100 Ni atoms.

10445. Tiggelen, Ad. van. **Determination of carbon monoxide with the aid of silver oxide.** *Ann. mines Belg.* **44**, 145-51, 391-7 (1943).—*C.A.* **39**, 2942^1.

Detailed directions were given for detg. CO by a procedure in which the combustion of the CO was catalyzed by pumice impregnated with Ag_2O. To prep. the catalyst, place granulated pumice in 8% $AgNO_3$ soln. and then in 8% KOH soln. After thorough washing, dry 5 hrs at 100°C and then 2 days at 270°C in a vacuum. The method was used for detg. traces of CO; CH_4 and H_2 did not disturb.

10446. Tomita, Akira. **Zinc catalyst. II. Influence of the starting salts and precipitants on the precipitated zinc catalysts.** *J. Chem. Soc. Japan* **64**, 431-7 (1943).—*C.A.* **41**, 3353*i*.

The starting salts, $ZnSO_4$, $Zn(NO_3)_2$, and $Zn(OAc)_2$, gave almost the same activity, but $ZnCl_2$ gave a lightly smaller activity. The effect of the precipitants were in the following order: $KHCO_3 > NaHCO_3 > K_2CO_3 > Na_2CO_3 > (NH_4)_2CO_3 >> KOH > NaOH >> NH_4OH$. A trace adsorbed alkali on the precipitant gave the catalyst a considerable activity.

10447. Tomita, Akira. **Action of zinc oxide catalyst in the decomposition reaction of methanol.** *Science* (Japan) **13**, 285-7 (1943).—*C.A.* **45**, 10023*f*.

Basic Zn carbonate, $Zn(OH)_2$, and $Zn(NO_3)_2$ were heated at various temps. The activity of ZnO catlyst in the decompn. of MeOH was compared. The tests of the catalyst by a thermal balance showed that ZnO prepd. from basic Zn carbonate or $Zn(OH)_2$ adsorbed H_2O mols. on the surface. The unimol. film of H_2O was considered to play an important role in the decompn. of MeOH.

10448. Ueno, Seiichi and Morita, Naohiko. **Influence of the conditions of precipitation on the activity of nickel catalysts. II. Precipitation with sodium carbonate.** *J. Soc. Chem. Ind. Japan* **46**, 45-7 (1943).—*C.A.* **43**, 5211*b*.

The $NiCO_3$ was pptd. on kieselguhr at 20°, 30°, and 50°C with equiv., slightly deficient, and slightly excessive amts. of Na_2CO_3 and with 5 different combinations of 2, 5, and 10% $NiSO_4$ soln. and 2, 5, and 10% Na_2CO_3 soln. The catalytic power was tested by hydrogenating soybean oil with 0.3% Ni 1 hr at 180°C with H_2 at 40 atms.

10449. Ueno, Seiichi and Tsuda, Sanae. **Velocity of hydrogenation of oleyl alcohol.** *J. Soc. Chem. Ind. Japan* **46**, 481-3 (1943).—*C.A.* **42**, 6629*g*.

Pure oleyl alc. prepd. from sperm oil was hydrogenated over a Pt-black catalyst in ethereal soln., and the vol. of H_2 absorbed was measured. The hydrogenation was a unimol. reaction, and its velocity was expressed: $dx/dt = K(a - x)$, where $K = (1/t) \ln [x/(a-x)]$ and t = time in min., a = vol. of H_2 required in the perfect hydrogenation, x = vol. of the hydrogen absorbed, and K = reaction velocity.

10450. Uyehara, O. A. and Watson, K. M. **Solid catalysts and reaction rates—oxidation of sulfur dioxide.** *Ind. Eng. Chem.* **35**, 541-5 (1943).—*C.A.* **37**, 4294^7.

Rate equations were tested with published data on the oxidation of SO_2 in a flow system over a platinized asbestos catalyst. The data were represented by an equation based on the assumption that the rate-controlling step was a surface reaction between SO_2 and at. O.

10451. Vol'fkovich, S. I. and Margolis, F. G. **Catalysts for the production of K_2SO_4 or Na_2SO_4 from KCl or NaCl by reaction with SO_2.** *Doklady*

Akad. Nauk S.S.S.R. **41**, 23-5 (1943).—*C.A.* **38**, 4500^1.

Catalysts tested for the reaction $4KCl + 2SO_2 + 2H_2O + O_2 \rightarrow 2K_2SO_4 + 4HCl$ included Al_2O_3, CuO, $Co(NO_3)_2$, $CoSO_4$, Fe_2O_3 and various Fe-contg. metallurgical by-products. The most effective catalysts were those contg. Fe, especially roasted pyrite ash, titanomagnetite slag and products obtained from the latter by acid or alkali treatment. At the optimum temp., 500-50°C, use of 1% of pyrite ash decreased the time required for 95-96% conversion of KCl to K_2SO_4 from 16-20 days to a matter of hrs. Catalysts contg. Fe were effective also in accelerating the reaction, $2KCl + SO_2 + O_2 \rightarrow K_2SO_4 + Cl_2$.

10452. WATANABE, SUSUMU; MORIKAWA, KIYOSHI, AND IKAWA, SHIGEYOSHI. **Synthesis of benzine by catalytic reduction of carbon monoxide at atmospheric pressure. V. Effect of adding lower hydrocarbons to the feed gas.** *J. Soc. Chem. Ind. Japan* **46**, 967-71 (1943).—*C.A.* **43**, 2406*e*.

The Fischer synthesis was carried out with 2 vols. CO and 1 vol. H_2 mixed with 8-13% hydrocarbon, and the result was compared with that for feed gas having no admixt. A catalyst of compn. $Co:Cu:ThO_2 = 9:1:2$ was used. When the feed gas contained satd. hydrocarbons, the rate of consumption of CO and the formation of CO_2 were lowered, and the formation of olefins was slightly increased. When the feed gas contained unsatd. hydrocarbons, the consumption of CO was lowered, but the production of oil was not decreased, about 50% of olefin added being hydrogenated and 30% taking part in polymerization.

10453. WATANABE, SUSUMU. **Synthesis of benzine by catalytic reduction of carbon monoxide at atmospheric pressure. VI. Consumption of carbon monoxide in passing through catalyst layer.** *J. Soc. Chem. Ind. Japan* **46**, 1128-30 (1943).—*C.A.* **43**, 2406*h*.

The synthesis of benzine was carried out by use of CO and H_2 in the ratio 1:2 and a catalyst of the compn. $Co:Cu:ThO_2 = 9:1:2$ at 197°C under pressure of 7-369 mm. The relation $x = ap^b$ held between the reaction pressure, p, and x, which represented the yield of oil, contraction of gas vol., or consumption of CO; a and b were consts. As the above formula was of the same form as that of Freundlich's adsorption isotherm, $y = a p^n$, it was observed that there was a direct relation between the consumption of CO and the adsorption of CO. The formula $x = ap^b$ held only when p was 30-200 mm.

10454. AKULOV, N. S. **The role of catalysis in the process of self-ignition.** *Compt. rend. acad. sci. U.R.S.S.* **43**, 301-5; *Doklady Akad. Nauk. S.S.S.R.* **43**, 317-21 (1944).—*C.A.* **39**, 3997^4.

The effect of a change in the ratio of the surface S of a neg. catalyst to the vol. V of the reaction space was studied. The scale of the boundary curve for the region of self-ignition along the axis of concns. increased proportional to $S^{1/2}/V^{1/2}$. The shifting of boundary curves along the temp. axis and the shape of theoretical boundary curves of the region of self-ignition agreed quantitatively with expt.

10455. ALEXANDER, JULIAN AND SHIMP, H. G. **Laboratory method for determining the activity of cracking catalysts.** *Natl. Petroleum News* **36**, R537-8 (1944).—*C.A.* **38**, 5067^3.

An accurate, reproducible test was developed. The app. and the operating procedure were described.

10456. APPLEBY, W. G.; DOBRATZ, C. J., AND KAPRANOS, S. W. **Vapor-phase dehydration of 1-heptanol over activated alumina.** *J. Am. Chem. Soc.* **66**, 1938-9 (1944).—*C.A.* **39**, 455^3.

1-Heptene was the principal product of dehydration of 1-heptanol over activated alumina at 380-400°C. No evidence of any chain-branching isomerization of 1-heptene over alumina was obtained.

10457. ATROSHCHENKO, V. I. **Losses of platinum-rhodium catalyst in the contact oxidation of ammonia.** *Trudy Khar'kov. Khim.-Tekhnol. Inst. im. S.M. Kirova* **4**, 138-40 (1944).—*C.A.* **42**, 6066*h*.

In a set of 15 (Pt 93%-Rh 7%) wire nets, (diam. 0.09 mm), the initial wt of one net (193-200 g) under 7 atm., concn. of NH_3 10.5-11.0%, temp. of the gas 175-85°C, temp. of contact 880-900°C, decreased after 5, 15, and 21.5 days by 5.56, 11.5, and 21.15 g, resp.; that of the 13th net, 2.43, 8.73, and 10.43 g. Instead of the present practice of replacing the nets one by one, it was recommended that the whole set be reversed after 2-3 regenerations.

10458. BAILEY, KENNETH C. **The retardation of chemical reactions, XI. "Retardation," "inhibition", and "negative catalysis". A case of negative catalysis.** *Proc. Roy. Irish Acad.*, Nov., **1944**, 3 pp.—*C.A.* **39**, 2448^7.

A distinction was suggested between the terms inhibition and retardation, involving restriction of the former to cases in which a reaction was brought to an apparent standstill. It was also suggested that a retardation be termed a neg. catalysis only if the usual criteria of catalysis be present. The reaction of EtOH with AcOH was retarded by minute amts. of alk. substances. This reaction now appears to be a true case of neg. catalysis.

10459. BALANDIN, A. A. AND PATRIKEEV, V. V. **Differential thermocouple in heterogeneous catalysis.** *J. Gen. Chem.* (U.S.S.R.) **14**, 57-69 (1944) (English summary).—*C.A.* **39**, 858^5.

Differential-thermocouple installations were used in the study of heterogeneous catalysts and catalytic processes in flow systems with automatic continuous recording. The procedure was applicable in a wide variety of studies of comparison of catalyst activities, detn. of relative activity vs. time, detn. of thermal data of the reactions. When alcs. were passed over Al_2O_3 in CO_2 a brief exothermic effect was found.

10460. CHAKRAVARTY, K. M. AND SARKER, J. M. **Catalytic formation of CH_4 from CO and H-a study of Ni and Ni-alumina catalysts prepared from the Hydroxide using KOH, NaOH and NH_4OH as precipitants.** *Current Sci.* **13**, 127 (1944).—*C.A.* **38**, 6178^9.

In a mixt. of CO, H_2 and H_2O, roughly 1:1:1, 2 reactions occurred in the presence of Ni catalysts:

(1) $2CO + 2H_2 \rightarrow CH_4 + CO_2$, (2) $CO + H_2O \rightarrow CO_2 + H_2$. The influence of KOH, NaOH and NH_4OH, used to ppt. Ni, was small. Alumina promoted reaction (1); its max. activity occurred at a concn. below 0.16%. The addn. of K_2CO_3 to the catalyst promoted reaction (2).

10461. Cheylan, Étienne. **Manganese carbonate oxidation catalysts.** *Mém. services chim. état (Paris)* **31**, 299-303 (1944).—*C. A.* **40**, 5986^4.

Com. hopcalite was made as follows: A mixt. of Cu and Mn salts was pptd. in the cold with or without additions of salts of Co, Ni, or Ce by means of an alk. carbonate, preferably $(NH_4)_2CO_3$. The ppt. was washed and converted, by rapid heating to 300°C in dry air, to a mixt. of CuO, MnO_2, and higher oxides of Ni, Co, and Ce.

10462. Cheylan, Étienne. **Thermal deactivation of manganese carbonate hopcalite.** *Mém. services chim. état (Paris)* **31**, 304-15 (1944).—*C.A.* **40**, 5986^6.

Deactivation resulted from a modification of structure; the chem. compn. remained unchanged. The CuO promoter did not enter into this change in structure. Heating for 15 mins. at 350°C lowered the activity of the "normal" product 11%.

10463. Dickinson, E. J. **Properties of chromic oxide gel and its catalytic activity for the aromatization of heptane.** *Trans. Faraday Soc.* **40**, 70-9 (1944).—*C.A.* **38**, 4499^5.

The reduction of Cr_2O_3 gel by H_2, the action of O_2 and H_2O on the reduced gel, and the action of heptane on both the oxidized and reduced forms were studied at low pressures. At 450°C dry H_2 reduced Cr_2O_3 to a limited extent, and some H_2 was irreversibly adsorbed. At 800°C the irreversible adsorption of gas was small or negligible, but the extent of reduction was greater than at 450°C. At 450°C O_2 oxidized the reduced gel completely and removed any combined H_2 as H_2O. H_2O oxidized only a small fraction of the reduced gel at 450°C, and a proportion was reversibly adsorbed.

10464. Dunbar, Ralph E. and Arnold, M. R. **Preparation and reclamation of copper-chromic oxide catalyst.** *Ind. Eng. Chem., Anal. Ed.* **16**, 441 (1944).—*C. A.* **38**, 5371^5.

Two inert carriers, Celite Carrier Type VII and Carborundum Brand, were found satisfactory for supporting Cu-Cr_2O_3 in the dehydrogenation of alcs. An alternate method of prepn., by heating the catalyst to 150°C for 10 hrs in place of the usual AcOH leaching, produced a catalyst of the same initial activity which was more readily lost with prolonged use. The reactivation was accomplished by controlled heating and a subsequent AcOH leaching.

10465. Eidus, Ya. T. **Catalysts for hydrogenation of carbon monoxide by joint application of the dynamic and static methods. I. Activity of the complex Fe-Cu-ThO_2-K_2CO_3 kieselguhr catalyst. II. Study of activity of catalysts composed of components of complex Fe-Cu-$ThO_2K_2CO_3$-kieselguhr catalyst.** *Bull. acad. sci. U.R.S.S. Classe sci. chim.* **1944**, 255-62, 349-58 (English summary).—*C. A.* **39**, 2391^6, 3142^3.

The reaction was studied in a current of gas and also, by rate of change of pressure, in a closed system. On Fe-type catalysts, in contrast to the Co-type catalysts, the intermediate step in the synthesis was the formation of carbides. Fe, Cu, and either ThO_2 or K_2CO_3 must be present. The complex catalyst at 245-65°C showed an activation energy of 28.7 cal/mol.

10466. Emmett, P. H. and Gray, Joseph B. **The hydrogenation of ethylene, propylene and 2-butene on iron catalysts.** *J. Am. Chem. Soc.* **66**, 1338-43 (1944).—*C.A.* **38**, 5133^9.

The kinetics, temp. coeffs. and effects of promoter on the hydrogenation of C_2H_4, C_3H_6 and 2-butene were detd. over six different Fe catalysts. There was no evidence that an activated adsorption of C_2H_4 played an important part in the hydrogenation. Below 0°C the adsorption of C_2H_4 and C_3H_6 were instantaneous and reversible. At -35°C and pressures from 100 to 400 mm of C_3H_6, the surface of the catalyst was covered by a quantity of adsorbed gas sufficient to form more than one layer of mols; the same was true for butene at -10°C. The rate of hydrogenation was nearly independent of the partial pressure of the olefins. For butene hydrogenation at -10°C, the rate of reaction was nearly const. although the thickness of the layer of adsorbed butene changed considerably. The inhibiting effect of the promoter of the promoted Fe synthetic-NH_3 catalysts on the rate of olefin hydrogenation was related to K_2O.

10467. Faith, W. L. and Rollins, E. J. **Catalytic vapor-phase oxidation of fatty oils.** *Ind. Eng. Chem.* **36**, 91-2 (1944).—*C.A.* **38**, 884^7.

Red oil (quality similar to U. S. P. grade oleic acid), sardine oil and soybean oil were converted to maleic acid, CO_2 and aldehydes in a one-step process of combined thermal decompn. and vapor-phase oxidation at 425°C. Dry preheated air and an oil spray in the vaporizer produced a mixt. of cracked oil vapor and air which was passed over a V_2O_5 catalyst, deposited on Alfrax pellets, in a converter.

10468. Giovannini, Erminio. **Influence of mixed catalysts on the ethanol-ammonia system.** *Chimica e industria* **26**, 5-7 (1944).—*C.A.* **41**, 7217*a*.

In the presence of mixed catalysts consisting of Al, Ni, and Ce oxides and of kaolin, Ni oxide acted primarily in the direction of dehydrogenating the alc. Appreciable amts. of AcH and heterocyclic compds. contg. the pyridine ring were obtained. The catalyst was prepd. by stirring kaolin in the soln. of the Ce, Al, and Ni salts to a pasty consistency and calcining the mass thus obtained. The abs. alc. satd. with gaseous NH_3 was placed in contact with the catalyst and subjected to various temps.

10469. Giovannini, Erminio. **The action of the ternary catalyst $Al_2O_3 + ZnO + CeO_2$ on the system ethyl alcohol-ammonia.** *Chimica e industria (Italy)* **26**, 132-4 (1944).—*C.A.* **40**, 3046^7.

The action of ZnO and Al_2O_3 increased the formation of AcH, higher aldehydes, hydrocarbons both satd. and unsatd., and their condensation products with NH_3. The max. of the dehydrogenating power of the catalyzers was observed with the ratio $ZnO/Al_2O_3 = 1:4$.

10470. HASEGAWA, SHIGEO. **Organic peroxides. I. Decomposition of methylhydroperoxide catalyzed by platinum sol.** *Rev. Phys. Chem. Japan* **18**, 33-46 (1944).—*C.A.* **41**, 4698*i*.

The decompn. velocity of methylhydroperoxide in aq. soln. in the presence of a Pt sol, detd. by the iodometric titration, showed an initial rapid decrease for 10-20 min. followed by a main linear decrement in which the apparent heat of activation was 14.5 kcal/mol. The higher the concn. of Pt sol, the greater was the retardation in the initial stage, but the concn. hardly affected the main stage.

10471. HERINGTON, E. F. G. AND RIDEAL, E. K. **Poisoning of metallic catalysts.** *Trans. Faraday Soc.* **40**, 505-16 (1944).—*C.A.* **39**, 2248^8.

Poisoning was examd. in active hydrogenating catalysts (e.g., Ni, Co, Pt, Pd in the face-centered cubic form). It was assumed that the rate was proportional to the surface concn. of the given reactant. If after poisoning with a substance that occupied one active center a fraction θ of the active spots was bare and an isolated group of n centers was required for reaction, then the no. of unpoisoned groups was proportional to θ^n. The plot of activity against poison concn. was linear throughout the entire poison range only when $n = 1$. It was stated that an explanation of catalytic behavior requiring "active spots" appeared in many cases to be unnecessary.

10472. HIRAI, TAIZO. **Manufacture of sulfuric acid by vanadium catalyst. IV. Swelling of vanadium catalyst.** *J. Soc. Chem. Ind. Japan* **47**, 507-11 (1944).—*C.A.* **42**, 6496*d*.

A catalyst that did not swell was prepd. by heating the molded compn. of V_2O_5, kieselguhr, clay, and KOH to 700°-800°C to produce a semi-melted porous mass. The swelling and disintegration of V catalyst was thought due to the formation of a hydrated double salt of K_2SO_4 and $V_2(SO_4)_5$; analysis of the red-brown matter produced on the surface of swollen catalyst indicated a compd. of formula $K_2SO_4V_2(SO_4)_5 \cdot 26H_2O$.

10473. HIRAI, TAIZO. **Manufacture of sulfuric acid by vanadium catalyst. V. Effect of carrier and contents of vanadium pentoxide and potassium oxide on the catalytic activity.** *J. Soc. Chem. Ind. Japan* **47**, 507-11 (1944).—*C.A.* **42**, 649*e*.

V catalyst was prepd. on an industrial scale, and the effect of carrier and the contents of V_2O_5 and K_2O on the rate of conversion of SO_2 into SO_3 was studied. A catalyst low in V_2O_5 had a high conversion rate, and the content of K_2O was varied through a wide range; no special advantage was found for the mol. ratio 1.66 of K_2O:V_2O_5.

10474. HÜTTIG, GUSTAV F. AND CADA, OLGA. **Thermal decomposition of alcohol vapors catalyzed by hydrated aluminum oxide given different preliminary treatments. The direction-setting effect.** *Kolloid-Z.* **109**, 1-4 (1944).—*C.A.* **41**, 2973*i*.

Cryst. $Al_2O_3 \cdot 2.5H_2O$ was partly dehydrated by heating (at 300°C) in the presence of various vapors and gases. The catalytic effects of these dehydration products on the decompn. of MeOH and EtOH vapors were then detd. The most effective catalyst for decompn. of the MeOH was the one dehydrated in the presence of MeOH. For decompn. of EtOH vapor the catalysts dehydrated in the presence of EtOH and BuOH were more effective than those heated in the presence of MeOH or PrOH vapors.

10475. ISHIKAWA, SEIICHI; KURODA, EI-ICHI, AND ISHINO, KIGEN. **Synthesis of lubricating oil from alcohols. II. Dehydration of cetyl alcohol and polymerization of resulting olefins.** *Bull. Inst. Phys. Chem. Research* (Tokyo), *Chem. Ed.* **23**, 373-81 (1944).—*C.A.* **42**, 7013*b*.

Cetyl alc. was dehydrated in the gaseous phase by passing the vapor through a tube contg. active clay heated to 300-450°C, and the resulting mixt. of olefins was polymerized by $AlCl_3$ to produce lubricating oil. Max. yield of 95.1% of olefin oil contg. 27.0% 1-hexadecene was obtained when the dehydration was carried out at 400°C.

10476. ISHWATARI, TAKEHIKO AND CHITANI, TOSHIZO. **Catalytic oxidation of carbon monoxide on the surface of silver. I. Experiments at the temperature from 353° to 464°C.** *J. Chem. Soc. Japan*, **65**, 13-16 (1944).—*C.A.* **41**, 3354*b*.

A mix. of $CO + O_2$ having various compn. was passed over a Ag catalyst, the total pressure of the mixt. being kept at 1 atm. With excess O_2, the reaction velocity increased with the partial pressure of CO; with excess CO, it increased with the partial pressure of O_2.

10477. JAGITSCH, ROBERT AND HEDVALL, J. ARVID. **Investigation of the reaction kinetics in the powder system magnesium oxide-salts.** *Arkiv Kemi, Mineral Geol.* **A19**, No. 14, 14 pp. (1944) (in German).—*C.A.* **41**, 5368*h*.

The rate of reaction of powd. MgO with powd. Ag_2SO_4 and Ag_3PO_4 was followed by the O_2 pressure produced by the instantaneous decompn. of the product Ag_2O. The observations were explained by the reaction being maintained by continuous migration of matter from the MgO to the Ag salt, since the total reaction surface continually decreased in agreement with theory when a definite Ag salt particle size was used.

10478. JOHN D. H. O. **The preparation of Adams' platinum oxide catalyst in quantity.** *J. Soc. Chem. Ind.* **63**, 256 (1944).—*C.A.* **39**, 393^4.

A new method of prepg. Adams' Pt oxide catalyst in 250 g quantities was described. Yields 92-98% were obtained rapidly by one operation.

10479. JOHNSTONE, H. F. AND WINSCHE, W. E. **Fused salt mixtures as reaction media.** *Ind. Eng. Chem.* **36**, 435-9 (1944).—*C.A.* **38**, 3187^7.

The thermal phase diagram for NaCl-$ZnCl_2$ was detd. ZnO suspended in this fused salt medium reacted very slowly with SO_2 and O_2 at 420-530°C, as did NaCl in NaCl-Na_2SO_4 at 700°C. Fe_2O_3 reacted with SO_2 and O_2 to form insol. $Fe_2(SO_4)_3$ in fused NaCl-$FeCl_3$ at 400°C. The rate was detd. by both diffusional and chem. resistances. Ilmenite suspended in the latter medium reacted above 550°C, with a preferential attack on the Fe constituent.

10480. KIPNIS, FRANK. **Separation of catalysts from hydrogenation reaction mixtures.** *Ind. Eng. Chem., Anal. Ed.* **16**, 637 (1944).—*C.A.* **39**, 3^5.

A filter aid, such as Dicalite 4200, was used with a Büchner funnel to give a clear filtrate.

10481. Korneichuk, G. P. and Khrizman, I. A. **Kinetics of the decomposition of ammonia on iron catalysts.** *J. Phys. Chem.* (U.S.S.R.) **18**, 389-94 (1944).—*C.A.* **39**, 3197^8.
Exptl. data were obtained at 350-500°C and initial pressures of 50-100 mm by a quasistationary method. With const. surface of the catalyst, the dynamic and the quasistationary methods gave the same result. The rate of the reaction was about 100 times as great on a promoted Fe catalyst, Fe—Al_2O_3—K_2O, free of nitride as on one contg. a nitride layer. The kinetic equation for the reaction was the same for pure Fe, promoted tech. Fe catalyst, and a nitrided promoted catalyst.

10482. Kwan, T. **Sulfur-coated nickel catalysts. II. Effect of amines and hydrogen pressure on catalytic hydrogenation.** *Bull. Inst. Phys. Chem. Research* (Tokyo), *Chem. Ed.* **23**, 163-72 (1944).—*C.A.* **43**, 7802*h*.
With Ni catalysts coated with a film of sulfide, the attempt was made to det. by kinetic studies whether the intermediate form of H was H^+ or $H_2{}^+$.

10483. Kwan, T.; Okada, K., and Matsushita, S. **Sulfur-coated nickel catalysts. III. Catalytic decomposition of isopropyl alcohol.** *Bull. Inst. Phys. Chem. Research* (Tokyo), *Chem. Ed.* **23**, 173-80 (1944).—*C.A.* **43**, 7802*h*.
In the catalytic decompn. of iso-PrOH, the presence of Ni treated with thiophene (and thus coated with NiS) accelerated the dehydration and retarded the hydrogenation of the $MeCH:CH_2$ which was formed. Up to the highest temp., the C—C bond was not broken.

10484. Lefrancois, Philip A. **Cuprous oxide as a catalyst: the effect of varying the proportions of promoter and stabilizer.** *Iowa State Coll. J. Sci.* **19**, 41-3 (1944).—*C.A.* **39**, 663^1.
To Cu_2O (Cu_2O 94%, H_2O 4% and Cu 2%) was added V_2O_4 or Cr_2O_3 as a stabilizer and alk. earth as a promoter. The catalysts contg. Cr_2O_3 were more active than those contg. V_2O_4, but their Cu_2O was reduced to Cu by acetophenone, whereas those contg. V_2O_4 were stable. The best promoter was CaO. When MgO was the promoter, the hydrogenation of furfural went beyond the production of furfuryl alc.

10485. Lel'chuk, S. L.; Balandin, A. A.; Vaskevich, D. N., and Groer, I. I. **Dehydrogenation of EtOH over mixed catalysts.** *J. Applied Chem.* (U.S.S.R.) **17**, 60-4 (1944).—*C.A.* **39**, 1130^9.
Using 3-component catalysts of Cu-Al_2O_3 promoted by Cd or Ti oxides, EtOH was dehydrogenated with the formation of considerable amts. of AcOH and EtOAc. The Cd-promoted catalyst had no advantage over the Cu-Al_2O_3 catalyst, while TiO_2 promoter favored the EtOAc formation. The formation of EtOAc on the TiO_2-promoted catalyst had a lower activation energy (5770 cal/mol.) than on the Cd oxide-promoted catalyst (14,500 cal/mol.).

10486. Loisy, R. **The rate of reaction on a point of a catalytic mass.** *J. chim. phys.* **41**, 82-5 (1944).—*C.A.* **40**, 1726^2.
An equation was derived for the rate of reaction of a liquid passing over the surface of a catalyst. $V_o = D_o\ (\gamma C_o/\gamma V_o)_E$, where V_o was the rate of the reaction, D_o the rate of flow of the liquid, C_o the concn. of the product studied, V_o the vol. of the catalytic mass.

10487. McCarthy, W. Walter and Turkevich, John. **Butene-1 and butene-2 equilibrium.** *J. Chem. Phys.* **12**, 405-8 (1944).—*C.A.* **39**, 239^2.
The equil. between $H_2C:CHEt$ and MeCH:CHMe was attained on activated alumina at 400° and 450°C. The total (*cis + trans*) MeCH:CHMe in mole % at those temps. was found to be 78.5 ± 1.5 and 75.5 ± 1.5, resp., in good agreement with the calcd. values of 79.2 and 77.1, resp.

10488. Morita, Noriyoshi. **Low-temperature catalytic oxidation of ammonia by oxide catalysts.** *J. Chem. Soc. Japan* **65**, 542-8 (1944).—*C.A.* **41**, 3356*e*.
The catalytic oxidation of NH_3 between 220°-440°C was studied in the presence of oxides of Ca, Cu, Cd, Ti, Al, Th, V, Cr, Mo, Mn, Fe, Ni, Co. The catalytic action of oxide was found in the order: Cr > Ni > Co > Mn > Fe > V > Cu > Cd.

10489. Ogawa, Toru; Kimumaki, Jo, and Fujisaki, Tokuo. **Iron catalyst for synthetic petroleum. II. Some characteristic properties of iron catalyst for synthetic petroleum.** *J. Soc. Chem. Ind. Japan* **47**, 242-3 (1944).—*C.A.* **42**, 7011*d*.
The activity of the ordinary Fe catalyst, which did not contain excess alkali, increased with time, passed through a max., and then decreased. The max. was affected strongly by the reaction temp. The higher the reaction temp. or activation temp., the earlier was the appearance of the max.

10490. Ogawa, Toru; Kimumaki, Jo, and Fujisaki, Tokuo. **Iron catalyst for synthetic petroleum. III. Influence of barium nitrate on iron catalyst.** *J. Soc. Chem. Ind. Japan.* **47**, 244-7 (1944).—*C.A.* **42**, 7011*e*.
$Ba(NO_3)_2$ was found to be an excellent accelerator for Fe catalyst, especially for low-alkali catalyst. The optimum amt. of K_2CO_3 for the catalyst was 2%. The order of immersion in K_2CO_3 and $Ba(NO_3)_2$ did not affect the activity.

10491. Ogura, Toyosaburo and Ichimaru, Tenji. **Reaction of methane and oxygen.** *J. Soc. Chem. Ind. Japan* **47**, 540-3 (1944).—*C.A.* **42**, 6082*c*.
When no catalyst was used, CH_4 and O_2 did not react below 600°C. As catalyst, Co was the most effective and Ni was the next. With Co as catalyst, the reaction took place even below 300°C when more than twice the vol. of O_2 was added to CH_4 producing CO_2 and H_2O. When an equiv. amt. of CH_4 and O_2 was taken, CO_2 and H_2O were produced and a part of the CH_4 remained below 800°C, while above 800°C, all CH_4 was changed to CO and H_2.

10492. Perperot, Henri; Cheylan, Étienne; Fleury-Larsonneau, Aandrée; Dodé, Maurice; Mering, Jacques, and Mathieu, Marcel. **Structure of catalytically active solid phases. III. Acid attack on montmorillonites (preliminary study).** *Mém. services chim. état (Paris)* **31**, 332-46 (1944).—*C.A.* **40**, 5986^3.

Boiling concd. acids removed from montmorillonite all metallic cations and probably also the ions O and OH that were between the 2 simple layers of silicates that formed the elementary plates of the structure. The structure of these plates was not altered by removal of cations so long as the no. of valences extd. did not exceed 8.

10493. Petrov, A. A. **The influence of catalysts on the order of addition of alcohols to propylene oxide.** *J. Gen. Chem.* (U.S.S.R.) **14**, 1038-43 (1944).—*C.A.* **40**, 7153^4.

Different isomeric monoethers of H_2C:CHMe were prepd. by reacting propylene oxide with large excesses of MeOH, EtOH, or PrOH in the presence of various catalysts. It was believed that Na alcoholates catalyzed the reaction by increasing the reactivity of the alc. without disturbing the relative stability of the two C—O bonds in propylene oxide, while in contrast, a change in relative stability of these bonds was effected by $ET_2O.BF_3$ and strong acids by virtue of formation of coordinate complexes with the epoxy O.

10494. Reyerson, L. H. and Oppenheimer, Hans. **The catalytic oxidation of ethylene to ethylene oxide.** *J. Phys. Chem.* **48**, 290-5 (1944).—*C. A.* **38**, 6178^1.

Catalysts of finely divided Ag supported on fused Al_2O_3 or produced by thermal decompn. of $Ag_2C_2O_4$ showed an optimum activity at 260-90°C, with yields of ethylene oxide of 30-45%. Addn. of steam lowered the activity slightly. Catalysts made by reduction of $Ag(NH_3)_2NO_3$-treated silica gel showed an optimum activity in the same temp. range with yields of 4-7% if the gas mixt. contained equal parts of steam and air.

10495. Riesz, C. H.; Pelican, T. L., and Komarewsky, V. I. **Catalytic dehydrogenation of natural-gas hydrocarbons.** *Oil Gas J.* **43**, No. 10, 67-9, 96-7 (1944).—*C.A.* **39**, 4749^8; **40**, 195^9.

Since neither a Cr_2O_3 gel catalyst nor a Cr_2O_3 catalyst supported on Al_2O_3 gave entirely satisfactory results, a catalyst was prepd. by co-pptn. of Cr and Al hydroxides. Expts. using this catalyst for the dehydrogenation of C_2H_6, C_3H_8, butane, and isobutane showed that equil. was almost attained at 450°-500°C for the latter 3 hydrocarbons. Above 500°C side reactions occurred and catalyst selectivity decreased.

10496. Roginskiĭ, S. Z. and Tsellinskaya, T. **Experimental investigation of the role of supersaturation in the preparation of catalysts.** *Acta Physicochim. U.R.S.S.* **19**, 225-47 (1944) (in English); *J. Phys. Chem. (U.S.S.R.)* **18**, 477-92 (1944).—*C.A.* **39**, 2447^8.

The decompn. of $NiCO_3$ was effected in an app. in which the CO_2 pressure was controlled by freezing out CO_2 in a cryostat maintained at various temps. The decompn. was autocatalytic. This decompn. was extremely rapid at CO_2 partial pressures of 10^{-4} to 10^{-2} mm of Hg; near the equil. pressure the decompn. was slow. The water content of the sample of $NiCO_3$ had a peculiar and as yet enexplained effect on the kinetics of the decompn.

10497. Schwab, Georg-Maria and Holz, Günther. **Electron concentration, lattice loosening, and catalysis.** *Z. anorg. Chem.* **252**, 205-24 (1944). *C.A.* **40**, 4282^6.

The velocity and the heat of activation of the dehydration of HCOOH by Ag alloys and a few Au alloys were detd. Vaporized HCOOH was passed over the catalyst in an elec. oven and the decompn. products were measured directly by flow meters. The alloying metals were Pt, Hg, Tl, Pb, Bi, Pd, Cd, In, Zn, Sb, Sn, and Ga. Pd, Pt, and Au decreased the heat of activation to a value that was between their own and that of Ag alone; all other elements increased it. Sb, Pb, and Bi gave very high increases. The activity increased linearly with the heat of activation.

10498. Schwab, George-Maria and Karatzas, Alexander. **Catalytic action of intermetallic phases and their mixtures.** *Z. Elektrochem.* **50**, 242-9 (1944).—*C.A.* **40**, 4942^6.

The activity and true heat of activation for the dehydration of formic acid were detd. by a dynamic technique on the various phases as revealed by x-ray examn. in the alloy systems Ag-Sb and Cu-Sn. Within the region of homogeneity of the α and β-phases, true heat of activation increased with the electron concn. and was of about of equal magnitude in the satd. phases and in the n-phase CuSn. The γ phase showed a striking max. in true heat of activation. These results were correlated with the wave-mech. theory of Hume-Rothery phases.

10499. Schwab, Georg-Maria and Schwab-Agallidis, Elly. **Is there coupled gas-solid catalysis?** *Kolloid-Z.* **109**, 99-106 (1944).—*C.A.* **41**, 2974*b*.

The catalytic splitting of HCOOH on solid Na_2SO_4 and $KClO_4$ had no effect on the very rapid transformation of the cryst. form of these salts. The temp. of the reaction BaO + $CuSO_4$ was reduced from 345° to about 280°C and that of the reaction BaO + $ZnSO_4$ from 340° to 305°C by the simultaneous catalyzed decompn. of EtOH. The results indicated that the reaction centers of the materials in the solid phase were too rigid to be changed by gas catalysis.

10500. Suito, Eiji. **Studies of colloidal catalysts by thermal analysis of the reaction velocity. V. Surface condition of the platinum catalyst judged from the carbon monoxide poisoning in the hydrogen peroxide decomposition reacton.** *Rev. Phys. Chem. Japan* **18**, 96-108 (1944).—*C.A.* **41**, 4698*f*.

The H_2O_2 decompn. reaction in the presence of Pt sol was retarded in the beginning owing to the transitory poisoning of Pt sol by CO before it acquired the ordinary reaction velocity when CO was removed by its oxidation by H_2O_2 or O_2 adsorbed from the air. The H-Pt sol was black and remained black after satn. with CO, the removal of which restored the original catalytic activity. The O-Pt sol was brown (owing to PtO_n on the surface) and turned red after satn. with CO.

10501. Tanida, Shigeo. **Studies on mixed catalysts. IV. High-pressure hydrogenation of benzene by means of nickel-molybdenum and nickel-tungsten catalysts. V. Promoting action of molybdenum and tungsten in the alloy systems for hydrogenation.** *Bull. Chem. Soc. Japan* **19**, 122-7, 129-39 (1944).—*C.A.* **42**, 329*i*, 330*h*.

If Mo or W was added to a Ni catalyst, the catalyst became heat-proof and acquired great activity. Prepn. of the catalyst by reduction should be carried out at a temp. as low as possible. If a gas mix. of H_2 and either benzene or ethylene was used, the reduction proceeded more smoothly at a lower temp. Nitro-benzene or acetone was hydrogenated in the presence of mixed catalysts composed of 2 or 3 elements: Ni-Al, Ni-Mo-Al, Ni-W-Al, Ni-Fe-Al, Ni-Si, Ni-Mo-Si.

10502. THACKER, CARLISLE M. AND MILLER, ELMER. **Carbon bisulfide production. Effect of catalysts on reaction of methane with sulfur.** *Ind. Eng. Chem.* **36**, 182-4 (1944).—*C.A.* **38**, 1080^6.

High yields of CS_2 were obtained by reaction of CH_4 with S at 700°C and below in the presence of catalysts. Particularly suitable catalysts were silica gel, activated Al_2O_3, promoted activated Al_2O_3, and Florite. Activated Al_2O_3 contg. a small amt. of Cr oxide gave yields of over 90% at below 700°C.

10503. TOMITA, AKIRA. **Zinc catalyst. III. Effect of the temperature of heat-treatment on catalytic activity.** *J. Chem. Soc. Japan* **65**, 478-86 (1944).—*C. A.* **41**, 3354*a*.

Oxides of Zn were prepd by adding K_2CO_3 or KOH to aq. soln. of $Zn(NO_3)_2$ and then heating the resulting ppt. at various temps. for dehydration. The oxide obtained by heating at 200°C gave the best result.

10504. TURKEVICH, JOHN. **Magnetic studies of chromium oxide catalysts.** *J. Chem. Phys.* **12**, 345-6 (1944).—*C.A.* **38**, 5452^2.

Cr oxide gel, obtained by the slow interaction in dil. soln. of $Cr(NO_3)_3$ with NH_3, was an efficient catalyst in hydrogenation-dehydrogenation reactions of hydrocarbons. This gel catalyst was unstable with respect to inactive cryst. Cr_2O_3, and reverted to the latter, undergoing the "glow phenomenon". Activated H_2 adsorption did not markedly affect the magnetic susceptibility of the active gel catalyst. The dried gel had an O-content intermediate between Cr_2O_3 and CrO_3.

10505. VAN ANTWERPEN, F. J. **Thermofor catalytic cracking.** *Ind. Eng. Chem.* **36**, 694-8 (1944).—*C. A.* **38**, 5067^1.

The thermofor process employed a moving catalyst. The catalyst flowed by gravity through the reaction zone after having been carried to the top of the reactor and regeneration kiln by elevators. The reaction temperatures were between 850-950°F and the reaction pressure was about 10-15 p.s.i. Clay of mesh size 6 was employed as catalyst and its regeneration was accomplished by burning off the carbon. A two-pass operation yielded butylenes equivalent to 8 percent of the gas oil.

10506. YAMAGUCHI, SHIGETO AND KWAN, TAKAO. **Electron-diffraction study of the surface structure of a catalyst. I.** *J. Chem. Soc. Japan* **65**, 378-80 (1944).—*C. A.* **41**, 3352*i*.

The surface of the Ni catalyst used in the hydrogenation of acetone was studied. The catalyst was prepd. as follows: pure Ni plate was polished, oxidized by air at 400°C overnight, reduced by means of H_2 at 300-400°C for 2 days, exposed to H_2S at 3 cm Hg pressure at 300°C for 5 hrs. The formation of NiS on the surface was confirmed. The effect of the ionic layers of S on the surface on the catalytic action was discussed.

10507. ALDRICH, R. C. **Manufacture and regeneration of Fischer-Tropsch catalyst.** *Natl. Petroleum News* **37**, No. 45, R922-4 (1945).—*C. A.* **40**, 195^7.

A study of the normal Co-Mg-Th-kieselguhr type catalyst used in a com. plant at Harnes, France, was given.

10508. ALEKSEEVSKIĬ, E. V. AND FRID, K. V. **The sorption and catalyst properties of active manganese dioxide toward vaporous and gaseous substances. IV. Catalytic properties of α-, β-, and γ-modifications of manganese dioxide.** *J. Gen. Chem.* (U.S.S.R.) **15**, 3-8 (1945) (English summary).—*C.A.* **40**, 1382^3.

Three modifications of MnO_2 were prepd. and their x-ray patterns detd. The size of crystals was smallest in α-, medium in γ-, and largest in β-modification. The catalytic oxidation of $PhNH_2$ into PhN:NPh proceeded effectively in the presence of the α-modification (the yield 45%), less in the presence of γ-(the yield 3%), and not at all in the presence of β-(the yield traces). The catalytic oxidation of CO was effected only in the presence of α-modification.

10509. ARCHIBALD, R. C. AND GREENSFELDER, B. S. **Promoted chromia-alumina catalyst for converting heptane to toluene.** *Ind. Eng. Chem.* **37**, 356-61 (1945).—*C.A.* **39**, 2629^2.

An active catalyst for the cyclization of paraffins was prepd. by adding chromic acid to γ-Al_2O_3 in just enough water for the CrO_3 to be absorbed completely. It was then calcined. Of promoters tried, K proved to be one of the best. Non-aromatizable hydrocarbons present in the charge had a poisoning action.

10510. BALANDIN, A. A. **Kinetics of hydrogenation and of related reactions. I. Mechanism of hydrogenation, dehydrogenation, and deuterium exchange. II. Kinetics of hydrogenation with nickel, platinum, and copper. III. Selective hydrogenation.** *Bull. acad. sci. U.R.S.S., Classe sci. chim.* **1945**, 339-58 (English summary); *Acta Physicochim. U.R.S.S.* **22**, 81-100, 101-20, 338-56 (1947).—*C.A.* **40**, 4593^7; **41**, 6801*a*.

Two kinds of active centers were assumed: K, capable of activating the adsorbed H_2, and K', activating only the hydrogenatable org. substance. Both K and K' adsorbed both H_2 and the initial, intermediate, or final products; the establishment of the adsorption equil. was faster than the subsequent reaction. Quant. treatment of these assumptions led to reaction rate equations for the cases of hydrogenation, dehydrogenation, and deuterium exchange, in terms of concns. of the initial, final, and extraneous products and of H_2 pressure, and of the rate consts. of the elementry steps of adsorption, activation, and chem. reaction.

10511. BALANDIN, A. A. **Catalytic hydrogenation. I. Kinetic equation of hydrogenation and dehydrogenation over nickel catalyst. II. Catalytic hydrogenation over nickel and platinum.**

Hydrogenation by deuterium. *J. Gen. Chem.* (U.(U.S.S.R.) **15**, 608-18, 619-27 (1945).—*C.A.* **40**, 5627^2.

Hydrogenation was assumed to require different areas of a Ni catalyst for activation of the hydrogenating substance and for activation of H_2. The adsorption on the active points of either type occurred according to the Langmuir isotherm. The kinetic equations deduced from these considerations explained the quant. relations observed in hydrogenation of toluene over a Ni catalyst on an Al_2O_3 carrier. The theory was used to explain the variation of the temp. effect with pressure, and the change of reaction order in catalyst poisoning by CO.

10512. BALANDIN, A. A. **Catalytic hydrogenation. 111. Further development of the theory. Hydrogenation over copper and palladium.** *J. Gen. Chem.* (U.S.S.R.) **15**, 770-80 (1945).—*C.A.* **40**, 6326^3.

The chem. reaction was assumed to take place between adsorbed material to be hydrogenated and adsorbed H_2 with the formation of an adsorbed semihydrogenated product. The latter reacted with adsorbed H_2 in a second step to form adsorbed hydrogenated product. Data for the hydrogenation of C_2H_4 over Cu, and of C_6H_6 and PhMe over Pd, could be expressed approx. by equations developed for the equalibria of the assumed reactions.

10513. BALANDIN, A. A. **Catalytic hydrogenation. IV. Modification of the hydrogen surface. Selective hydrogenation of mixtures.** *J. Gen. Chem.* (U.S.S.R.) **15**, 781-90 (1945) (English summary).—*C.A.* **40**, 6326^6.

The theoretical rate of hydrogenation was found to be zero order at the beginning of the reaction and first order near the end, which was in agreement with known facts. An equation was derived for selective hydrogenation that expressed correctly the complex aspect of the kinetic curves that had been reported.

10514. BALANDIN, A. A.; BOGDANOVA, O. K., AND SHCHEGLOVA, A. P. **Catalytic dehydrogenation of commercial butane-butylene fraction of cracking gas.** *J. Applied Chem.* (U.S.S.R.) **18**, 609-11 (1945).—*C.A.* **40**, 6791^4.

Catalytic dehydrogenation of com. mixt. of butane-butylene showed the possibility of production of butadiene from petroleum cracking gases. Three catalysts were approx. equally effective in producing 35-49% butadiene at 570-625°C with contact time of 1-2 sec.

10515. BALANDIN, A. A. AND EĬDUS, YA. T. **Principle of conservation of the valence angle in the multiplet theory of catalysis.** *Compt. rend. acad. sci. U.R.S.S.* **49**, 655-7 (1945) (in English).—*C.A.* **40**, 5627^5.

The stereofactors in the formation of activated complexes on hydrogenation and dehydrogenation catalysts were considered. The optimum internuclear distance in the crystal lattice of the active metal could be calcd. from the valence bonds and angles of the complex, and on this basis, W, Mo, V, Cr, and Fe were suggested as catalysts for the hydrogenation of ethylene. The difference in hydrogenation activities of different planes of Ni crystals was offered as addnl. evidence for the theory.

10516. BENTLEY, F. J. L. AND FEACHÉM, C. G. P. **Alumina catalysts for organix reactions.** *J. Soc. Chem. Ind.* **64**, 148-9 (1945).—*C.A.* **39**, 4279^7.

The active form of Al_2O_3 catalysts γ-alumina, was hydrated to boehmite. Repeated hydration and and dehydration enchanced or restored the activity of alumina catalysts as evaluated by the dehydration of ethanol to ethylene. The hydrations were accomplished in water at 60°C for 3-day periods, each of which was followed by dehydration at 450°C in air.

10517. BOOTH, N.; WILKINS, E. T.; JOLLEY, L. J., AND TEBBOTH, J. A. **Catalytic synthesis of methane. Experimental work at the Fuel Research Station.** *Gas Research Board, Communi.* **GRB21**, 39 pp. (1945).—*C.A.* **43**, 2402*a*.

Synthesis from H_2-enriched blue water-gas on a reduced catalyst containing Ni 100, ThO_2 22, kieselguhr 100 pts. became vigorous at approx. 220°C. The temp. of the catalyst rose and the reaction reached equil. at a space velocity 3700 vols. per vol. per hr. The catalyst was very sensitive to S compds. Carbon deposition decreased rapidly as the H_2/CO ratio (R) rose, but still occurred at the inlet end of the bed when $R = 1.5$. Deposition of carbon was retarded by replacing part of the ThO_2 by MgO, by washing and calcining the kieselguhr carrier at 700°-800°C, and by pptg. the catalyst in the presence of small amts. of phosphate.

10518. BURFORD, W. B., III AND FRAZER, J. C. W. **The poisoning of nickel hydrogenation catalysts by water vapor.** *J. Am. Chem. Soc.* **67**, 331-2 (1945).—*C.A.* **39**, 1350^3.

Water vapor poisoned Ni hydrogenation catalysts, the effect being noticeable as low as 3×10^{-4} mm pressure of water vapor. The poisoning was reversible, the catalyst being reactivated by heating in H_2.

10519. CHAO, TSUNG-YAO; HSU, WEI-WEN, AND WEN, CHANG. **A study of iron catalysts for the synthesis of liquid fuels from carbon monoxide and hydrogen.** *J. Chinese Chem. Soc.* **12**, 1-14 (1945).—*C.A.* 40, 3865^7.

Fe plus varying amts. of Cu as promoter were dissolved in HNO_3, mixed with starch, kieselguhr, and K_2CO_3 and ignited. Water gas was passed through the reactor at a rate of 2 liters per hr and the yield measured in terms of ml/m^3 of gas. Each run was continued for 20 days or more and the products were examd. daily. Optimum results at 240°C were obtained when about 0.5% of K_2CO_3 was present and the Fe:Cu ratio 5:1.

10520. EĬDUS, YA. T. **Investigation of the catalysts for hydrogenation of carbon monoxide by joint application of the dynamic and the static methods. III. Role of the alkaline activator in the formation of the surface of the Fe-Cu-ThO_2-K_2CO_3-kieselguhr catalyst.** *Bull. acad. sci. U.R.S.S., Classe sci. chim.* **1945**, No. 1, 62-70 (English summary).—*C.A.* **39**, 4792^2.

The activity of 5 catalysts, comprising the components of the complex catalyst, and their combinations was investigated. The alk. activator K_2CO_3 occupied a substantial portion of the contact surface, caused the interaction of CO_2 with the catalytic surface at 258°C, and played an important part in the catalytic processes of carbide formation and hydrogenation of CO.

10521. EUCKEN, A. AND WICKE, E. **The interpretation of heterogeneous dehydrating catalyses by exchange of hydrogen atoms.** *Naturwissenschaften* 32, 161-2 (1945).—*C.A.* 40, 2062⁵.

The heat of adsorption of PrOH and of H_2O on the catalytically active centers of bauxite was about the same (30 to 25 kcal per mole). Intensive degassing of the bauxite, 900°C in high vacuum, caused the activity to decrease, and to recover only after an induction period. The catalyst lost considerable H_2O during degassing. Treatment of the degassed bauxite with H_2O vapor eliminated the induction period.

10522. FAIRBROTHER, F.; SKINNER, H. A.; SYKES, P. H.; EVANS, A. G.; POLANYI, M.; MELVILLE, H. W., AND EVANS, M. G. **Friedel-Crafts Catalysts and polymerization.** *Nature* 156, 638-9 (1945).

The most active catalysts showed greater percentage bond-contraction than did the weaker catalysts. The effectiveness of the catalyst may be due to the decrease in free energy from catalyst—reactant complex to catalyst-product complex being more marked than the decrease in free energy of the reaction in the absence of catalyst. The polymerization of *iso*-butene catalysed by BF_3 suggested an energy chain-mechanism. Experiments on the photopolymerization of vinyl acetate were discussed. The steric factor for propagation in polymerization given by the transition state theory was of the same order as that found experimentally. In the case of termination reactions, however, the theory was unable to interpret the experimental results.

10523. FREĬDLIN, L. KH.; BALANDIN, A. A.; LEBEDEVA, A. I., AND FRIDMAN, G. A. **Catalytic replacement of halogen by hydroxyl in the aromatic series. I. Catalytic activity of silica gels and their deactivation.** *Bull. acad. sci. U.R.S.S., Classe sci. chim.* 1945, 53-60 (in English, 60-1).—*C.A.* 40, 4576⁶.

The activity of silica gels in the vapor-phase hydrolysis of PhCl was studied. The temp. and the space velocity were the most important factors affecting the direction and the rate of the reaction. Silica gels were deactivated above 550-600°C (Okatov's gel), and some were deactivated even at 450°C (German gel). The impregnation of silica gel with H_3PO_4 deactivated it for the vapor-phase hydrolysis of PhCl, but made it 24 times as active in the reaction of dehydration of alc.

10524. FREĬDLIN, L. KH.; BALANDIN, A. A.; FRIDMAN, G. A., AND LEBEDEVA, A. I. **Catalytic replacement of halogen by hydroxyl in the aromatic series. II. Activators of silica gel.** *Bull. acad. sci. U.R.S.S., Classe sci. chim.* 1945, 375-83 (English summary).—*C.A.* 40, 4576⁹.

With highly active purified silica gel catalysts (in quartz or Pyrex reaction tubes 15-20 mm long, catalyst 50 ml, temp. const. within ± 1°) most inorg. salts were actually found to lower its catalytic activity with regard to the yield of phenol. The catalyst was regenerated by heating in a stream of air at 500°C for 5 hrs. With $CrCl_3$ (5%) in the catalyst, the activity was lowered in the whole temp. range 450°-550°C; at 550°C, the phenol yield was 8-10%, as compared with the 20-22% without salt.

10525. GHOSH, J. C. AND ROY, A. N. **Catalytic formation of diolefins from monoölefins.** *Current Sci.* 14, 156-7 (1945).—*C.A.* 39, 4791⁵.

The chem. equil. in the catalytic dehydrogenation of $EtCH:CH_2$ and of $Me_2CHCH:CH_2$ at low pressures was studied. The temp. of neutral equil. for $EtCH:CH_2$ was found to be 744°C, for $Me_2CHCH:CH_2$, 671.5°C. The various thermodynamic functions involved in the dehydrogenation equil. were calcd. and tabulated.

10526. GHOSH, J. C. AND SASTRY, S. L. **Chromium oxide as a promoter in catalysts for the Fischer-Tropsch synthesis.** *Nature* 156, 506-7 (1945).—*C.A.* 40, 1083⁵.

The use of a Cr_2O_3 catalyst (composed of Co 34%, Cu 4%, ThO_2 2.3%, Ce_2O_3 0.24%, Cr_2O_3 4.6%, on kieselguhr) gave yields of liquid hydrocarbons about double those obtained with Fe-Cu catalysts.

10527. GLUKHOVSKAYA, L. AND BRUNS, B. **Catalytic oxidation of hydrogen in the presence of manganese dioxide.** *J. Phys. Chem.* (U.S.S.R.) 19, 262-5 (1945).—*C.A.* 40, 514⁴.

A mixt. of H_2 and O_2 was recirculated over MnO_2 previously heated for several hrs at 200-300°C. The yield of H_2O was immeasurably small below 100°C. At 125° and 150°C the activity of the catalyst decreased during an expt. to about 0.6 of the original activity; at 175°C its activity was const. The rate of reaction was independent of O_2 (37 to 300 mm of dibutyl phthalate) and roughly proportional to H_2 (75 to 300 mm of dibutyl phthalate). The energy of activation was 14,300 cal per mol.

10528. GREENSFELDER, B. S. AND VOGE, H. H. **Catalytic cracking of pure hydrocarbons. Cracking of paraffins.** *Ind. Eng. Chem.* 37, 514-20 (1945).—*C.A.* 39, 4445⁵.

A series of individual paraffin hydrocarbons from C_3H_8 to wax were subjected to cracking with "UOP cracking catalyst type B," of which the principal components were SiO_2, ZrO_2, and Al_2O_3. C_3H_8 underwent little change. C_4H_{10} was not isomerized. Cracking was not extensive until decane and isodecane were reached. The catalyst had little effect on the 1st and 2nd C—C bonds of normal paraffin chains, but caused the inner bonds to break more easily. Isomerization occurred chiefly in olefinic compds. No direct isomerization of paraffins was noted.

10529. GREENSFELDER, B. S. AND VOGE, H. H. **Catalytic cracking of hydrocarbons; cracking of olefins.** *Ind. Eng. Chem.* 37, 983-8 (1945).—*C.A.* 39, 5443².

Cracking of olefins over a SiO_2-ZrO_2-Al_2O_3 catalyst was studied under conditions similar to those used in the cracking of paraffins. Aliphatic 2-16-C olefins and several diolefins and cyclic olefins were examd. Generally 400°C was used for aliphatic olefins and 500°C for the others. The olefins were more reactive than were the paraffins. The cyclic olefins showed even higher reactivity and gave exceptionally large quantities of higher-boiling products.

10530. GREENSFELDER, B. S. AND VOGE, H. H. **Catalytic cracking of pure hydrocarbons. Cracking of naphthenes.** *Ind. Eng. Chem.* 37, 1038-43 (1945).—*C.A.* 40, 699^7.

Naphthenes such as cyclohexane, methylcyclopentane, methylcyclohexane, hexahydroindan, isopropylcyclohexane, decalin, cyclopentylcyclohexane, amylcyclohexanes, bicyclohexyl, and amyldecalins were investigated. Under conditions similar to the cracking of olefins and paraffins over a SiO_2 (86.2%)—ZrO_2 (9.4%)—Al_2O_3 (4.3%) catalyst, it was found that the total decompn. increased with mol. wt from 7% for C_6 to 79% for C_{18}. A comparison with thermal cracking was made and showed that catalytic cracking was 500 to 4000 times faster, gave more satd. gases and liquids, a higher ratio of liquid to gas, and showed a smaller amt. of condensation products.

10531. GREENSFELDER, B. S.; VOGE, H. H., AND GOOD, G. M. **Catalytic cracking of pure hydrocarbons. Aromatics and comparison of hydrocarbon classes.** *Ind. Eng. Chem.* 37, 1168-76 (1945).—*C.A.* 40, 1010^6.

The catalytic cracking of 22 aromatic hydrocarbons over a SiO_2-ZrO_2-Al_2O_3 catalyst was studied. The preferred flow rate was 13.7 moles of hydrocarbon per liter of catalyst per hr. At 500° and 550°C the percentages of toluene cracked were 1.7% and 1.2%, resp. Propylbenzene and isopropylbenzene were decompd. (43% and 80%, resp.) almost exclusively into propylene and benzene. Mild cracking (400) of butylbenzene, *sec*-butylbenzene, and *tert*-butylbenzene resulted in 13.9%, 49.2%, and 80.4% decompn.

10532. GREKHNEV, M. A. AND EROSHEVSKIĬ, I. G. **Relation between the rate of catalytic reactions and the quantity of catalyst used.** *J. Gen. Chem.* (U.S.S.R.) 15, 146-50 (1945) (English summary).—*C.A.* 40, 1382^5.

The dehydrogenation of isoborneol over Cu-Ni catalyst at 185-96°C increased with increase in the quantity of catalyst used to a limiting value, beyond which almost no increase was achieved.

10533. GRINEVICH, V. M. **Selection of new raw materials for ammonia catalyst.** *J. Applied Chem. (U.S.S.R.)* 18, 313-21 (1945) (English summary).—*C.A.* 40, 3576^2.

Ores, after magnetic sepn. from SiO_2, were possible NH_3 catalysts since the presence of SiO_2 up to 2% did not show a neg. effect on the catalyst activity, provided that enough K_2O was present. The ore was subjected to double magnetic sepn., alk. fusion, and followed by a double sepn. to yield 23% of finished product. The catalyst could be regenerated by oxidation of KNO_3.

10534. GRYAZNOV, V. M.; KOROBOV, V. V., AND FROST, A. V. **Active centers of aluminosilicate catalysts.** *Compt. rend. acad. sci. U.R.S.S.* 48, 339-42 (1945).—*C.A.* 40, 4942^4.

A no. of catalysts for enriching benzene and cracking gas oil were studied. The catalysts were prepd. by impregnating pure silica gels with acidified aq. $Al_2(SO_4)_3$ solns. of various concns. The disproportioning of H_2 proceeded as a reaction of the first order, which provided a method of estg. the activity of a catalyst. The active centers were groups of two Al atoms each.

10535. HASEGAWA, SHIGEO. **Physicochemical studies of copper catalyst. V. The decomposition of methanol by reduced copper.** *Rev. Phys. Chem. Japan* 19, 132-9 (1945) (English summary, 151-2).—*C.A.* 44, 2356*g*.

CuO obtained by adding KOH soln. to $Cu(NO_3)_2$ was reduced by H_2 at 280°C for 24 hrs. The results indicated: $CH_3OH \rightarrow H_2 + HCHO \rightarrow H_2 + CO$. If the initial pressure of methanol was a and the pressures of HCHO and of CO at time t were x and y, resp., the reaction velocity was expressed by $dz/dt = K_1(a - z)/-z^n$, where $z = x + y$ and n was const. greater than 1. The apparent heats of activation of the first and second reaction stages were $E_1 = 17.7$ and $E_2 = 14.0$ kcal, resp.

10536. HERBO, CL. AND HOU, S. **The mechanism of catalytic reactions. IV. The benzene-catalyst interaction.** *Bull. soc. chim. Belg.* 54, 203-35 (1945) (in French).—*C.A.* 41, 1537*e*.

The interaction of benzene with Ni-Cr_2O_3 catalyst during hydrogenation and the nature of the forces involved were studied. The heat of adsorption of benzene on Ni catalyst was 12,300 cal/mol. The heat of adsorption of H_2 under the same conditions was much greater (about 40,000 cal/mol.). H_2 dominated the catalytic surface almost to the complete exclusion of the benzene mols. Since hydrogenation of the benzene must take place through union with H_2 on the catalytic surface, the reaction was very slow on Ni-Cr_2O_3 catalyst, because few gaseous benzene mols. reached the surface of the catalyst.

10537. HERINGTON, E. F. G. AND RIDEAL, E. K. **The catalytic cyclization of aliphatic hydrocarbons. I. II.** *Proc. Roy. Soc.* (London) A184, 434-46, 447-63 (1945).—*C.A.* 40, 1796^2.

The aromatization of a paraffin proceeded through the formation of a monoölefin which was held on the catalyst by two-point contact. The promoter action of the central atoms in heteropoly acids of Mo could be attributed to the stabilization of the MoO_2 produced during the H_2 pretreatment. The alumina used as a support for Mo catalysts played the same role.

10538. HULBURT, HUGH M. **Chemical reactions in continuous-flow-systems—heterogeneous reactions.** *Ind. Eng. Chem.* 37, 1063-9 (1945).—*C.A.* 40, 2^6.

An analysis of kinetics of wall-catalyzed reactions in a stream flowing through a cylinder showed that conversion depended on 2 dimensionless ratios involving diffusion rate, specific reaction rate, and over-all flow rate (space velocity).

10539. KOBOZEV, N. I.; NIKOLAEV, L. A.; ZUBOVICH, I. A., AND GOL'DFEL'D, YU. M. **The principle of ensemble and aggravation in catalysis. I. The**

method of fluctuation analysis of active centers. Catalysis in the range of subcrystalline structures. *J. Phys. Chem.* (U.S.S.R.) 19, 48-71 (1945); *Acta Physicochim.* U.R.S.S. 21, 289-320 (1946).—*C.A.* 39, 3722¹; 40, 6325⁹.

The active part of a catalyst consisted of a few atoms having the right configuration and being located on the surface of a support. If the no. of catalytically-active atoms in a cell equaled that required for the given reaction, this cell was an "active spot"; if *n* was too small or too large, this cell was inactive. The no. was 3 for Fe on charcoal or asbestos for NH_3 synthesis, 4 for Mo on charcoal for NH_3 synthesis, 2 for Pd on charcoal or $BaSO_4$ for hydrogenation of ethylene derivs., 2 for Pt-Hg for electrolytic hydrogenation of cinnamic acid, 2 for Fe-As for the same reaction, 2 for Pt on charcoal for hydrogenation of toluene.

10540. Kobozev, N. I. **The principle of ensemble and aggravation in catalysts. II. The principle of aggravation and a structure classification of catalysts.** *J. Phys. Chem.* (U.S.S.R.) **19**, 142-51 (1945).—*C.A.* **39**, 3997³.

The active atom, mol., or particle of a catalyst could combine (chemically or physically) with another active unit, forming an "active ensemble" or with an inactive unit ("aggravator") which, however, affected the activity of the active group.

10541. Kodama, Shinjiro; Tarama, Kimio; Takazawa, T.; Fujita, Koichi; Tejima, T.; Ito, S., and Yokomaku, Y. **Synthesis of gaseous hydrocarbons from carbon monoxide and hydrogen. VII. Effect of temperature on synthesis with cobalt catalysts.** *J. Soc. Chem. Ind. Japan* **48**, 3-8 (1945).—*C.A.* 43, 2398*e*.

Hydrocarbons were prepd. from a 1:2 mixt. of CO and H_2 by means of Co 100, Cu 12.5, ThO_2 2.5, U_3O_8 1.25 and diatomaceous earth 125 parts, at 180°-290°C, and a period of operation of 24 hrs. Temp. elevation increased the yield of the lower hydrocarbons, but did not increase the relative yield of CH_4 as was the case with the Fe catalysts. The difference in comparing Co and Fe catalysts was explained by evapn. of hydrocarbons from the surface of the catalyst and a decrease in adsorbed H atoms.

10542. Kodama, Shinjiro; Tarama, Kimio; Takazawa, T.; Fujita, Koichi; Tejima, T.; Ito, S., and Yokomaku, Y. **Synthesis of gaseous hydrocarbons from carbon monoxide and hydrogen. VIII. Effect of compn. of the synthesis gas on iron catalysts.** *J. Soc. Chem. Ind. Japan* **48**, 3-8 (1945).—*C.A.* 43, 2398*g*.

A catalyst of Fe 100, Cu 25, diatomaceous earth 125, and K_2CO_3 2 parts was used at 270°C over a period of 6 hrs. For the Gasol synthesis the optimum CO:H_2 ratio was 50-60 to 50-40. For the least CH_4 production the ratio was 1:1. For max. Gasol production with least CH_4 the ratio was 1:1.5.

10543. Kodama, Shinjiro; Tarama, Kimio; Takazawa, T.; Fujita, Koichi; Tejima, T.; Ito, S., and Yokomaku, Y. **Synthesis of gaseous hydrocarbons from carbon monoxide and hydrogen. IX. Effect of addn. of diatomaceous earth on iron catalysts.** *J. Chem. Soc. Ind. Japan* **48**, 3-8(1945).—*C.A.* 43, 2398*h*.

A catalyst of Fe 100 + Cu 24 parts was used with CO and H_2 (1:1) at 270°C over a period of 16 hrs. The addn. of diatomaceous earth improved the life of the catalyst; 125% diatomaceous earth was most suitable for Gasol synthesis.

10544. Kodama, Shinjiro; Tarama, Kimio; Takazawa, T.; Fujita, Koichi; Tejima, T.; Ito, S., and Yokomaku, Y. **Synthesis of gaseous hydrocarbons from carbon monoxide and hydrogen. X. Effect of various carriers on the iron catalysts.** *J. Chem. Soc. Ind. Japan* **48**, 3-8 (1945).—*C.A.* 43, 2398*i*.

A catalyst of Fe 100, Cu 25, and K_2CO_3 2 was used with CO and H_2 (1:1.5). With active carbon an increase in the volatile fractions was found. With white clay, the Gasol yield was very small, but its compn. was unusual being high in C_4 and C_3 hydrocarbons, and the degree of unsatn. high (70-85%). Japanese acid clay increased the yield of gaseous hydrocarbons, 125% giving max. Gasol (27.4 liters per m³).

10545. Kodama, Shinjiro; Tarama, Kimio; Takazawa, T.; Fujita, Koichi; Tejima, T.; Ito, S., and Yokomaku, Y. **Synthesis of gaseous hydrocarbons from carbon monoxide and hydrogen. XI. A comparative study of the synthesis under normal pressure and other pressures. XII. Effect of pressure. XIII. Effect of temperature at constant pressure.** *J. Soc. Chem. Ind. Japan* **48**, 3-8 (1945).—*C.A.* 43, 2398*e*, 2399*a*, *b*.

With a catalyst of Fe + 25% Cu on 125% diatomaceous earth at 5-20 kg/cm² the yield of Gasol and the rate of reaction showed max. values at 15 kg/cm². With the same catalyst + 2% K_2CO_3 on 125% white clay at 5-40 kg/cm² there was no change in the yield of oil. Elevation of temp. increased the yield of lower hydrocarbons, but increased yields of CH_4 also occurred because of the increase in the reactivity of H_2.

10546. Kodama, Shinjiro; Tarama, Kimio; Takazawa, T.; Fujita, Koichi; Tejima, T.; Ito, S., and Yokomaku, Y. **Synthesis of gaseous hydrocarbons from carbon monoxide and hydrogen. XIV. Effect of various carriers and promoters.** *J. Chem. Soc. Ind. Japan* **48**, 3-8 (1945).—*C.A.* **43**, 2399*c*.

The effect of white clay and active carbon as carriers was studied for Fe + 25% Cu + 2% K_2CO_3. White clay increased the yield of hydrocarbons and decreased the reactivity of H_2. Active carbon increased the reactivity. The effect of K_2CO_3 on the following catalysts was studied: Fe + 25% Cu + 250% white clay, Fe + 25% Cu + 125% active carbon, and Fe + 25% Cu + 125% Japanese acid clay. K_2CO_3 increased the yield of higher hydrocarbons, decreased the reactivity of H_2, and increased the unsatd. content of the Gasol.

10547. Kodama, Shinjiro; Tarama, Kimio; Takazawa, T.; Fujita, Koichi; Tejima, T.; Ito, S., and Yokomaku, Y. **Synthesis of gaseous hydrocarbons from carbon monoxide and hydrogen. XV. Summary of the studies on the synthesis under pressure.** *J. Chem. Soc. Ind. Japan* **48**, 3-8 (1945).—*C.A.* **43**, 2399*e*.

Pressure increased the life of Fe catalysts, and increased the total rate of reaction; the yield of Gasol approached 30 liters/m^3. The optimum temp. was 270-320°C. Raising the pressure increased the tendency to form higher hydrocarbons as well as lower hydrocarbons, especially CH_4 and C_2H_6.

10548. Lel'chuk, S. L. **Effect of promoters in the catalytic dehydrogenation of alcohols to esters as related to their place in the periodic table.** *Compt. rend. acad. sci. U.R.S.S.* 49, 652-4 (1945) (in English).—*C.A.* 40, 5627^7.

The activity of metals and their oxides as promoters for the catalytic dehydrogenation of alcs. to esters over Cu was related to their position in the periodic system. Data on conversions of EtOH to ethyl acetate (and acetaldehyde) showed greatest activity with 0.1% U^{+3} on Cu, with 55.7% conversion to ethyl acetate. Active elements included Ce in group III, and the even series in groups IV, VI, and VIII, more effective with increasing at. wt.

10549. Luyten, L. and Jungers, J. C. **The kinetics of the catalytic synthesis of methane in nickel.** *Bull. soc. chim. Belg.* **54,** 303-18 (1945).—*C.A.* 41, 2310*f*.

The reaction was characterized by a strong adsorption of CO on the catalyst and a comparatively weak adsorption of H_2 (or D_2). The reaction was not inhibited by the products of the reaction. The energies of activation were $E_{CH_4} = 27,000$ cal, $E_{CD_4} = 25,000$ cal.

10550. Mamedli, M. G. **Catalytic desulfurization of gasolines.** *J. Applied Chem.* (U.S.S.R.) **18,** 62-8 (1945).—*C.A.* **39,** 5443^6.

Some samples of Apsheron clays could be used directly as desulfurizing catalysts in vapor-phase gasoline treatment at 300°C and 1 atm. pressure with 1:1 ratio between clay vol. and gasoline vol. per hr. The S content was reduced by 75%.

10551. Mavity, Julian M.; Zetterholm, Earl E., and Hervert, Geo. **Styrene production by catalytic dehydrogenation—low pressure operation.** *Trans. Am. Inst. Chem. Engrs.* **41,** 519-28 (1945).—*C.A.* **40,** 240^6.

The catalytic dehydrogenation of ethyl-benzene to styrene was discussed with particular regard to the effect of the operating variables, pressure, temp., space velocity, and process period length on conversion, styrene yield, and extent of carbon deposition. Correlations based on lab.-scale expts. with Universal Oil Products com. dehydrogenation catalyst showed favorable effects from reduction of pressure or from increase in temp. within the respective ranges investigated (80 mm abs. to 50 p.s.i.g., and 550° to 630°C).

10552. Maxted, Edward B. **The detoxication of of catalyst poisons. I. General survey of some detoxicants.** *J. Chem. Soc.* **1945,** 204-7.—*C.A.* **39,** 3997^8.

The applicability of various peracids or their salts as detoxicating agents for Pt hydrogenation catalysts was studied. Poisons investigated were cysteine, β-thionaphthol, and thiophene. Persulfates, perphosphates, perchromates, and other compds. were considered.

10553. Maxted, Edward B. **Form of catalyst poisoning curves.** *Trans. Faraday Soc.* **41,** 406-10 (1945).—*C.A.* **39,** 5160^8.

The poisoning of Pt catalysts by thiophene and by β-thionaphthol for the hydrogenation of crotonic acid was studied. Exptl. conditions were chosen so that zero-order hydrogenation was obtained with an unsupported formate-reduced Pt of approx. uniform grain size, and a nearly zero-order hydrogenation with another kieselguhr-supported catalyst made by reduction with H_2 of Pt Cl_4 in glycerol suspension.

10554. Maxted, Edward B. **Studies in the detoxication of catalyst poisons. II. Use of various oxidizing agents for the detoxication of cysteine.** *J. Chem. Soc.* **1945,** 763-6.—*C.A.* **40,** 3046^9.

The detoxication of cysteine was studied (in the hydrogenation of unsatd. compds. with a Pt catalyst) by means of perphosphoric acid, potassium persulfate, dil. HNO_3 and H_2O_2. The first and the last together were probably the most satisfactory reagents. The soln. at the concn. used did not appreciably attack the double bond of the unsatd. substance in which the cysteine occurred as poison.

10555. Maxted, Edward B. and Marsden, Arthur. **Studies in the detoxication of catalyst poisons. III. Detoxication of cysteine with metallic peracids.** *J. Chem. Soc.* **1945,** 766-8.—*C.A.* **40,** 3047^1.

Complete restoration of the activity of Pt catalyst, previously reduced to about 1% of the original value, was obtained by using solns. contg. small quantities of pertungstates, permolybdates, or pervanadates. Twenty-fold amts. of pertitanates and peruranates were less effective.

10556. McBee, E. T.; Hass, H. B., and Wiseman, P. A. **Catalytic vapor-phase oxidation of ethylene.** *Ind. Eng. Chem.* 37, 432-8 (1945).—*C.A.* 39, 2736^4.

C_2H_4 was converted to ethylene oxide, CO_2, and H_2O in a catalytic vapor-phase air oxidation. A controlled mixt. of air and C_2H_4 was preheated and oxidized over a Ag catalyst in a Pyrex tube surrounded by a molten salt bath. The catalyst was prepd. by coating pieces of corundum with Ag_2O.

10557. Mercier, Stanley M. **Hot-catalyst elevators.** *Mech. Eng.* 67, 635-8 (1945).—*C.A.* **40,** 4^2.

Catalyst elevators used in Thermofor catalytic cracking units were described. Bucket-type elevators employing 2 strands of chain of welded construction were found most suitable and a Ni-Cr-iron bushing specially heat-treated to work with a medium Cr-Mo heat-treated pin was developed.

10558. Newton, R. H.; Dunham, G. S., and Simpson, T. P. **The TCC catalytic cracking process for motor gasoline production.** *Trans. Am. Inst. Chem. Engr.*, **41,** 215-32 (1945); *Natl. Petroleum News* 37, R441-52; *Oil Gas J.* **44,** No. 4, 84-95 (1945).—*C.A.* 39, 2863^8.

The TCC process had sep. reaction and regeneration zones and continuous movement of a solid catalyst through each. The factors governing rate of flow of pellet catalyst in beds, and methods of insuring uniform flow and distribution were studied in plant-scale models. The characteristics of the cracking catalyst required a min. temp. of about 900°F to burn off the coke deposit in order to regenerate the catalyst; and also the max. temp. must not be over about 1200°F, in order not to damage the catalyst.

10559. Newton, R. H. and Shimp, H. G. **The design and operating features of Houdry fixed-bed catalytic cracking units.** *Trans. Am. Inst. Chem. Engrs.* **41**, 197-213; *Natl. Petroleum News* **37**, R333-6 (1945).—*C.A.* **39**, 2864².

The oil to be cracked and the air for regeneration of the catalyst were alternately passed through a bed of pelleted catalyst. The alternate oil and air cycles made it necessary to purge the catalyst before and after each operation. The cyclic operation was carried out with 3 or more catalyst vessels so that the flow of both oil and air was continuous. The heat control of the catalyst vessels was accomplished by circulating an inorg. salt heat-transfer medium. To promote rapidity of combustion of the carbon deposit, and permit max. utilization of the catalyst, air at about 45 p.s.i. was used for regeneration.

10560. Nikolaeva, A. F.; Tatevskiĭ, V. M., and Frost, A. V. **The catalytic action of aluminosilicates. IV. Transformation of cyclohexene over activated clay.** *J. Gen. Chem. (U.S.S.R.)* **15**, 796-8 (1945).—*C.A.* **40**, 6945⁶.

Passage of cyclohexene over activated clay at 260°C resulted in formation of methylcyclopentane and cyclohexane in the ratio 10:1. Small amts. of unsatd. and aromatic hydrocarbons were formed and there was a 14% loss as gas or tar.

10561. Paty, Marcel. **The activation of Raney nickel by sodium hydroxide.** *Compt. rend.* **220**, 827-9 (1945).—*C.A.* **40**, 2062⁸.

Hydrogenations were performed with 6 g Ni in 100 ml boiling EtOH. The addn. of 0.6 g NaOH cut the hydrogenation time of $Me_2C{:}CHMe$ (1/50 mole) from 2 hrs 13 min. to 1 hr 16 min.; for $PhCH_2CN$ (1/20 mole), 0.6 g NaOH cut the time from 129 min. to 54 min., but 1 g NaOH increased the time to 4 hrs; for anethole (1/10 mole), 0.3 g NaOH cut the time from 61 to 31 min., but 0.6 g NaOH increased it to 112 min. The alky. disappeared soon after the addn. of the NaOH. Action of the NaOH on residual Al or Al-Ni alloy in the Raney Ni was thought to change the activity of the catalyst.

10562. Rao, K. Venkateswara. **Synthesis of ammonia from active nitrogen.** *Proc. Indian Acad. Sci.* **22A**, 239-42 (1945).—*C.A.* **40**, 2594⁹.

Comparative tests were reported for 55 substances as catalysts for the synthesis of NH_3 from N_2 activated by a condensed elec. discharge. The catalysts giving the highest yields of NH_3 were, in decreasing order: Sn-Pb alloy, Mg, W, Rose metal, tin.

10563. Roginskiĭ, S. Z. **Kinetics of catalytic processes on highly nonuniform surfaces.** *Compt. rend. acad. sci. U.R.S.S.* **47**, 412-16; *Doklady Akad. Nauk S.S.S.R.* **47**, 430-4 (1945).—*C.A.* **40**, 4942².

A surface was assumed with a broad distribution of sites with respect to the heat of formation of the transition complex. The Langmuir system of equations of the kinetics was replaced by a new system which included (1) quasi van't Hoff kinetics equations, (2) zero orders for one or several components, (3) logarithmic or fractional power increase of the quantity adsorbed with time or complete independence of the concns. of the initial reactants, (4) fractional powers of the concns. of the reaction components.

10564. Roginskiĭ, S. Z. **Concentration isotherms of catalyst poisoning.** *Compt. rend. acad. sci. U.R.S.S.* **47**, 558-60; *Doklady Akad. Nauk S.S.S.R.* **47**, 579-81 (1945).—*C.A.* **40**, 3969⁹.

10565. Roĭter, V. A.; Gaukhman, S. S., and Tudorovskaya, M. A. **Catalytic oxidation of hydrogen sulfide in the presence of hydrogen.** *J. Applied Chem. (U.S.S.R.)* **18**, 459-68 (1945) (English summary).—*C.A.* **40**, 4858⁴.

The efficiency of a Ni-Pb catalyst on kieselguhr for the reaction of oxidation of H_2S in the presence of O_2, N_2, and H_2 was studied in relation to temp., space velocity, H_2S concn., O concn., and moisture. The extent of oxidation depended primarily on temp. and the ratio of O_2 to H_2S; this ratio was 2.5 to 4.0 for complete oxidation, with an apparent temp. max. at 370°C.

10566. Sakata, Tokuji. **The effect of pressure on the catalytic reaction between hydrogen and carbon monoxide.** *Rev. Phys. Chem. Japan* **19**, 50-66 (1945).—*C.A.* **45**, 3681e.

The synthesis of MeOH with a catalyst prepd. from CrO_3 and ZnO was studied at 330-400°C in the pressure range from 100 to 300 atms. The content of MeOH in the crude liquid product increased with pressure. A catalyst prepd. from $K_2Cr_2O_7$, ZnO, and KOH was used for the synthesis of isobutanol from H_2 and CO. The crude liquid product obtained at 300 atms. was richer in isobutanol than that at 100 atms., but the ratio of isobutanol to MeOH was not affected by the pressure.

10567. Simpson, T. P. **T.C.C. (Thermofor catalytic cracking) announces liquid processing using pelleted clay or beaded catalyst.** *Oil Gas J.* 44, No. 1, 88-90 (1945).—*C.A.* **39**, 3150⁹.

The catalyst was either pelleted clay or synthetic bead and the handling was the same for both the liquid and vapor charge processes. Normal operating ranges were 800-950°F, pressure 5-15 p.s.i.g., catalyst to oil ratio 1:1-6:1 catalyst residence time from a few min. to 2 hrs and space velocity of 0.2-3. Coke deposits were 2-3 times those for gas oil charge, but normal for heavy stocks.

10568. Simpson, T. P.; Eastwood, S. C., and Shimp, H. G. **Liquid-charge technique in thermofor-catalytic-conversion processing.**

Petroleum Refiner **24**, No. 11, 436-42 (1945); *Natl. Petroleum News* **37**, R977-83 (1945); *Oil Gas J.* **44**, No. 29, 119-29 (1945).—*C.A.* **40**, 447^7.

Concurrent solid-bed downflow type reactors were used and the feed either total liquid or liquid-vapor, or alternately vapor and liquid charged separately at the top of the reactor. Data were given showing properties of typical charge stocks and products. Deasphalting of charge greatly reduced coke and resulted in improved yields of motor gasoline. Catalyst may be synthetic bead, synthetic pellets, or pelleted clay.

10569. SPANGENBERG, JUAN G. **Esterification of acetic acid in the vapor phase. Catalytic action of some salts and metal oxides.** *Industria y quim.* (Buenos Aires) 7, 393-401 (1945).—*C.A.* **41**, 4028*e*.

Oxide catalysts were prepd. by satg. pumice with acetate or nitrate solns. and heating until oxides formed; salt catalysts, also on pumice, were heated to below decompn.: (1) ZrO_2 90.9, Ce_2O_3 9.1%; (2) Co_3O_4 98.5, ThO_2 1.5%; (3) ThO_2; (4) BeO; (5) CdO; (6) $ThO_2$50, Al_2O_3 50%; (7) Ce_2O_3; (8) $AgVO_3$ 92.6, Ag 7.3%; (9) $SrMoO_4$; (10) $Co_3(PO_4)_2$; (11) ZrO_2; (12) TiO_2. Yields were given for the vapor-phase esterification of AcOH with 5 primary, 1 primary unsatd., 2 secondary, and 3 tertiary alcs. The catalyst temp. varied from 245° to 410°C; the velocities ranged from 40 to 100 ml/hr. Best results were obtained with TiO_2, ThO_2, and ZrO_2 in descending order for all alcs. tested.

10570. STEINER, H. **Catalytic dehydrocyclization of paraffins.** *J. Am. Chem. Soc.* **67**, 2052-4 (1945).—*C.A.* **40**, 792^3.

Dehydrogenation and cyclization were both affected by the poisoning of the catalyst. Where the poisoning action was due to accumulation of polymer, the 2 reactions were affected to much the same extent. When H_2O, and particularly C_2H_4, was poison, the dehydrogenation rate was repressed even more than the cyclization, but the decline was still parallel.

10571. STOURDZÉ VISCONTI, YVONNE. **Obtaining elementary sulfur. The catalytic property of vanadium oxide in the reduction of sulfurous gas by carbon monoxide.** *Rev. quím. ind.* (Rio de Janeiro) **14**, No. 163, 22-6 (1945).—*C.A.* **40**, 5212^2.

Bauxite, impregnated with V salts, was used as catalyst in 197 tests carried out to obtain S from SO_2 and CO. The V catalyst acted not only by its surface action, but also by means of its lower oxides. Since SO_2 and CO both had a reducing action on the V oxides, especially V_2O_5, the S yields were affected in some tests by the reduction of the catalyst. The S yield increased with increasing concn. of the gas mixt. and improved at a ratio $CO/SO_2 > 2$, especially at a low velocity. The best results were obtained at 600°C and 25 liter/hr.

10572. THOMAS, CHARLES L. AND HOEKSTRA, JAMES. **Fluidized-fixed-bed method for contacting solids with gases and vapors.** *Ind. Eng. Chem.* **37**, 332-4 (1945).—*C.A.* **39**, 2024^5.

The flow of gases counter-to-gravity through a mass of powd. solid produced a "fluidized fixed bed" at certain crit. rates of flow. The fluidized fixed bed was particularly adapted to catalytic reactions where powd. catalysts could be used. Localized thermal effects in the catalyst bed were eliminated by the moving catalyst. The powder d., particle size and shape, and bed dimensions affected the limits of flow rate that would give the fluidized-fixed-bed condition. The procedure was applied to catalytic cracking of gas oil and to H_2-transfer treatment of unsatd. gasoline.

10573. TREJO, ALFONSO. **Catalysis by activated adsorption.** *Quimica* (Mex.) 3, 117-119 (1945).—*C.A.* **39**, 5160^6.

A design was suggested for a surface-catalytic reactor for, e.g., the oxidation of SO_2 on Pt black.

10574. VOORHIES, JR., ALEXIS. **Carbon formation in catalytic cracking.** *Ind. Eng. Chem.* **37**, 318-22 (1945).—*C.A.* **39**, 2194^5.

The wt percentage of carbon formed on the catalyst during catalytic cracking of hydrocarbons was approx. a logarithmic function of the length of time elapsed since the catalyst was regenerated. An equation was developed showing the interrelation of feed stock conversion, feed rate, and length of period between catalyst regenerations in a typical case. Carbon on the catalyst functioned as a diffusion barrier and the rate of diffusion was inversely proportional to the wt percentage of carbon on the catalyst.

10575. WAGNER, CARL. **Conversion over catalysts of maximum efficiency.** *Chem. Tech.* **18**, 1-7 (1945).—*C.A.* **44**, 10472*d*.

With streams in tubular canals and in corpuscular motion, the unconverted substrate fraction decreased exponentially with the length of the catalyst bed. The limiting length of the bed was that necessary for the disappearance of a substrate concn. for a given starting concn. In laminated gas streams, the limiting length was proportional to the stream velocity; however, with turbulent streams, the limiting length decreased only slightly with increased velocity. For the oxidation of NH_3 over a 3000-mesh/cm^2 Pt gauze, the upper limit of the velocity was 6 cm/sec when 99% of the NH_3 came in contact with the Pt surface.

10576. WAGNER, CARL. **Temperature adjustment on catalysts of maximum efficiency.** *Chem. Tech.* **18**, 28-34 (1945).—*C.A.* **44**, 10472*g*.

When the gas temp. was relatively low and the catalyst surface of the order of the max. temp., it was possible to have a completely adiabatic reaction course. The stability of specific operating conditions, such as the relation of the catalyst temp. and the change in the inlet gas temp., activation energy of the catalyst, substrate concn., and gas-stream velocity, was studied in detail.

10577. ZIMENS, KARL ERIK. **Kinetics of heterogeneous exchange reactions. I. Study of solid**

reactions by means of isotope exchange. *Arkiv Kemi, Mineral. Geol.* **A20**, No. 18, 1-26 (1945) (in German).—*C.A.* **41**, 4027*d*.

The general features of heterogeneous tracer reactions were outlined. The following steps were considered: (1) diffusion through the surrounding soln. or gas medium to the solid surface, (2) the chem. exchange in the boundary layer, (3) diffusion into the interior of the solid phase.

10578. ALCHUDZHAN, A. A. AND VVEDENSKIĬ, A. A. **Kinetics and mechanism of the reaction of catalytic hydrogenation of hydrocarbons. III. Kinetics of hydrogenation of benzene over nickel.** *J. Gen. Chem.* (U.S.S.R.) **16**, 415-19 (1946).—*C.A.* **41**, 644*e*.

The hydrogenation of benzene over Ni was studied at 100°, 120°, 140°, 180°, and 227°C in the vapor state. The max. of reaction rate was observed at stoichiometric ratio of H_2 to benzene. Increase of reaction temp. caused the reaction rate to pass through a max., the position of the latter being dependent on the activity of the catalyst sample used and located within the limits of 150-170°C.

10579. ALCHUDZHAN, A. A. AND VVEDENSKIĬ, A. A. **Kinetics and mechanism of the reaction of catalytic hydrogenation of hydrocarbons. IV. Peculiarities of inconstancy of activity of nickel catalyst in benzene hydrogenation.** *J. Gen. Chem.* (U.S.S.R.) **16**, 420-6 (1946).—*C.A.* **41**, 644*g*.

After a change of operating temp. during benzene hydrogenation over Ni, the activity of Ni catalyst changed in time (upward or downward) to a const. value. On changes of contact time or on introduction of steam into the reaction mixt., the degree of hydrogenation changed, but upon return to the standard conditions the catalyst reverted to its original activity instantly. Treatment of the Ni catalyst with benzene brought the activity to zero, whereas treatment with H_2 increased its activity.

10580. ANON. **Thoria-alumina catalyst best for isoparaffin synthesis—zinc oxide is less efficient, less expensive.** *Tech. Rept. No.* **110-45**; *Oil Gas J.* **44**, No. 37, 86, 89 (1946).—*C.A.* **40**, 1643^9.

A catalyst composed of alumina and thoria proved to be the best for use in German isoparaffin syntheses. Increase of alumina content increased CH_4 formation. Zinc oxide and alumina catalyst showed slightly lower yields but better promise as a com. catalyst. Pressures of 4,500 p.s.i. and temps. of 788-842°F were used to form isoparaffins from CO and H_2 by the Fischer-Tropsch synthesis.

10581. ANTIPINA, T. V. AND FROST, A. V. **The catalytic activity of pure aluminum hydroxide.** *Compt. rend. acad. sci. U.R.S.S.* **53**, 45-6 (1946).—*C.A.* **41**, 1539*h*.

Spectroscopically pure $AlCl_3$ was hydrolyzed with water vapor, the powd. alumina mixed with sugar sirup, and 4 catalyst samples were ignited at 400°, 500°, 800°, and 1200°C. Their activity for the dehydration of 96% EtOH was studied at 375°, 420°, 425°, and 450°C. Dehydration rates for 400° and 450°C were given, the max. being 277 ml (S.T.P.) of C_2H_4 per min. per ml catalyst at 400°C, space velocity 4.7, catalyst ignited at 500°C.

10582. ANTIPINA, T. V.; SAVUSHKINA, V. I., AND FROST, A. V. **Kinetics of catalytic dehydration of ethyl alcohol.** *Vestnik Moskov. Univ.* **1946**, No. 3/4, 119-22.—*C.A.* **42**, 2850*d*.

The linear relation between $v_0 \ln[1/(1-y)]$ and $v_0 y$ held for $C_2H_5OH \rightarrow C_2H_4 + H_2O$ with both abs. alc. over an Al_2O_3-SiO_2 catalyst at 425°C, $\alpha = 0.4$ and $\beta = 0.8$, and with alc.-water mixts. at 400°C over an Al_2O_3 catalyst heated at 800°C. y = degree of conversion of the initial reactant, v_0 = vol. of reactant fed into the catalytic space per unit of time; α and β on the products of the adsorption coeffs. of the initial substance and the reaction products by the corresponding stoichiometric mol. no. and the pressure.

10583. AVDEEVA, A. V.; ADON'EVA, N. V., AND BUKHAREVA, E. M. **Catalytic oxidation of hydrogen sulfide to sulfur dioxide in purifying natural gas.** *Khim. Prom.* **1946**, No. 11, 17, 18.—*C.A.* **41**, 3940*b*.

Oxidation of H_2S to SO_2 was studied with and without catalysts: an empty tube, a tube packed with pumice, and pumice on which were deposited Ni, Ni-Pb, Ni-Bi, Ni-Ag, Ni-Mo, Ni-Al, Ni-Pb-Al, Ni-Bi-Al, Ni-Pb-Bi, etc. The compn. of the gas used in these expts was N_2 96-7, O_2 2.8-3.25, and H_2S 0.2-0.75%. The temps. were 200-360°C. As the velocity of the gas increased the effectiveness of the empty reactor dropped faster than that of the one packed with pumice. Of the catalysts tested the most effective was Ni-Al.

10584. BALANDIN, A. A.; BODANOVA, O. K., AND SHCHEGLOVA, A. P. **Kinetics of the dehydrogenation of butylene on a chromium catalyst.** *Izvest Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* **1946**, 497-513.—*C.A.* **42**, 6218*e*.

Cr catalyst ("No. 41") was tested for const. activity by the rate of dehydrogenation of butylene to butadiene at const. space velocity and temp., and regenerated in an air stream between runs. Conditions for kinetic study were 540-70°C and high space velocity, 11,500 liter/liter catalyst/hr. The amt. of butadiene formed was independent of the length of the run (6.9 and 12 min.). At a time of contact of 0.3 sec, the apparent activation energy of butylene → H_2 + butadiene was 26.26-27.93 kcal/mole at 551-600°C and 34.34-34.74 at 535-559°C.

10585. BALANDIN, A. A.; KHARINA, Z. V., AND TEIS, R. V. **Isotopic exchange in the hydrogenation of benzene with deuterium over platinum and chromic oxide catalysts.** *Compt. rend. acad. sci. U.R.S.S.* **53**, 715-18 (1946).—*C.A.* **41**, 4698*d*.

Exchange with D_2 occurred during the hydrogenation of benzene over a Pt-on-asbestos catalyst and over Cr_2O_3. At 100°C with the Pt catalyst and with a H_2-benzene mole ratio of 4, complete hydrogenation was achieved, but the degree of isotopic exchange was 5-34%. With the Cr_2O_3 catalyst at 160°C, and with the other conditions the same, the degree of hydrogenation was about 8-12%, whereas the degree of isotopic exchange amounted to as much as 74%.

10586. Balandin, A. A. and Vasiunina, N. A. **Effect of the nature of the asbestos carrier on the activity of platinum catalysts.** *Compt. rend. acad. sci. U.R.S.S.* **52**, 139-42 (1946) (in English).—*C.A.* **41**, 2310*c*.

Fibrous chrysotile asbestos and straight-fiber asbestos, amphibole type, were carefully washed with HNO_3 to remove all Fe, then with water till the diphenylamine test for NO_3 was neg. Active Pt catalysts (8% Pt) were prepd. The rate of dehydrogenation of cyclohexane to benzene when chrysotile asbestos was used as carrier for the catalyst was found to be twice that with amphibole asbestos as carrier, and the activation energy in cal/mole was 13,600 for the chrysotile-type catalyst and 14,300 for the amphibole type.

10587. Balandin, A. A. and Vasserberg, V. **The distribution of active centers on mixed catalysts. I. Decomposition of isopropyl alcohol on $Al_2O_3.ZnO$.** *Acta Physicochim. U.R.S.S.* **21**, 678-88 (1946) (in English).—*C.A.* **41**, 1539*e*.

Isopropyl alc. (0.5-5 mm pressure) was completely adsorbed by 4.64 g of 90% Al_2O_3-10% ZnO catalyst which had been dried at 300°C for 40-50 hrs to 0.00004 mm pressure. The reaction was followed at 82°-106°C by measuring C_3H_8 pressure. At small surface covering from 0.06 to 0.15 ml (N.T.P.) per g, the reaction velocity rose linearly; it remained const. to about 0.8 ml per g, above which the const. fell. The activation energy at sparse covering of the surface was 18,000 cal per mol., and 8,900 in the horizontal range.

10588. Bloch, Herman S. and Schaad, Raymond E. **Dehydroisomerization of butane.** *Ind. Eng. Chem.* **38**, 144-7 (1946).—*C.A.* **40**, 2611⁵.

Two catalysts were tried for the production of isobutylene from *n*-butane by the process of first dehydrogenating and then isomerizing. One consisted of equal vols. of granular olefin-isomerization catalyst, 20 SiO_2:1Al_2O_3:0.1 ThO_2, and granular dehydrogenation catalyst, 10% Cr_2O_3 on Al_2O_3. These were mixed and were called "mixed catalyst". For the 2nd, the "composited catalyst", the 2 component catalysts were ground together in about the same proportions and pelleted. The mixt. of granules was much more effective as a catalyst than the composited catalyst.

10589. Bogoyavlenskaya, M. L. and Koval'skiĭ, A.A. **Initiating a homogeneous reaction in a gas by solid catalyst.** *J. Phys. Chem.* (U.S.S.R.) **20**, 1325-31 (1946) (in Russian).—*C.A.* **41**, 2972*g*.

A thermocouple was placed along the axis of the reaction vessel and readings were compared when the catalyst was: (a) spread over the wall of the vessel, and (b) formed a coating on the thermocouple. The two readings were alike for the reaction between CO and SO_2 in the presence of Al_2O_3 at 170-250 mm Hg (starting pressure) and 568-574°C. The reaction between SO_2 and H_2 in the presence of Al_2O_3 also seemed homogeneous. The oxidation of SO_2 in the presence of Pt was heterogeneous. The oxidation of H_2 and of NH_3 on Pt seemed partly heterogeneous.

10590. Butyagin, P. Ya. and Elovich, S. Ya. **Kinetics of catalytic oxidation of propylene.** *Compt. rend. acad. sci. U.R.S.S.* **54**, 603-6 (1946) (in English).—*C.A.* **41**, 5007*f*.

Catalytic oxidation of C_3H_6 was governed by the same law as the activated adsorptions of O_2 and C_3H_6. The reaction proceeded mainly in space. The catalyst generated active centers, part of which were bound firmly to the catalytic surface, whereas the rest were desorbed and initiated a space reaction of the chain type. Hence, catalytic oxidation of C_3H_6 was a combination of a heterogeneous and a homogeneous process.

10591. Buu-Hoï. **Transfers of energy among mixed catalysts.** *Bull. soc. chim.* **1946**, 115-17.—*C.A.* **40**, 5986⁵.

A mechanism was proposed, based on transfer of energy without loss between atoms of the promoter and the support, so that the energy absorbed by the whole catalyst was conveyed by jumps to certain centers where it was used in the chem. reaction.

10592. Capell, R. G.; Amero, R. C., and Wood, W.H. **Fuller's earth as a binder for catalysts and adsorbents.** *Petroleum Refiner* **25**, No. 2, 69-71 (1946).—*C.A.* **40**, 2595⁵.

Florigel, a grade of floridin, was kneaded with H_2O to form a sticky, plastic substance. The characteristics which made Florigel suitable as a binder were summarized.

10593. Cotton, Ernest. **Germany's Fischer-Tropsch process.** *Natl. Petroleum News* **38**, No. 23, R425-34 (1946).—*C.A.* **42**, 9112*b*.

Com. methods of prepg. and purifying synthesis gas, manuf. of the catalyst, type of reactors employed, the actual synthesis procedure, and the products obtained were discussed.

10594. Craxford, S. R. **Mechanism of the Fischer-Tropsch reaction.** *Trans. Faraday Soc.* **42**, 576-80 (1946).—*C.A.* **41**, 262*g*.

When a mixt. of CO and $2H_2$ was passed over a catalyst suitable for hydrocarbon synthesis at 185°C, the amt. of oil formed at first increased to a max. with increase in length of catalyst bed. It then decreased, the oil formed in the first part of the catalyst bed being decompd. to CH_4 in the second part.

10595. Craxford, S. R. **Function of the promoters in the catalysts for the Fischer-Tropsch synthesis.** *Trans. Faraday Soc.* **42**, 580-5 (1946).—*C.A.* **41**, 262*i*.

The rates of some simple pertinent reactions were detd. for 5 catalysts: (1) Co; (2) Co-ThO_2, 100-18; (3) Co-kieselguhr, 1:1; (4) Co-ThO_2-kieselguhr, 100:18:100; (5) Co-ThO_2-kieselguhr, 100:21:100. All of these catalysts were equally active for the reaction: $C_2H_4 + H_2 \rightarrow C_2H_6$ at 20°. Both kieselguhr and thoria were powerful promoters for the reaction $2CO + 2Co = Co_2C + CO_2$. The most effective catalyst contained 18% ThO_2 and no kieselguhr; catalyst (5) reacted very much more slowly than (4). The ThO_2 and kieselguhr did not act primarily by increasing the available area of the Co, but as specific promoters for the formation and reduction of CoC_2.

10596. Csuros, Zoltán. **Catalysis and catalysts.** *Magyar Tech.* **1**, 41-5 (1946).—*C.A.* **40**, 6945^5.

No direct parallelism could be detected between the quantity of catalyst and the reaction velocity, but the existence of a max. and a min. could be proved. Variation of the amount of catalyst made possible selective hydrogenation.

10597. Csuros, Zoltán; Zech, Konstantin, and Pfliegel, Tódor. **Selective hydrogenation by means of catalysts. II.** *Hung. Acta Chim.* **1**, 24-47 (1946).—*C.A.* **41**, 110*c*.

Crotonic, tiglic, and cinnamic aldehydes and PhCH:CHCOPh were hydrogenated in a semimicro app. with colloidal Pd, or with Pd pptd. on $BaSO_4$ as catalysts. The effects of the amt. of catalyst on the velocity of hydrogenation and the result of reaction were detd. With an optimal amt. of catalyst, the carbonyl group could be hydrogenated before the double bond.

10598. Daniels, L. S. **Fluid-catalyst technique.** *Petroleum Refiner* **25**, No. 9, 435-42 (1946).—*C.A.* **42**, 9139*a*.

The fluid-catalyst cracking process was discussed using powd. catalyst mixts. to accomplish the essential operations of oil reaction, catalyst transfer, and catalyst regeneration. Diagrams showing the operations of the various parts of the process were shown.

10599. Dodd, R. H. and Watson, K. M. **Process design of catalytic reactors—dehydrogenation of butane.** *Trans. Am. Inst. Chem. Engrs.* **42**, 263-91 (1946).—*C.A.* **40**, 4941^8.

A small pilot plant was designed and built for the engineering analysis of catalytic processes. The design permitted operation over wide ranges of conditions on a variety of systems employing solid catalysts. Operation was either as an "integral reactor," to simulate the results of a com. reactor, or as a "differential reactor" for the direct detn. of abs. reaction rates. The equipment, coupled with thermodynamic and kinetic principles, permitted the establishment of optimum process conditions from a relatively few small-scale expts.

10600. Eĭdus, Ya. T. **Synthesis of liquid and solid hydrocarbons from water gas at atmospheric pressure on a precipitated $Fe\text{-}Cu\text{-}ThO_2\text{-}K_2CO_3$-marshallite catalyst.** *J. Gen. Chem.* (U.S.S.R.) **16**, 869-74 (1946).—*C.A.* **41**, 1987*g*.

Pptd. $Fe\text{-}Cu\text{-}ThO_2\text{-}K_2CO_3$-marshallite catalyst was shown to have a rather high effectiveness in the synthesis of hydrocarbons from water gas at 250 °C at atm. pressure. The best catalyst contained 1/2 ratio between ThO_2/K_2CO_3, which were used in 2% amt. relative to Fe.

10601. Eĭdus, Ya. T. **Reduction of catalysts for the synthesis of aliphatic hydrocarbons from mixtures of carbon monoxide and hydrogen.** *J. Gen. Chem.* (U.S.S.R.) **16**, 875-83 (1946).—*C.A.* **41**, 1824*g*.

A comparative study was made on reduction of the following water-gas catalysts: $Co\text{-}ThO_2$-kieselguhr (100:18:100), $Fe\text{-}Cu\text{-}ThO_2\text{-}K_2CO_3$-kieselguhr (100:25:2:2:125), and $Fe\text{-}CuThO_2\text{-}K_2CO_3$-marshallite (100:25:2:2:125). CO was adsorbed on the 1st catalyst 4 times more effectively than on the 2nd and 3rd, after H_2 reduction. Slow heating-up of the latter catalysts during H_2 reduction gave most active catalysts.

10602. Eĭdus, Ya. T. **Investigation of catalysts for the hydrogenation of carbon monoxide with joint application of the dynamic and the static methods. IV. Comparative study of the kinetics of carbide formation and the hydrogenation of carbon monoxide on cobalt, nickel and iron catalysts.** *Izvest. Akad. Nauk Otdel. Khim. Nauk* **1946**, 447-53.—*C.A.* **43**, 6063*g*.

The reactions taking place on $Co\text{-}ThO_2$ (100:18), $Ni\text{-}Mn\text{-}Al_2O_3$ (100:20:10), and $Fe\text{-}Cu\text{-}ThO_2\text{-}K_2CO_3$ catalysts were studied. The catalysts were deposited on marshallite in a 1:1 ratio. With the Co and Ni catalysts the hydrogenation reaction (2 $CO + H_2 \rightarrow CO_2 + CH_2 \rightarrow CH_2)_n$) took place much faster than the carbide formation (2 $CO \rightarrow CO_2$ + carbide C).

10603. Eĭdus, Ya. T. and Pusitskiĭ, K. V. **Catalytic hydrocondensation of carbon monoxide with ethylene.** *Compt. rend. acad. sci. U.R.S.S.* **54**, 35-8 (1946) (in English).—*C.A.* **41**, 3741*h*.

Using Co, two Co catalysts, the catalytic interaction of C_2H_4 with CO in the presence of H_2 at 760 mm pressure, was studied. A hydrocondensation reaction of CO with C_2H_4 in the presence of H_2 took place; 75% by vol. of liquid product was formed at the expense of the initial C_2H_4. The presence of a considerable amt. of O-contg. compds. was detected, particularly alcs.

10604. Elovich, S. Ya.; Zhabrova, G. M.; Margolis, L. Ya., and Roginskiĭ, S. Z. **Laws underlying the selection of catalysts for complete oxidation of organic compounds.** *Compt. rend. acad. sci. U.R.S.S.* **52**, 421-3 (1946).—*C.A.* **41**, 1538*g*.

The catalytic activity and stability of a no. of metals, oxides, and combinations of oxides were detd. Nontransitional elements and colorless oxides of transitional elements failed to show appreciable activity. Cr_2O_3, MnO_2, and NiO were quite active at first but soon lost their activity.

10605. Erchak, Michael, Jr., and Ward, Roland. **Catalytic properties of the products of the solid phase reaction between barium carbonate and ferric oxide.** *J. Am. Chem. Soc.* **68**, 2093-6 (1946).—*C.A.* **41**, 24*e*.

CO with excess O_2 (free from CO_2 and H_2) was passed over a given wt of catalyst at a const. rate at 325 °C. The CO_2 formed was detd. Catalysts corresponding to various compns. and temps. of prepn. were tested. Contour diagrams were prepd. in which the temps. of prepn. were the ordinates, the compns. of the original mixts. the abscissas, and the lines of the contours connected points corresponding to equal catalytic activity.

10606. Evans, A. G.; Holden, D.; Plesch, P.; Polanyi, M.; Skinner, H. A., and Weinberger, M. A. **Friedel-Crafts catalysts and polymerization.** *Nature* **157**, 102 (1946).—*C.A.* **40**, 2105^8.

Expts. on the polymerization of isobutene and the dimerization of diisobutene with Friedel-Crafts catalysts showed that a 3rd component, probably water, was necessary for rapid reaction. With small amts. of catalyst the extent of the reaction depended on the amt. of BF_3.

10607. FARAGHER, W. F. AND HORNE, W. A. **Manufacture and regeneration of catalysts at I. G. Farbenindustrie A.-G. plants, Ludwigshafen/ Oppau, Germany.** *U.S. Bur. Mines*, Circ. **7368**, 6 pp. (1946).—*C.A.* **40**, 7535^8.

The method of making and regenerating the 4 principal catalysts for high-pressure synthesis of hydrocarbons was described and flow sheets given. Four addnl. catalysts were described briefly.

10608. FISHER, F. E.; WATTS, H. C.; HARRIS, G. E., AND HOLLENBECK, C. M. **Catalytic conversion of hydrocarbons. Catalytic promoting effect of antimony tetroxide in the aromatization of hydrocarbons with a chromia-alumina catalyst.** *Ind. Eng. Chem.* **38**, 61-4 (1946).—*C.A.* **40**, 1647^8.

CrO_3 was deposited on Al_2O_3 and the dried and ignited catalyst contained 8 wt % of Cr_2O_3. To this catalyst, moistened with acetone, was added Sb_2O_5 sufficient to make the Sb_2O_5 content of the final dried and ignited mass from 8 to 10%. The Sb_2O_4 acted as a promoter in the dehydrogenation and cyclization reactions and the yields of aromatic hydrocarbons were improved. The catalyst in use underwent 65 regenerations with little loss of activity. When heptane was cyclized, 24% of the charge was lost in fragmentation. The yield of aromatic hydrocarbons, chiefly toluene, was 25.7% of the theoretical. Carbon formation on the catalyst and losses in handling and measuring accounted for 12.5% of the charge.

10609. FREĬDLIN, L. KH.; BALANDIN, A. A.; LEBEDEVA, A. I., AND FRIDMAN, G. A. **The mechanism of the vapor-phase catalytic substitution of hydroxyl for aryl halogen.** *Acta Physicochim. U.R.S.S.* **21**, 55-79 (1946).—*C.A.* **40**, 5627^9.

Silica gel was used as a catalyst for the replacement of aryl halogen by OH. Only Cu and its salts promoted the action of silica gel, whereas other salts decreased it. A theory based on the formation of intermediate silicate esters was proposed.

10610. FROST, A. V. **Kinetics of catalytic cracking.** *Vestnik Moskov. Univ.* **1946**, No. 3/4, 111-17.—*C.A.* **42**, 2850*a*.

The formula was derived: $v_0 \ln[1/(1 - y)] = \alpha + \beta v_0 y$, where y = degree of conversion of the initial reactant, v_0 = vol. of reactant fed into the catalytic space per unit of time, the consts. α and β depended on the products b_1 and b_i of the adsorption coeffs. of the initial substance and of the reaction products by the corresponding stoichiometric mol. no. and the pressure, on the increase n of the total no. of mols., the surface area S of the catalyst, and the 1st-order rate const. k_1 at the surface, in the form $\alpha = k_1 b_1 S/(1 + n + \Sigma\ b_i)$ and $\beta = (n - b_1 + \Sigma b_1)/(1 + n + \Sigma b_i)$. The disproportionation of H_2 (decrease of the iodine no.) in a cracking-gasoline fraction b. 100-150°C, over an activated clay and a synthetic aluminosilicate catalyst of area 250-300 m^2/g was explained.

10611. GOL'DANSKIĬ, V. I. AND CHIRKOV, N. M. **Heterogeneous ionic catalysis. (Study of esterification and of hydrolysis of esters in the vapor phase.)** *J. Phys. Chem.* (U.S.S.R.) **20**, 1333-45 (1946) (in Russian).—*C.A.* **41**, 2973*a*.

The reaction between EtOH and AcOH vapors at 75°C in a glass vessel was immeasurably slow, but was much accelerated by HCl (1-36% of AcOH). In the presence of HCl the equil, between equimol. amts. of EtOH, AcOH, EtOAc, and H_2O was reached at 92 mol. % of EtOAc. The rate of esterification up to 40% transformation was independent of time, and the reaction was completely heterogeneous. The above esterification was the first example of a heterogeneous catalysis in a multimol. adsorption layer.

10612. GOL'DANSKIĬ, V. I. AND ELOVICH, S. YU. **Catalytic hydrogenation of organic compounds in the liquid phase. II. Kinetics of hydrogenation of oleic acid.** *J. Phys. Chem.* (U.S.S.R.) **20**, 1085-93 (1946) (in Russian).—*C.A.* **41**, 2973*e*.

Solns. of 0.7 g of oleic acid in 20 ml of AcOH $+ Ac_2O$ were shaken with H_2 in the presence of 0.1 g of Pt on $BaSO_4$. The rate of consumption of H_2 increased with the rapidity of shaking up to 300 (at 15°C) or 600 (at 40°C) shakes per min. and remained const. at a more intense agitation. It was concluded that below 300-600 shakes the rate v of reaction was detd. by diffusion, and at higher frequencies by the kinetics of the chem. process.

10613. GOL'DANSKIĬ, V. I.; SEMENOV, N. N., AND CHIRKOV, N. M. **Heterogeneous catalysis in polymolecular adsorption layers.** *Compt. rend. acad. sci. U.R.S.S.* **52**, 777-9 (1946) (in English).—*C.A.* **41**, 5371*f*.

EtOH was esterified with AcOH in the presence of 0.6-18.0% HCl at 56-336 mm and 45-82°C with varying surface area of the glass vessel. The rate of the initial zero-order reaction was proportional to the area. Equil. was obtained at 92% esterification in the adsorbed layer as compared with 66% in the liquid phase, but the temp. coeff. were practically identical.

10614. GORDON, ALVIN S. **Uncatalyzed reaction of natural gas and steam.** *Ind. Eng. Chem.* **38**, 718-20 (1946).—*C.A.* **40**, 5545^8.

The uncatalyzed reaction of natural gas with steam was studied in a porcelain reaction chamber between 1225° and 1516°C with gas to steam ratios of 1.5 and 5, and contact times, t, between 0.21 and 4.6 sec. The extent of carbonization was a function of the gas to steam ratio and varied erratically with temp. and t; there was some carbonization even at high temps., long t, and a gas to steam ratio of 5.

10615. HASEGAWA, SHIGEO. **Organic peroxides. II. The decomposition of ethyl hydroperoxide catalyzed by platinum solution.** *Rev. Phys. Chem. Japan, Shinkichi Horiba Commen.* Vol. **1946**, 21-30.—*C.A.* **44**, 4319*e*.

The decompn. velocity of Et hydroperoxide and of H_2O_2 in aq. soln. catalyzed by a Pt sol was measured by iodometric and manganometric titrations, resp., between 30 and 50°C. The decompn. proceeded like that of Me hydroperoxide. After an initial stage of rapid decrease of the rate, the main stage was a 1st-order reaction with an apparent activation energy of 15 kcal/mole in the case of Et hydroperoxide and of 11.6 kcal/mole in the case of H_2O_2.

10616. HEILMANN, RENÉ; DUBOIS, JACQUES E., AND BEREGI, LADISLAS. **Preparation and activation of Raney nickel.** *Compt. rend.* **223**, 737-9 (1946). — *C.A.* 41, 6376*e*.

Ni catalyst was prepd. by 2 methods and platinized by two methods. The effect of the Pt was a function of the method of introduction and of the activity of the Ni.

10617. HERBO, CL. AND HAUCHARD, V. **The mechanism of catalytic reactions. V. Contributions to the study of promotion.** *Bull. soc. chim. Belges* **55**, 177-201 (1946). — *C.A.* 41, 4368*h*.

The activity of a catalyst was expressed by the kinetic coeff., *k*, of the elementary process constituting the slowest step in the over-all reaction. From the effect of temp. on *k* it was possible to decide whether the variation of the activity from one catalyst to another was due to the quality or the quantity of active centers. The activities of a series of Ni-BeO catalysts for the hydrogenation of benzene showed that the no. of active centers varied, but the quality of the centers was unchanged. The curve for active surface per g of Ni approached asymptotically a horizontal limit for increasing quantities of BeO promoter.

10618. HICKINBOTTOM, W. J. **Activation of catalysts in olefin reactions.** *Nature* **157**, 520 (1946). — *C.A.* 40, 4282^5.

Neither BF_3 nor $AlCl_3$ alone caused polymerization of olefins; promoters such as HCl or traces of H_2O must also be present. Olefins reacted with isoparaffins in the presence of BF_3 or $AlCl_3$ with HCl, inorg. halides, H_2O, HF, or finely divided metals as promoters.

10619. HINSHELWOOD, C. N. **The more recent work on the reaction between hydrogen and oxygen.** *Proc. Roy. Soc.* (London) **A188**, 1-9 (1946). — *C.A.* 41, 3349*b*.

Chain mechanisms were reviewed and the various explosion limits discussed. Effect of the state of the walls was considered, particularly the coating of the reaction vessel walls with salts. The mechanism of the removal of radicals at the surface was discussed, particularly with reference to a wall coated with KI.

10620. JAGITSCH, ROBERT AND BENGTSON, BO. **Investigation of the reaction kinetics in the system lead oxide-lead silicate.** *Arkiv. Kemi, Mineral Geol.* **A22**, No. 6, 18 pp (1946) (in German). — *C.A.* 41, 5369*d*.

For the reactions $PbO + PbSiO_3 \rightarrow Pb_2SiO_4$ and $2\ PbO + Pb_2SiO_4 \rightarrow Pb_4SiO_6$ the rates of reaction followed the expression: $dm/dt = \text{const.}/m$, where m was the quantity of product formed. For the cell $Pt|PbO|Pb_2SiO_4|PbSiO_3|Pt$ at 680°C the e.m.f. was about 0.01 v., and the sp cond. of lead orthosilicate from 570° to 715°C was given by $48\exp(-25{,}500/RT)$ ohm cm. The small cond. indicated that the reaction was not due to migration of ions, but to uncharged PbO mols.

10621. JAGITSCH, ROBERT AND PERLSTROM, GUNVOR. **Investigation of the reaction kinetics in the system MgO-$Mg_2P_2O_7$.** *Arkiv. Kemi, Mineral Geol.* **A22**, No. 5, 16 pp. (1946) (in German). — *C.A.* 41, 5369*b*.

Pellets of MgO and $Mg_2P_2O_7$ placed in contact and heated to 890°-1050°C formed $Mg_3(PO_4)_2$. The pellets and product film were easily sepd. By x-ray diagrams, by marking the original interface with Pt black, or by impregnating either MgO or $Mg_2P_2O_7$ with $Ra(NO_3)_2$, it was shown that the product $Mg_3(PO_4)_2$ was formed on both sides of the original contact film. The elec. cond. of $Mg_3(PO_4)_2$ at these high temps. showed a transference no. = 1 for Mg^{++}.

10622. KAGAN, M. YA. AND FLID, R. M. **Kinetics and mechanisms of catalytic hydro-dehydrogenation reactions. I. The kinetics of the dehydrogenation of cyclohexane and methylcyclohexane in the presence of a hydrogen acceptor.** *Acta Physicochim. U.R.S.S.* 21, 358-76 (1946) (in English); *J. Phys. Chem.* (U.S.S.R.) 20, 503-16 (1946). — *C.A.* 40, 6950^6.

The kinetics of the reaction $C_6H_{12} + C_6H_5CH_3 \rightleftharpoons C_6H_6 + C_6H_{11}CH_3$ were studied in both forward and reverse directions over a 16% Pd on silica gel and 20% Cr_2O_3 on silica gel catalyst. The temp. range was 125-170°C for the Pd, 327-366°C for the Cr_2O_3 catalyst. No H_2 was evolved. The activation energies of the forward and reverse reactions were equal, ~ 10-kcal on Pd and ~ 13 kcal on Cr_2O_3. Dehydrogenation of cyclohexane over Cr_2O_3 in absence of a H acceptor (with liberation of H_2) had an activation energy of 40 kcal.

10623. KIPERMAN, S. AND TEMKIN, M. **Kinetics of ammonia synthesis on molybdenum catalyst.** *Acta Physicochim* 21, 267-82 (1946) (in English); *J. Phys. Chem.* (U.S.S.R.) 20, 369-78 (1946). — *C.A.* 40, 6950^9.

A flow system was used with 2 ml of Mo catalyst prepd. by reducing ammonium molybdate in NH_3 for 20 hrs at 600-650°C. X-ray diffraction patterns indicated the presence of metallic Fe and Mo_2N. The apparent activation energy of NH_3 decompn. on Mo catalyst as calcd. from the synthesis rate was 42.5 kcal/mole. The NH_3 synthesis on Fe and Mo had the same mechanism.

10624. KLIMENOK, B. V. **Tubular laboratory furnace for the study of catalytic processes by flow method.** *J. Applied Chem.* (U.S.S.R.) 19, 1231-2 (1946) (in Russian). — *C.A.* 41, 6083*d*.

A tube of Mo glass of 2.5 cm diam. had an axial sheath for the thermocouple, 3 side tubes at the upper end for introduction of the catalyst, the starting material, and, if necessary, a gas (air), and a three-way stopcock at the lower end for removal of the products. The tube could be heated to 500°C with 250-400 watts and reached that temp. in 20-30 min. Between 200° and 600°C the temp. was uniform over a length of about 15 to about 55 cm from the upper end.

10625. KOROBOVA, M. I. AND KOROBOV, N. I. **Catalytic agents for the reduction process in blast furnaces.** *Bull. acad. sci. U.R.S.S., classe sci. tech.* **1946**, 567-77. — *C.A.* 42, 8737*a*.

Since H_2 was more effective than CO in reducing iron ore above 840°C, addn. of 2-9% steam to the blast was tried. During a 23-day test in a Magnitogorsk furnace, the av. production rate with steam added was 1455 tons per day as compared to 1135 on dry blast. The blast temp. was maintained at 750-800°C when steam was added. The addn. of steam increased production from 1000 to 1113 tons per day, the blast temp. ranging from 500° to 730°C.

10626. Lavrovskiĭ, K. P. and Mikhnovskaya, A. A. **Catalytic alkylation of hydrocarbons as method of production of motor fuels.** *Bull. acad. sci. U.R.S.S., Classe sci. tech.* **1946**, 1589-602 (in Russian).—*C.A.* **41**, 3283*c*.

Gas-phase alkylation of aromatic hydrocarbons with paraffin-olefin mixts. was studied with 3 synthetic aluminosilicate catalysts and three activated natural aluminosilicates, askanite, gumbrin, and Zikeev clay. The clays (250 g), finely ground and wetted with 900 ml water, were treated with 176.5 ml of 35.39% HCl, dried for 2 hrs at 100°C, washed, decanted, and dried on the filter, then in a drying oven until cessation of evolution of water vapor. The expts. were carried out in a catalyst vol. of 100 ml.

10627. Lel'chuk, S. L.; Vaskevich, D. N.; Belen'kaya, A. P., and Dashkovskaya, F. A. **Kinetics of the direct esterification of alcohol. I. Effect of promotors on the reaction velocity.** *Izvest. Akad. Nauk S.S.S.R., Otdel Khim. Nauk* **1946**, 191-200.—*C.A.* **42**, 6630*g*.

The catalysts were prepd. by pptg. with alkali from Cu acetate and the nitrate of the corresponding promotor, washing to neutral, and drying at 100°C. The yields of reactions $EtOH \rightarrow AcH + H_2$, $AcH + H_2O \rightarrow AcOH + H_2$, $EtOH + AcOH \rightarrow AcOEt + H_2O$ satisfied the Arrhenius linear relation between log k and 1/T (assuming the yield to represent the reaction velocity k) on Cu-Zn, Cu-Fe, Cu-Zr, and Cu-Ce catalysts. The apparent activation energies were calcd.

10628. Luntz, D. M. and White, E. A. **A résumé of the development of thermofor catalytic cracking.** *Calif. Oil World* **39**, No. 17, 11-16; No. 18, 37-42 (1946).—*C.A.* **40**, 7579^7.

Thermofor Catalytic Cracking units the catalyst moved downward countercurrent to the oil vapors. Spent catalyst was transferred by means of continuous bucket-type elevators to the regenerator and back to the reactor. Modifications of the original design included a larger-size catalyst (4-10 mesh).

10629. Mankash, E. K.; Borisova, G. P.; Orochko, D. I., and Frost, A. V. **Kinetics of catalytic cracking of paraffin over activated aluminum silicate.** *Neftyanoe Khoz.* **24**, No. 6/7, 26-34 (1946).—*C.A.* **41**, 2879*h*.

The cracking of a wax (mol. wt 320) in a reaction tube packed with activated aluminum silicate catalyst conformed closely to a unimol. consecutive reaction. The velocity const. slightly decreased at low feed rates. The apparent energy of activation, calcd. from these equations, was 13,-550 for the overall decompn. of the feed, 16,400 for the decompn. of cracked gasoline, 11,900 for the formation of gasoline and 15,000 cal mol. for the decompn. of the residue recycled to the second pass.

10630. Margolis, Ya. L. and Todes, O. M. **The kinetics of exothermal catalytic reactions in a current. II. Theory of reaction on a short contact layer.** *Inst. Phys. Chem. Moscow,* **21**, 885-98 (1946) (in English).—*C.A.* **41**, 3356*h*.

Two steady regimes for a comparatively short reactor, "quiet reaction" and "combustion regime", were established. For an unsteady extinction regime, the rate of cooling of the reactor and the activity of the catalyst were connected by an almost linear relation; this permitted the development of a simple method of evaluating the relative activities of catalysts for a given reaction.

10631. Margolis, L. Ya. and Todes, O. M. **The kinetics of catalytic oxidation in a stream—oxidation of isoöctane.** *Compt. rend. acad. sci. U.R.S.S.* **52**, 515-18 (1946) (in English); *Doklady Akad. Nauk S.S.S.R.* **52**, 519-22 (1946) (in Russian).—*C.A.* **41**, 4028*c*.

Air-isoöctane streams were passed over 8 spinel-like catalysts at 300-600°C. The catalyst concn., spread on asbestos, varied from 0.5 to 67%. Similar Pt and Pd catalysts contd. 0.05-0.1% metal. The products were practically stoichiometric CO_2 and H_2O. By variation of isoöctane concn. the reaction was found to be second order and independent of O_2.

10632. Martinuzzi, Enzo A. **Catalytic oxidations in the gas phase. Vanadium pentoxide as catalyst.** *Rev. facultad quim. ind. y agr.* **15/16**, No. 26, 97-107 (1946/47).—*C.A.* **42**, 8058*h*.

Catalysts of Ag metavanadate, V_2O_5, V_2O_5 with Fe, Ca, and K, were prepd. on silica gel and infusorial earth; also a zeolitic structure of Cr_2O_3, SnO_2, SiO_2 with 10% gypsum. Oxidation of SO_2 and of EtOH were studied with different catalysts temps., space velocities, and compns. of gases. Best conversion of SO_2 occurred with SO_2 7-8% of the entering gas and Ag metavanadate, and Fe, Ca, and K.

10633. Maxted, E. B. and Marsden, Arthur. **The catalytic removal of organic sulfur compounds from coal gas by metallic thiomolybdates.** *J. Soc. Chem. Ind.* **65**, 51-2 (1946).—*C.A.* **40**, 3868^6.

The S-content of coal gas was reduced by destructive hydrogenation with $CoMoS_4$ supported on bauxite granules as a catalyst. The H_2S was removed by adsorption with iron oxide or $Cu_3(PO_4)_2$. At 450-480°C at a space velocity of about 750, the S-content was reduced from about 18 grains per ft^3 to below 5 grains. Under these conditions the catalyst could be used continuously for over a month without revivification.

10634. Moldavskiĭ, B. L. and Bezedel, L. S. **Aluminum silicate-catalyzed dealkylation of side chains in aromatic hydrocarbons.** *J. Gen. Chem.* (U.S.S.R.) **16**, 1633-42 (1946) (in Russian).—*C.A.* **41**, 4779*b*.

The catalyst, a natural Gruzin (Georgian) bleaching clay, finely ground, was activated by 20% HCl in the cold during a few days, washed, dried at 100°C, pressed, and granulated to 2-3 mm. The reactions were carried out uniformly at 410°C, 1.5 vols. hydrocarbon per 1 vol. catalyst, for 1 hr, with 14 compds. The mechanism of the silicate catalysis was interpreted in terms of a formation of a complex between the alkylbenzene and the neg. charged O atoms of the catalyst, polarization of the alkyl-ring bond, exchange of alkyl against proton, and desorption of C_6H_6 from the catalyst.

10635. MORA, A.; BLASCO, E., AND DOBLAS, J. **Catalytic aromatization of Puertollano gasoline.** *Combustibles (Zaragoza)* 6, No. 31/32, 3-22 (1946).—*C.A.* 42, 8449*g*.

Varying catalysts, temps., and pass velocities were tested to det. optimum conditions. With a Cr_2O_3 catalyst deposited on silica gel at 550 °C and a velocity of 0.3 ml/hr/ml of catalyst zone, 49% of liquid product was obtained of which 63% was aromatic (13% of total aromatic compds. was benzene, 43% toluene). This optimum catalyst decreased in activity after 30 hrs but could be almost completely regenerated. Higher temps. increased the percentage yield of aromatic compds. in the total liquid, but reduced the yield.

10636. NICOLAI, J.; D'HUNT, M., AND JUNGERS, J.C. **Synthesis of methane from carbon dioxide and hydrogen over nickel.** *Bull. soc. chim. Belges* 55, 160-76 (1946).—*C.A.* 41, 4699*a*.

The kinetics were compared for the hydrogenation of CO and CO_2 over Ni in the range 0.1 to 1 atm. and 180-300 °C. Kinetics of the CO-H_2 reaction indicated that H_2 was feebly adsorbed, CO strongly adsorbed by Ni. The velocity was not significantly affected by the presence of the products. Reaction was more rapid when D_2 was used in place of H_2. Kinetics of the CO_2-H_2 reaction indicated that both reactants were weakly adsorbed, the products retarded the reaction and D_2 behaved exactly like H_2.

10637. NIKOLAEV, L. A. AND KOBOZEV, N. I. **The "catalase" properties of cobalt and nickel ions.** *J. Phys. Chem.* (U.S.S.R.) 20, 145-50 (1946).—*C.A.* 40, 5626^9.

$CoSO_4$ and $NiSO_4$, either in aq. soln. or adsorbed on asbestos, Al_2O_3, $BaSO_4$, H_2SnO_3, or charcoal, did not greatly accelerate the decompn. of dil. H_2O_2. Co^{++} and Ni^{++} adsorbed by silica gel were a little more active. The "catalase" activity of a Ni^{++} ion on silica passed through one, and that of a Co^{++} ion through two maxima when the ratio metal: silica increased.

10638. OBRYADCHIKOV, S. N. AND MARUSHKIN, B. K. **Investigation of the fluid catalyst process.** *Neftyanoe Khoz.* 24, No. 11, 36-45 (1946).—*C.A.* 41, 3946*c*.

The laws relating to the behavior of finely divided solid particles in conditions simulating the fluid catalyst process were studied on models made of glass, by using fine sand suspended in a stream of water. The pressure losses were directly proportional to the weight of the particles in the fluidized layer. In a system with continuous circulation of the catalyst from the bottom towards the top, the concn. of the catalyst at various levels of the reactor were detd. by measuring the pressure gradient at the different levels.

10639. PANCHENKOV, R. M. AND TOPCHIEVA, K. V. **Kinetics of the disproportionation of hydrogen in gasolines over aluminosilicate catalysts of various compositions.** *Vestnik Moskov. Univ.* 1946, No. 2, 39-46.—*C.A.* 42, 3163*d*.

Six catalysts were studied with various silica and Al_2O_3 contents: 100,0; 90, 10; 84,16; 70,30; 50,50; 0,100. Silica and alumina gels were mixed and formed into cubes, dried 6-7 hrs at 40-50 °C, then 48 hrs at 170 °C, and heated in an air stream 4 to 5 hrs at 500 °C. The effect of these catalysts on a cracking-gasoline fraction was followed by detn. of I_2 number.

10640. PAUL, R. **The activation of Raney nickel by the addition of metals other than the precious metals.** *Bull. soc. chim.* 1946, 208-11.—*C.A.* 40, 6380^9.

Raney catalysts prepd. from alloys of Al, Ni, and Co, Cr or Mo in the ratio 52% Al to 48% other two metals were compared as catalysts for the hydrogenation of safrole, benzonitrile, and furfural. The added metals acted as promotors for Ni at 3-10% concn. in the catalyst.

10641. PAVLIC, A. A. AND ADKINS, HOMER. **Preparation of a Raney nickel catalyst.** *J. Am. Chem. Soc.* 68, 1471 (1946).—*C.A.* 40, 6763^2.

Details were given of the prepn. of a Raney Ni catalyst from the Ni-Al alloy at approx. 50%C. It was more active, particularly below 100 °C, than the catalyst prepd. by other methods.

10642. PEARCE, A. W. **Catalytic cracking for gasoline production.** *Trans. Inst. Chem. Engrs.* (London) 24, 133-40 (1946).—*C.A.* 43, 6814*c*.

The advantages of catalytic over thermal cracking were presented. Operating details of the Houdry process were discussed in which one ounce of catalyst per barrel of feed was usually consumed. The operating details of the Thermofor, Fluid catalytic, and small-scale Universal Oil Products M-S fluid process were also discussed.

10643. POLANYI, M. **Activation of catalysts in olefin reactions.** *Nature* 157, 520 (1946).—*C.A.* 40, 4282^4.

The reaction of isobutene with $TiCl_4$ at low temp. was induced by traces of H_2O but not affected by dry HCl.

10644. PORTER, RICHARD W. **Unusual techniques feature the production of synthetic bead catalyst.** *Chem. & Met. Eng.* 53, No. 4, 94-8, 138-41 (1946).—*C.A.* 40, 4185^1.

The process was described with aid of a flowsheet.

10645. PSHEZHETSKIĬ, S. A. AND RUBINSHTEIN, R.N. **Kinetics of heterogeneous reactions on porous catalysts.** *J. Phys. Chem.* (U.S.S.R.) 20, 1127-36 (1946) (in Russian); *Acta Physicochim. U.R.S.S.* 21, 1075-88 (1946) (in English).—*C.A.* 41, 2972*c*.

The diffusion of the reactants to the surface of a porous catalyst was discussed. Conditions were defined under which (a) no hydrodynamic flow was created by the reaction, (b) diffusion of only one reactant had to be considered, and (c) the temp. gradient within the catalyst grain had a measurable effect.

10646. RADLOVE, S. B.; TEETER, H. M.; BOND, W.H.; COWAN, J. C., AND KASS, J. P. **Catalytic iso-**

merization of vegetable oil. Nickel catalysts. *Ind. Eng. Chem.* 38, 997-1002 (1946).—*C.A.* 40, 7656^2.

Catalysts, effective for the isomerization of vegetable oils to conjugated forms, were diatomaceous earth and carbon black, Ni on kieselguhr, and Ni on carbon black. These catalysts did not split ester linkages. Ni-on-carbon was most effective, particularly when prepd. by the reduction of a suitable Ni salt on Nuchar XXX or Nuchar C-190. When 6-8% of reduced catalyst was heated for 6 hrs at 170°C with alkali-refined soybean or linseed oil, 30-45% conjugation was obtained. A sample of catalyst could be used to isomerize 5 to 10 batches of oil before its activity was lost.

10647. Riesz, C. H.; Komarewsky, V. I.; Kane, L. J.; Estes, Frances, and Lurie, Pierre. **Catalytic gasification of higher hydrocarbons.** *Am. Gas Assoc. Monthly* 28, 159-64 (1946).—*C.A.* 40, 3334^7.

Ni catalysts (5, 10, and 15% by wt) supported on Al_2O_3 were tested for activity in the steam-hydrocarbon reaction at 527°, 727°, and 827°C. Propane (99.9% pure) and hexane (75% hexane and 25% methylcyclopentane) showed nearly complete conversion to CO_2, CO and H_2. Carbon deposition on the catalyst was avoided by the employment of high steam-hydrocarbon ratios. Addnl. H_2 or air was found to suppress carbon formation.

10648. Roginskiĭ, S. Z. and Todes, O. M. **Kinetics of catalytic reactions in a flow system. I. Dynamics of processes at constant activity of the catalyst.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* 1946, 381-9.—*C.A.* 42, 8054*i*.

A differential equation was developed and solved relating the change in concn. with distance from the entrance of the reaction space, no. of active centers, order of the reaction, and the chem. reaction rate const. Generally, the higher the order of the reaction, the longer was the zone over which the reaction extended. The fall of the stationary-state concn. along the tube, for a reaction governed by a Langmuir-type law, was intermediate between the line corresponding to zero order (steepest fall) and the 1st-order curve. This type of kinetics held for cases where adsorption on the catalyst surface was established practically momentarily, and the chem. reaction was of the 1st-order with respect to the surface concn.

10649. Roginskiĭ, S. Z. and Todes, O. M. **Kinetics of catalytic reactions in a flow system. III. Dynamics of processes in the presence of catalyst poisons.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* 1946, 475-81.—*C.A.* 42, 8055*h*.

The case of a poison carried by the gas stream and adsorbed on consecutive layers of the catalyst column was treated. On passing consecutive layers of the column, the rate of sorption of the poison fell continuously. The head of the sorption wave, with a low concn. of the reactant, moved along with the gas stream with the velocity u. The tail of the wave, where the concn. of the reactant had reached its final value, moved at the considerably lower velocity v. The width of the wave increased proportionally to the time.

10650. Roy, A. N. **The catalytic formation of diolefins from monoölefins. II. Poisoning and promotion of chromium oxide catalysts in the dehydrogenation of monoölefins to diolefins.** *Proc. Natl. Inst. Sci.* 12, 103-6 (1946).—*C.A.* 42, 3246*b*.

The yield of butadiene decreased progressively from 30.8 to 11.3% as the preliminary drying period for the catalyst was increased from 7 to 39 hrs. Na vapor did not affect the reaction and did not promote polymerization. The introduction of 10% P_2O_5 into the catalyst lowered the yield but did not promote polymerization. Small amts. (1.0-1.5%) of S promoted the activity of the catalyst, but the products contained H_2S. In the dehydrogenation of 3-methyl-1-butene to isoprene over Cr_2O_3 at 330-400°C and at 15-30 mm progressive deactivation of the catalyst occurred, but its activity could be restored by treatment with H_2.

10651. Roy, A. N. **The catalytic formation of diolefins from monoölefins. III. Catalytic dehydrogenation of 1-butene in the presence of air at reduced pressure.** *Proc. Natl. Inst. Sci.* 12, 107-10 (1946).—*C.A.* 42, 3246*d*.

The presence of approx. an equal vol. of air increased the yield of butadiene although equil. was not reached. Over a $Cr_2O_3$80, $Al_2O_3$5, Cu 15% catalyst at 500°C and 300 mm 1-butene and air in a 61:39 vol. ratio yielded 47.4% butadiene. Increasing the vol. of air lowered the yield. Expts. with equal vols. of air and 1-butene were made at 500-50°C and at pressures of 160-230 mm. The yield reached 34.9% at 550° and 165 mm with a space velocity of 56.8.

10652. Rubinshteĭn, A. M. and Fribitkova, N. A. **Primary submicroscopic crystals in heterogeneous catalysis.** *Acta Physicochim. U.R.S.S.* 21, 79-100 (1946) (in English).—*C.A.* 40, 6325^9.

The activity, selectivity, and activation energy of MgO catalysts were studied in relation to their phys. structure. Samples were selected by x-ray analysis on the basis of primary crystal size and crystal lattice consts. Their activity was detd. for the conversion of butanol at 400°-460°C to butyraldehyde by dehydrogenation and butylene by dehydration. Catalysts with normal MgO lattice spacing and crystal size of 22-63 A. showed max. activity for both butyraldehyde by dehydrogenation and butylene by dehydration in the size range 25-30 A.

10653. Saegebarth, E. O. **Catalytic reforming process of Standard Oil Company of California.** *Petroleum Engr.* 17, No. 8, 95-100 (1946).—*C.A.* 40, 5911^4.

A charging stock of gasoline boiling range was reformed over a co-pptd. Al_2O_3-MoO_3 catalyst to dehydrogenate naphthenes and produce toluene or xylenes. Nitration-grade toluene was produced by isolating a product of 85-90% purity and reforming this product over the catalyst to increase the toluene content.

10654. Sakaki, Tomohiko. **Heterogeneous catalytic hydrogenation in gaseous systems. I. Reaction of acetylene and steam.** *J. Chem. Soc. Japan* 67, 117-19 (1946).—*C.A.* 45, 538*g*.

C_2H_2 and steam were passed over a ZnO catalyst at 300-550 °C. The ZnO was prepd. by heating $Zn(OH)_2$ at 450 °C in a quartz reaction tube. The C_2H_2 flow was 100 ml/min., and the C_2H_2:H_2O ratio was 1:13. The following reactions probably took place: $C_2H_2 + H_2O = CH_3CHO$; $2C_2H_2 + 3H_2O = (CH_3)_2CO + CO_2 + 2H_2$; $C_2H_2 + 2H_2O = CH_3CO_2H + H_2$; and $2C_2H_2 + 4H_2O = CH_3CO_2H + CO_2 + 2H_2 + CH_4$.

10655. Selwood, Pierce W.; Hill, Fred N., and Boardman, Harold. **A new magnetic effect applied to the structure of catalytically active soils.** *J. Am. Chem. Soc.* **68**, 2055-9 (1946).—*C.A.* **41**, 23*b*.

Magnetic susceptibility measurements were applied to catalytically active solids such as Cu-Cr_2O_3 to indicate oxidation states and structural properties in these substances. The magnetic properties of a supported transition group oxide approached those of the same element at high magnetic diln. The anomalous temp. coeff. of susceptibility shown by pure Cr_2O_3 was not due to Cr—O bonds, but rather to Cr-Cr interaction. Measurements were also made in catalysts consisting of MoO_3 supported on γ-Al_2O_3 and on a group of the so-called "chromite" catalysts.

10656. Suito, Eiji. **Studies of colloidal catalysts by thermal analysis of reaction velocity. VII. The permanent poisoning of catalysts.** *Rev. Phys. Chem. Japan, Shinkichi Horiba Commem. Vol.* **1946**, 35-41.—*C.A.* **44**, 4319*g*.

The permanent poisoning of H_2O_2 decompn. in the presence of Pt sol by $HgCl_2$, $Hg(CN)_2$, KCN, and KCl was studied. In the case of $HgCl_2$ and $Hg(CN)_2$ the activity of the catalyst decreased in proportion to the log of the poison concn.; with KCl the log of the activity had a linear relation to the log of the poison concn.; with KCN no simple relation was found. The poisoning was complete when a unimol. film of poison covered the Pt surface.

10657. Sussman, Sidney. **Catalysis by acid-regenerate cation exchangers.** *Ind. Eng. Chem.* **38**, 1228-30 (1946).—*C.A.* **41**, 839*b*.

Acid-regenerated cation exchangers were applied as esterification catalysts in acetal synthesis, ester alcoholysis, acetal alcoholysis, alc. dehydration, ester hydrolysis, and sucrose inversion. These catalysts simplified the procedures for reactions involving high-boiling and viscous compds., because the catalysts could be sepd. from the reaction products by simple filtration. Compds. which polymerize in the presence of acid, such as furfural, were esterified directly by cation exchangers.

10658. Tamura, Mikko and Shida, Shoji. **Comparison of the catalytic activities of some solid salts in the recombination of hydrogen free atoms (atomic hydrogen) and hydroxyl free radicals (free hydroxyl radicals).** *Rev. Phys. Chem. Japan, Shinkichi Horiba Commens. Vol.* **1946**, 115-20.—*C.A.* **44**, 1313*f*.

Water vapor was passed through a Wood's discharge tube, past a thermometer coated with the solid salt, through a trap cooled with solid CO_2 and alc., and finally was removed by vacuum pumps. The rise in temp. was measured for KF, KCl, KBr, KI, KCl, NaCl, RbCl, LiCl, NaF, LiF, Li_2CO_3, Na_2SO_4, $NaNO_3$, K_2SO_4, NH_4Cl, KNO_3, $MgCl_2$, $Ca(NO_3)_2$, CaF_2, Pt, K_2CO_3, and glass. The order of catalytic activity decreased in the order Rb, K, Na, Li for carbonates, halides, and nitrates and in the order metal carbonates, nitrates, halides for K and Na salts.

10659. Tatievskaya, E. P. and Chufarov, G. I. **Kinetics of reduction and dissociation of metal oxides.** *Bull. acad. sci. U.R.S.S., Classe sci. tech.* **1946**, 1005-14 (in Russian).—*C.A.* **41**, 1538*h*.

The dissocn. pressure of CuO in the given temp. interval was about 10^7 times higher than that of Cu_2O. The rates of reduction of both oxides by H_2, however, were found to be approx. equal, in measurements with initial H_2 pressures of 200, 100, and 50 mm Hg, at 200 and 250 °C. The rate of dissocn. of CuO into Cu_2O and O_2 was a linear function of the difference between the equil. dissocn. pressure of O_2 and the prevailing pressure. The B.E.T. surface areas of CuO and Cu_2O were 0.203 and 0.167 m^2/g, resp., and accounted for the approx. equality of the rates of reduction.

10660. Temkin, M. and Pyzhev, V. M. **Methods of preparing a nonpyrophoric reduced catalyst for ammonia synthesis.** *J. Phys. Chem.* (U.S.S.R.) **20**, 151-2 (1946).—*C.A.* **40**, 5887³.

The com. catalyst for NH_3 synthesis was made nonpyrophoric if after reduction at 500 °C it was cooled in a N_2-H_2 mixt. and then treated with a mixt. of N_2, H_2, and 0.5-1% of air. The catalyst became covered with an oxide film, but was readily reduced by N_2-H_2 at 475 °C; this had no effect on its activity. The nonpyrophoric catalyst with H_2 formed 0.0006 to 0.0024 g H_2O/g catalyst.

10661. Ternisien, Jean and Mélot, H. F. **The catalysis of oxidation of combustible gases.** *Chimie & industrie* **57**, 11-21 (1946).—*C.A.* **41**, 5781*a*.

The catalysis of Mn, Ni, and Co catalysts, activated by Pt, was studied. With coal gas and a mixed Mn-Pt catalyst, the max. combustion temp. (940.5 °C) was obtained with 25% $PtCl_4$ to 100% $Mn(NO_3)_2$. With Co-Pt catalyst under the same conditions, the max. combustion temp. (940.5 °C) was obtained with 25% $PtCl_4$ to 100% $Co(OAc)_2$. The max. temp. with Pt alone was 928 °C.

10662. Todes, O. M. **Kinetics of exothermal catalytic reactions in flow. I. Theory of the reaction across a long layer of contact.** *Izvest. Akad. Nauk. S.S.S.R., Otdel. Khim. Nauk* **1946**, 47-56.—*C.A.* **42**, 6626*i*.

A theory was developed from the material balance per unit vol. of the catalyst column, and from the expression of the heat balance, including the heat of the reaction, the heat conveyed by the gas flow, that transmitted by conductance and that given up across the walls of the reaction tube. At not too high temps. T, in the kinetic region, c (concn. of reactants at time t) first increased with $(T - T_0)$, up to a max. of the order RT_0^2/E (where E = activation energy of the reaction), then fell off a little with further increasing T. On still further-rise of T. the reaction went over into the diffusional zone where *c* again increased with rising ($T - T_0$).

10663. Todes, O. M. **Kinetics of exothermal catalytic reactions in flow. II. Dynamics of processes on aging catalysts.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* **1946**, 483-8.—*C.A.* **42**, 6627*g*.

A stationary concn. wave was established along the tube; at a given time *t*, *c* decreased along *x*, the depth into the tube, from a high c_2 to a low c_1, the values of c_2 and of c_1 decreasing uniformly, each along its own course, with increasing *x*. At a given *x*, *c* increased with time from c_1 to c_2. The width of the wave in all cases decreased with rising temp. Relations were qualitatively similar for reactions other than first-order.

10664. Tschernitz, John L.; Bornstein, Sidney; Beckmann, R. B., and Hougen, O. A. **Determination of the kinetics and mechanism of a catalytic reaction.** *Trans. Am. Inst. Chem. Engrs.* **42**, 883-905 (1946).—*C.A.* **41**, 644*c*.

The vapor-phase hydrogenation of mixed isooctenes (commonly called codimer) by a solid supported Ni catalyst was analyzed into 17 possible chem. steps. The independent diffusion of reactants to the catalyst surface and of the product away from the surface was recognized. For the stated reaction the rate mechanism consisted of a surface reaction between activatedly adsorbed H_2 and codimer to form activatedly adsorbed hydrogenated codimer.

10665. Turkevich, John and Smith, Robert K. **Unitary theory of hydrocarbon catalytic reactions.** *Nature* **157**, 874 (1946).—*C.A.* **40**, 5628¹.

In the isomerization of 1-butene by H_3PO_4 the rate of exchange of T at 27 °C was slower than the rate of isomerization, the difference corresponding to a difference in activation energies of 3 kcal. The differences in the rate were due to the different zero-point energies of H and T bonds. T_2O and TCl did not exchange with butene; T_3PO_4 did not exchange with C_2H_4, but did exchange with C_3H_6. The catalyst must furnish a H atom and accept a H atom at a distance of ~ 3.5A. This condition was satisfied by H_2SO_4 (3.45A), H_3PO_4 (3.46A), silicic acid (3.50A), $HClO_4$ (3.41A), wet $AlCl_3$ ($HAlCl_4$) (3.46A), and partially hydrogenated Ni (3.52A).

10666. Twigg, G. H. **The mechanism of the catalytic oxidation of ethylene. I. Experiments using a flow system.** *Proc. Roy. Soc. London*, **A188**, 92-104 (1946).—*C.A.* **41**, 3354*e*.

The catalytic oxidation of ethylene was detd. in a flow system on an Ag catalyst. The products of reaction were ethylene oxide and CO_2 and H_2O. The isomerization of ethylene oxide to acetaldehyde by the catalyst in the absence of O_2 proceeded to a large extent through a preliminary isomerization of the ethylene oxide to acetaldehyde. The rate of oxidation of acetaldehyde was extremely rapid and no trace of acetaldehyde was found during the oxidation of ethylene or of ethylene oxide. An energy of activation of about 27 kcal was found for the production of ethylene oxide.

10667. Twigg, G. H. **The mechanism of the catalytic oxidation of ethylene. II. Reactions between ethylene, etc., and chemisorbed oxygen monolayers.** *Proc. Roy. Soc. London* **A188**, 92-104 (1946).—*C.A.* **41**, 3355*a*.

Expts. were made at 263°C and higher temps. between adsorbed O atoms on an Ag catalyst, and ethylene, ethylene oxide, and acetaldehyde. The course of reaction was followed by measuring the change in pressure, and the products analyzed by microfractionation of the gases at low temps. The absence of an induction period in the pressure-time curve showed that oxidation of ethylene to CO_2 and H_2O was possible by a route not through ethylene oxide. The reaction of acetaldehyde with the oxygenated catalyst was too fast to measure. On a clean catalyst, ethylene oxide was simultaneously isomerized to acetaldehyde and converted back to ethylene and adsorbed O. Both ethylene oxide and acetaldehyde, but not ethylene, were adsorbed with decompn. to form a nonvolatile layer on the catalyst.

10668. Twigg, G. H. **The mechanism of the catalytic oxidation of ethylene. III. The reactions between ethylene and oxygen in a static system.** *Proc. Roy. Soc. London* **A188**, 123-41 (1946).—*C.A.* **41**, 3355*i*.

At 263°C the rate of oxidation of ethylene to ethylene oxide on a Ag catalyst was proportional to the ethylene pressure and to the first power of the concn., c of adsorbed O on the catalyst. The rate of the direct oxidation of ethylene to CO_2 was proportional to the ethylene pressure and to c^2. The rate of oxidation of ethylene oxide was proportional to the ethylene oxide pressure and independent of c. The kinetic equations for the course of reaction with time were integrated by means of the Bush differential analyzer. A large part, and possibly the whole, of the catalyst surface must be engaged in reaction.

10669. Twigg, G. H. **The catalytic oxidation of ethylene.** *Trans. Faraday Soc.* **42**, 284-90 (1946).—*C.A.* **41**, 2385*d*.

The catalyst was made by plating glass-wool fibers with a thin coating (10^{-4} mm) of Ag. O was chemisorbed as atoms whereas none of the other reactants was adsorbed. The adsorption and desorption of O were slow activated processes, and it was possible to form surface layers of O, pump out the reaction vessel, and allow various gases to come in contact with the O layer. In addn. to carrying out reactions in both flow and static systems, information was also obtained from reactions between O adsorbed on the catalyst and the other gases concerned. C_2H_4 could be oxidized either to ethylene oxide, or directly to CO_2 and H_2O.

10670. Voge, H. H.; Good, G. M., and Greensfelder, B. S. **Catalytic cracking of pure hydrocarbons.** *Ind. Eng. Chem.* **38**, 1033-40 (1946).—*C.A.* **42**, 2749*g*.

Secondary reactions were studied: the nature and extent of olefin isomerization; olefin satn. via H transfer and effect on satn. of temp., flow rate, and diluents; the effect of olefin structure upon H transfer reactions; Decalin and Tetraline as H donors; a comparison of H transfer and catalytic hydrogenation; and the production of polymers and aromatic hydrocarbons from olefins. A silica-alumina-zirconia cracking catalyst, a com. synthetic silica-alumina, a silica-alumina-magnesia, and an activated natural clay all gave similar results as catalysts.

10671. VVEDENSKIĬ, A. A.; DOBRONRAVOV, R. K., AND FROST, A. V. **Kinetics and the mechanism of catalytic hydrogenation of hydrocarbons.** *J. Gen. Chem.* (U.S.S.R.) **16**, 71-6 (1946) (English summary).—*C.A.* **40**, 6950^5.

The rate of hydrogenation of benzene over Pd black at 240°C at atm. pressure was independent of the partial pressure of benzene between 0.1 and 0.45 atm. The reaction was hindered by cyclohexane long before equil. conditions were reached. It was proposed that the reaction proceeded between benzene adsorbed on the catalyst and H_2 dissolved in Pd catalyst.

10672. VVEDENSKIĬ, A. A. AND SIDOROV, N. V. **Kinetics of the synthesis of ammonia under high pressure. I. The temperature conditions in the reaction zone.** *J. Appl. Chem.* (U.S.S.R.) **19**, 1157-68 (1946) (in Russian).—*C.A.* **41**, 6122*b*.

In order to insure uniformity of temp. over the reaction zone, it was necessary and sufficient to distribute the catalyst non-uniformly. In particular, the catalyst must be dild. in the first segments of the reaction column. With a mixt. of 5 ml (12.5 g) catalyst of grain size 1-2 mm, with 25 ml (220 g) of Cu of grain size 1-1.5 mm, total height about 180 mm, the temp. remained const. over the whole length within ± 5°, except under $p = 800$ where an increase of the rate of flow r of the H_2 and N_2 mixt. from 150 to 1500 liters/hr caused the temp. of the gas to rise by 40°C. Under $p = 100$ to 500, at $r = 150$ to 1500, the temp. was practically uniform. Instead of Cu, corundum grains can be used as diluent with the same effectiveness. Diln. of the catalyst lowered the yield of NH_3 as against the conventional operation under conditions of temp. drop along the reaction column.

10673. ZAL'KIND, YU. S. AND BAL'YAN, KH. V. **Action of some inhibitors in catalytic hydrogenation in the presence of palladium.** *Trudy Leningrad. Tekhnol. Inst. im.Leningrad. Soveta* **1946**, No. 12, 73-86.—*C.A.* 44, 7220*i*.

The inhibiting action of NH_4CNS, $(NH_2)_2CS$, $Pb(OAc)_2$, and $Cu(OAc)_2$ during hydrogenation with colloidal Pd of $(\vdots CC(OH)Me_2)_2$, $Me_2C(OH)C\vdots CH$, and $Me_2C(OH)CH{:}CH_2$ in general decreased in the above order. The Pb salt was more active with alcs., and the Cu salt with the glycol.

10674. ZHABROVA, G. M.; ROGINSKIĬ, S. Z. AND FOKINA, E. A. **The promotion of contacts by means of metal-organic compounds.** *Compt. rend. acad. sci. U.R.S.S.* **52**, 313-16 (1946) (in English).—*C.A.* 41, 1539*i*.

A copper chromite catalyst, prepd. by the pyrolysis of $CuCrO_4$ and corresponding closely to the formula $CuCr_2O_4$ after removal of excess CuO with 10% CH_3COOH, was treated with pure $PbEt_4$. Its activity was investigated for the decompn. of H_2O_2 (static system) the oxidation of H_2 (static system), and the oxidation of isoöctane (dynamic system). About 1/8 of the Pb used was taken up by the catalyst. The decompn. of 1.7 *M* H_2O_2 reached a max. with about 3% PbO_2 in the catalyst.

10675. ADKINS, HOMER AND PAVLIC, A. A. **Hydrogenation of esters to alcohols over Raney nickel. I.** *J. Am. Chem. Soc.* **69**, 3039-41 (1947).—*C.A.* 42, 3327*g*.

The hydrogenations were carried out at 50°C for 7 hrs under 150-200 atm. H_2; the reaction mixt. was 20-35 ml EtOH. Et 1-piperidineacetate with the Raney-Ni catalyst contg. 12-13% Al yielded 98% 1-piperidineëthanol; digestion of the catalyst for 6 hrs reduced the yield to 55%; digestions for 24 hrs or elimination of the digestion period gave catalysts which yielded 14 and 4%, resp. The Al content of the catalyst and its catalytic activity did not appear to be closely related.

10676. ALEXANDER, JULIAN, JR. **Standard laboratory method for the determination of cracking catalyst activity.** *Proc. Am. Petroleum Inst.* **27**, III, 51-6 (1947).—*C.A.* 42, 6094*f*.

A modified procedure for evaluating activity, when heavy reduced-crude charging stock was used, consisted of adding 20% steam, replacing quartz with Corhart grain, and raising the cracking temp. to 850°F. The app. was used to study the effect of space velocity on activity. A variation of 1% of the former corresponded to a change of 0.1 of the latter.

10677. ANDERSON, ROBERT B.; KRIEG, ABRAHAM; SELIGMAN, BERNARD, AND O'NEILL, WILLIAM E. **Fischer-Tropsch synthesis - tests of cobalt catalysts at atmospheric pressure.** *Ind. Eng. Chem.* **39**, 1548-54 (1947).—*C.A.* 42, 1039*a*.

A Co:thoria:magnesia:kieselguhr (100:6:12:200) was described. Pelleted catalysts produced more light hydrocarbons and CO_2 than granular catalysts. The flow of synthesis gas was varied and the temp. adjusted to give the same percentage conversion. Under these conditions the degree of unsatn. increased with increase in flow and temp., while the most unsatd. products had a Br number of 30. Over-all activation energies were 24 to 27 kcal per mole. Yields of liquid hydrocarbons were found to range between 60 and 85% of the total weight of hydrocarbons formed.

10678. BALANDIN, A. A. AND EGOROVA, N. P. **The catalytic properties of the pentoxides of columbium and tantalum.** *Doklady Akad. Nauk S.S.S.R.* **56**, 255-8 (1947).—*C.A.* 44, 8215*a*.

The catalytic prepns. included $Cb_2O_5 + Ta_2O_5$ in varying proportions alone, on asbestos, on Al_2O_3, also with the addn. of Cb or Ta metal; also pure Cb and Ta metals and V_2O_5 alone and on asbestos. These prepns. were tested as catalysts at 300°-500°C for the oxidation (of napthalene), dehydration (isopropyl alc., cyclohexanol), and esterification (isoamyl alc. + HOAc). The oxides were more effective catalysts than the prepns. contg. metallic Cb and Ta. The catalytic activity of Ta_2O_5 was about 1.3 times that of Cb_2O_5. Comparison with V_2O_5 showed that the latter was especially effective as a catalyst for dehydrogenation whereas Cb_2O_5 and Ta_2O_5 catalyzed dehydration reactions predominantly.

10679. Batchelder, H. R. **Sulfur-resistant catalysts.** *Am. Gas. Assoc. Monthly* **29**, 222-5 (1947).—*C.A.* **41**, 5371*g*.

A large no. of catalysts were tested for the C_3H_8-steam reaction in the presence of H_2S. The best were based on NiS. Attempts to promote by addn. of Th or Zr oxide were unsuccessful.

10680. Berti, V.; Salvi, G., and Ghisoni, V. **Production of gaseous olefins by catalytic pyrolysis of mineral oils.** *Riv. combustibili* **1**, 129-48 (1947).—*C.A.* **42**, 8451*f*.

Catalytic cracking was effected at 770-80°C (810-30°C was necessary when the reaction was carried out in tubes packed only with Fe fillings), with less carbonization and tar formation. With an $Al_2O_3.SiO_2$ catalyst, only 4-6% of heavy residue (b.p. 360°C) resulted, whereas 10-15% was formed in the absence of a catalyst.

10681. Birkhimer, E. R.; Macuga, S. J., and Leum, L. N. **Bench-scale test method for evaluating cracking catalysts.** *Proc. Am. Petroleum Inst.* **27, III**, 90-9 (1947).—*C.A.* **42**, 6094*i*.

A small amt. of feed (24 ml) was charged to each test, and a distn. technique was employed on vols. of liquid products as low as 5-10 ml. Two hundred g of pelleted catalyst was used in the standard test, but other quantities were used in modified tests for product distribution measurements over a range of conversions.

10682. Bitepazh, Yu. A. **Relation between catalytic activity and ion-exchange ability of aluminosilicates.** *J. Gen. Chem.* (U.S.S.R.) **17**, 199-207 (1947).—*C.A.* **42**, 21*h*.

A rough parallelism was found between the cation-exchange capacity of 6 different natural clays and kaolins, as expressed by their total content of the exchangeable cations $H^+ + Al^{+++}$ (in milliequiv./100 g), and their cracking catalytic activity after acid activation and ignition at 500-20°C. The catalytic activity was detd. by the yield in vol. of gasoline (fraction b.p.<200°C) in cracking a raw oil b.p. 230-300°C, and by the enrichment in aromatics and unsatd. compds. of a cracking-gasoline of I_2 no. 89, aromatics content 0%. The high catalytic activity was due primarily to an exchange of Na^+, not to the increased porosity brought about by an acid treatment.

10683. Bosworth, R. C. L. **Chemical similarity in heterogeneous catalysis.** *Trans. Faraday Soc.* **43**, 399-406 (1947).—*C.A.* **42**, 1459*g*.

When the reaction mixt. was passed over the catalyst mass, the thermal energy and each particular mol. species produced (or destroyed) by chem. reaction was carried along by the stream or carried to the walls by diffusion in the case of mol. species, or by conduction, turbulent conduction, or radiation in the case of heat. When all the conditions for similarity in chem. systems involving heterogeneous catalysis were satisfied, when conduction (or turbulent conduction) provided the dominant mode of heat transfer, the length of the reaction tube and the size of the catalyst grains were directly proportional to the diam. of the reaction tube.

10684. Bridger, G. L.; Pole, G. R.; Beinlich, A. W. Jr., and Thompson, H. L. **Production and performance of ammonia-synthesis catalyst.** *Chem. Eng. Progress* **43**, No. 6, *Trans. Am. Inst. Chem. Engrs.* 291-302 (1947).—*C.A.* **41**, 5265*e*.

The process consisted of (1) purification of high-grade natural magnetite ore by dry tabling on an air separator table, (2) prepn. of synthetic magnetite by burning high-purity ingot Fe in O_2, and (3) fusion of a mixt. of synthetic magnetite, purified natural magnetite, ingot Fe, KNO_3, Al_2O_3, and recycled catalyst fines, followed by sizing of the fused product by crushing, tumbling, and screening. The catalyst contained about 66% Fe_2O_3, 31% FeO, 1.0% K_2O, and 1.8% Al_2O_3.

10685. Brinkley, Stuart R. Jr. **Heat transfer between a fluid and a porous solid generating heat.** *J. Appl. Phys.* **18**, 582-5 (1947).—*C.A.* **41**, 5007*e*.

A theory was applied to the description of temp. in a catalytic reaction, such as the Michael process for the synthesis of hydrocarbons from CO and H_2.

10686. Brown, O. W. and Frishe, W. C. **Catalytic oxidation of aniline in the vapor phase.** *J. Phys. & Colloid Chem.* **51**, 1394-1400 (1947).—*C.A.* **42**, 1793*h*.

Thallium, lead, bismuth and their intermetallic compds. were good catalysts for the vapor phase reduction of nitrobenzene to azobenzene and aniline. The mixt. of air and aniline vapor was passed over the oxide under atm. pressure and from 250° to 500°C. The nonalk. products were condensed and the alk. ones absorbed in 1 *N* H_2SO_4. The catalyst consisted of 60% thallic oxide and 40% asbestos. The yield of azobenzene and phenazine and on the percentage conversion of aniline indicated that the optimum temp. was about 350°C.

10687. Bruns, B. P. **Catalysis in stages.** *J. Phys. Chem.* (U.S.S.R.) **21**, 1011-18 (1947) (in Russian).—*C.A.* **42**, 2501*e*.

If the reaction between 2 gases, *A* and *B*, could be accelerated by a catalyst when the catalyst was brought in contact with first *A* alone and then *B* alone, the catalysis occurred in stages. Catalysis in stages was impossible if the catalyst was chemically altered during catalysis (e.g., MnO_2 is reduced to Mn_2O_3 when it accelerated the reaction between CO and O_2). The hydrogenation of ethylene in the presence of Pt could not be realized in stages, because the metal surface contained two types of regions one of which was blocked by the adsorbed gas.

10688. Chirkov, N. M. and Vinnik, M. I. **Heterogeneous acid-base catalysis in multimolecular films.** *Doklady Akad. Nauk S.S.S.R.* **58**, 1697-1700 (1947).—*C.A.* **46**, 4339*b*.

Treatment of app. walls with HCl vapor catalyzed the decompn. of paraldehyde and the rate rose sharply with increase of temp. Up to P/P_{d}

(P_d =dewpoint) 0.3 the content of HCl was linear with the amt. of adsorbed HCl. At P/P_d 0.5-0.6 the activation energy of depolymerization was 26 kcal/mole. The catalytic activity of the wall-adsorbed HCl dropped with introduction of H_2O vapor; a smaller decline occurred with EtOH vapors.

10689. Conn, M. E. and Connolly, G. C. **Testing of cracking catalysts.** *Ind. Eng. Chem.* **39**, 1138-43 (1947).—*C.A.* **41**, 7085*g*.

A small lab.-scale, fixed-bed catalytic cracking app. was designed for testing catalysts both as to the effect of different methods of prepg. them and as to changes in their activity during use. Relative activity of a catalyst was found from a single detn. of percentage converted because the percentage of oil converted was linear with respect to throughput, plotted on log-log paper. Gas-forming and carbon-depositing tendencies of catalysts could also be rated from the test data.

10690. Constable, F. H. **The dynamics of selective catalytic autopoisoning.** *Proc. Intern. Congr. Pure and Applied Chem.* **11**, 391-6 (1947).—*C.A.* **44**, 8214*a*.

On a homogeneous surface, the reaction velocity was an inverse exponential in the time. The rate of poisoning of the different centers in a distribution of active centers varied with the heat of activation on each. The distribution const. was proportional to the temp. at which the surface was frozen in equil. The dehydrogenation of alc. by active Cu was detd. between 602° and 673°K.

10691. Craxford, S. R. **The chemistry of the Fischer-Tropsch synthesis.** *Fuel* **26**, No. 6, 119-23 (1947).—*C.A.* **42**, 737*h*.

The best catalyst for the reaction of CO and H_2 to form higher hydrocarbons contained Co, thoria, magnesia, and kieselguhr in the proportions by weight of 100:5:8:200. It was prepd. by pouring a boiling soln. of the mixed nitrates, a boiling soln. of Na_2CO_3, and the kieselguhr, made into a thin paste with H_2O, simultaneously and rapidly into a vessel fitted with a stirrer, filtering at once and washing thoroughly. With a suitable kieselguhr, this catalyst gave about 77% conversion of CO at 185°C with a CO + $2H_2$ flow of 1 liter per g Co per hr. The catalyst was best reduced at 350°-400°C for a period of 40 to 120 min. with H_2 rates of about 500 m^3/m^3 of catalyst/hr. The addn. of CH_4 to the reaction mixt. suppressed the normal formation of CH_4 favoring production of higher hydrocarbons.

10692. Craxford, S. R. **The Fischer-Tropsch synthesis with cobalt catalysts.** *J. Soc. Chem. Ind.* **66**, 440-4 (1947).—*C.A.* **42**, 3648*d*.

The best catalysts contained Co with one or more activators and were prepd. by pptg. the carbonates onto kieselguhr as a carrier. The moist filter cake was dried immediately. The activators were usually ThO_2 and MgO. The surface area of a catalyst (Co 100, $ThO_2{}^6$, MgO 12, kieselguhr 200) was much larger than that of the sep. constituents. The reduction of the catalyst was the most crucial step; normal temps. were 350° to 400°C with times of 42 to 120 min. and H_2 rates of 5,000 vols. per vol. of catalyst per hr. The best catalysts were 65-70% reduced.

10693. Csuros, Zoltan. **Selective catalytic hydrogenation.** *Muegyetemi Közlemények* **1947**, 110-18.—*C.A.* **42**, 3726*g*.

Cis and *trans* isomers were each hydrogenated at different rates by varying the amt. of Pd catalyst. The speed of hydrogenation was not a linear function of the amt. of catalyst, but reached a max. and min. value with a definite amt. of catalyst. These conclusions were verified with fumaric and maleic acids; oleic and elaidic acids; angelic and tiglic acids; brassidic and erucic acids; meconic and citraconic acids; cinnamic, coumaric, coumarinic, and crotonic acids.

10694. Darlington, F. H. **Organic sulfur removal process.** *Am. Gas Assoc. Monthly* **29**, 147 (1947).—*C.A.* **44**, 5077*i*.

Org. S compds. in carburetted water-gas were removed. The gas, compressed to 10 p.s.i. and preheated to 426.5°C, entered the top of a catalyst chamber contg. $MgSO_4$-ZnO catalyst. On leaving the bottom at 343°C, the gas was cooled and passed through an oxide purifying box. Org. S compds. were reduced from 15 to less than 3 grains per ft^3. Weekly revivification of the catalyst was effected by passing air for 12 hrs at a rate of 8 ft^3 per min.

10695. Davidson, R. C. **Cracking sulfur stocks with natural catalyst.** *Petroleum Refiner* **26**, No. 9, 663-72 (1947).—*C.A.* **42**, 9138*f*.

The relation between the crystal structures of montmorillonite catalyst and the phenomenon of rehydration were shown. The importance of rehydrating catalyst before cracking high-S stocks of gas oil was described.

10696. Delépine, Marcel. **Hydrogenation with Raney nickel.** *Compt. rend.* **224**, 1396-9 (1947).—*C.A.* **41**, 5780*i*.

Many hydrogenations over Raney Ni reported in which high temperatures and pressure were used could be run under ordinary conditions adaptable to most labs., particularly if Na_2CO_3 was added. Thus, glutaconic ester was prepd. by hydrogenation of $CO(CH_2COEt)_2$ at ordinary temp. and pressure followed by dehydration.

10697. Dupont, G. and Dulou, R. **Study of the catalytic properties of clays.** *Verre silicates ind.* **12**, No. 8, 19-21 (1947) *Ceram, Abstracts in J. Am. Ceram. Soc.* **31**, No. 6, 143 (1948).—*C.A.* **43**, 6799*a*.

Montmorillonitic clays treated by heating to 360°C in H_2 were used as catalysts for isomerization from pinene to camphene.

10698. Eastwood, S. C.; Hornberg, C. V., and Potas, A. E. **Thermofor catalytic cracking unit.** *Ind. Eng. Chem.* **39**, 1685-90 (1947).—*C.A.* **42**, 1413*d*.

The construction and operation of a Thermofor catalytic cracking pilot unit with max. charge capacity of 2 barrels per day was described in detail.

10699. Eischens, Robert P. and Selwood, Pierce W. **Susceptibility-composition isotherm for the**

chromium-aluminum oxide catalyst system. *J. Am. Chem. Soc.* 69, 1590-4 (1947).—*C.A.* 41, 7214*b*.

Results were given for Cr_2O_3 supported on γ-Al_2O_3, the concn. of Cr varying from 0.11 to 41.4% by wt. The susceptibility per g of Cr was calcd. in each case by the Wiedemann additivity law. At 85°K this varied from 300 for 0.11% Cr to 61.9 for 41.4% Cr. A diagrammatic representation of the possible structure was presented, showing the relative arrangements of the O^{-2}, Al^{+3}, and Cr^{+3} ions.

10700. EUCKEN, ARNOLD AND WICKE, EWALD. **Hydrogen exchange on oxidic contact catalysts.** *Z. Naturforsch.* 2a, 163-6 (1947).—*C.A.* 42, 7148*d*.

The dehydration of alcs. on oxidic contact catalysts (bauxite and Al_2O_3) was studied. Surface OH groups of the contact substance were catalytically active, and this activity was based on an exchange of H particles according to the "principle of least structure change." Pretreatment of the catalyst by dehydration or by exposure to O_2 or at. O, successful application of the catalyst to dehydration of *trans*-crotyl alc., and proof that the primary product was HDO when the catalyst contained OD groups were used to verify the concept.

10701. FUNASAKA, WATARU AND FUKUSHIMA, RYOICHI. **Removal of organic sulfur compounds from gas mixtures for synthesis. X. Influence of impurities on the purification of industrial gases.** *J. Soc. Chem. Ind. Japan* 50, 122-4 (1947).—*C.A.* 44, 9136*g*.

C_2H_4 had a deleterious effect on Fe and Al catalysts for the removal of org. S compds., but not on Ni and Cu at 250°C. At 400°C no effect was detectable. C_6H_6 had no effect, while C_2H_2 had a deleterious effect. Acidic gases, such as CO_2 or HCN, transformed CS_2 to H_2S, especially at high temperature. A high CO_2 content had a deleterious effect at high temps. HCN also had a deleterious effect. Air, N_2, and water vapor gave good results.

10702. FUNASAKA, WATARU; FUKUSHIMA, RYOICHI; JINTA, TOMIO; INABA, TESUO; MATSUBARA, ITSUO, AND YUGUCHI, MASAYASU. **Removal of ethyl mercaptan and ethyl sulfide from hydrogen, natural gas, and cracking gas.** *J. Soc. Chem. Ind. Japan* 50, 125-6 (1947).—*C.A.* 44, 9136*i*.

EtSH could be removed easily, Et_2S with difficulty. Fe, Ni, Cu, Mn, Cr, Al, and Mg catalysts were suitable for EtSH and Cu and Ni for Et_2S. Et_2S gave H_2S with Cr and Al catalysts.

10703. FUNASAKA, WATARU; FUKUSHIMA, RYOICHI; JINTA, TOMIO; MATSUBARA, ITSUO, AND YUGUCHI, MASAYASU. **Removal of carbon disulfide and thiophene from water gas and natural gas.** *J. Soc. Chem. Ind. Japan* 50, 124-5 (1947).—*C.A.* 44, 9136*h*.

CS_2 could be removed by Ni, Cu, and Sn catalysts and thiophene by Fe, Ni, Cu, Mn, Cr, Al, and Mg. With Cr as a catalyst H_2 was formed.

10704. GHOSH, J. C.; BASAK, N. G., AND BADAMI, G. N. **Nickel-thoria-kieselguhr catalyst for the Fischer-Tropsch reaction. I.** *Current Sci.* 16, 318-19 (1947).—*C.A.* 43, 5921*f*.

A catalyst was prepd. by pptn. of Ni and Th carbonates on kieselguhr by addn. of NH_4HCO_3 to a soln. of the nitrates in presence of excess of CO_2, and subsequent reduction in H_2 first at 500°C and then at 300-350°C (for 6 hrs in each case). The catalyst gave 147.5 g of hydrocarbons other than CH_4 per m^3 of synthesis gas with a space velocity of 0.90 liter per hr per g of Ni.

10705. GHOSH, J. C.; BASAK, N. G., AND BADAMI, G. N. **Nickel-thoria-kieselguhr (100:18:100) catalyst for the Fischer-Tropsch reaction. II.** *Current Sci.* 16, 353 (1947).—*C.A.* 43, 3167*f*.

Expts. with the catalyst at 195°C and atm. pressure with water gas (CO:H_2 ratio of 1:1) gave hydrocarbon yield comparable to that obtained with synthesis gas (CO:H_2 ratio of 1:2). Max. yield of approx. 18 g of CH_4, 80 g other gaseous hydrocarbons, and 45 g liquid hydrocarbons per m^3 of water gas was obtained with space velocity of 0.91 liter per hr per g of Ni.

10706. GHOSH, J.C.; BASAK, N.G., AND VENKATESAN, C. **Nickel-thoria-kieselguhr (100:18:100) catalyst for the Fischer-Tropsch synthesis at medium pressure. III.** *Current Sci.* 16, 377 (1947).—*C.A.* 43, 3167*h*.

At 70 p.s.i. with synthesis gas as well as water gas, the best reaction took place at 205°C. When synthesis gas was used, the yield of CH_4 was high. With water gas, the yield of CH_4 decreased with a corresponding increase of gaseous and liquid hydrocarbons.

10707. GOL'DANSKIǏ, V. I. **Heterogeneous catalysis in multimolecular adsorption layers. Esterification equilibrium in two-phase systems.** *J. Phys. Chem.* (U.S.S.R.) 21, 431-8 (1947) (in Russian).—*C.A.* 41, 6801*b*.

The equil. const. K for the reaction AcOH + EtOH = AcOEt + H_2O in liquid phase was calcd. from the equil. in the vapor phase and the vapor pressure of the constituents. The equil. in the vapor at 45-75°C corresponded to 92% AcOEt, and the equil. const. was 305 at 45°C and 196 at 75°C. The equil. in the presence of multimol. adsorption layers must depend on the relative vols. of the gas phase and the adsorbed layers.

10708. GOL'DANSKIǏ, V. I. AND CHIRKOV, N. M. **Heterogeneous ionic catalysis. Study of acid-catalyzed reactions of esterification and ester hydrolysis in the vapor phase.** *Acta Physicochim. U.R.S.S.* 22, 363-80 (1947) (in English).—*C.A.* 41, 6800*f*.

10709. GOL'DANSKIǏ, V. I. AND KARASEV, V. V. **Application of polarization-microscopic techniques in the study of catalysis in multimolecular adsorbed layers.** *Doklady Akad. Nauk S.S.S.R.* 57, 793-5 (1947).—*C.A.* 46, 5951*h*.

A study of EtOH-AcOH esterification was briefly reported. The kinetic characteristics in adsorbed layer were identical with that in the liquid state if the adsorbed layer contained at least 5-10 mol. layers.

10710. GONCHAROVA, M. A. AND KABANOVA, M. F. **The mechanism of the catalytic refining of thermally cracked or reformed distillates with activated clay.** *Azerbaidzhanskoe Neftyanoe Khoz.* 26, No. 1/2, 24-7 (1947).—*C.A.* 42, 7515*d*.

Several thermally cracked or reformed distillates were subjected to catalytic refining four different ways: (1) treated with nonactivated clay at 200°-400°C; (2) hydrogenated over an aromatizing catalyst of the Al_2O_3-CrO_3 type at 350°C and 30 atm.; (3) treated in the vapor phase with activated Al_2O_3 at 250°-450°C; and (4) treated in the vapor phase with activated clay at 400°C. The group compn. and octane nos. of the products indicated that treatment over clay-type catalysts involved H-disproportionation in which part of the cyclic olefins was dehydrogenated to aromatics and the other part to naphthenes.

10711. Good, G. M.; Voge, H. H., and Greensfelder, B. S. **Catalytic cracking of pure hydrocarbons. Cracking of structural isomers.** *Ind. Eng. Chem.* 39, 1032-6 (1947).—*C.A.* **41**, 7085*e*.

Six groups of isomeric hydrocarbons were subjected to cracking in the presence of SiO_2-Zr_2O_3-Al_2O_3 catalyst, in order to study the influence of structure on rate of cracking. The presence of tertiary C increased the rate. The presence of quarternary C reduced it. It had been concluded from previous work that naphthenes crack faster than paraffins. This depended, however, upon how much tertiary C the paraffin isomer contained in its structure.

10712. Gracasso, Guiseppe. **Nomogram for, and considerations on, the catalytic conversion of carbon monoxide.** *Chimica* 2, 321-5 (1947).—*C.A.* **42**, 9118*f*.

A nomogram was given for the catalytic conversion of CO with H_2O vapor, in relation to the concn. of vapor, at temps. from 350° to 600°C, with an initial content of CO up to 100%.

10713. Graham, Ronald P. and Thomas, Arthur W. **The reactivity of hydrous alumina towards acids.** *J. Am. Chem. Soc.* 69, 816-21 (1947).—*C.A.* **41**, 4395*d*.

The catalytic effect of hydrous alumina on the hydrolysis in water of Me oxalate and of MeI was found to be in the order of the rates of reaction of the resultant acids with alumina. The reactivity of hydrous alumina as regards complete soln. in acids was shown to decrease with increasing temp. of prepn. of the oxide, the effect being ascribed to an increasing oxolation of the alumina structure. With increasing temp. of prepn., the no. of surface hydroxo groups passed through a max., and became zero in the case of ignited alumina.

10714. Greensfelder, B. S.; Archibald, R. C., and Fuller, D. L. **Catalytic reforming. Fundamental hydrocarbon reactions of petroleum naphthas with molybdena-alumina and chromia-alumina catalysts.** *Chem. Eng. Progress* 43, No. 10 *Am.' Inst. Chem. Engrs.* 561-8 (1947).—*C.A.* **41**, 7714*d*.

Characteristics of certain MoO_2-Al_2O_3 and Cr_2O_3-Al_2O_3 catalysts were compared. With pure hydrocarbons, the Cr_2O_3 catalysts were highly effective for the dehydrogenation of cyclohexane homologs and the dehydrocyclization of amenable aliphatic hydrocarbons to aromatic. Under H_2 pressure, the MoO_2 catalysts were superior from the standpoint of sustained high activity for dehydrogenation of cyclohexane homologs and for their ability to catalyze paraffin isomerization and the dehydroisomerization of the homologs of cyclopentane to those of benzene.

10715. Gridger, G. L.; Pole, G. R.; Beinlich, A. W. Jr., and Thompson, H. L. **Production and performance of ammonia-synthesis.** *Chem. Eng. Progress* 43, No. 6, *Trans. Am. Inst. Chem. Engrs.* 291-302 (1947).—*C.A.* **41**, 5265*e*.

The catalyst contained about 66% Fe_2O_3, 31% FeO, 1.0% K_2O, and 1.8% Al_2O_3; amts. of impurities were kept low by proper choice of raw materials and by extreme care to avoid contamination in the manufg. operation. A supply of catalyst was made for the TVA plant and for one other NH_3 plant. Lab. tests showed that max. activity of the catalyst was obtained when Fe^{+2}/Fe^{+3} was 0.5. Pilot converter tests made under operating conditions indicated that catalysts having no significant differences in activity could be made from purified natural magnetite, synthetic magnetite or mixtures of the two.

10716. Grote, H. W. and Olsen, C. R. **Pilot-plant evaluation of fluid cracking catalysts.** *Oil Gas J.* 46, No. 28, 332-6; *Petroleum Refiner* 26, No. 11, 104 (736)-106 (738) (1947).—*C.A.* **42**, 1726*f*.

Lab. methods were given to evaluate fresh catalyst samples as well as samples that have seen service. Catalysts which appeared promising by lab. procedures should be evaluated in a pilot plant on a 3-4 barrel per day scale.

10717. Guiter, Henri. **The catalytic oxidation of ammonia.** *Bull. soc. chim. France* **1947**, 77-9.—*C.A.* **41**, 5007*i*.

Air bubbled through NH_4OH (sp. gr. 0.951) and dried was passed through heated catalysts at 15 liters/hr. Doubled 0.06-mm Pt gauze at 675°C gave 1590 ml N oxides. Pure CoO (1 cm bed depth) at 705°C gave as much oxide; CoO + 5% NiO gave 91% as much at 645-705°C; CoO + 5% Cr_2O_3 gave 93% as much at 655°C. The temp. of equil. of Ni oxides was too low for NH_3 oxidation, for Cr oxides too high.

10718. Gutyrya, V. S.; Goncharova, M. A., and Kabanova, M. F. **Mechanics of the aromatizing action of aluminosilicates.** *Azerbaidzhanskoe Neftyanoe Khoz.* 26, No. 7, 26-8 (1947).—*C.A.* **43**, 3998*g*.

Floridin, activated floridin, natural and activated bentonite, and synthetic aluminosilicate were tested as aromatizing catalysts at 400°-540°C for thermal cracking distillates; 60% of the olefins were converted into aromatics and naphthenes. As the reaction temp. increased, the quantity of naphthenes decreased and the quantity of aromatics increased.

10719. Hall, C. C. and Smith, S. L. **Hydrocarbon synthesis in the presence of cobalt catalysts at medium pressures.** *J. Inst. Petroleum* 33, 439-59 (1947).—*C.A.* **42**, 735*d*.

The effect of a pressure of 150 p.s.i. on the synthesis of hydrocarbons from H_2 and CO with a Co:ThO_2:MgO:kieselguhr catalyst was studied. Conversion with synthesis gas (H_2:CO = 2:1) was about

10% greater, and the rate of catalyst deterioration was 30-50% less than at atm. pressure.

10720. HALL, C. C. AND TAYLOR, A. H. **Chemical engineering aspects of the Fischer-Tropsch process.** *Trans. Inst. Chem. Engrs.* (London) *Advance Copy*, Jan. 7, 1947, 15 pp. *C.A.* **41**, 1827*b*.

A summary of chemical engineering data on the Fischer-Tropsch process was collected in Germany by Allied investigators. Synthesis catalyst was granular (1-3 mm in diam.), contg. in parts by wt: Co 100, ThO_2 5, MgO 8, kieselguhr 200. The reaction was exothermic (80 B.t.u. per ft^3 CO and H_2 converted) and was carried out at a temp. of 170-220°C, depending on catalyst age.

10721. HANSFORD, R. C. **A mechanism of catalytic cracking.** *Ind. Eng. Chem.* **39**, 849-52 (1947).—*C.A.* **41**, 6392*h*.

When n-C_4H_{10} was cracked at 482°C in the presence of dried com. $SiO_2.Al_2O_3$ catalyst, the conversion of the hydrocarbon in 30 sec. under stated conditions was 28-29%. Adsorption of water on the catalyst (0.15 to 0.29 wt % of the catalyst) increased the decompn. activity to 36-40%. By using D_2O instead of H_2O in preconditioning the catalyst, it could be proved that some reaction took place between the water and the hydrocarbon. The probable mechanism was that the hydrocarbon mol. gave up a proton to the water adsorbed on the catalyst particle and a neg. hydrocarbon ion was left.

10722. HENRIQUES, H. J. **Evaluation of vapor-phase reactions with solid catalysts.** *Ind. Eng. Chem.* **39**, 1564-70 (1947).—*C.A.* **42**, 2477*h*.

App., assemblies, and techniques were described useful for bench-scale studies of vapor-phase reactions over solid catalysts at pressures of 1 to 50 atm. and at elevated temps.

10723. HERINGTON, E. F. G. AND RIDEAL, E. K. **The catalytic dehydrogenation of naphthenes. I. Kinetic study.** *Proc. Roy. Soc.* (London) **A190**, 289-308 (1947).—*C.A.* **42**, 4036*g*.

The dehydrogenation of naphthenes was studied on a chromium oxide supported on alumina catalyst at 400°C and above. Cyclohexene was detected and estd. in the products from cyclohexane, and side reactions producing olefin other than cyclohexene proceeded at only 0.01 of the speed of the main reaction at 450°C. If the contact time was sufficiently long, a stationary concn. of olefin was established. The loss of the first pair of H atoms from cyclohexane was the slow step in the reaction, requiring an activation energy of 36 kcal/g mol.

10724. HERNANDEZ, L. AND NORD, F. F. **Mechanism of catalytic hydrogenation and dehydrogenation with rhodium.** *Experientia* **3**, 489-90 (1947).—*C.A.* **42**, 1793*e*.

A Rh catalyst prepd. with polyvinyl alc. as a supporting colloid differed from similarly prepd. Pd catalysts in being sensitive to pH and to the presence of functional groups. The reaction velocity consts., $k \times 10^6$, were (room temp.) 11.1, 10.8, 10.4, 10.1, 9.25, 9.02, 8.79, 6.25, and 1.85 for the hydrogenation of nitrobenzene para-substituted with CN, CHO, NO_2, COOH, I, Cl, Br, OCH_3 and NH_2 groups, resp., whereas the value for nitrobenzene was 8.33. Rh ionized the H_2 so that H^+ was the effective hydrogenating agent, whereas for Pd, H atoms were involved. S enhanced the activity of the Rh catalyst toward the dehydrogenation of formic acid and isopropyl alc. at 95°C.

10725. HORNADAY, GEORGE F. AND ARDERN, DAVID B. **Small-scale laboratory testing of cracking catalysts.** *Proc. Am. Petroleum Inst.* **27**, III, 100-7 (1947).—*C.A.* **42**, 6095*b*.

Cracking and aging studies were made in an app. consisting of a catalytic cracking case with charging and product-recovery equipment. The catalyst (600 ml) was placed in a stainless steel tube surrounded by a Pb bath, and tested at 800-950°F, up to 4 atm. pressure, space velocity 0.4-3.0 vol. of liquid oil per hr per apparent vol. of catalyst, and with or without steam included with the oil charged.

10726. HOUTMAN, J. P. W. **The polymerization of olefinic substances by Friedel-Crafts catalysts.** *J. Soc. Chem. Ind.* **66**, 102-3 (1947).—*C.A.* **41**, 5780*a*.

Extreme care was used to maintain anhyd. conditions. Isobutene was polymerized with BF_3 at -80°C, the polymerization beginning in the gas phase. When C_2H_4 was used as a solvent at -102°C, the polymerization took place in the liquid phase. With solid $AlCl_3$ polymerization was found both at room temp. when isobutene vapors were passed over the catalyst and at -80°C with isobutene in the liquid state. Isobutene formed a head-to-tail polymer. The fixation of the free electron pair initiated the chain reaction, and it occurred using substances that were able to take up electrons, e.g., protons, acids, and Friedel-Crafts catalysts. The halide itself took part in the reaction and not the acid that could be formed with the halide with small amts. of water.

10727. KARZHAVIN, V. A. **Heat transfer in apparatus for catalytic synthesis of hydrocarbons and water gas.** *Khim. Prom.* **1947**, No. 5, 14-19.—*C.A.* **43**, 2343*a*.

A method was given for calcg. the heat transfer in catalytic synthesis of hydrocarbons from CO and H_2. This method was applicable to both tubular and plate reactors. The temp. varied considerably along the catalyst and for best results the cooling should be adjusted to the conditions of each particular sector of the catalyst.

10728. KEǏER, N. P. AND ROGINSKIǏ, S. Z. **Effect of the free energy of preparation on the catalytic activity of pyrolytic nickel monoxide.** *J. Phys. Chem.* (U.S.S.R.) **21**, 539-43 (1947) (in Russian).—*C.A.* **41**, 6801*d*.

$NiCO_3$ was partly decompd. at 270°C (the CO_2 pressure was kept either below 9 mm Hg or between 10^{-2} and 10^{-6} mm Hg). The former gave a 30% decompn. within 230 min., and the latter within 17 min. Both procedures were followed by evacuation at 250°C for 1.5 hrs. The specimens obtained were tested as catalysts for the oxidation of CO by O_2 at 20°C and 1 mm Hg. The activity of a catalyst was greater, the greater the degree of supersatn.

during its prepn. The catalytic activity could be varied at will by varying the degree of supersatn.

10729. KODAMA, SHINJIRO; MURATA, YOSHIO, AND HARA, ISAO. **Gasoline synthesis from carbon monoxide and hydrogen. LXXI. Activity and deactivation of iron catalysts. LXXII. The composition of gases and flow velocity.** *J. Soc. Chem. Ind. Japan* **50**, 119-20, 120-1 (1947).—*C.A.* 44, 9135*c*.

Gasoline was synthesized 29 hrs from CO and H_2 in a mol. ratio of 1:1 at 250°C with (1) Fe + 12.8% Cu or (2) Fe + 25% Cu + 152% kieselguhr. The addn. of K_2CO_3 and H_3BO_3 increased the activity of these catalysts. The optimum amt. of K_2CO_3 was 1% for (1) and 2% for (2). In the synthesis of gasoline with Fe catalysts, carbides and free carbon were formed by the activation of CO.

10730. KOMAREWSKY, V. I. **High-frequency dielectric heating in heterogeneous catalysis.** *Science* **105**, 291 (1947).—*C.A.* 41, 3353*a*.

High-frequency dielec. heating was used in the dehydration of EtOH on alumina, and dehydrocyclization of heptane to toluene on Cr_2O_3-alumina. The exptl. results for the 2 reactions were given.

10731. KRICHEVSKAYA, E. L. **Kinetics of the oxidation of sulfur dioxide on vanadium pentoxide.** *J. Phys. Chem* (U.S.S.R.) **21**, 287-300 (1947) (in Russian).—*C.A.* 41, 6121*f*.

Mixts. of SO_2 (4-40%), O_2 (5-40%), and CO_2 (the rest) were forced through a bed of pure V_2O_5, and the SO_3 detd. The degree of transformation varied between 18 and 71%. The reaction consts. at 475°, 500°, amd 575°C were in the ratio 0.06:0.14:0.9. The decompn. of SO_2 on V_2O_5 was detd. at 575°C. The apparent heat of activation of the SO_3 formation was 34,000 cal. The rate of this reaction was detd. by that between adsorbed SO_2 and adsorbed O_2. The reaction on tech. catalysts was detd. by the rate of sorption of O_2 and by the diffusion within the pores of the catalyst.

10732. KRISHNA, BAL AND GHOSH, SATYESHWAR. **Heterogeneous catalytic activity of colloidal silver in the reduction of silver acetate.** *J. Phys. & Colloid Chem.* **51**, 1130-7 (1947).—*C.A.* 42, 1112*c*.

The reaction between resorcinol and AcOAg in aq. soln. at 35°C was first order with respect to each reactant. Colloidal Ag was a pos. catalyst, and hydrogen ions were neg. catalysts. Protective colloids enhanced the reaction rate by preventing the gradual pptn. of colloidal Ag.

10733. LAHUERTA CASAUS, PASCUAL. **Directly formed catalysts and polycatalysts. Investigation with respect to a selective polycatalyst of powerful bleaching action [for reducing oleaginous products.]** *Combustibles* 7, 151-62 (1947).—*C.A.* **42**, 7067*g*.

"Directly formed" catalysts prepd. by thermal decompn. of Ni formate were compared with other catalysts. Ni chromate and $Al_2O_3/Cr_2O_3/$ Ni possessed superior activity, absolutely satisfactory selectivity, and energetic bleaching action. A simple technique was given with diagram of app., for obtaining polycatalysts of this type.

10734. LEL'CHUK, S. L. **Fundamental questions of the genesis of skeleton catalysts.** *Doklady Akad. Nauk S.S.S.R.* **56**, 933-5 (1947).—*C.A.* 44, 7466*b*.

In the production of skeleton catalysts from readily volatile components, sufficient mixing was obtained in the kryptol furnace so that treatment in the high-frequency furnace was unnecessary. Rapid cooling of the melt gave a more active catalyst for the dehydration of alc. (to AcOEt) than cooling in the furnace. The degree of washing of the catalyst required depended on whether the sol. component activated or passivated the reaction. The activity of the Cu-Al-Cr catalyst investigated increased as the washing out of the Al was continued.

10735. LEL'CHUK, S. L.; VASKEVICH, D. N.; BELEN'KAYA, A. P., AND DASHKOVSKAYA, F. A. **Kinetics of the reaction or direct esterification of alcohol. III. Effect of the composition of polycomponent catalysts on the kinetics of the reaction.** *Bull. acad. sci. U.R.S.S., classe sci. chim.* **1947**, 235-8 (in Russian).—*C.A.* 42, 4436*b*.

The introduction of a 3rd component into a Cu-base binary catalyst was studied on the direct esterification reaction, assumed to proceed over the stages: (1) $RCH_2OH \rightarrow RCHO + H_2$, (2) $RCHO + H_2O \rightarrow RCOOH + H_2$, (2a) $RCH_2OH + H_2O \rightarrow RCOOH + 2H_2$, (3) $RCH_2OH + RCOOH \rightarrow RCH_2OCOR + H_2O$. At 275°C, space velocity 600 ml EtOH/liter catalyst/hr, the simple Cu catalyst gave an ester yield of $Y = 12.3\%$, the binary Cu + 2% Ce, 37%. Under the same conditions, the effects of a 3rd component (wt % relative to Cu) were BaO (10) $Y =$ 4.7%; Al_2O_3 (5) 19.8%; MnO (2) 3.82%; Ag (5) 0.58%; Ni (5) 11.3% (the last at 250°). Although CdO has but little effect on the activity and the activation energy of (3) was high (14.5 kcal), the Cr_2O_3, TiO_2, and ThO_2 ternary catalysts were clear instances of coactivation.

10736. LUKOVTSEV, P. AND LEVINA, S. **Hydrogen overvoltage on nickel in alkaline solutions.** *J. Phys. Chem.* (U.S.S.R.) **21**, 599-610 (1947) (in Russian).—*C.A.* 41, 6820*i*.

The slopes of the curves of overvoltage υ against c.d. were almost identical for Ni rods and plates in different positions. The υ on Ni, prepd. without contact with air, in x N NaOH + 0.2 N KCl at $i = 10^{-5}$ amp./cm² increased between $x = 1$ and $x = 10^{-2}$ by 88-92 mv., between $x = 10^{-2}$ and 10^{-3} by 22 mv., and between $x = 10^{-3}$ and 10^{-4} by 6-8 mv. The capacity of Ni electrode calcd. from the rate of decay of υ after switching off the current was greater in the later stages of the decay.

10737. MAMEDLI, M. G. **Catalytic desulfurization of gasoline. II.** *J. Applied Chem.* (U.S.S.R.) **20**, 115-19 (1947) (in Russian).—*C.A.* 41, 5705*g*.

Gas-phase desulfurization of straight-run gasoline with 0.06% S was studied at 300°C, vol. ratio catalyst/gasoline 1:1/hr, with over 12 different clays (SiO_2 45.58 to 56.89, Al_2O_3 12.41 to 18.40, CaO 2.91 to 12.53).. Ignition losses paralleled the CaO content. Very small amts. of FeS were found in the clay after the run, indicating that its formation played only a minor role in the fixation of S. The catalytic process consisted of two stages, decompn. of the org. S compds. with formation of H_2S followed by a fixation of the latter by the clay. The H_2S formed in the first phase of the process underwent mainly decompn. into H_2 and S, the latter being adsorbed by the clay.

10738. Margolis, L. Ya and Todes, O. M. **Kinetics of exothermal reactions in streaming gas. III. Kinetics of catalytic combustion of isoöctane and of cyclohexane.** *Bull. acad. sci. U.R.S.S., Classe sci. chim.* **1947**, 443-52 (in Russian).—*C.A.* **42**, 1794*b*.

Combustion of flowing mixts. of 2,2,4-trimethylpentane and of cyclohexane with air were carried out between 250° and 660°C over spinel-type catalysts (chromites, aluminates, manganites, etc.) on asbestos, at concns. varying between 0.1% and 67%, so as to ensure a convenient rate of combustion; chromites were prepd. by decompn. of the chromates, aluminates by fusing salts of Al and the desired metal; combustions were also carried out over Pt and Po (0.05-0.1%) on asbestos. In all cases, the combustions led to practically pure CO_2 and H_2O; in no case was a trace of CO detected; the H_2O contained no more than 0.01% aldehydes and 0.02% acids.

10739. Margolis, L. Ya. and Todes, O. M. **Poisoning and modification of catalysts.** *Doklady Akad. Nauk S.S.S.R.* **58**, 421-4 (1947).—*C.A.* **46**, 4342*e*.

$MgCr_2O_4$-MgO and $CuCr_2O_4$-CuO catalysts were treated with 0.5-10% poisons, H_3PO_4, H_3BO_3, H_2SO_4 (as $BaSO_4$), in catalytic oxidation with isoöctane. As the amt. of the poison increased, the order of the reaction of oxidation changed gradually from 2nd order to 1st or even to zero order. In the region of 1st-order reaction the temp. coeff. of reaction rate followed Arrhenius formulation, but activation energies varied depending on the concn. of the poison.

10740. Mathieu, Marcel. **Structure and catalytic activity.** *Bull. soc. chim. France* **1947**, 14-27.—*C.A.* **41**, 5007*d*.

Concepts of catalysis were reviewed with emphasis on the theory of Balandin and on its three-dimensional equiv. that crystal voids of proper shape were active. Montmorillonite clays were most active after being boiled with 30-45% H_2SO_4 until 2/3 of the metal atoms and some water of constitution were removed. X-ray studies showed that the crystal layers were intact though less regular. The vast gaps thus left might account for the isomerization catalysis of the clays.

10741. Maxted, E. B. **Detoxication of catalyst poisons. V. Thiophene.** *J. Chem. Soc.* **1947**, 624-7.—*C.A.* **41**, 6801*f*.

A hydrogenation system with crotonic acid as the unsatd. substance, thiophene in benzene and in tech. benzene, resp., was used. The substance was hydrogenated first to thiophane by virtue of its preferential adsorption on the catalyst. This in turn was oxidized to thiophane sulfone. In the latter, the toxic S-atom was shielded. The hydrogenation stage was effectively limited to the amt. originally adsorbed. Complete detoxication could be achieved by means of repeated hydrogenation-oxidation processes, the second stage offering no difficulties.

10742. McReynolds, Hubert. **Bench-scale method for determining activity of cracking catalysts in powdered form.** *Proc. Am. Petroleum Inst.* 27, III, 78-83 (1947); *Petroleum Refiner* **26**, No. 12, 790-4 (1947).—*C.A.* **42**, 6094*g*, 9138*i*.

A small reactor having a length to diam. ratio of 18 was immersed in a Pb bath maintained at 920°F. A standard gas oil was evapd. and passed through a fluidized catalyst bed contg. 400 g of catalyst at a normal wt space velocity of 2 for 30 min. The resulting liquid product was stabilized and fractionated to obtain a 400°F end-point gasoline. The gas and carbon producing tendencies of catalysts could also be detd. The reproducibility of the tests was good.

10743. Mills, Ivor W. **Prediction of activity of cracking catalysts from heat of wetting.** *Oil Gas J.* **46**, No. 28, 237-41 (1947).—*C.A.* **42**, 1727*c*.

Pelleted clay and synthetic silica-alumina catalysts in both the bead and pellet form were investigated. CH_3OH appeared to be the most favorable liquid as it gave a good temp. rise, could be obtained in a pure state, and was easy to handle. Free H_2O caused a decrease in the heat of wetting and the hydrate produced a high value. Carbon had little effect but iron oxide may be detrimental. Activities did not necessarily blend in a linear relationship.

10744. Nikolaev, L. A. **Catalase properties of complex copper compounds.** *Vestnik Moskov. Univ.* **1947**, No. 6, 115-18.—*C.A.* **42**, 3654*b*.

Complexes of Cu with simple alkyl amines activated the catalysis of the decompn. of H_2O_2 by Cu^{++} but to a lesser degree than $[Cu(NH_3)_4]^{++}$. Adsorption on graphite lowered somewhat the activities of all the complexes examd. to varying degrees.

10745. Nyman, C. J. and O'Brien, T. D. **Catalytic reduction of sodium sulfate.** *Ind. Eng. Chem.* 39, 1019-21 (1947).—*C.A.* **41**, 6029*d*.

At 550°-600°C and below, no reduction occurred. At 600°C, reduction by H_2 in the presence of an Fe catalyst was quite effective. At 650°C and above, the catalytic effect of Cu was equiv. to Fe. Above 800°C, CH_4 was quite reactive, perhaps as a result of cracking of the gas. The reduction product was mainly Na_2S. Only occasional, small amts. of $Na_2S_2O_3$ and Na_2SO_3 were found.

10746. Oblad, A. G.; Messenger, Joseph V., and Brown, H. Trueheart. **Isomerization of 1- and 2-pentenes.** *Ind. Eng. Chem.* **39**, 1462-6 (1947).—*C.A.* **42**, 857*f*.

The vapor-phase isomerization of 1-pentene and 2-pentene was studied over the range 177°-427°C and at liquid space velocities from 0.5-24 hr^{-1}. The catalysts employed were specially prepd. aluminas. Based on the apparent similarity between the nature of the solid catalysts studied and the acidic catalysts commonly used in liquid-phase hydrocarbon reactions, a mechanism involving carbonium ions was proposed to explain the vapor-phase isomerization of olefins.

10747. Obolentev, R. D. and Usov, Yu. N. **The additivity of the conversion of binary mixtures of aliphatic hydrocarbons in aromatization over a chrome catalyst.** *J. Gen. Chem.* (U.S.S.R.) 17, 897-906 (1947) (in Russian).—*C.A.* 42, 1570*i*.

The yields of aromatic compds. obtained over a Cr catalyst at 480°C, vol. rate 0.5, duration of runs 30-42 min., were detd. in pure *n*-heptane, isoöctane, 1-heptene, 2-methy-2-hexene, 3-methyl-3-heptene, and in binary mixts. thereof. The catalyst was activated in an air stream 4-5 hrs before each series and 1-1.5 hrs after each run and tested with *n*-heptane under the standard conditions adopted. Coking and resinification was on the whole more abundant with unsatd. compds., the more so the more branched the chain and the higher the mol. wt; additivity in binary mixts. was not strict.

10748. Oborin, V. I. **Elementary structure of alumina catalyst.** *Neftyanoe Khoz.* 25, No. 11, 50-4 (1947).—*C.A.* 42, 5750*d*.

The catalytic action was exerted by γ-alumina. Silica as a carrier supplied a large surface for the crystn. of alumina. On an arbitrary scale, the activity of alumina-silica cracking catalysts ranged in the order: $Al(OH)_3$ prepd. from $Al_2(SO_4)_3$ by pptn. with alkali and added while wet to silica gel, 1.00; same, but pptd. from Al NH_4 alum, 0.91; $Al(OH)_3$ pptd. from the sulfate with NH_3 and mixed with silica gel, 0.80; copptd. gel from $Al_2(SO_4)_3$ and Na_2SiO_3, 0.61; copptd., dense gel from Al NH_4 alum and Na_2SiO_3, 0.34; same, but friable, 0.17; the friable co-gel impregnated with $Al(NO_3)_3$ and calcined, 0.77; and silica gel impregnated with $Al_2(SO_4)_3$ to ppt. $Al(OH)_3$ on hydrolysis, 0.73.

10749. Ohtsuka, Hiroshi. **Studies on the solid phosphoric acid used as polymerization catalyst for olefin gases.** *Mem. Faculty Eng. Hokkaido Univ.* 8, No. 1, 11-57 (1947).—*C.A.* 42, 6997*i*.

Studies were made on the state of the phosphoric acid on the carrier surface, the kinds of carriers, and the methods of activation and reactivation of the catalyst. The mechanism proposed was that of proton exchange between the acid and the hydrocarbon.

10750. Panchenkov, G. M.; Topchieva, K. V.; Uspenskaya, E. A., and Frost, A. V. **The kinetics of catalytic disproportionation of hydrogen in gasolines in the presence of activated clay.** *Comp. rend. acad. sci. U.R.S.S.* 55, 319-21 (1947) (in English).—*C.A.* 41, 6459*d*.

A gasoline fraction (boiling up to 150°C and having an I_2 no. of 102) was passed at varying velocities and at 210°-400°C over an activated askanite catalyst. The disproportionation of H was a first-order reaction relative to the concn. of the reacting substance; the velocity was practically independent of the temp. The reaction proceeded in the diffusion area and the diffusion processes were slower than the conversion of the substances on the surface of the catalyst.

10751. Porter, Richard, W. **Sorbitol from corn sugar by catalytic reduction.** *Chem. Eng.* 54, No. 11, 114-17 (1947).—*C.A.* 42, 2578*i*.

High-pressure hydrogenation of corn sugar with Ni-clay catalyst was described.

10752. Pratt, Thomas W. **Aromatic adsorption index for the estimation of surface area and catalytic activity.** *Proc. Am. Petroleum Inst.* 27, III, 38-47 (1947).—*C.A.* 42, 5750*b*.

The aromatic adsorption index of dried cracking catalysts was detd. by shaking 3.50 g of catalyst intermittently for 2 hrs with 5 ml of 30% toluene in isooctane and subsequently detg. *n* of the soln. This index was directly related to the B. E. T. surface area, regardless of the history or source of the catalyst; but, the relation between the index area as detd. by butane adsorption depended on the prior treatment of the catalyst.

10753. Prettre, Marcel; Eichner, Charles, and Perrin, Marcel. **The participation of methane in reactions involving synthesis and transformation of aliphatic hydrocarbons.** *Compt. rend.* 224, 278-79 (1947).

In the presence of a catalyst of reduced nickel on kieselguhr under atmospheric pressure, it was shown that CH_4 participated in the chemical reactions involved in the catalyst.

10754. Pshezhetskiĭ, S. Ya. **Transitional kinetic states of catalytic reactions on porous catalysts.** *J. Phys. Chem.* (U.S.S.R.) 21, 1019-25 (1947) (in Russian).—*C.A.* 42, 2501*c*.

The measured rate of a gas reaction on a porous catalyst was detd., depending on the reaction temp., either by the rate of external gas diffusion, or by that of internal gas diffusion, or by the rate of the chem. reaction proper. The transitions between these 3 states were calcd. Because the transitions were gradual, the dependence of the over-all rate of reaction on temp. varied gradually. The apparent activation energy calcd. from temp. coeff. of the over-all rate may have any value between zero and that of the true activation energy.

10755. Rice, T. and Ivey, F. E., Jr. **Design and operation of a bench-scale automatic catalyst-aging unit.** *Petroleum Processing* 2, No. 12, 950-1; *Oil Gas J.* 46, No. 28, 227-8, 234 (1947).—*C.A.* 42, 1727*a*.

The product distribution obtainable from catalysts at various activity levels, the effect of operating variables on product distribution, and other information pertaining to the operation of com. catalytic cracking equipment could be detd. The fixed-bed pilot plant unit was designed to operated on a 30-min. cycle with an on-stream period of 10 min., a vacuum- and N_2-purge period of 5 min., a regeneration period of 10 min. and a N_2-purge period of 5 min.

10756. Rigamonti, R. and Agliardi, N. **Kinetics of the reaction of carbon monoxide with water vapor in the presence of a zinc oxide catalyst.** *Chimica e industria* 29, 145-9 (1947).—*C.A.* 44, 9784*g*.

The reaction of CO with H_2O in the presence of ZnO catalyst was studied. Within the range 270°-440°C, when the reaction tended to equil., the proportion of active centers in the surface, the proportion being detd. by a distribution function.

10762. Schwab, Walmar. **The catalytic replacement of bromine by hydrogen in the presence of Raney nickel.** *Experientia* 3, 28-9 (1947) (in French).—*C.A.* 41, 4366*c*.

In the debromination of 1-hydroxy-3-methyl-4-bromoanthraquinone, 1-methoxy-3-methyl-4-bromoanthraquinone, 1-hydroxy-6, 8-dimethoxy-3-methyl-4-bromoanthraquinone, and 1,6,8-trimethoxy-3-methyl-4-bromoanthraquinone by means of H_2 over Raney Ni, it was found that a HO— para to the Br caused a much more rapid removal of Br than a CH_3O— in the same position. However, methoxyl groups in the 6 and 8 positions only slightly retarded the speed of removal of Br.

10763. Shankland, Rodney V. and Schmitkons, George E. **Determination of activity and selectivity of cracking catalyst.** *Proc. Am Petroleum Inst.* 27, III, 57-77 (1947).—*C.A.* 42, 6095*c*.

A lab. test method was suitable for testing granular, powd., or pilled catalyst for cracking activity and selectivity. Cracking activity of a test catalyst was reported in terms of the relative wt of a reference catalyst required to give the same extent of cracking at otherwise identical conditions. The selectivity factors most commonly detd. were the coke-and-gas producing factors.

10764. Sidorov, I. P. and Livshits, V. D. **Kinetics of ammonia synthesis in isothermal conditions.** *J. Phys. Chem.* (U.S.S.R.) 21, 1177-81 (1947) (in Russian).—*C.A.* 42, 2495*h*.

The equation of Temkin and Pyzhev was valid for the synthesis of NH_3 at 300 atm. between 425 and 525°C, when the rate of flow of outgoing gas varied from 15,000 to 150,000 times the vol. of catalyst per hr. The catalyst was Fe promoted with Al_2O_3 and K_2O.

10765. Taylor, Hugh S. and Liang, Shou Chu. **The heterogeneity of catalyst surfaces for Chemisorption. I. Zinc oxide.** *J. Am. Chem. Soc.* 69, 1306-12 (1947).—*C.A.* 41, 5772*d*.

A new technique for detg. adsorption isobars was applied to the study of the adsorption of H_2 by ZnO over the temp. range 77-600°K. Desorption of chemisorbed H on raising the temp. was shown through certain temp. ranges, followed by re-adsorption at still higher temp. The data indicated a marked heterogeneity of the ZnO surface for the adsorption of H_2 that must be taken into consideration in attempting to evaluate energies of activation for adsorption and catalysis.

10766. Temkin, M. and Kiperman, S. **Kinetics of synthesis and decomposition of ammonia on various catalysts.** *J. Phys. Chem.* (U.S.R.R.) 21, 927-52 (1947) (in Russian).—*C.A.* 42, 2501*g*.

The equation for the rate v of reaction, $v = k_1P_1(P_2^3/P_3^2)^{\alpha} - k_2(P_3^2/P_2^3)^{1-\alpha}$ in which P_1, P_2, and P_3 were the partial pressures of N_2, H_2, and NH_3, resp., and k_1, k_2, and α were const., was integrated by assuming the total pressure to be const. The energy of activation was expressed as a function of α. The above equation was valid only when the system was not too far removed from the equil. speed of the inverse reaction was not markedly different from that of the direct reaction. With the catalyst investigated (obtained by decompn. of the basic carbonate) the speed const. was independent of the concn. of H_2O vapor (more intensely adsorbed by the catalyst), but depended on the concn. of CO. The apparent order of the reaction with respect to the latter may be from 0.5 to 1.

10757. Roginskiĭ, S. Z. **Poisoning and modifying catalysts.** *J. Phys. Chem.* (U.S.R.R.) 21, 1143-58 (1947) (in Russian).—*C.A.* 42, 2501*i*.

A definite impurity can either raise or lower the efficiency of a catalyst according to its amt. The effect of a definite amt. of an impurity can be pos. or neg. according to conditions. The increase of efficiency was not always due to a reduction in the activation energy, but may be assocd. with an increased energy of activation. Catalysts can be modified by addns., not only poisoned or promoted.

10758. Sato, Seibi and Oda, Ryohei. **Studies on ion-exchange synthetic resins. III. Catalytic reaction in esterification.** *Chem. High Polymers* (Japan) 4, 139-40 (1947).—*C.A.* 46, 2706*a*.

Resin obtained by condensation of sulfonated PhOH and HCHO was used as a catalyst in esterification of fatty acids with alc.

10759. Sborgi, U.; Giovanni, E., and Federico, L. **Thermal-fission of methane in the presence of a platinum catalyst.** *Ann. chim. applicata* 37, 106-14 (1947).—*C.A.* 41, 7214*f*.

The amt. of CH_4 decompd. in the presence of a catalyst consisting of 0.4% Pt black deposited on pumice was detd. in the range 500°-1100°C. The ratio H_2/CH_4 approached 2.0 at the higher temps.

10760. Scheumann, W. W. and Rescorla, A. R. **Aromatic adsorption index as rapid method for approximating catalyst activity.** *Petroleum Processing* 2, No. 12, 946-7; *Petroleum Refiner* 26, No. 12, 119 (815)-121 (817); *Oil Gas J.* 46, No. 28, 231-4 (1947).—*C.A.* 42, 1726*g*.

The catalyst sample was first heated at 850°F. A sample (3-1/2-g) was then weighed into an adsorption vessel and 5 ml of 30% toluene and 70% isoöctane was added. The adsorption vessel was shaken in a mech. shaker for 2 hrs. The aromatic adsorption index was the difference between the n of the original hydrocarbon mixt. and that of the hydrocarbon mixt. after contact with the catalyst multiplied by 10^4.

10761. Schwab, Georg-Maria. **The absolute reaction velocity of contact catalysis.** *Proc. Intern. Congr. Pure and Applied Chem.* (London) 11, 621-6 (1947) (in English).—*C.A.* 46, 2383*d*.

The Arrhenius equation, $k = k_0 \exp(-q/RT)$ or $\log k = B - (q/RT)$ was studied. A kinetic approach and the assumption of a smooth and fully activated surface permitted the calcn. of the upper limit of B within the limits of errors in the surface, the thickness, and the mol. frequency. The values of B for almost all catalysts were lower than the calcd. limit; consequently, B must depend on other factors. In general, the real activity of a given catalyst depended on the upper limit of B and the state. Variations of the adsorbed amt. of N_2 may cause the decompn. of NH_3 to be a zero-order reaction at very low NH_3 concns.

10767. TOPCHIEVA, K. V. AND PANCHENKOV, G. M. **The kinetics of the disproportionation of hydrogen in gasolines as depending on the composition of aluminum silicate catalysts.** *Compt. rend. acad. sci. U.R.S.S.* **55,** 505-8 (1947) (in English).—*C.A.* **41,** 7211*i*.

The H-enriching activities of a series of catalysts contg. different proportions of Al_2O_3 and SiO_2 were detd. using the 100°-150°C fraction from com. cracked gasoline. Pure silica was inactive, pure Al_2O_3 somewhat active, and the 30% Al_2O_3-70% of SiO_2 catalyst, corresponding to $Al_2O_3.4SiO_2$, was most active. The activity of the catalyst was a function of the no. of active $Al_2O_3.4SiO_2$ mols. on the surface.

10768. TSUTSUMI, SHIGERU AND SHIBAYAMA, KAZUO. **Polymerization of butylene by means of active clay.** *Mem. Inst. Sci. Ind. Research, Osaka Univ.* **5,** 162-5 (1947).—*C.A.* **46,** 8357*f*.

C_4H_8 was converted into polymerized oil at 170°C by active-clay catalyst. The durability of the catalyst was increased by adding 2% $Zn(NO_3)_2$ and heating to 300°C. C_4H_8 was polymerized also by SiO_2-Al_2O_3 gel. The catalyst with a ratio of SiO_2/Al_2O_3 of 40:60 was the most effective. Addn. of $ZnCl_2$ increased the catalytic activity.

10769. WEBB, G. M. AND EHRHARDT, C. H. **Properties of cracking catalysts.** *Petroleum Processing* **2,** 5-8 (1947).—*C.A.* **42,** 9138*i*.

The basic types of cracking catalysts were the natural catalysts, such as Super Filtrol; silica-base catalysts, such as silica-alumina, silica-magnesia, and silica-zirconia, and the alumina-base catalysts. Procedures were presented by which some important characteristics were detd.

10770. WEBB, G. M.; SMITH, M. A., AND EHRHARDT, C. H. **Chemical and physical properties of alumina-molybdenum oxide catalysts for hydroforming.** *Petroleum Processing* **2,** 836-40 (1947).—*C.A.* **42,** 9139*f*.

The conventional impregnated form of an alumina-molybdenum oxide catalyst for hydroforming was found to be of low activity, high in coke formation, and to have poor catalytic and strength stability. Catalysts made by pptn. of aluminum hydrogel in the presence of ammonium molybdate, followed by drying, calcining, and pelleting have high activity, greatly improved stability, and decreased coke formation.

10771. WICKE, E. **Importance of surface diffusion for the effectiveness of porous catalysts. II. Surface diffusion at low pressures.** *Angew. Chem.* **B19,** 94-6 (1947).—*C.A.* **42,** 442*d*.

The application of the Poiseuille and the Knudsen equations to combined streamline and mol. flow was discussed. Measurements were reported for fritted-glass filters, an activated carbon, and reduced Ni powder. Discrepancies between actual flow and calcd. flow were thought to be due to surface diffusion of the gas.

10772. WICKERT, K. **Corrosion and catalysis.** *Arch Metallkunde* **1,** 270-5 (1947).—*C.A.* **42,** 6302*g*.

In the presence of NaCl, Fe was attacked much more rapidly under otherwise identical conditions. NaCl did not enter into the final product, nor did the soln. suffer a change in concn. The observations were made on 200 ml of soln. with one calomel and one glass electrode. Any changes in potential would be caused by changes in the electrolyte. O_2 was admitted to the soln. through a glass tube; 98% pure Fe powder was selected. The potential, converted into pH values, plotted vs. time yielded 2 typical curve formations: the NaCl type and the $ZnCl_2$ type. In type NaCl reaction the Fe content dropped to 94.7% at the end of the test.

10773. YAMANAKA, TATSUO. **Center of catalysis of catalysts for hydrogenation.** *Bull. Inst. Phys. Chem. Research* (Tokyo); *Chem. Ed.* **23,** 440-64 (1947).—*C.A.* **42,** 6628*g*.

Reduced Cu lost its hydrogenating activity by the poisoning action of diethyl sulfide. When only a small amt. of ZnO was added, it gave rise to semifusion leading to decrease in the active portion, whereas its addn. in suitable amt. served to suppress semifusion and increased the active portion. Reducing activity of Cu was largely lost by the poisoning of diethyl sulfide. The case was similar to that when Ni was poisoned by H_2S, but as the active portion left unpoisoned was much smaller in case of Cu than Ni, Ni was preferred. Reduced Cu had the catalytic power of reducing the carbonyl group to OH in H_2 under pressure.

10774. YAMANAKA, TATSUO. **Catalytic center of hydrogenation catalysis.** *Bull. Inst. Phys. Chem. Research Chem. Ed.* **23,** 481-98 (1947).—*C.A.* **42,** 6629*e*.

The catalytic activity of Pd catalyst in the hydrogenation of acetylene increased when heat-insulating material was used as a supporter. However, the mechanism of polymerization of C_2H_2 was different from that of Ni catalyst. Pd had a dehydrating action because it lacked a strong adsorbing power for H_2. Therefore, even when the partial pressure of H_2 was not strong, a decrease in the amt. of C_2H_2 was not perceptible. Polymerization of C_2H_2 was caused only when H_2 was mixed with C_2H_2. Consequently, semifusion of the catalyst was not effective in decreasing this trouble.

10775. ADKINS, HOMER AND BILLICA, HARRY R. **Preparation of Raney nickel catalysts and their use under conditions comparable with those for platinum and palladium catalysts.** *J. Am. Chem. Soc.* **70,** 695-8(1948).—*C.A.* **42,** 3328*c*.

NaOH (160 g) in 600 ml H_2O at 50°C was treated (25-30 mm) with 125 g Raney Ni-Al alloy, the suspension was stirred 50 min. at 50°C, the catalyst (termed W-6) was washed 3 times by decantation, transferred to a special washing tube, and washed with 15 liters H_2O (about 250 liter/min) under H_2 pressure, and finally washed in a centrifuge tube with 150 ml 95% EtOH and then with abs. EtOH; the catalyst should be stored in a refrigerator in a closed vessel filled with abs. EtOH.

10776. ADKINS, HOMER; RAE, DOROTHY S.; DAVIS, JAMES W.; HAGER, GLENN F., AND HOYLE, KATHRYN. **Sulfur as a promoter for a nickel catalyst in dehydrogenation.** *J. Am. Chem. Soc.* 70, 381-2(1948).—*C.A.* 42, 2247*i*.

Thiophene-free C_6H_6 was not effective with a Ni catalyst in the oxidation (dehydrogenation) of bicyclohexyl to Ph_2. However, C_6H_6 contg. thiophene or Ph_2S in a suitable proportion to the wt of the catalyst present brought about an almost quant. conversion. With thiophene, the optimum quantity was about 10 mg per g of catalyst.

10777. ALCHUDZHAN, A. A. AND VVEDENSKII, A. A. **Kinetics and mechanism of the hydrogenation of hydrocarbons. V. Effect of benzene, cyclohexane, and nitrogen on the change of the activity of nickel catalysts in the hydrogenation of benzene.** *Zhur. Obshchei Khim.* **18**, 261-7(1948).—*C.A.* 42, 8596*f*.

Upon treatment of 0.33 mole C_6H_6 during 90 min. at 230°C, the hydrogenating activity, *a*, of the Ni catalyst fell from about 10 % hydrogenation of C_6H_6 at 230°C to zero; in subsequent operation in C_6H_6 + H_2, *a* rose slowly but attained a stationary value of only about 6% in 150 min. On another batch of Ni catalyst, a very slow attainment of *a* in operation in C_6H_6 + H_2 was observed after a 48-hr treatment with H_2, the stationary *a* (~11%) being attained only after 150 min. Subsequent treatment with N_2, 1 liter/hr, 85 min., caused the initial *a* to drop to about 3%; in operation, *a* rose rapidly to a stationary 8%. Although deactivation with H_2-free C_6H_6 was followed only by partial recovery of *a*, the recovery was complete after deactivation of C_6H_6 contg. a small amt. of H_2. Cyclohexane lowered *a* in the same way as C_6H_6; complete restoration of the former *a* required very prolonged treatment with H_2, of the order of hundreds of hrs.

10778. ALCHUDZHAN, A. A.; VVEDENSKII, A. A., AND FROST, A. V. **Kinetics and mechanisms of the hydrogenation of hydrocarbons. VI. Mechanism of the catalytic hydrogenation on nickel and palladium.** *Zhur. Obshchei Khim.* 18, 268-75(1948).—*C.A.* 42, 8597*c*.

Hydrogenation on Ni proceeded either through dissolved H_2, in analogy with the soln. of H_2 in Pd, and that establishment of a stationary concn. of H_2 required time, or by ascribing slow rates to the establishment of stationary concns. of C_6H_6 and of cyclohexane through adsorption and desorption on Ni. The activity of a catalyst could be restored to its original value by prolonged reactivation with H_2 which showed the phys. constancy of the adsorptive properties of the catalyst surface.

10779. AMAN, J.; FARKAS, L., AND FARKAS, A. **Some catalytic hydrogen exchange reactions of hydrocarbons.** *J. Am. Chem. Soc.* 70, 727-32 (1948).—*C.A.* 42, 4035*c*.

The following exchange reactions of H (D) atoms in Pd and Ni catalysts at pressures of 20-700 mm in the range of 80°-170°C were investigated by both circulatory and static methods: H_2O and ethylene, water and butene, water and butane, butene and butane, and butane and ethylene. Two mechanisms were proposed for the catalytic exchange of hydrocarbons with mol. H_2. It was not possible to decide whether those H atoms attached to the double bonded C atoms exchanged more readily than the remainder. Of particular significance was the absence of exchange between butane and water under conditions under which the exchange between butene and water took place rapidly.

10780. AMIEL, JEAN; BRENET, JEAN, AND RODIER, GEORGES. **Molecular structure of manganese dioxide.** *Compt. rend.* 227, 60-1(1948).—*C.A.* 42, 7587*d*.

The magnetic susceptibility of activated MnO_2 (37.9×10^{-6}) was greater than that of normal MnO_2 (28.9×10^{-6}) because of a diminution of the Mn-O distance.

10781. AMIEL, JEAN; RODIER, GEORGES, AND BRENET, JEAN. **The parallelism of the evolution of the catalytic, magnetic, and depolarizing properties of some samples of manganese dioxide.** *Compt. rend.* 227, 1356-8(1948).—*C.A.* 43, 7313*d*.

Nine samples of MnO_2 were examd. catalytically by measurement of the rate of decompn. of H_2O_2. In general, samples of comparable purity, the one normal and the other active, showed a simultaneous increase in catalytic power, depolarizing ability, and magnetic susceptibility.

10782. ANDERSON, ROBERT B.; HALL, W. KEITH, AND HOFER, L. J. E. **Fischer-Tropsch synthesis. IV. Properties of reduced cobalt catalysts.** *J. Am. Chem. Soc.* 70, 2465-72(1948).—*C.A.* 42, 8058*e*.

Reduced Co-ThO_2-MgO-kieselguhr and Co-ThO_2-kieselguhr catalysts and similar prepns. with one or more of the components omitted were studied. B.E.T. surface areas and CO chemisorptions at -195°C, Hg and He d., and x-ray diffraction were detd. The promotors prevented excessive decreases in surface area on reduction. Kieselguhr as a carrier was somewhat effective in preventing the decrease in surface area on reduction, but its most important function was to prevent the decrease in bulk vol. of the catalyst on reduction. The chemisorption studies with CO showed that an appreciable fraction of the surface was occupied by promoter.

10783. ANDERSON, ROBERT B.; KRIEG, ABRAHAM; SELIGMAN, BERNARD, AND TARN, WILLIAM. **Fischer-Tropsch cobalt catalysts. Influence of type of kieselguhrs.** *Ind. Eng. Chem.* 40, 2347-50 (1948).—*C.A.* 43, 3167*d*.

Catalysts of the Co-thoria-magnesia-kieselguhr (100:6:12:200) type, pelleted, were tested with 2:1 H_2 -CO synthesis gas at atm. pressure, const. space velocity, and temp. was varied to maintain const. contraction of 70%. Five American kieselguhrs were tested, in combination with several special treatments. The more active catalysts were prepd. with kieselguhrs having smaller concn. of removable Fe. No correlation was found with small amts. of other impurities present, with particle size, surface area, or structure of natural diatoms.

10784. ANISIMOV, S. R. AND KHAIDAROV, G. I. **Catalytic properties of hafnium zirconium**

oxides. *Zhur. Obshchei Khim.* 18, 40-2(1948).—*C.A.* 42, 8428*c*.

Catalysts of pure HfO_2 and ZrO_2 were tested with 95.5% EtOH flowing at 30 ml/hr, between 285 and 555°C, in N_2. The Hf catalyst was prepd. by fusing 99.5% pure HfO_2 with a 5-fold excess of Na_2CO_3 at 800°C, dissolving in H_2SO_4, pptg. Fe with NH_4CNS + ether, pptg. $Hf(OH)_4$ with NH_4OH, washing to remove all CNS^- and drying 5 hrs at 150°C; the ZrO_2 catalyst was prepd. in a similar way. Both catalysts caused both dehydration and dehydrogenation of EtOH and their activities were almost identical. Firing at above 500°C (8 hrs in air) destroyed almost completely the catalytic properties of both ZrO_2 and HfO_2.

10785. APEL'BAUM, L. AND TEMKIN, M. **Oxidation of ammonia on gauzes of platinum and platinum-rhodium, I, II.** *J. Phys. Chem.* (U.S.S.R.) 22, 179-94, 195-207(1948)(in Russian).—*C.A.* 42, 5321*a*.

A quartz tube contained *n* wire gauzes (wire diam. 0.09 mm) placed next to each other. The geometrical surface area, *S*, was 1.87 cm^2. The outgoing gas was oxidized by H_2O and the soln. titrated with NaOH; the result yielded $x - y$, x and y being the concns. of NO and NH_3, resp., in the gas. In some expts. x and y were measured separately. The inlet gas was mostly 10% NH_3, 90% air, the pressure was atm., and the temp. of the gauzes usually was 800-900°C. It was assumed that the highest value of $x - y$ obtained by increasing *n* represents x alone and that the relative yields of NO and the by-products (presumably NH_4NO_2 and NH_4NO_3) were independent of *n*. The concn. y could then be calcd. from the exptl. values of $x - y$. The rate of reaction was detd. by diffusion.

10786. AYERS, EUGENE; MONTGOMERY, C. W., AND HIRSCH, JOEL H. **Problems associated with Fischer-Tropsch process.** *Petroleum Engr.* 20, No. 3, 203-12(1948).—*C.A.* 43, 1550*c*.

The Fischer-Tropsch process produced 1 vol. of gasoline from approx. 2000 vols. gas (synthesis and recycle), and for this reason the equipment was especially large and expensive. Wax and carbon deposition and carbide formation on the catalyst, the great amt. of heat transfer involved, the high power requirements, and the large ratio of "oxygenated" by-products to fuel hydrocarbons were other difficulties encountered.

10787. AYRES, EUGENE; MONTGOMERY, C. W., AND HIRSCH, JOEL H. **Some problems associated with the Fischer-Tropsch process.** *Petroleum Refiner* 27, No. 11, 583-5(1948).—*C.A.* 43, 2401*g*.

The improvement of space-time yields in this process increased the prevalence of side reactions on the catalyst. The more important of these reactions discussed briefly were: (1) carbon deterioration of Fe, with a suggested mechanism for catalyst powdering and (2) formation of wax.

10788. BALANDIN, A. A. **The multiplet theory and the transition-state theory.** *Doklady Akad. Nauk S.S.S.R.* 63, 535-8(1948).—*C.A.* 43, 2852*a*.

If A_1 was the initial reactant, A_2 the product in the gas phase, A_{a_1} and A_{a_2}, resp., the adsorption complexes between A_1 and A_2 and the catalyst surface, A^* the intermediate activated complex, the heterogeneous reaction was written in the form $A_1 \rightleftharpoons A_{a_1} \rightleftharpoons A^* - A_{a_2} \rightleftharpoons A_2$. With f, f_a, and f_s designating, resp., the partition function of the reactant in the gas phase, of the adsorbed mols., and of the unoccupied active centers at the surface, the adsorption equil. const. $a = f_a/(f.f_s).\exp.\ (\Delta H_a/kT)$, where ΔH_a = heat of adsorption. The ratio f_a/f was evaluated by the usual factorization wherein, in the adsorbed state, the translational factor obviously disappeared; there were 3 rotational and 3 vibrational degrees of freedom, whereas the internal degrees of freedom remained unchanged.

10789. BALANDIN, A. A. AND KIPERMAN, S. L. **Reversible and complex-reversible poisoning of a nickel catalyst in dehydrogenation.** *Doklady Akad. Nauk. S.S.S.R.* 63, 387-90(1948).—*C.A.* 43, 2499*b*.

Rates of dehydrogenation were detd. in equimol. mixts. of cyclohexane with C_6H_6, toluene, m-$C_6H_4Me_2$, o-$C_6H_4Me_2$, mesitylene, PhEt, C_7H_{16}, C_8H_{18}, and 2,2,3-trimethylheptane, at 236°C (rate of flow 0.2 ml/min.) on a Ni-on-Al_2O_3 catalyst. The catalyst bed was 2.4 cm high (5 cm before reduction) in a 2.3 cm diam. tube. The H_2 evolved in 3 min. was corrected for const. activity of the catalyst by intermediate runs with cyclohexane. The vol. of H_2 plotted against the amt., in %, of cyclohexane in the mixt. gave displacement curves composed of rectilinear, convex, and concave portions. Complete linearity indicated equality of the relative adsorption coeffs. of cyclohexane and the other hydrocarbon.

10790. BEDNARS, C.; LUNTZ, D. M., AND BLAND, R. E. **A study of operating variables in thermofor catalytic cracking.** *Chem. Eng. Progress* 44, No. 4, *Trans. Am. Inst. Chem. Engrs.* 293-8(1948).—*C.A.* 42, 4335*f*.

Temp. was varied from 800° to 930°F, space velocity from 0.2 to 2.4 $V_o/hr/V_c$, and catalyst activity from 28 to 36 A.I., when a Mid-Continent heavy gas oil was cracked over activated clay catalysts. Max. gasoline yields were obtained from a combination of high-catalyst activity, low temp., and low-space velocity. An increase in reaction temp. improved the ASTM and Research octane values of the catalytic motor gasoline, with the greatest effect on Research octane.

10791. BLASCO, E.; DOBLAS, J., AND YZU, L. **Catalytic aromatization of paraffinic gasolines.** *Combustibles* 8, No. 42, 62-6(1948).—*C.A.* 43, 3997*d*.

Cr oxide catalyst on silica gel was used in aromatization of imported straight-run gasoline. A spiral of Cu wire in the preheater desulfurized the feed. At 550°C the yield of liquid products was 62%, contg. 100% aromatic hydrocarbons. At intermediate temps. formation of dienes necessitated refining of the products by washing with 84% H_2SO_4 to det. aromatic hydrocarbons by ultraviolet absorption. At 500°C, a 93% yield of gasoline contg. 30% aromatic hydrocarbons and of I_2 no. 4.5 resulted. For aviation gasoline this latter method was suitable; for production of pure aromatic hydrocarbons the lower space velocity at 550°C was suitable.

10792. Blesa, Antionio Ara. **The effect of micellar surface on the catalytic decomposition of hydrogen peroxide by platinum sols prepared by the electrolytic [Bredig] method.** *Rev. acad. cienc. exactas, fís.-quím. y nat. Zarogoza Ser.* 2A, 3, No. 2, 39-64(1948); *Anales real. soc. espan. fís. y quím.* 45B, 561-76(1949).—*C. A.* 44, 6712*c*.

Pt sols were prepd. by using various potentials and current ds. and the particles sizes were detd. ultramicroscopically. All had radii in the range 75-95 mμ. KCN by itself aided the decompn. of H_2O_2 to an extent roughly proportional to the KCN concn. Addn. of increasing amts. of KCN to the Pt sol first decreased and then increased the rate at which it decompd. H_2O_2. The amt. of KCN required to give min. velocity ("lethal dose") for a particular sol increased roughly with the total surface area of the sol particles. The specific lethal dose (wt of KCN per unit of surface) was nearly const. at 0.65 mg per cm^2 for all sols studied. Expts. with an aq. soln. of I_2 gave results similar to KCN.

10793. Bonét-Maury, Paul and Lefort, M. **The catalytic properties of element 84 (polonium 210).** *Compt. rend.* 226, 173-5(1948); *J. Chem. Soc., Suppl. Issue No.* 2, S322-3(1949).—*C. A.* 42, 2865*e*; 44, 7638*f*.

The relation between catalyst concn. and the rate of decompn. of H_2O_2 for Pt, Pd, and Po was studied. At concns. of the order of 10^{-2} to 10^{-3} γ/ml, the effectiveness of Po was somewhat less than that of Pt. The effect of Pt dropped to practically zero at 5×10^{-4} γ/ml, while Po had an observable effect at 10^{-7} γ/ml.

10794. Booth, N.; Wilkens, E. T.; Jolley, L. J., and Tebboth, J. A. **Catalytic synthesis of methane. Experimental work of the Fuel Research Station.** *Gas Research Board, Copyright Pub. No.* 21/11, 44 pp(1948).—*C. A.* 43, 3169*e*.

Ni catalysts supported on kieselguhr and promoted with ThO_2 and MgO were used with water-gas-H_2 mixts. of varied compns. In a lab.-scale app. at 250-350°C with a gas throughput of 1 ft^3/hr at atm. pressure, the catalysts enabled the conversion of over 99% of the CO for long periods with space velocities of 3700 vol. of gas per vol. catalysts space per hr. The deposition of carbon on the catalyst was controlled: (1) use of suitable conditions in the prepn. of the catalyst; (2) choice of suitable promoters and supports, (3) use of H_2:CO ratios of 3:1 in the process gas; (4) addns. of moderate proportions of water vapor to the process gas; and (5) effective removal of the exothermic heat of reaction to avoid high temps. in the catalyst bed.

10795. Bourns, A. N. and Nicholls, R. V. V. **The catalytic action of aluminum silicates. II. The dehydration of 1,3-butanediol, and 1,4-butanediol over activated Morden bentonite.** *Can. J. Research* 26B, 81-8(1948).—*C. A.* 42, 4928*i*.

1,3-Butanediol passed over activated Morden bentonite at 250-350°C yielded 2.2-27.5% PrCHO, 7.9-23.7% 3-buten-1-ol, b_{760} 113.5°, d_4^{20} 0.850, n_D^{20} 1.4210, 3.4-11.1% of the cyclic butyral of 1,3-butanediol, b_{760} 161.3-1.5°, d_4^{20} 0.915, n_D^{20} 1.4254, 16.2-29.0% 1,3-butadiene, and some propene, 2-butene, CH_2O, and carbon.

10796. Braude, G.; Shurmovskaya, N., and Bruns, B. **The kinetics and mechanism of the catalytic hydrogenation of carbon monoxide I. A method of preparation of metal catalysts from oxides and handling the catalysts without contact with the air.** *J. Phys. Chem.* (U.S.S.R.) 22, 483-6(1948)(in Russian).—*C. A.* 42, 7147*g*.

The reduced metal was kept in H_2 and the samples also withdrawn in H_2.

10797. Braude, G. and Bruns, B. **The kinetics and mechanism of the catalyst hydrogenation of carbon monoxide. II. Formation of iron carbide during hydrogenation of carbon monoxide on an iron catalyst.** *J. Phys. Chem.* (U.S.S.R.) 22, 487-94(1948)(in Russian).—*C. A.* 42, 7147*h*.

Mixts. of CO and H_2 in ratios 1:3 to 1:5 were circulated at 225-350°C over an Fe catalyst prepd. by H_2 reduction of Fe_2O_3. The main reaction occurring was $n\mathrm{Fe} + \mathrm{CO} + \mathrm{H_2} \rightarrow \mathrm{Fe_nC} + \mathrm{H_2O}$. When the catalyst was used for longer time, the concn. of carbon in it increased and its efficiency decreased; the catalytic activity almost disappeared when 0.24 atom C was deposited per 1 atom Fe. The slow drop of pressure was due to the reaction between this carbide and excess H_2.

10798. Bremner, J. G. M. **The mechanisms of contact catalytic reactions.** *Research* 1, 281-5 (1948).—*C. A.* 42, 4435*c*.

Hydration-dehydration, alkylation-dealkylation, isomerization, polymerization and hydrogenolysis reactions, in which carbonium ions were considered to be formed, involved electron transfer between the catalyst and reactant mols.

10799. Bridger, G. L.; Gernes, D. C., and Thompson, H. L. **Development, production, and performance of water-gas conversion catalyst.** *Chem. Eng. Progress* 44, No. 5, *Trans. Am. Inst. Chem. Engr.* 363-82(1948).—*C. A.* 42, 4723*d*.

The process comprised: (1) pptn. by addn. of Na_2CO_3 soln. to $FeSO_4$ soln., (2) washing the ppt. by multiple decantation and repulping, (3) addn. of MgO to the thickened ppt. immediately before filtration and partial drying, (4) mixing the partially dried filter cake with $K_2Cr_2O_7$ and freshly ppt. aluminum hydroxide (contg. $Mg(OH)_2$, which was used as a filter aid) in an edge runner, (5) extruding the mixt. into 5/16 in. diam. rods which were cut to approx. 1/2 in. lengths, and (6) drying and roasting the formed catalyst in a steam-heated screen drier and an electrically heated kiln, resp. The catalyst contained about Fe_2O_3 54, MgO 17, $K_2Cr_2O_7$ 6.8, Al_2O_3 0.3, Na_2O 0.3, SO_3 0.5, CO_2 14, and H_2O 7%. The catalyst possessed high activity, long life, and an exceptional ruggedness.

10800. Brodsky, Michel and Berquin, Yves. **Contact sulfuric acid: determination of water formed on the catalyst.** *Bull. soc. chim. France* 1948, 470-2.—*C. A.* 42, 6495*g*.

An app. which carefully reproduced conditions found in industrial contact process equipment was constructed and applied to the analysis of water formed during the catalysis. The method, based on an acidimetric titration of the H_2SO_4 formed by the action of SO_3 and H_2O, had a precision of about 3% and a sensitivity to an amt. of oxidizable H corresponding to 50 mg H_2O per m^3 of catalyzed gas.

10801. Brooks, Benjamin T. **Active-surface catalysts in formation of petroleum.** *Bull. Am. Assoc. Petroleum Geol.* 32, 2269-86(1948). —*C.A.* 43, 5929*g*.

Geol. and chem. evidence was given for a relatively low temp. history for all petroleums. Active-surface minerals included most clays. Pure limestone or dolomites had a neglible effect and oils suffered little change after migration to them. Absence of olefins and presence of aromatics was indicative of catalytic action.

10802. Burwell, Robert L. Jr. **Catalytic racemization and dehydrogenation of optically active sec-butyl alcohol by copper and by zinc chromite.** *J. Am. Chem. Soc.* 70, 2865-9(1948). —*C.A.* 43, 1249*d*.

Rates of catalytic dehydrogenation and racemization of l-sec-butyl alc. were measured simultaneously over Cu and Zn chromite catalysts. Racemization was far more extensive than could be accounted for by the production of inactive alc. by rehydrogenation of MeCOEt. Dehydrogenation on Cu was inhibited by the reaction products relative to the racemization. With Zn chromite, the reactions were poisoned, probably by adsorption of products of concurrent condensation reactions.

10803. Chalmers, B.; King, R., and Shuttleworth, R. **The thermal etching of silver.** *Proc. Roy. Soc.* (London) A193, 465-83(1948).—*C.A.* 43, 3758*f*.

Grain boundaries appeared as grooves when Ag was heated in air, O_2, H_2, N_2, and in a vacuum and the grooves were visible on specimens heated in air at temps. as low as 300°C. Striations appeared when O_2 was present in the heating atm. and could be caused to disappear by heating in N_2. The lowest temp. at which they were observed on heating in air was about 500°C. Both striations and grain-boundary grooves were formed at the high temp. and were not produced by the cooling process.

10804. Chrétien, André and Thomas, Albert. **The catalytic synthesis of hydrogen cyanide from methane and ammonia.** *Bull. soc. chim. France* 1948, 354-7.—*C.A.* 42, 6495*d*.

The catalytic reaction $2NH_3 + 2CH_4 + 3O_2 \rightarrow 2HCN + 6H_2O + 229{,}800$ cal was studied. The yields of HCN for different ratios of O_2 to NH_3 and CH_4 to NH_3 were detd. The yield of HCN reached a max. of about 55% when the ratio of O_2 to NH_3 was 1.5. With excess O_2, the yield dropped because of oxidation of HCN. The yield of HCN reached 62% when the ratio of CH_4 to NH_3 was 1.1. The max. temp. was about 1110°C when the CH_4 to NH_3 ratio was about 0.8%. The max. temp. was about 1200 when the O_2 to NH_3 ratio was 3.0. The addn. of Rh to the Pt catalyst increased the yield and the activity of the catalyst, while the loss during the run was decreased.

10805. Cornubert, Raymond and Phélisse, Jean. **Systematic study of Raney nickel. Selective hydrogenation of** α, β**-ethylenic ketones.** *Compt. rend.* 227, 1131-3(1948).—*C.A.* 43, 4651*i*.

The hydrogenation of PhCH:CHCOMe in pure EtOH with Raney Ni-Al alloy as catalyst gave $Ph(CH_2)_2CH(OH)Me$.

10806. Cremer, E. **The absolute calculation of the rates of heterogeneous reactions.** *Experientia* 4, 349-51(1948)(in German).—*C.A.* 43, 471*h*.

The results of an investigation of the decompn. of EtCl on various chlorides were presented. It was found that $\log A = q/a + \text{const.}$ The latter relation was explained by assuming quantum leakage of an electron as the rate-detg. step.

10807. Dart, J. C. and Oblad, A. G. **Heat of cracking and regeneration in catalytic cracking.** *Chem. Eng. Progress* 45, 110-18(1948).—*C.A.* 43, 3180*d*.

The heat of reaction in once-through catalytic cracking at 850°F of an East Texas gas oil varied from a heat of reaction of + 100 B.t.u./lb of charge at 35% conversion to a heat of reaction of + 118 B.t.u./lb at 55% conversion. Above 55% conversion the heat of cracking decreased with an increase in conversion to a heat of reaction of + 45 B.t.u./lb of charge at 80% conversion. An increase in av. reaction temp. from 860° to 900°F at const. conversion had substantially no effect on the heat of reaction. The heat of cracking was endothermic to the extent of + 280 B.t.u./lb of product at 35% conversion and decreased uniformly to about + 50 B.t.u./lb of product at 80% conversion.

10808. Daudel, Raymond and Sandorfy, Camille. **Application of the method of mesomeric molecular diagrams to the study of adsorption and heterogeneous catalysis.** *Bull. soc. chim. France* 1948, 358-61.—*C.A.* 42, 8058*d*.

When ethylene was adsorbed by a surface, a bond occurred between a mobile electron on the surface and one end of the ethylene chain, and a valence bond was liberated at the other extremity of the chain. In the hydrogenation of benzene, 2 H atoms were bonded to mobile electrons on the surface. A benzene mol. was bonded to the surface at one of its apexes, in between the 2 H atoms. An adjacent apex took on a charge and attached the nearest H. The bonded apex then attached the other H.

10809. Dibeler, Vernon H. and Taylor, T. Ivan. **Mass-spectrometric and infrared study of rates of deuterium exchange, isomerization, and hydrogenation of the n-butenes.** *J. Chem. Phys.* 16, 1008-9(1948).—*C.A.* 43, 24*f*.

The Ni-catalyzed D_2 exchange, isomerization, and hydrogenation of the *n*-butenes were studied. Mass-spectrometric and infrared analyses were used to det. rate consts. for the initial stages of these processes.

10810. Dilke, M. H.; Eley, D. D., and Maxted, E. B. **Catalytic poisons and magnetic suscep-**

tibility. *Nature* 161, 804(1948).—*C.A.* 42, 6184*h*.

A finely divided sample of Pd (prepd. by reduction of $PdCl_2$ in glycerol by H_2 at 150°C) was evacuated in an ampul at 150°C, sealed off, and its susceptibility measured by the Sucksmith method. The ampul was reattached to the vacuum app. and the Pd satd. with Me_2S gas at 20°C. The amt. adsorbed was measured, the ampul resealed and measured in the magnetic balance. Since Me_2S was an easily condensible gas, the adsorption corresponded to at least 2 monolayers; that is, a van der Waal's layer on top of a chemisorbed layer. Only the chemisorbed layer affected the susceptibility.

10811. Dowden, D. A. **Catalysis and the electronic structure of solids.** *Research* (London) 1, 239-40(1948).—*C.A.* 42, 3648*a*.

The rate of catalytic hydrogenation of double bonds at metal surfaces reached a max. with Group VIII metals and a min. with Group IB pure metals. There was a parallel between this and phys. properties that were functions of the no. of holes in the *d*-band at the top of the Fermi distribution. Catalytic activity must be a function of those characteristics that effect the rate and equil. of H_2 ionization at the metal surface. The ionization process and the rate of electron transfer depended upon factors such as differences between electron affinities, ionization potentials, and electron-level ds. of the solid and the substrate, and upon the shape of the potential barrier at the surface.

10812. Eastwood, S. C. and Potas, A. E. **Thermofor pyrolytic cracking process.** *Petroleum Engr.* 19, No. 12, 43-6(1948).—*C.A.* 42, 8451.

A modification of the Thermofor catalytic cracking process employed high temps. such as 950°C, low pressures (approx. atm.), and contact times of the order of 1 sec to produce high yields of C_2H_4. The process could be employed with a wide variety of charge stocks and produced 25-40% yields of C_2H_4, together with smaller amts. of C_3H_6, C_6H_6, PhMe, 8-13 carbon aromatic compds., and butadiene.

10813. Eischens, Robert P. and Selwood, Pierce W. **Structure and activity of the chromium-aluminum oxide catalyst system.** *J. Am. Chem. Soc.* 70, 2271-3(1948).—*C.A.* 42, 8598*b*.

Surface areas of catalysts (1.9% to 34.5% Cr), made by the impregnation of Al_2O_3 and boehmite, decreased linearly with increase in Cr. At the "*l*" point of the magnetic susceptibility curve, corresponding to the inflection point from a low to a high rate of change of the susceptibility with Cr diln., only 1/9 of the Al_2O_3 surface was covered with Cr_2O_3. Measurements of catalytic activity for the cyclization of heptane at 490°C showed a close relationship between activity and susceptibility. Susceptibility in this system was a measure of the dispersion of Cr atoms.

10814. Feachem, G. and Swallow, H. T. S. **Alumina catalysts for vapor-phase organic dehydrations, deaminations, etc.** *J. Chem. Soc.* 1948, 267-72.—*C.A.* 42, 5750*g*.

Catalytic activity of Al_2O_3 catalysts was detd. by the dehydration of EtOH to C_2H_4 as a function of liquid-feed space velocity. Catalytic activity was greatest on complete conversion of boehmite to γ-Al_2O_3 as detd. by diffraction patterns, and was inversely proportional to the Na_2O content. Samples of boehmite prepd. by different methods showed varying rates of dehydration to Al_2O_3, from 6 hrs at 350°C for boehmite derived from bayerite to over 5 days at 450°C for boehmite derived from pptd. gibbsite by heating under pressure.

10815. Fuzek, John F. and Smith, Hilton A. **Kinetics of heterogeneous reactions with special reference to catalytic hydrogenation.** *J. Am. Chem. Soc.* 70, 3743-5(1948).—*C.A.* 43, 2079e.

The usual method of applying kinetic equations for homogeneous reactions to heterogeneous reactions was inadequate. Whenever the vol. of a gaseous system was changed, conventional rate equations must be modified. The true rate consts. for such heterogeneous reactions differed from those for homogeneous reactions of the same order by the dimensions of vol.

10816. Gallaway, W. S. and Murray, M. J. **Isomerization of certain olefins by silica gel at room temperature.** *J. Am. Chem. Soc.* 70, 2584-6(1948).—*C.A.* 42, 8150*g*.

BuEtC:CH_2 isomerized almost completely (90%) when passed through a silica column at 25°C; Me_3CCH:CMe_2 and Me_3CCH_2CMe:CH_2 were isomerized approx. to the equil. mixt. of these olefins. BuCH:CH_2 was not appreciably isomerized. Reduction of the temp. of the adsorption column to about -20°C nearly halted the isomerization of the olefins studied.

10817. Ghosh, J. C. and Basak, N. G. **Chromium oxide as a catalyst promoter for Fischer-Tropsch synthesis at medium pressures.** *Petroleum* 11, 131-2, 146(1948).—*C.A.* 42, 5643*g*.

A Co-Cu-ThO_2-kieselguhr catalyst was compared to one contg. these elements and 4.6% Cr_2O_3. The latter gave high yields of hydrocarbons (160 g/m^3 synthesis gas) at 205°C, a pressure of 5 atm., and a space velocity of 570-600 ml/hr of catalyst. The ratio CO:H_2 was 1:1. A pressure increase to 9 atm. did not increase the yield of hydrocarbons, but increased formation of CH_4 and CO_2. The catalyst was reduced at 237-240°C.

10818. Glukhovskaya, L. and Bruns, B. **Formation of hydrates of manganese dioxide in the catalytic oxidation of hydrogen.** *Zhur. Fiz. Khim.* 22, 793-6(1948).—*C.A.* 42, 8598*f*.

The rate of oxidation of H_2 by O_2 in the presence of MnO_2 was independent of the small water content of the catalyst. The H_2O formed in this reaction was adsorbed by MnO_2. Hydrates were produced which were thermodynamically unstable; the energy necessary for their formation was supplied by the energy of oxidation of H_2.

10819. Goddui, C. S. and Thornton, D. P. Jr. **Low-temperature carbonization of coal produced most of Japan's synthetic oil.** *Petroleum Processing* 3, 121-31(1948).—*C.A.* 42, 9112*d*.

Production achieved in coal-hydrogenation, Fischer-Tropsch, and low-temp. coal-carbonization plants was less than 750,000 barrels in 1944, the greater part coming from coal carbonization. A mixt. of Fe_2O_3, S, and $Sn(OH)_2$ was chosen as a standard catalyst. A natural Fe catalyst was discovered, but yields were much lower than with Co catalysts.

10820. GOL'DANSKIĬ, V. I. **Dependence of the rate of heterogeneous catalytic reactions on the amount of the catalyst.** *Zhur. Fiz. Khim. (J. Phys. Chem.)* 22, 1374-80(1948).—*C.A.* 43, 2498*a*.

If the rate v of a uni-mol. reaction or a bimol. reaction was detd. by the rate of adsorption or by the rate of diffusion toward the catalyst surface, then $1/v$ was a linear function of $1/S$, S being the surface area of the catalyst. The v of bimol. reactions, both components of which were nearly equally adsorbed, passed through a max. when S increased.

10821. GORDON, ALVIN S. **Pyrolysis of methane flowing through a porcelain tube in the region 1000°.** *J. Am. Chem. Soc.* 70, 395-401 (1948).—*C.A.* 42, 3244*e*.

The decompn. of CH_4 in a porcelain tube at temps. between 1007° and 1075°C was studied. Within this range, the 1st-order consts. increased with increasing decompn. There was a catalytic effect of C_2H_2, probably homogeneous, since the percentage of C_2H_2 increased with increasing percentage of decompn. There was probably no effect of C_2H_4 on the decompn. of CH_4. There was a large catalytic effect of surface in the early stages of the reaction which disappeared by the time 30% of the CH_4 was decompd.

10822. GRACE, E. J. **Narrow range control improves "cat cracker" operation at Sun Oil Company.** *Instrumentation* 3, No. 4, 8-9(1948). —*C.A.* 42, 8452*a*.

Instrumentation for fixed-bed catalytic cracking was described.

10823. HEINEMANN, FELIX. **Catalysts in petroleum refining.** *Petroleum Refiner* 27, No. 5, 273-9(1948).—*C.A.* 42, 9139*e*.

Catalyst reaction and catalyst compns. for the use of hydrocarbon chemistry were discussed. It was concluded that catalyst activity cannot be predicted, but must be detd. experimentally.

10824. HEINEMANN, HEINZ; LALANDE, W. A. JR., AND MCCARTER, W. S. W. **Activated bauxite as a catalyst for polymerization of C_4 olefins.** *Ind. Eng. Chem.* 40, 1224-6(1948).—*C.A.* 42, 5650*c*.

Catalyst activity increased with bauxite dehydration and bauxite activation temp. up to 1400°F. Max. polymerization of isobutylene at atm. pressure was obtained at 200-350°F. Rates of polymerization of iso-and normal butylenes were sufficiently different to permit exclusive polymerization of isobutylene from C_4 olefin mixts. at 400°-600°F. In this range isobutylene conversion was still 31-45% while that of butylenes was zero. The polymerization of mixts. of satds. and unsatd. C_4 hydrocarbons in the presence of activated bauxite catalysts required employment of pressures of 300-500 p.s.i. and about 350°F.

10825. HERNANDEZ, L. AND NORD, F. F. **Interpretation of the mechanism of catalytic reductions with colloidal rhodium in the liquid phase.** *J. Colloid Sci.* 3, 363-75(1948).—*C.A.* 43, 27*e*.

A hydrogenation catalyst was prepd. by dissolving $RhCl_3$ in a 2% aq. soln. of polyvinyl alc., adding NaOH to form $Rh(OH)_3$, and reducing with H_2. The stable colloidal dispersion of Rh was used to catalyze the hydrogenation of aq. EtOH solns. of a no. of org. compds. at room temp. and 1 atm. The rate of hydrogenation of *p*-substituted nitrobenzenes increased as the *p*-substituent changed, the order being: $-NH_2$ (slowest), $-OCH_3$, -H, -Br, -Cl, -I, -COOH, $-NO_2$, -CHO, -CN (fastest). The catalytic activity of Rh involved the formation of an unstable intermediate complex involving ionic H.

10826. HERNANDEZ, L. AND NORD, F. F. **The influence of sulfur on catalytic dehydrogenations with rhodium.** *J. Colloid Sci.* 3, 377-82(1948).—*C.A.* 43, 27*i*.

The colloidally dispersed Rh dehydrogenated iso-PrOH to acetone at 95°C in an aq. soln. contg. sulfide ion. HCOOH was dehydrogenated to produce CO_2 and H_2 in alc. soln. at 95°C. The rate of dehydrogenation increased with the addn. of elementary S up to an at. ratio of Rh:S = 1:3. The rate of hydrogenation of maleic acid in the presence of this Rh catalyst was decreased by S up to an at. ratio of Rh:S = 8:3. However, the catalyst activity under these conditions increased slightly after 5-10 min. These observations suggested that S facilitated dehydrogenation by acting as a H acceptor.

10827. HORSFIELD, S. W. **The catalytic cracking process as a means of peak load shaving.** *Am. Gas J.* 169, No. 1, 11-14, 50(1948).—*C.A.* 42, 6515*b*.

The cracking operations were: (1) mixing the vapor from the liquefied petroleum gas with air and steam in the correct proportions, (2) cracking the mixt. in cracking tubes, (3) cooling the resulting, reformed gas, and (4) enriching this gas to produce a final gas with the desired heating value. The cracking-furnace temps. were maintained within close limits at 982°C. By controlling the proportions of air and steam, reformed gas ranging from 180 to 350 B.t.u. per ft^3 and from 0.52 to 0.65 d. may be produced.

10828. HORSFIELD, S. W. **Catalytic reforming.** *Am. Gas Assoc. Monthly* 30, No. 7/8, 9-11, 39 (1948).—*C.A.* 42, 8443*a*.

The catalytic reforming of propane gave an addnl. gas production and relieved the gas-transmission system during peak loads. The cracking plant consisted of 3 units, 2 of them originally designed for reforming natural gas. The nickel oxide catalyst was impregnated on 3/4 in. refractory cubes and occupied approx. 19 out of 26 ft of tube space; below this zone were small pieces of alundum. The main control of the plant was the flow of process vapor; the proportions of process air and steam were automatically controlled. Propane vapor and air were first mixed and heated to 350°F before steam was added, and the mixt. was then fed to the furnace. No appreciable carbon deposition was noted.

10829. Juliard, A.; Rayet, R., and Ludé, A. **Kinetic study of the dissociation of carbon monoxide accompanying the reduction of metallic oxides.** *Discussions Faraday Soc.* **1948**, No. 4, 193-6.—*C. A.* 43, 4933*b*.

The reduction of Fe_2O_3 and NiO was studied by recording the wt change of weighed (1.8 and 1.4 g, resp.) samples with time, and measuring and analyzing the CO-CO_2 stream at varying temps. Pure Ni did not catalyze the dissocn. of CO. Ordinarily the dissocn. commenced at the onset of the reduction reaction and increased approx. linearly once more when reduction was complete. It was stopped completely at 600°C by the addn. of 30% CO_2. Sponge Ni, in contrast to the sintered samples normally used, markedly catalyzed the CO dissocn. This material could be poisoned by exposure for 1 hr at 700°C in a CO_2 stream. In the Fe expts. CO did not undergo dissocn. as long as no metallic Fe was present.

10830. Kagan, Yu. B. and Bashkirov, A. N. **Use of the differential thermocouple for kinetic measurements.** *Izvest. Akad. Nauk. S.S.S.R. Otdel, Tekh. Nauk* **1948**, 349-58.—*C. A.* 42, 6626*b*.

The temp. difference between an active catalyst and an inert substance placed in the same tube was assumed proportional to the rate of evolution (or absorption) of heat of reaction, hence proportional to the rate of the reaction. This was tested experimentally on the oxidation of Cu on a Kieselguhr carrier. At 245°C oxidation was complete; at 80°C, calcd. on the assumption of a const. proportionality factor between 80° and 245°, oxidation was 27.37% compared to 26.79% by analytical detn. The thermocouple was placed between 5 ml of the catalyst and 5 ml of glass cylinders, sepd. by mica, placed in the same tube.

10831. Kastens, Merritt L. and Hutchinson, J. C. **Contact sulfuric acid from sulfur.** *Ind. Eng. Chem.* **40**, 1340-9(1948).—*C. A.* 42, 7495*f*.

A no. of old, Pt-catalyst plants were rebuilt for V catalyst. The raw material was S for 78% of the acid produced, pyrites for 12.2%, Zn and Cu ores 7.2%. High-purity acid was produced directly from S, and no Pb was necessary in the construction of the plant. New plants were almost completely exposed to the weather in all parts of the country.

10832. Kazanskii, B. A. and Liberman, A. L. **Cyclization of paraffin hydrocarbons with a quaternary carbon atom, and mechanism of the aromatization of paraffins on platinized carbon.** *Doklady Akad. Nauk S.S.S.R.* **61**, 67-70 (1948).—*C. A.* 42, 8448*h*.

The catalytic aromatization of 3,3-dimethylhexane proceeded with the intermediate formation of 1,1-dimethylcyclohexane. With a Pt-carbon catalyst, characterized by 92% dehydrogenation of cyclohexane at 300°C and space velocity 0.33, 23.1 g of 3,3-dimethylhexane at 300°C and space velocity 0.11, gave 850 ml gas (H_2 85.6%, CH_4 9.8%) and 21.2 g catalyzate. The catalyzate of the reaction at 290°C showed the Raman lines of 1,1-dimethylcyclohexane, 459, 705, 829, 963, and 1029 cm^{-1}; the 705 line was very distinct from the 715, 724, 732, triplet of 3,3-dimethylhexane.

10833. Kemball, Charles and Taylor, Hugh S. **The catalytic decomposition of ethane and ethane-hydrogen mixtures.** *J. Am. Chem. Soc.* **70**, 345-51(1948).—*C. A.* 42, 2849*h*.

The decompn. was followed by mass-spectrum analysis using the ratio of the "16 peak" to the "30 peak." The rate of C_2H_6-H_2 decompn. on a supported Ni catalyst = $kp^{0.7}_{C_2H_6} - p^{-1.2}_{H_2}$ over a wide range of compn. with an energy of activation of 52 kcal/mole. At low ratios of H_2/C_2H_6, abnormal kinetics set in. Ethane decomposed quantitatively over this catalyst to CH_4 and carbon with a rate dependent on $p^{0.7}_{C_2H_6}$ and an energy of activation of 40 kcal/mole. The carbon was reversibly deposited and was converted to CH_4 by H. The rate-detg. step of CH_4 formation was the breaking of the C—C bond.

10834. Kobe, Kenneth A. and Hosman, Paul D. **Catalytic oxidation of ammonia to nitrous oxide.** *Ind. Eng. Chem.* **40**, 397-9(1948).—*C. A.* 42, 6063*g*.

NH_3 was oxidized to NO over a manganese oxide-bismuth oxide catalyst. A max. yield of 71% was obtained at 200°C at a space velocity of 5 to 6 ml of gas per ml of catalyst per min., with a gas mixt. contg. approx. 10% NH_3 and 90% O_2. After about 40 hours of use, the catalyst activity decreased rapidly.

10835. Kodama, Shinjiro and Murata, Yoshio. **Studies on the water-gas reaction. I. The activities of catalysts made from natural ocher.** *J. Chem. Soc. Japan*, Ind. Chem. Sect. **52**, 41-3(1948).—*C. A.* 45, 1749*h*.

Catalysts made from natural ocher (Fe_2O_3 64.8%, H_2O 6.4%, wt loss by calcination 20.7%, apparent sp. gr. 0.62), to which were added 5-15% Cr_2O_3 and 5-15% K_2CO_3, were found effective in the water-gas reaction. Cr_2O_3 might promote the activation of water vapor and inhibit the formation of free carbon.

10836. Kodama, Shinjiro; Tahara, Hideichi; Nakabayashi, Tadaaki, and Hongo, Masami. **Gaseous synthesis from carbon monoxide and hydrogen at elevated pressures. IX. The influence of the composition of the raw gas on the reaction.** *J. Chem. Soc. Japan, Ind. Chem. Sect.*, **51**, 23-4(1948).—*C. A.* 44, 9135*g*.

With H_2:CO ratios in the raw gas of 1.1, 2.0, or 2.7, oil yields were 61, 57, or $50 g/m^3$, resp., with a catalyst (Fe + Cu 25 + kieselguhr 125 + K_2CO_3 6% at 10 kg/cm^2 pressure and 210°C. Under similar conditions the addn. of 16% CO_2 (CO:H_2 = 1:1) decreased the oil yield, but 5% CO_2 did not.

10837. Kodama, Shinjiro; Tahara, Hideichi; Nakabayashi, Tadaaki, and Hongo, Masami. **Gaseous synthesis from carbon monoxide and hydrogen at elevated pressures. X. The dependence of the oil yields on the gas flow.** *J. Chem. Soc. Japan, Ind. Chem. Sect.* **51**, 24-3(1948).—*C. A.* 44, 9135*h*.

With Fe catalyst contg. Cu 25 + kieselguhr 125 + K_2CO_3 6% at 10 kg/cm^2 an increase in the flow rate from a reference value, 4 liter (N.T.P.)/hr, decreased the yield/unit vol. and increased the yield/unit time at 210° and 230°C. A decrease of the flow rate decreased the yield/unit vol. only slightly at 190° and 210°C.

10838. KODAMA, SHINJIRO; TAHARA, HIDEICHI; HONGO, MASAMI, AND FUJITA, H. **Gaseous synthesis from carbon monoxide and hydrogen at elevated pressures. XI. Alkalies used in the preparation of the iron catalyst and chlorine as a poison.** *J. Chem. Soc. Japan, Ind. Chem. Sect.*, **51**, 24-5(1948).—*C.A.* 44, 9135*i*.

To conduct the reaction with an Fe catalyst contg. Cu 25 + kieselguhr 125% at 10 kg/cm^2 and 210°C with a gas ratio $CO:H_2 = 1:1$, Na_2CO_3 was the best pptg. agent, and addn. of 6% K_2CO_3 to the catalyst was necessary. Cl in large amts. lowered the yield.

10839. KOMAREWSKY, V. I.; BOS, L. B., AND COLEY, J. R. **Vanadium oxide, a hydrogenation catalyst.** *J. Am. Chem. Soc.* 70, 428-30(1948).—*C.A.* 42, 2500*f*.

The catalyst (35 V_2O_5—65% Al_2O_3) was prepd. by copptn. from solns. of Na_3VO_4 and $Al(NO_3)_3$. The optimum temp. for olefin hydrogenation was 400°C; the hydrogenation of iso-C_4H_8, 1-hexene, and 1-octene was in excess of 95%. The max. allowable space velocity was increased materially by increasing the pressure (0.25 at 21 atm.). At atm. pressure the hydrogenation of iso-C_4H_8 was 98.6, 60.2, and 15% at space velocities of 0.046, 0.150, and 0.345; with 1-octene a space velocity of 0.10 at 1 atm. gave 98.6%; at 21 atm., yields of 94.9, 82.2, and 58.9% resulted with space velocities of 0.25, 0.50, and 1.00. The new catalyst was resistant to S poisoning.

10840. KRAUSE, ALFONS. **Oxidation-reduction catalysts. LXVIII.** *Przegląd Chem.* 6, 129-35(1948).—*C.A.* 43, 2079*h*.

Mechanism of the action of oxidation-reduction catalysts was discussed in the light of current theories, special consideration being given to metallic hydroxides.

10841. KRAUSE, ALFONS. **Theory of catalytic decomposition of hydrogen peroxide.** *Poznan Towarz. Przyjaciol Nauk, Prace Komisji Mat. Przyrodniczej, Ser. A.* 5, No. 3, 163-80(1948).—*C.A.* 44, 7131*e*.

It was assumed that the aq. soln. of H_2O_2 contained 2 kinds of isomeric mols., one acting as oxidizing agent, the other as reducing agent. Catalytic decompn. of H_2O_2 occurred by metallic catalysts because one agent was the final acceptor, whereas the other molecule was dehydrogenated, the final product being O_2 and OH_2. In this reaction free radicals HO and HO_2 appeared, able to initiate an uninterrupted chain of catalytic reaction, accompanied by electronic resonance.

10842. KRISHNA, BAL AND GHOSH, S. **Calculation of velocity constant in presence of heterogeneous autocatalyst.** *Proc. Natl. Acad. Sci. India* **17A**, 65-8(1948).—*C.A.* 46, 4896*d*.

In the reaction $Fe^{++}+Ag^{+}\rightarrow Fe^{+++}+Ag$, the no. and size of the particles of the Ag autocatalyst constantly changed. The curve for velocity const. (k) *vs.* time (t) ascended first and then descended as the Ag coagulated. On the assumption that the colloidal Ag was a homogeneous catalyst and was proportional to the total amt. of Ag formed (x), and that the expression for the slow uncatalyzed reaction $k_1(a-x)^2$ was negligible, $dx/dt = k_1\ (a-x)^2 + k_2(a-x)^{2x}$ became the 3rd-order reaction, $dx/dt = k(a-x)^2x$, and by integration between t_2 and t_1, $k(t_2-t_1) = (1/a^2)\{\ln[x_2(a-x_1)/x_1(a-x_2)]\} + (1/a)\{[1/(a-x_2)] - [1/[a-x_1)]\}$.

10843. KUMMER, J. T.; BROWNING, L. C., AND EMMETT, P. H. **Thermodynamic calculations concerning the possible participation of the carbides of iron as intermediate in Fischer-Tropsch synthesis.** *J. Chem. Phys.* 16, 739-40 (1948).—*C.A.* 42, 6623*d*.

Equil. consts. for the synthesis of *n*-1-olefins (C_2-C_6) and of *n*-paraffins (C_1-C_8) were calcd. at 227° and 327°C. These products were not formed by the reduction of Fe_2C. In addn., it was unlikely that either Fe_3C or "hexagonal" Fe_2C was the intermediate at the temp. and pressure range commonly employed in the Fischer-Tropsch synthesis.

10844. KUMMER, J. T.; DEWITT, T. W., AND EMMETT, P. H. **Some mechanism studies on the Fischer-Tropsch synthesis using C^{14}.** *J. Am. Chem. Soc.* 70, 3632-43(1948).—*C.A.* 43, 2080*i*.

The greater part of the product was formed by some process other than by the reduction of carbide as an intermediate. Only about 10% of the hydrocarbon product appeared to have been formed through the carbide for Fe catalysts at or below 260°C and for Co at 200°C; at 300°C the part of the reaction occurring through the carbide reduction mechanism seemed to average about 16%. The percentage formed through the carbide phase was not critically dependent on the $H_2:CO$ ratio in the range 1:1 to 3:1, on the total pressure of the synthesis in the range 150-800 mm, or on the percentage Fe_2C initially present in the range 4-100%.

10845. KUMMER, J. T. AND EMMETT, P. H. **Use of C^{14}, N^{15}, and deuterium in studying catalytic reactions and adsorption processes on iron catalysts.** *Brookhaven Conf. Rept.*, BNL-C-8, *Isotopic Exchange Reactions and Chem. Kinetics, Chem. Conf.* No. 2, 1-26(1948).—*C.A.* 45, 5502*c*.

The use of C^{14} in studying the mechanism of Fischer-Tropsch synthesis over Fe catalysts was discussed, and also $C^{14}O$ in chemisorption measurements on Fe, $N^{15}N^{15}$ in detg. the extent of exchange of N isotopes at 450-500°C over Fe, and D_2 in measuring the amt. of H_2 remaining on promoted and on unpromoted Fe catalysts after an extended reduction and evacuation at 500°C.

10846. LAIDLER, KEITH J. **Mechanism of some elementary surface reactions.** *Pittsburgh Intern. Conf. on Surface Reactions* **1948**, 51-9; *J. Phys. & Colloid Chem.* 53, 712-32(1949).—*C.A.* 42, 8595*f*; 43, 6897*b*.

Basic rate and equil. equations for adsorption and desorption processes were developed and applied to the production and recombination of atoms and free radicals at surfaces. The calcns. agreed with exptl. data concerning (1) the production and recombination of H atoms on heated W filaments, and (2) recombination of H atoms on Pyrex.

10847. Leidheiser, Henry, Jr. and Gwathmey, Allan T. **The catalytic reaction of hydrogen and oxygen on plane faces of a single crystal of copper.** *J. Am. Chem. Soc.* 70, 1200-6(1948). —*C.A.* 42, 4435*g*.

Single crystals were used in the form of spheres exposing all possible faces and in the form of slices parallel to a particular face. The crystals were mechanically and electrolytically polished. With O_2 concns. of 1-20% at 400°C, regular rearrangements were found to take place in the surface of the metal, exposing certain facets on some faces, roughening others without the development of particular planes, whereas other faces remained quite smooth. Appreciable differences in rate existed between (100) and (111). These differences depended on both the differences in activity per unit of surface and on the differences in total surface area exposed.

10848. Leva, Max; Grummer, Milton; Weintraub, Murray, and Storch, H. H. **A study of fluidization of an iron Fischer-Tropsch catalyst.** *Chem. Eng. Progress* 44, No. 9, 707-16(1948).—*C.A.* 42, 7957*d*.

Typical mixts., comprising components varying in size from 32-to 325-mesh, were investigated by using air and He as fluids. The new data were in agreement with the correlations based on the exptl. work with sand beds when proper allowance was made for the greater irregularity of the particles. The application of the correlations to process design was discussed on the basis of typical Fischer-Tropsch operating data.

10849. Levesque, Charles L. and Craig, Andrew M. **Kinetics of an esterification with cation-exchange resin catalyst.** *Ind. Eng. Chem.* 40, 96-9(1948).—*C.A.* 42, 2165*b*.

A phenol-formaldehyde sulfonic-type resin (similar to Amberlite IR-100) catalyzed the esterification of butanol and oleic acid. Presumably only those acid groups near the surface of the resin were effective catalytically for such large reactant mols., whereas for smaller mols. all the acid groups in the particle were active.

10850. López-Rubio, Fernando Blasco and Pacheco, José de la Rubia. **The mechanism of the catalytic process for the synthesis of hydrocarbons by the Fischer-Tropsch process.** *Ion* 8, 86-9(1948).—*C.A.* 42, 6543*b*.

Fe was less active than Co or Ni, but it had the advantage of being effective over a wide range of temps., and was characterized by production of liquid hydrocarbons with CO_2 as by-product. Co gave a product rich in olefins. Ni tended to produce CH_4 along with liquid and solid paraffins. Carbonyls of the metals were assumed to be the primary active materials. $[Fe(CO)_5]_4$ was thought to be reduced to 2 mols of C_8H_{18} and a Fe carbonyl of much lower CO content; the lower carbonyl was reconverted to Fe.

10851. Margolis, L. Ya and Todes, O. M. **Kinetics of exothermal catalytic reactions in a flow system. IV. Investigation of the stationary and the nonstationary oxidation of isoöctane on a copper-chromium catalyst.** *Invest. Akad. Nauk S.S.S.R., Otdel Khim. Nauk* **1948**, 174-81.—*C.A.* 42, 7148*i*.

Measurements of the temp. established in the oxidation of isoöctane, (40 liters/hr) on Cu-Cr catalysts with 10,30, and 67% active contact substance on asbestos, were compared with theoretical expressions. Experimentally the loss of heat through convection by the gas stream was only 5-9% of the total heat balance; the main loss of heat occurred through the walls of the reaction tube. Exptl. data confirmed the linearity of log (ΔT) as a function of time for the nonstationary state, independently of the rate of flow (16,27,44 liters/hr).

10852. Margolis, L. Ya and Todes, O. M. **Catalytic oxidation of organic compounds in flow.** *Zhur. Obshchei Khim.* **18**, 1043-50(1948).—*C.A.* 43, 927*d*.

The kinetics in air mixts. were investigated on spinel-type catalysts (chromites, aluminates, etc.) on asbestos; the concn. of the catalyst on the carrier was gradually decreased as the temp. was raised. At a given temp., the rate const. of the oxidation was found to be proportional to the conc. of the catalyst. Oxidation of isoöctane, cyclohexane, and methyl-cyclohexane, on Cu-Cr and Mg-Cr catalysts, followed a 2nd-order law. The identity of the rate law, and the closeness of the sp. rate const. of isoöctane and cyclohexane may be linked with a cyclization of the former on Cr_2O_3. Normal C_5H_{12}, C_7H_{16}, C_8H_{18}, as well as C_2H_4 and C_6H_6, on the same catalysts, followed 1st order law.

10853. Maxted, E. B. **Some recent advances in catalysis.** *J. Soc. Chem. Ind.* 67, 93-7(1948). —*C.A.* 42, 7149*i*.

Naturally occurring catalyst poisons were converted to nontoxic derivs. Compds. contg. P, As, Sb, Bi, S, Se, and Te, elements inherently toxic to Ni, Pt, and similar catalysts, were non-toxic if all valence electrons were "shielded" and toxic if these electrons were free to make the poison a donor to the electron pool of the catalyst and thus selectively adsorbed on it. Piperidine and pyridine were self poisoning, but their hydrochlorides were readily hydrogenated. S compds. in coal gas were destructively hydrogenated at 400° to 500°C to H_2S when the thiomolybdates of Cu, Sn, Mn, Co, Ni, or Fe on bauxite carriers were used as catalysts; the H_2S was absorbed in an Fe oxide purifier.

10854. Maxted, E. B. and Walker, A. G. **Self-poisoning effect in the hydrogenation of pyridine.** *J. Chem. Soc.* **1948**, 1093-7.—*C.A.* 43, 1536*f*.

The slow rate of catalytic hydrogenation of free pyridine was considered to be the result of a self-poisoning effect. It was attributed to the possession of a free-electron pair by the N atom, which resulted in strong adsorption by the metallic catalyst. If the N atom structure was shielded by hydrogenating in acid soln., so that the pyridinium ion (non-toxic) was formed, the toxicity was inhibited.

10855. MILLETT, H. C. **Manufacture of contact sulfuric acid from arsenical pyrites.** *Chemistry & Industry* 38, 595-600(1948).—*C.A.* 43, 3153*i*.

Arsenical pyrite fines for the manuf. of H_2SO_4 should be 1/32 to 3/8 in. in size and have a max. of Cu 0.5, Zn 1.7, and As 0.15%. The pyrite was roasted in multi-hearth burners. The hot gases were then purified, dried, drawn into the converters contg. a catalyst which had 4% V_2O_5 and a bulk d. of 48-50 lb./ft^3, and finally into the absorption towers.

10856. MIYAKE, ROICHI. **Hydrogenation of fatty oils. XI. Adkins' catalyst. Characteristic of the catalyst and significance of addition of barium chromate.** *J. Pharm. Soc. Japan* 68, 38-9(1948)(English summary).—*C.A.* 44, 353*a*.

Adkins' catalyst and Cu-kieselguhr catalyst were similar in many respects, except superior uniformity of dispersion of Cu in the former. $BaCrO_4$ did not hamper the reduction of copper oxide, and might act as an increased carrier.

10857. MONTGOMERY, C. W. AND WEINBERGER, E. B. **Product distribution in the synthesis of hydrocarbons from carbon monoxide and hydrogen.** *J. Chem. Phys.* 16, 424-5(1948).—*C.A.* 42, 4437*f*.

An interesting feature of the Fischer-Tropsch synthesis was the peculiar distribution of the reaction products and the relatively small production of C_2, C_3, and C_4 hydrocarbons with Co catalysts at atm. pressure and 190°-200°C. It was shown mathematically that thermodynamic equil. among the n-paraffins produced a distribution that was qualitatively similar to that observed experimentally. The calcns. also indicated that the true catalyst temp. was higher than the measured temp.

10858. MONTGOMERY, C. W.; WEINBERGER, E. B., AND HOFFMAN, D. S. **Thermodynamics and stoichiometry of synthesis gas production by the partial oxidation of methane.** *Ind. Eng. Chem.* 40, 601-7(1948).—*C.A.* 42, 4329*a*.

The thermodynamics of the CH_4-steam-H_2-CO-CO_2-carbon system was studied and extended to cover detns. of the conditions of temp., pressure, and O_2-CH_4 ratio for max. yield of synthesis gas per mol. of O_2 and per mol. of CH_4. A detailed discussion was presented of the problem of carbon formation at equil. conditions and when the product gases were cooled.

10859. MORTON, MAURICE AND NICHOLLS, R. V. V. **Catalytic action of aluminum silicates. III. Conversion of 1,1-diphenylethane to styrene over Morden bentonite.** *Canadian J. Research* 26B, 581-91(1948).—*C.A.* 43, 1251c.

Finely powd. Morden bentonite was treated with H_2SO_4, filtered, dried, and broken into lumps; the 4-8 mesh material was electrically heated. Higher temps. resulted in increased conversions as well as increased styrene content in the converted products; the styrene content reached a max. at about 600°C. Faster feed rates resulted in decreased total conversion but increased styrene content in the products. The use of H_2O as a diluent greatly increased the conversion efficiency.

10860. MUKHERJEE, PHANINDRA NATH AND DASGUPTA, H. N. **Volatilization of phosphorus as halides (preliminary note).** *J. Indian Chem. Soc., Ind. & News Ed.* 11, 47-50(1948).—*C.A.* 43, 515*e*.

P halides were prepd. by passing a current of dry Cl_2 or HCl over an anhyd. mixt. of $Ca_3(PO_4)_2$, carbon, and SiO_2 at about 950°C. Bone ash, charcoal, and quartz powder were ground separately, throughly mixed, dried at 120°C and placed in a silica combustion tube in an elec. furnace. A const. flow of dry Cl_2 or HCl gas was passed through the tube for 2 hrs while the temp. of the furnace was kept at 950°C. The condensation product in the receiver was a mixt. of PCl_3, PCl_5, and $POCl_3$.

10861. NAGASAKO, NOBORU AND MIYAZAKI, SHOZO. **Studies on the catalytic decomposition of ammonia. The catalytic decomposition on tungsten and molybdenum.** *Bull. Tokyo Inst. Technol.* 13, 124-32(1948).—*C.A.* 44, 10552*f*.

The decompn. of NH_3 on electrically heated Mo and W filaments indicated adsorption of N_2 from the gas phase was negligible. The active surface was covered with H_2 and NH_3. The reaction rates gave activation energies of 42.7 kcal/mole for W and 45.6 kcal/mole for Mo.

10862. NAUMOV, A. I. **Kinetics of the catalytic isomerization of ethylene oxide into acetaldehyde.** *Zhur. Fiz. Khim* 22, 797-800(1948).—*C.A.* 42, 8598*d*.

Ethylene oxide was passed through a mixt. of silica gel and Al powder or through an Al silicate. When ethylene oxide passed at atm. pressure through the catalyst bed, the reaction took place in a narrow layer of the bed in which the temp. may be 100°C above that in the rest of the catalyst; this hot zone traveled along the bed at about 0.05 cm/min. At low pressures, p, (4 to 45 mm Hg) $\log m = a + \log p$, m being the amt. of acetaldehyde (g) produced within 1 ml of the catalyst per hr. When the time of contact was 0.015 sec, a was -2. Within the range 30° to 110°C, $\log m = b - (2080/T)$, T being abs. temp. and b about 7.5.

10863. NEIMAN, M. B. AND SHUSHUNOV, V. A. **A kinetic method of physiochemical analysis. II. Kinetics of the reaction between tin-sodium alloys and ethyl bromide vapors.** *J. Phys. Chem. (U.S.S.R.)* 22, 145-55(1948)(in Russian).—*C.A.* 42, 5315h.

The pressure of EtBr vapor brought into contact with a Sn-Na alloy remained nearly const. for a period t and then decreased first rapidly and then more and more slowly. The main reaction product below about 55°C apparently was $SnEt_4$; at higher temp. $SnEt_2Br_2$ seemed to form.

10864. NEIMAN, M. B. AND SHUSHUNOV, V. A. **A kinetic method of physiochemical analysis. III. Kinetics of the reaction between ternary alloys Na-Pb-Mg and ethyl chloride vapors.** *J. Phys. Chem. (U.S.S.R.)* 22, 157-60(1948)(in Russian).—*C.A.* 42, 5316b.

Addn. of 0.1 wt % Mg to the alloy Na-Pb slightly shortened the induction period *t* of the reaction with EtCl. Addn. of 0.3-2% greatly lengthened *t*, e.g., from 0.25 to 1.8 hrs by 1% Mg at 35°C. When the ratio Na:Pb was varied, with the Mg concn. kept equal to 0.1%, there was a sharp min. of *t* at 50 at. % Na as in the absence of Mg.

10865. NICOLAI, J.; MARTIN, R., AND JUNGERS, J. C. **Kinetics of the hydrogenation of benzene.** *Bull. soc. chim. belges* 57, 555-74(1948).—*C. A.* 44, 419*b*.

The catalyst was prepd. by reduction of $NiCO_3$ deposited on kieselguhr. At 70°-150°C the hydrogenation produced cyclohexene and had an activation energy of 11 kcal. At 150°-250°C it was complex. Above 250° the product was CH_4 and the activation energy was 45 kcal. In the region of formation of CH_4 the order was first in hydrogenation of C_6H_6 and neg. in H_2. The adsorption of CO was stronger than that of benzene, and CO was hydrogenated first. Adsorption of CO_2 was about the same as that of benzene. MeOH was not strongly adsorbed and below 160°C had no effect, whereas at high temps. it was decompd. and then converted to CH_4.

10866. OBORIN, V. I. **Cracking processes on alumina catalysts in the light of the multiplet theory of catalysis.** *Zhur. Obshchei Khim.* 18, 612-28(1948).—*C. A.* 43, 1250*d*.

The reactions that occurred in catalytic cracking were analyzed. If these reactions were written with the reacting groups facing each other and the bonds broken and those newly formed considered, the cracking of open-chain hydrocarbons, cracking isomerization, condensation of olefins, cyclization without dehydrogenation and chain opening of cycloparaffins had one type of doublet index; dehydrogenation, cyclization-dehydrogenation of diolefins, and hydrogenation had a second type of index. The role of O in the catalyst was solely in ionization of the metal atoms. Active double centers were constituted in SiO_2-Al_2O_3 catalysts by 2 Al ions in SiO_2-ZrO_2-Al_2O_3 catalysts, possibly by 1 Al and 1 Zr ion.

10867. OHTA, NOBUTO. **Method of measuring the proton-donating intensity or "PD-intensity" of solid catalysts of the proton-donor type.** *J. Chem. Soc. Japan, Ind. Chem. Sect.* 51, 16-17(1948).—*C. A.* 44, 9224*h*.

The "PD-intensity", one of the factors detg. the activity of solid catalysts of the proton-donor type, was detd. from the % *n*-butene produced in the dehydration of iso-BuOH. The relative values obtained at 300°-400°C were: Al_2O_3 gel < $Al_2(SO_4)_3$ < SiO_2 gel < acid earth < SiO_2 gel + Al_2O_3 gel (1:1) < SiO_2 gel (B) < H_3PO_4 + SiO_2 (85:15) < H_3PO_4 + charcoal (20:80).

10868. OHTA, NOBUTO. **Nature of the active center of mixed silica-alumina catalysts.** *J. Chem. Soc. Japan, Ind. Chem. Sect.*, 51, 18-19 (1948).—*C. A.* 44, 9225*b*.

Both the catalytic dehydration of iso-BuOH at 350°C (10 ml/hr) with 0.50 g catalyst and isomerization of n-butene at 400° (1.50 g/hr) with 2.50 g catalyst increased when the amt. of silica was 30-70%, whereas the PD-intensity in the dehydration increased monotonically with % silica. The active centers newly produced in the region of coexistence of SiO_2 and Al_2O_3 were due to SiO_2, and their PD-intensity was weakened by the existence of Al_2O_3 gel.

10869. OHTA, NOBUTO. **Relation between the proton-donating intensity and the activity of butanol-dehydration on solid catalysts of the proton-donor type.** *J. Chem. Soc. Japan, Ind. Chem. Sect.* 51, 20(1948).—*C. A.* 44, 9225*c*.

The dehydration of alcs. in the presence of proton-donor type catalysts belonged to a class of acid-base catalysis of Brønsted-Lowry. Dehydration of BuOH at 250°-450°C with H_3PO_4, SiO_2 gel, pure Al_2O_3 gel, and Al_2O_3 gel contg. basic Al sulfate confirmed this classification, if the 1st step was assumed to det. the rate for the entire reaction.

10870. OHTA, NOBUTO. **Relation between the proton-donating intensity and the activity of isobutylene polymerization on solid catalysts of the proton-donor type.** *J. Chem. Soc. Japan, Ind. Chem. Sect.*, 51, 20-1(1948).—*C. A.* 44, 9225*e*.

The isomerization of isobutylene (1.50 liter/hr) for 32 catalysts at 450°C with 2.50 g catalyst were compared with their PD-intensities. The catalytic polymerization of olefins was a type of acid-base catalysis. Seven catalysts incompletely freed from halogen ions showed deviations.

10871. OHTA, NOBUTO. **Relation between the proton-donating intensity and the activity of isobutylene polymerization on solid catalysts of the proton-donor type.** *J. Chem. Soc. Japan, Ind. Chem. Sect.*, 51, 21-3(1948).—*C. A.* 44, 9225*f*.

A comparison of 20 catalysts showed a parallel relation between their PD-intensity and polymerization of isobutene (20 liters/hr with 6.3 g catalysts at 150°C.) As long as the amt. of C_4H_8 polymerized was less than 80%, the oil produced at the same temp. always had the same compn., rich in dimer. When the PD-intensity of the catalyst was strong, a mechanism was proposed based on acid-base catalysis. More trimer was formed with catalysts with stronger PD-intensities.

10872. OHTA, NOBUTO. **Relation between the dehydration reaction of isopropyl alcohol, ethanol, or methanol and the proton-donor intensity of catalysts.** *J. Chem. Soc. Japan, Ind. Chem. Sect.*, 51, 138-9(1948).—*C. A.* 44, 9225*h*.

The catalytic dehydration of iso-PrOH and EtOH with $2H_3PO_4$ + silica and pure Al_2O_3 gel, (PD-intensities 70 and 10, resp.) proceeded similarly to BuOH. Both catalysts had the same activity at 400°C. The formation of ethers as secondary products was favored more with the pure Al_2O_3. The dehydration of MeOH gave Me_2O alone, the activity of pure Al_2O_3 being greater.

10873. OHTA, NOBUTO. **Alkylation of phenol and m-cresol with isopropyl alcohol in the vapor phase.** *J. Chem. Soc. Japan, Ind. Chem. Sect.*, 51, 141-3(1948)—*C. A.* 44, 9226*c*.

By a flow method PhOH was alkylated catalytically with gaseous iso-PrOH at 200°, 250°, and 300°C. The catalysts of large PD-intensity ($2H_3PO_4$-SiO_2 or active earth) produced $C_3H_7C_6H_4OH$ and $C_3H_7OC_3H_7$, while those of small PD-intensity ($Al_2(SO_4)_3$ or Al_2O_3) gave $C_6H_5OC_3H_7$ and $C_3H_7C_6H_4OC_3H_7$. At higher temps. production of C_3H_6 predominated. Iso-PrOH could be produced with the same catalyst from C_3H_6 and H_2O, suggesting that the propylation was performed by the decompn. of iso-PrOH into C_3H_6 and H_2O.

10874. Ohta, Nobuto. **Alkylation of phenol with methanol, ethanol, and isobutyl alcohol and the reaction mechanism of phenol with alcohols.** *J. Chem. Soc. Japan, Ind. Chem. Sect.* 51, 143-4(1948).—*C.A.* 44, 9226*e*.

PhOH was alkylated with MeOH, EtOH, and iso-BuOH with $2H_3PO_4$-SiO_2 and Al_2O_3 gel catalysts. In these alkylations with catalysts of small PD-intensity the relative velocities were: MeOH-EtOH < iso-PrOH < iso-BuOH; with catalysts of large PD-intensity the relative velocities were: iso-PrOH < iso-BuOH < MeOH < EtOH.

10875. Ohta, Nobuto. **The effect of the proton-donating intensity of catalysts and production of methylcyclopentene in cyclohexene isomerization.** *J. Chem. Soc. Japan, Ind. Chem. Sect.*, 51, 145-6(1948).—*C.A.* 44, 9226*g*.

After passage of 20-30 ml gaseous cyclohexene over various catalysts, the amts. of methylcyclopentene, methylcyclopentane, and methylenecyclopentane were detd. Al_2O_3 gel (PD-intensity 10) gave no reaction at 350°C and a space velocity of 2, but produced 94% methylcyclopentene at 400°C, while $2H_3PO_4$-SiO_2 (PD-intensity 70) produced 91.5% at 350°C and a space velocity of 10. Cyclohexene could be isomerized more easily with catalysts of high PD-intensity, the secondary reactions occurring under more severe conditions.

10876. Parravano, G.; Hammel, E. F., and Taylor, Hugh S. **The exchange reaction between methane and deuteriomethanes on silica-alumina cracking catalysts.** *J. Am. Chem. Soc.* 70, 2269-70(1948).—*C.A.* 42, 7148*f*.

The exchange reaction between CH_4 and deuteriomethanes on SiO_2-Al_2O_3 cracking catalysts occurred measurably at 345°C and higher. The activation energy between 345° and 384°C was 13 kcal. A mechanism for the cracking process of hydrocarbons involved 2 steps: scission of C-H bonds, and then scission of C-C bonds. Ethylene hydrogenation took place on the same catalyst in the same temp. range.

10877. Pauw, F. de and Jungers, J. C. **Kinetics of hydrogenation of acetylene on nickel.** *Bull. soc. chim. belges* 57, 618-30(1948).—*C.A.* 44, 915*h*.

Catalyst A was prepd. by reducing $NiCO_3$ pptd. on kieselguhr; B was prepd. by reducing at 350°C oxide from the calcination of $Ni(NO_3)_2$. With catalyst A and equimolar H_2 and C_2H_2 there was no reaction at 29°-100°C, but if H_2 was admitted first, there was rapid reaction. Equimolar H_2 and C_2H_4 reacted. Acetylene poisoned the catalyst by forming polymers. The less active catalyst B was periodically regenerated with H_2 at 300°C. At 29°-30°C an initial reaction of steady rate continued until about one mole of H_2 was used per mole of C_2H_2; the rate then increased. The strong adsorption of C_2H_2 inhibited hydrogenation of C_2H_4 as long as C_2H_2 was present.

10878. Plant, J. H. C. and Newling, W. B. S. **Catalytic removal of organic sulfur compounds from coal gas.** *Inst. Gas Engr., Commun.* No. 344; *Gas World* 129, 807-8, 922-7; *Gas J.* 256, 654, 657, 659(1948).—*C.A.* 43, 3172*f*.

Operation of a plant for the treatment of 1.5 million ft^3 of purified, unstripped coal gas from horizontal retorts daily showed: (1) The practical min. limits for org. S compds. other than thiophene was 3 grains per 100 ft^3. (2) It is most unlikely that the continuous decompn. of thiophene in coal gas will ever be practical. (3) The most suitable industrial catalyst was Ni subsulfide on a china-clay support. (4) The optimum working range of a catalyst was 330° to 380°C. (5) Uniform distribution across the catalyst bed was essential. (6) The heat consumption depended only on the sensible heat of the outgoing treated gas and surface losses from the plant.

10879. Rabes, I. and Schenck, Rudolf. **Adkins' copper chromite catalysts and the mechanism of their action.** *Z. Elektrochem.* 52, 37-9 (1948).—*C.A.* 43, 6336*a*.

The active reducing agent in this catalyst was finely divided Cu suspended on Cr_2O_3. It was derived from the following reactions: $2\ CuO + Cr_2O_3 \rightarrow Cu_2Cr_2O_4 + 1/2\ O_2$; $Cu_2Cr_2O_4 + H_2 \rightarrow 2\ Cu + Cr_2O_3 + H_2O$, the latter taking place very readily in the presence of H_2 under pressure.

10880. Reed, R. M. and Eriksen, Arne. **Hydrogen and synthesis gas production.** *Calif. Oil World* 41, No. 16, 3, 5, 7, 9, 11(1948); *Gas* 24, No. 10, 53-6.—*C.A.* 42, 9097*g*.

H_2 for petroleum hydrogenation was made by reaction of natural gas with steam at about 1600°F in a furnace contg. vertical Cr-Ni alloy tubes. The resultant gas mixt. is passed over an iron oxide catalyst at about 850°F. to yield a gas contg. about 77% H_2, 18% CO_2, and the balance CO, CH_4, and N_2. H_2 for NH_3 synthesis was produced by a similar process, except that addnl. N_2 was introduced into the gas mixt. High-purity H_2 was made by using propane or butane in place of CH_4.

10881. Reitmeier, R. E.; Atwood, Kenton; Bennett, H. A., Jr., and Baugh, H. M. **Production of synthesis gas by reaction of light hydrocarbons with steam and carbon dioxide.** *Ind. Eng. Chem.* 40, 620-6(1948).—*C.A.* 42, 4328*f*.

Synthesis gas with a wide range of compns. was produced from properly selected reacting mixts. of light hydrocarbons, steam, and (or) CO_2, without deposition of carbon on the catalyst. The absence of carbon under the predicted conditions and the formation of the predicted synthesis gas compn. were confirmed by lab. tests on CH_4 and C_3H_8 over a wide range of compns.

10882. Rescorla, A. R.; Ottenweller, J. H., and Freeman, R. S. **Evaluation of catalysts for catalytic cracking.** *Anal. Chem.* 20, 196-202 (1948).—*C.A.* 42, 5215*e*.

Methods for detg. the following phys. properties were given: density (aerated, freely settled, compacted, and under pressure), volatility at 1750°F, and particle size (sieve analysis and Roller air elutriation methods). Routinely, only Al, Na, and Fe were detd. in the catalysts which were essentially Al silicates. The activity of catalysts was measured in the lab. either by a detn. of surface area or by using small-scale lab. cracking units which duplicated conditions encountered in the large com. units.

10883. Rienacker, Gunther and Sarry, Brigitte. **Catalytic research on alloys. XII. The parahydrogen conversion on Cu-Pt mixed crystals.** *Z. anorg. Chem.* 257, 41-58(1948).—*C.A.* 43, 4088*b*.

The high activity and low activation energy characteristic of pure Pt catalysts held for the para-H_2 conversion in alloys contg. as little as 16 at. % Pt. The activity fell off sharply for alloys richer in Cu. The fact that the catalytic activity of Pt for the dehydrogenation of HCOOH fell off rapidly in alloys contg. less than 44 % Pt showed that this process was more complex than the para-H_2 conversion; but since the alloys contg. a higher percentage of Pt showed similar catalytic activity for the two processes, it was likely that dehydrogenation involved adsorption and labilization of HCOOH followed by catalytically influenced desorption of split-off H_2.

10884. Riesz, C. H. **Catalytic cracking of hydrocarbons.** *Am. Gas Assoc., Proc.* 30, 505-16 (1948).—*C.A.* 43, 6814*b*.

The rapid development of catalytic hydrocarbon-cracking processes for peak-load gas-generating application was discussed. Further research was deemed necessary to explore application of the process to feeds other than propane and butane, to the generation of gas under pressure, and to the development of more active and possibly S-resistant catalysts.

10885. Riesz, C. H.; Batchelder, H. R., and Lurie, P. C. **Catalytic reforming of hydrocarbons.** *Am. Gas Assoc. Monthly* 30, No. 2, 17-22(1948).—*C.A.* 42, 2739*i*.

The catalytic reforming of propane was found suitable as a means of producing the low-gravity carrier gas. By appropriate selection of propane space velocity, steam-propane ratio, air-propane ratio, and temp., it was possible to increase the pilot-plant capacity by a factor of at least four in comparison to furnace atm. generation. A furnace temp. of 1850°F was required for best performance with the standard catalyst; below 1750°F there was considerable carbon deposition.

10886. Riesz, C. H.; Lister, Fred; Smith, L. G., and Komarewsky, V. I. **Catalysts for hydrocarbon synthesis.** *Ind. Eng. Chem.* 40, 718-22 (1948).—*C.A.* 42, 4325*d*.

Hydrocarbon synthesis catalysts were regarded as ''complex-action'' catalysts, combining the two functions of hydrogenation and polymerization. Two-component catalysts were prepared contg. Co, Ni, or Fe for the hydrogenating action; ThO_2, SiO_2, Al_2O_3, or ZnO as polymerization components. Co-ThO_2, Co-SiO_2, and Co-Al_2O_3 were particularly active catalysts, optimum liquid formation occurring when the metal content of the catalyst was 75% by wt.

10887. Roginskiĭ, S. Z. **Pressure and concentration isotherms of poisoning of catalysts through blocking.** *Izvest. Akad. Nauk S.S.S.R. Otdel, Khim. Nauk* **1948**, 383-90.—*C.A.* 44, 1314*i*.

A statistical theory of the dependence of the activity, A, of a catalyst on the equil. pressure p of the poison in the vol. was developed for a nonhomogeneous surface, and ordered distribution of the poison over the surface. Two cases were considered: blocking began at the most active points on the surface or at the least active points. For any nonexponential distribution, isobars and isosters of A were exponential functions of the temp. When blocking began at the least active points, and spread gradually in the direction of the controlling zone, A first remained unchanged over a wide range of p.

10888. Roginskiĭ, S. Z. **Poisoning of catalysts through blocking in uncorrelated adsorption of the poison.** *Izvest. Akad. Nauk S.S.S.R. Otdel. Khim. Nauk* **1948**, 493-502.—*C.A.* 44, 1315*d*.

In the case when the sequence of the adsorption was independent of the distributions $p(E)$ and $p(k)$, of the chem. reaction activation energy E and rate const. k over a nonhomogeneous catalyst surface, the integrated catalytic activity was expressed by a special function of the amt. of poison adsorbed. Comparison of the wt and concn. isotherms should permit the establishment of the character of the adsorption of the poison. The independence of the poison distribution of E leads to a distribution irrespective of the source of the linear poisoning law. Isobars of poisoning were derived from the isotherms, for the case of a homogeneous surface, and a nonhomogeneous surface with an exponential power, or uniform distribution of Q.

10889. Roginskiĭ, S. Z. and Tselinskaya, T. F. **Experimental test of the supersaturation theory. III. Low-temperature oxidation reactions on nickelous oxide.** *Zhur. Fiz. Khim. (J. Phys. Chem.)* 22, 1360-73(1948).—*C.A.* 43, 2498*h*.

NiO catalysts were prepd. by heating $NiCO_3$ at different CO_2 pressures. These catalysts accelerated the oxidation of CO by O_2 at room temp. below 2 mm Hg. For very active catalysts, the rate v of oxidation decreased during one expt. according to $v = v_0 \exp(-aq)$, q being the amt. of oxidized and v_0 and a consts. For less active catalysts, v decreased as in a reaction of the first order. At 160°C the catalysts worked indefinitely. Neither O_2 nor CO affected the activity at room temp. The rate of adsorption of CO was too slow to account for the rate of oxidation. $NiCO_3$, 33% of which was transformed into NiO, was as active as pure NiO.

10890. ROTINYAN, A. L.; DROZDOV, B. V., AND KOGAN, T. M. **Kinetics of the displacement reaction on Raney nickel and nature of the activity of a skeleton catalyst.** *Zhur. Priklad. Khim.* 21, 810-15(1948).—*C. A.* 43, 928*c*.

Rates of displacement by Raney Ni of Cu from a soln. similar to a Ni-refining bath were detd. with different prepns. of the Ni powder. An alloy of the compn. $NiAl_3$ was made by fusion of pure Ni and Al, cooled rapidly, and leached cold in alkali, changed several times. The resulting pyrophoric fine Ni powder contained up to 0.6% Al. Its high activity in the reaction $Ni + Cu^{++} \rightarrow Ni^{++} + Cu$ was not detd. significantly by its B.E.T. surface area (electrolytic Ni powder was 0.8 m^2/g). A decisive factor, was no doubt, presence of H_2 in the Raney Ni. In expts. at 70°C, with 2 equivs. Ni per equiv. Cu, samples rich in H_2 carried the reaction practically to completion.

10891. RUBINSHTEIN, A. M. AND PRIBYTKOVA, N. A. **Effect of thiophene on nickel catalysts for hydrogenation and dehydration of cyclic hydrocarbons.** *Doklady Akad. Nauk. S. S. S. R.* 61, 285-8(1948).—*C. A.* 42, 8452*b*.

Ni-MgO catalysts, prepd. by sintering of NiO+MgO mixts. under controlled conditions, were poisoned by treating 3-g portions of the catalyst with 10 mg C_4H_4S in cyclohexane soln., each treatment retaining 1.0 mg S per g of catalyst. The activity *A* was tested (batches of 3 g, height of catalyst layer 50 mm, diam. 12 mm) in hydrogenation of C_6H_6 with excess H_2 at 120°, 140°, and 160°C and in dehydrogenation of cyclohexane at 300°, 325°, and 350°C. In dehydrogenation, *A* changed little (~63%) up to about 3 mg S, then decreased with further increasing S down to about 20% with 7 mg S.

10892. RUSSELL, ALLEN S. AND STOKES, JOHN J. JR. **Heat stability of molybdena-alumina dehydrocyclization catalysts.** *Ind. Eng. Chem.* 40, 520-4(1948).—*C. A.* 42, 4437*h*.

Al_2O_3-MoO_3 catalysts were heated (500°-800°C) in air for 16 hrs or in steam for 6 hrs, and the effect on their activity was detd. as a function of type, area, and MoO_3 concn. The activity was estd. by degree of conversion of n-C_7H_{16} to PhMe under standardized conditions, and yields of coke, gases, and liquid olefins were also detd. Surface areas were detd. by adsorption of C_4H_{10} at 0°C. Activated Al_2O_3 of the "low-silica H" and "F" types showed catalytic activity stable towards loss of area on heating until the area was just sufficient to accommodate the MoO_3 in a surface monolayer; thereafter activity decreased linearly with loss in area.

10893. SAKHAROV, B. A. AND DURYNINA, L. I. **Catalytic oxidation of methanized city gas (mixture of methane and hydrogen).** *Doklady Akad. Nauk S. S. S. R.* 63, 289-91(1948).—*C. A.* 43, 2403*d*.

Degrees of oxidation of CH_4 and (CH_4 + H_2) were detd. for a mixt. dild. with air to a 3-5-fold excess of O_2, passed over a 8-cm length of catalyst (24 ml) (0.63-0.06 m/sec., between 300° and 800°C), with the following catalysts on grog of 0.5-0.7 in. grain size: Fe_2O_3 10 + MnO_2 2, Pd 2, K_2O 2, and CuO 4 + MnO_2. Complete oxidation of CH_4 + H_2 was reached only on the activated contacts between 750° and 770°C.

10894. SAKHAROV, B. A. AND NIKOLAEVA, T. N. **Catalytic combustion of the exhaust gases of internal combustion engines on refractories.** *Bull. acad. sci. U. R. S. S., Classe sci. tech.* **1948**, 79-86(in Russian).—*C. A.* 42, 6515*h*.

Exhaust gases contg. CO 2.5, H_2 1.5%, with the CO:H_2 ratio varying between 2:1 and 1.4:1 (av. 1.6:1), amt. of hydrocarbons not over a few 0.1%, ratio O_2:sum of combustible gases = 4, were passed on grog catalysts, at 300° and 500°C. The grog catalysts, grain size 5-7 mm, were activated with Fe, Mn, and Cu as nitrates, converted into oxides by firing at 500°C, and with Pd as chloride, reduced in H_2, then oxidized in O_2 and fired at 500°C. On nonactivated grog, the degree of combustion *y*, at low velocities was 17% at 300° and 37% at 500°C; *y* was nearly 100% with catalysts activated with either Fe + Mn, Cu + Mn, or Pd. Under conditions of complete inactivity of the carrier, the ratios of the catalytic activities of the activators themselves were: (Cu + Mn) : Pd: (Fe + Mn) = 1:0.88:0.03 at 300°, and 1:0.83:0.57 at 500°C.

10895. SAVAGE, ROBERT H. **Poisoning of platinum catalysts at high temperatures.** *J. Chem. Phys.* 16, 237-40(1948).—*C. A.* 42, 3649*b*.

Poisoning films of exceptional thermal stability were formed on a Pt catalyst when it was heated in hexamethyidisiloxane vapor at pressures of about 0.001 mm. These films prevented the combination of H_2 and O_2 at low pressures and were not removed until heated to about 1440°K in the presence of H_2 or to higher temps. in O_2.

10896. SCHAY, GEZA. **The catalytic decomposition of ammonia on copper and platinum surfaces.** *Hung. Acta Chim.* 1, No. 3, 1-6(1948).—*C. A.* 43, 8827*g*.

It was proposed that the NH_3 decompn. took place in the weakly adsorbed NH_3 layer and was retarded by the strongly ad-H_2, but the model must be completed by the following: Similarly to the adsorption of H_2, the NH_3 occupied 2 adjacent places when adsorbed, and became anchored by 2 of its H atoms, the remaining NH radical pointing away from the surface. The decompn. was the reaction of two such neighboring radicals forming N_2 and H_2 and leaving 4 adsorbed H atoms on the surface.

10897. SCHUMAN, S. C. **The role of the carbides of iron in the Fischer-Tropsch synthesis.** *J. Chem. Phys.* 16, 1175(1948).—*C. A.* 43, 1636*a*.

Equil. consts. were calcd. for the reactions: $Fe_2C + (2n-1)H_2 + (n-1)\ CO = C_nH_{2n} + 2Fe + (n-1)H_2O$, and $Fe_2C + 2nH_2 + (n-1)CO = C_nH_{2n+2} + 2Fe + (n-1)\ H_2O$, for n = 2 or 8, at 500°K and 600°K. The results indicated that the formation of hydrocarbons from Fe_2C was thermodynamically possible under the conditions of the Fischer-Tropsch synthesis.

10898. SCHWAB, GEORG-MARIA AND KARATZAS, ALEXANDER. **The catalytic action of salt pairs.**

J. Phys. & Colloid Chem. 52, 1053-60(1948).—*C. A.* 42, 6628*c*.

The catalytic decompn. of C_2H_5Cl was studied kinetically on surfaces of $BaCl_2$, $MnCl_2$, $PbCl_2$, and 3 binary systems of 2 of these components comprising a mixed crystal, a eutectic, and a compd., at atm. pressure and between 330° and 380°C. The log of the first term of the Arrhenius equation was a linear function of the activation energy. The eutectic $PbCl_2$-$MnCl_2$ (70 mol. % $PbCl_2$) gave results indicating an additive mixed catalyst; in the mixed crystal $BaCl_2$ slight promotion was observed.

10899. SCHWAB, GEORG-MARIA AND PESMATJOGLOU, SOTERIA. **Transitory poisoning of nickel catalysts.** *Festskr. J. Arvid Hedvall* 1948, 533-40.—*C. A.* 42, 6218*a*.

Expts. were run on the dehydrogenation of HCOOH vapor, detg. the activation energy *q*, and *B* (the activity const.) using NiS, NiSe, NiTe, NiAs, NiSb, and NiBi compds. all of which crystd. in the η phase. Comparative expts. were run with Ni compds. in the α-phase, contg. 1 atom % of S, Se, Te, As, Sb, and Bi. It was found that H_2S, H_2Se, etc. were evolved in the HCOOH vapor indicating that the catalysts did not remain unchanged. No systematic variation of *q*, with either the type or percentage of poison, was observed. Values of *B* plotted as a function of *q* for each poisoned catalyst and pure Ni showed in every case an approx. straight line.

10900. SCHWAB, GEORG-MARIA AND PESMATJOGLOU, SOTERIA. **Metal electrons and alloy catalysis. The system gold-cadmium.** *J. Phys. & Colloid Chem.* 52, 1046-53(1948).—*C. A.* 42, 6628*a*.

The two consts. of the Arrhenius equation were measured for the dehydrogenation of gaseous HCOOH with Au-Cd as catalyst. The activity increased with increasing activation energy, as did the Brinell hardness of the alloys. The true energy of activation increased with the α-phase with increasing electron concn. up to a limiting value; in the β-and ϵ-phases it was lower, but in the γ-phase there was a sharp max.

10901. SCHWARZKOPF, PAUL. **The theory of sintering.** *Powder Met. Bull.* 3, 74-87(1948).—*C. A.* 43, 982*b*.

Sintering progressed in 3 steps which may be partly overlapping: formation of point contact between adjacent powder particles, laterial growth to larger contact areas, and disappearance of disconnected pores. In all 3 stages, the observed changes were considered stabilization of the atom arrangement. The formation of point bonds resulted in the replacement of free surfaces with transition layers in which the atoms had lost their high mobility. Compact bond (green strength) was explained by crystn. taking place across the transition layers connecting the particles at the contact areas.

10902. SEELIG, HERMAN S. AND MARSCHNER, ROBERT F. **Production of synthesis gas by catalytic decomposition of methanol.** *Ind. Eng. Chem.* 40, No. 4, 583-6(1948).—*C. A.* 42, 4328*i*.

CH_3OH decompn. over a supported catalyst of Cu and NiO was employed to produce about 250 ft^3 per hr of a synthesis gas having a H_2:CO ratio of 2. The only by-products were traces of CO_2 and hydrocarbons, and carbon. The catalyst was regenerated by periodically burning off the deposited carbon. Operation of the service unit for 550 hrs did not impair the catalyst.

10903. SELWOOD, P. W. **Valence inductivity and catalytic action.** *Pittsburgh Intern. Conf. on Surface Reactions* 1948, 49-51.—*C. A.* 42, 7607*i*.

The supported oxides of the transition group followed the Curie-Weiss law and thus could be considered as magnetically dil. The oxides of Cr, Ni, and Mn, supported on γ alumina, were studied. The susceptibility per g of Cr greatly increased when the concn. of Cr decreased; the curve showed a crit. point in the neighborhood of 9%. The catalytic activity of the chromia-alumina system during decyclization of heptane depended on the dispersion state of Cr and the magnetic susceptibility was a quant. measure of dispersion. The susceptibility curve for supported Ni, although similar to that of Cr, had a less pronounced crit. point. In the case of Mn, the Weiss const. and the Curie const. changed rapidly.

10904. SELWOOD, P. W. AND DALLAS, NICK. S. **Susceptibility isotherms for supported copper oxide.** *J. Am. Chem. Soc.* 70, 2145-7(1948).—*C. A.* 42, 8597*h*.

Catalysts prepd. by the impregnation of γ Al_2O_3 (surface area 200 m^2/g) with $Cu(NO_3)_2$, ignition at 390°C for 24 hrs showed a marked increase in magnetic susceptibility at 10-11% Cu. The susceptibility of the reduced catalysts dropped substantially to zero, while that of the reoxidized samples was as high or higher than the original value. Catalytic activity of the catalysts, dild. with γ Al_2O_3 to a const. concn. of 3.2% Cu, was detd. for the dehydrogenation of iso-PrOH. At low concns. of Cu, the susceptibility followed the Curie-Weiss law. The catalyst with the more highly dispersed Cu showed the greater catalytic activity.

10905. SIROTKIN, G. D. **Deterioration in service of vanadium catalysts used for oxidation of sulfur dioxide.** *Zhur. Priklad, Khim. (J. Applied Chem.)* 21, 245-8(1948).—*C. A.* 43, 2744*e*.

Fe-Sb-V catalyst, from various shelves of a contact app. after prolonged service and fall of activity, was tested for bulk wt, vol. contraction, loss of V_2O_5, loss of Sb_2O_3, accumulation of Fe_2O_3, of SO_3, and of As_2O_3, the ratio V_2O_5/V_2O_4, the rate const. of oxidation of SO_2 (for each 10° between 420° and 480°C), and the apparent activation energy in that temp. range. Losses of activity ranged from 47 to 96%.

10906. STORCH, H. H. **Review of development of processes for synthesis of liquid fuels by hydrogenation of carbon monoxide.** *Chem. Eng. Progress* 44, No. 6, 469-80(1948).—*C. A.* 42, 5200*h*.

The salient features of all processes were collected in a single table, so as to facilitate comparisons of operating temps., pressures, space-time yields, product distributions, and steel requirements.

10907. Stowe, J.M.; Marshall, E.E.; Nickel, L.L., and Greenwood, R.S. **Alumina cracking catalysts.** *Petroleum Processing* 3, 317-24(1948).—*C.A.* 42, 9138*g*.

Kerosene was cracked over activated bauxite and activated alumina impregnated with compds. of Mg, B, Si, and F. Fe compds. in bauxite were deleterious, since they retarded the formation of aromatic compds., and used up the feed stock to produce gas and carbon deposit. Activated alumina, which contained practically no Fe, gave better yields of higher-quality gasoline than the best bauxites. Of the compds. added to the activated alumina, magnesia, chromium fluoride, and zinc fluoride gave high yields of liquid olefins; magnesium fluoride gave gas of increased density; boric acid, ammonium fluoborate and fluosilicic acid gave high conversion rates. Best results were obtained with an activated alumina contg. about 3% silica.

10908. Tatievskaya, E.P.; Chufarov, G.I., and Antonov, V.K. **Kinetics of reduction and of dissociation of manganese oxides.** *Izvest. Akad. Nauk S.S.S.R., Otdel, Tekh. Nauk* 1948, 371-83.—*C.A.* 42, 6624*h*.

Equil. and velocity of dissocn. and of reduction to MnO by H_2 were detd. for powders of MnO_2, Mn_2O_3, and Mn_3O_4, of B.E.T. surface areas 2.31, 0.444, and 0.444 m^2/g, resp. Exptl. equil. pressures for Mn_2O_3 at 1000°, 1050°, 1100°K, from the dissocn. and the oxidation side, gave 3.0 and 3.7, 10.0 and 14.5, 28.0 and 46.0, as against the calcd. 3.98, 10.98, 27.60 mm Hg; for MnO_2 at 700°K, from the dissocn. side (the reverse oxidation did not take place), 3.6 as against the calcd. 3.52. The apparent activation energies E_d were for MnO_2 38.3 kcal/mole, for Mn_2O_3~60 kcal/mole. The velocity of reduction of MnO_2 to MnO between 300° and 500°C at an initial p_{H_2} 200 mm, fell sharply with the progress of the reaction at its initial stages.

10909. Tebboth, J.A. **The decomposition of carbon monoxide by nickel catalysts. The reaction mechanism between 250° and 450°C.** *J. Soc. Chem. Ind.* 67, 62-6(1948).—*C.A.* 42, 5319*i*.

Unsupported and unpromoted Ni catalysts (from pptd. $NiCO_3$) showed little activity for the decompn. of CO between 250° and 450°C. The presence of thoria and kieselguhr in a Ni catalyst prepd. from the pptd. $NiCO_3$ caused a marked increase in the rate of decompn. of CO. Elementary carbon formation occurred in Ni catalysts at all temps., being least at 250° and greatest at 325° to 350°C. The Ni of such promoted and supported catalysts was converted almost quantitatively to Ni_3C at 250°C. Above this temp. carbide formation was incomplete. Decompn. of Ni_3C, in the presence of thoria and kieselguhr, occurred above 250°C and was rapid at 300°C.

10910. Teichner, Stanislas. **Development of the specific surface of Fischer catalysts during reduction.** *Compt. rend* 227, 478-80(1948).—*C.A.* 43, 27*b*.

Surface detns. were made (N_2 adsorption isotherms at - 195°C and C_4H_{10} adsorption isotherms at 0°C) on pptd. Ni-promoter-kieselguhr catalysts. The various treatments, wt loss (%) and surface (m^2/g) were, resp.: (1) evacuation at 20°C for 26 hrs, 4.3, 28; (2) evacuation at 180°C for 16 hrs, 11.0, 39; (3) reduction with H_2 at 450°C for 18 hrs and evacuation at 180°C for 48 hrs, 22.8, 87. The mean pore diam. of the unreduced catalyst was 18 A. The increase in specific surface was not due to a laminated structure, but to holes caused by the loss of volatiles.

10911. Tolley, I.G. **Catalytic oxidation of sulfur dioxide on metal surfaces. I.** *J. Soc. Chem. Ind.* 67, No. 10, 369-73 (1948).—*C.A.* 43, 5910*g*.

The metal surfaces studied were mild steel, Al-sprayed steel, and aluminized steel. The presence of water vapor inhibited catalytic oxidation on all 3 surfaces. Catalytic activity of mild steel increased considerably on exposure; Al-sprayed steel reached a max. in 12 hrs; aluminized steel showed const. activity throughout the test. Coating steel with Al considerably reduced the rate of catalytic oxidation of SO_2.

10912. Topse, Haldor F.A. and Nielsen, Anders. **The action of vanadium catalysts in the sulfur trioxide synthesis.** *Trans. Danish Acad. Tech. Sci. No.* 1, 3-17(1948)(in English).—*C.A.* 42, 7946*b*.

K, Rb, and Tl were far better activators than Na, Ba, and Cu, as the former produced compds. with a higher SO_3 content than pyrosulfates. These compds. of high SO_3-content melted at contact temps. and the V_2O_5 was dissolved in a highly viscous melt, which covered the carrier with a film. Addnl. activation resulted from the addn. of Fe and (or) Mn up to 15-20 mol % of the V.

10913. Trainer, R.P.; Alexander, N.W., and Kunreuther, Frederick. **Fluid-bed catalytic cracking plant.** *Ind. Eng. Chem.* 40, 175-82 (1948).—*C.A.* 42, 2750*g*.

Spent catalyst was freed from entrained and adsorbed hydrocarbons in an external stripper which permitted an exact measure of the stripping efficiency, avoided diln. of the oil vapors in the reactor with steam and permitted study of the stripping mechanism. Product vapors were freed from entrained catalyst by stone filters. The procedure for starting the unit was described in detail.

10914. Trambouze, Yves. **Chemical changes in Fischer catalysts during their preparation.** *Compt. rend.* 227, 971-2(1948).—*C.A.* 43, 2853*b*.

Catalysts were prepd. by several methods, and the chem. nature of the Ni was detd. by extn. with NH_4OH, with HNO_3, and by fusion.

10915. Tsutsumi, Shigeru. **Hydrogenation of saturated oil, and that of rice oil of high acid number with nickel oxide as catalyst. III. The mechanism of action of water and acid clay on nickel oxide.** *J. Nippon Oil Technol. Soc.* 1, No. 3, 17-18(1948).—*C.A.* 43, 5610*g*.

H_2O was adsorbed by the double bond of the C:O group to cause polarization. When acid clay and H_2O were used, the clay was electrically neg. and the polarization was still stronger. The presence of H_2O was unnecessary in an oil having a high acid no. The supply and demand of electrons between the C:O group and H_2O-acid clay cancel each other, and the effect at the double bond became less while the use of acid clay alone gave polarization at the double bond.

10916. Turkevich, John and Smith, Robert K. **Catalytic isomerization of 1-butene to 2-butene.** *J. Chem. Phys.* 16, 466-80 (1948).—*C.A.* 42, 5409*g*.

The interconversion of $H_2C:CHEt$ and $MeCH:CHMe$ was studied on the catalysts H_2SO_4, H_3PO_4, $Al_2(SO_4)_3$, $Cu_2P_2O_7$, $Al_2(SiO_3)_3$, $Ni_2(SO_4)_3$, Al_2O_3, Cr_2O_3 on alumina, ThO_2, silica gel, CaO, radioactive H_3PO_4, Na_2SO_4, $CuSO_4$, and $NaHSO_4$. This work was paralleled by the study of the exchange of H and T between C_4H_5, C_3H_6, and C_2H_4 and the catalyst H_2TPO_4.

10917. Viland, C.H. and Seth, James. **Catalytic cracking of heavy distillate.** *Oil Gas J.* 47, No. 3, 196-9(1948).—*C.A.* 42, 6094*d*.

The catalyst level was controlled at a low point in the stripper to prevent recirculation and thereby increase yields. Decreased coking and gas yields for a given level of conversion and a substantial decrease in the unit operating inventory of catalyst was accomplished. Test showed a decrease in the percentage of fines in the catalyst after long-time operation. Addn. of special fine-grind catalyst (0.20 μ particles) instead of replacement with regular grade was an advantage over the former procedure.

10918. Watt, George W. and Davies, Darwin D. **The catalytic activity of metals produced by the reduction of salts in liquid ammonia. I. Nickel.** *J. Am. Chem. Soc.* 70, 3753-5 (1948).—*C.A.* 43, 2536*a*.

Thermal decompn. of $Ni(NH_2)_2.2NH_3$ at 10^{-3}mm produced successively: $Ni(NH_2)_2$ (at 42.3°C), Ni_3N_2 (at 119.3°C), Ni_3N (at 362°C), and Ni and N_2 (at 585°C). The reduction of $NiBr_2$ and NiI_2 by solns. of K in liquid NH_3 at -33.5° yielded, resp., pyrophoric and nonpyrophoric Ni together with some $Ni(NH_2)_2.2NH_3$. Preliminary expts. on the catalytic activity of Ni from the reduction of Ni salts in NH_3 in the hydrogenation of allyl alc. were described.

10919. Weller, Sol; Hofer, L.J.E., and Anderson, R.B. **The role of bulk cobalt carbide in Fischer-Tropsch synthesis.** *J. Am. Chem. Soc.* 70, 799-801 (1948).—*C.A.* 42, 3550*f*.

Evidence showed that for Co catalysts, bulk Co_2C was neither an intermediate in the Fischer-Tropsch synthesis nor a catalytically active substrate for the synthesis. The presence of an extensive amt. of the carbide severely inhibited the reaction. Used catalysts showed no carbide by X-ray analysis, but samples carbided before synthesis showed carbide to be present after synthesis. The low-temperature unstable cubic Co produced by reduction of Co catalysts was not converted to hexagonal Co during the synthesis.

10920. Wenzel, Wilhelm. **The synol process. A new synthesis of aliphatic alcohols.** *Angew. Chem.* B20, 225-30 (1948).—*C.A.* 43, 994*d*.

The predominant production of alcs. from CO and H_2 was developed by using fused Fe catalysts permitting operating temps. as low as 180°C.

10921. Wilhelm, R.H.; Johnson, W.C.; Wynkoop, R., and Collier, D.W. **Reaction rate, heat transfer, and temperature distribution in fixed-bed catalytic converters. Solution by electrical network.** *Chem. Eng. Progress* 44, No. 2, *Trans. Am. Inst. Chem. Engrs.* 105-16 (1948).—*C.A.* 42, 2145*g*.

Fundamental heat-balance equations were presented. Data necessary for solution were discussed under the headings: (1) kinetics and thermo-dynamics of the reaction, (2) solid-gas convection heat and mass-transfer coeffs., and (3) thermal cond. of granular media. A semiempirical correlation for estg. the cond. of granular media was presented. A method for rapidly analyzing thermal problems in catalytic reactors by means of an elec. network is described. The network depended upon the math. analogy between Fourier's law of heat cond. and Ohm's law of elec. cond.

10922. Wocasek, Joseph J. and Koch, John R. **Fluoride catalysis at 175°C of the reaction: glycerol plus fatty acid.** *J. Am. Oil Chemists' Soc.* 25, 335-7 (1948).—*C.A.* 43, 4030*g*.

SbF_3, ZnF_2, and CoF_2 of the 15 metallic fluorides studied were outstanding. SbF_3 was the most active, but in large amt. it caused decompn. and charring. With ZnF_2 the reactions of stearic, oleic, and linolenic acids after 15 hrs were 95, 94, and 92% completed; at least 3/4 of the diglycerides were converted to triglycerides. ZnF_2 caused the monoglyceride to form at a rate approx. 4 times that of the uncatalyzed reaction and the diglyceride at a 6-fold rate. Unsatn. and viscosity were not affected seriously in the presence of the fluorides except SbF_3. In uncatalyzed reactions the esterification of stearic, oleic, and linolenic acid proceeded at the same general rate. After 15 hrs the reactions were 72, 83, and 84% completed. resp.

10923. Woodward, L.A. and Glover, A.T. **Molybdenum oxide catalysts for the reduction of phenol to benzene.** *Trans. Faraday Soc.* 44, 608-16(1948).—*C.A.* 43, 2081*c*.

When MoO_3 was used at atm. pressure, the activity - time curves from 325° to 440°C showed an initial rise from zero to a max., indicating that the effective catalyst was formed from the trioxide by reduction. Samples of MoO_2 prepd. by complete reduction of the trioxide at 300° or 350°C were active when tested at 350°C. Dioxide similarly prepd. by reduction at 450°C was almost inactive at 350°C. Active dioxide was pyrophoric; inactive dioxide was not. Considerable quantities of O_2 were taken up by active dioxide on exposure to air, but the x-ray diagram was still that of MoO_2 without any MoO_3, and the material remains catalytically active.

10924. Wright, S.R.; Dimock, W.R., and Davis, S.G. **Evaluation of catalysts used in the synthesis of hydrocarbons.** *Can. Chem. Process Inds.* 32, No. 1, 53-4, 57 (1948).—*C.A.* 42, 2417*e*.

The methods used in evaluating Fischer-Tropsch catalysts on a semi-pilot-plant scale were given.

10925. Zelinskiĭ, N.D. **New syntheses of hydrocarbons from carbon monoxide.** *Doklady Akad. Nauk S.S.S.R.* 60, 235-7 (1948).—*C.A.* 42, 6510*g*.

Comparative kinetic studies of the rates of formation of hydrocarbons from CO + H_2, of formation of carbide in the reaction between CO and the catalyst, and of the reduction of the carbides by H_2 demonstrated that intermediate carbide formation played a role only on Fe catalysts, not on Co and on Ni. The Fischer-Tropsch reaction proceeded by way of the intermediate radical CHOH (CHOH + H_2 → H_2O + CH_2). Closely related to this mechanism was the catalytic hydrocondensation of CO with olefins to satd. and unsatd. aliphatic hydrocarbons, and the catalytic hydropolymerization of olefins to satd. and unsatd. aliphatic hydrocarbons. These reactions were detd. by intermediate formation of CH_2 radicals.

10926. Amiel, J.; Brenet, J., and Rodier, G. **Parallelism between the magnetic, catalytic, and depolarizing properties of samples of manganese dioxide used in cells of the Leclanché type.** *Bull. soc. chim. France* 1949, D507-10; *Colloques intern. centre natl. recherche sci., Polarisation matiere No.* 17, 140-3(1949).—*C.A.* 44, 6690*g*.

Comparisons were presented between "normal" and "activated" MnO_2, i.e. the form useful as a depolarizer in cells of the Lechanché type. The activation, indicated by an increase in depolarizing properties, was accompanied by a change in the dimensions of the lattice. Magnetic measurements showed a marked increase in the susceptibility. Similarly the catalytic power measured by the velocity of decompn. of oxygenated water, increased.

10927. Anderson, Robert B.; Hall, W. Keith; Krieg, Abraham, and Seligman, Bernard. **Fischer-Tropsch synthesis. V. Activities and surface areas of reduced and carburized cobalt catalysts.** *J. Am. Chem. Soc.* 71, 183-8(1949).—*C.A.* 43, 3273*h*.

The surface of a catalyst used in the synthesis was found to be heavily covered with hydrocarbon. Hydrogenation at 200°C removed 90% of these adsorbed hydrocarbons, and reduction with H_2 at 400°C restored the catalyst to the same condition as after the initial reduction. There was no evidence of sintering of the catalyst or of carbon deposition. Activity data for operation at 1 and 7.8 atms. were related to the adsorbed hydrocarbon film. Decrease in the accessibility of the surface of these catalysts either by deposition of excessive quantities of wax or by reduction of av. pore diam. by pelleting caused an increase in the fraction of methane and other light hydrocarbons and in some cases a decrease in activity. The surface area did not change appreciably when the Co in the catalysts was converted to cobalt carbide.

10928. Anderson, Robert B.; Krieg, Abraham, and Friedel, R.A. **Fischer-Tropsch synthesis-differential reaction rate studies with cobalt catalyst.** *Ind. Eng. Chem.* 41, 2189-97(1949).—*C.A.* 44, 2358*a*.

A pelleted Co:ThO :kieselguhr (100:18:100) catalyst was studied in a fixed-bed reactor (90 cm long bed) at atm. pressure and 186-207°C. The reactor contained a special tube for the removal of gas samples at 9 points along the length of the bed. About 5% A was added to the feed gas as a reference component. With all gas compns. the synthesis rate was high in the first 10% of the bed and lower and essentially const. in the remainder of the bed until the reactants were nearly completely consumed. The gas compns. in the bed in the region of const. synthesis rate varied considerably. CH_4 was formed by primary reactions as well as by hydrocracking of higher hydrocarbons, the latter being favored by high H_2 and hydrocarbon partial pressures.

10929. Anon. **A report on Houdriflow.** *Petroleum Processing* 4, 137-8(1949); *Petroleum Refiner* 28, No. 1, 110-12 (1949).—*C.A.* 43, 7217*h*.

The Houdriflow moving-bed catalytic cracking process differed from the Thermofor catalytic cracking: (1) The catalyst was transported from the bottom to the top of the unit by a flue-gas lift, making available a wide range of circulation rates; (2) catalyst-to-oil ratios in the range of 4:1 to 8:1 were used; (3) a simplified regenerator; and (4) a superimposed, self-supporting circular reactor and regenerating section made it necessary to lift the catalyst only once per cycle.

10930. Badger, E.H.M.; Griffith, R.H., and Newling, W.B.S. **The catalytic decomposition of simple heterocyclic compounds. I. Preparation and properties of molybdenum sulfide and nickel sulfide catalysts.** *Proc. Roy. Soc.* (London) A197, 184-93 (1949).—*C.A.* 44, 2357*e*.

The prepn. and properties of Mo disulfide and Ni subsulfide catalysts, used for the decompn. of simple heterocyclic compds., were described. Equil. between Ni sulfide, Ni subsulfide and metallic Ni were also examd. by magnetic measurements. The adsorption of H_2 and of the heterocyclic compds. was detd. on the various catalysts over a wide temp. range. Data were given for adsorption on Ni_3S_2 of H_2, thiophene, furan, tetrahydrothiophene, and tetrahydrofuran.

10931. Balandin, A.A. and Isagulyants, G.V. **Orientation of decahydronaphthalene and of cyclohexane molecules in dehydrogenation on oxide and on metallic catalysts.** *Doklady Akad. Nauk S.S.S.R.* 64, 207-10 (1949).—*C.A.* 43, 4551*d*.

Equal rates were obtained on a Cr_2O_3 catalyst (1.5 g) on asbestos (20% CrO_3 by wt), at a flow rate of 0.0092 mole/10 min. for the dehydrogenation of decahydronaphthalene (approx. equimol. mixt. of *cis* and *trans*) and of cyclohexane, measured by the amt. of (97-98%) H_2 evolved and expressed by % conversion p in 10 min. The Arrhenius straight lines log p against $1/T$ for dehydrogenation of decahydronaphthalene and cyclohexane were parallel (equal activation energies) and almost coincided. Dehydrogenation expts. were detd. on a Ni catalyst (20 g, 20 cm), at approx. the same rate of flow as on Cr_2O_3. Between 200° and 300°C, the Arrhenius lines for dehydrogenation of decahydronaphthalene and for cyclohexane were parallel (activation energy of 12.5 kcal mole), but the rate of dehydrogenation of decahydronaphthalene was roughly twice that of cyclohexane.

10932. Balandin, A.A. and Kukina, A.I. **Dependence of the specificity of catalysts on their genesis.** *Doklady Akad. Nauk S.S.S.R.* 64, 65-8(1949).—*C.A.* 43, 4087*d*.

Seven different prepns. of Cr_2O_3 catalysts (treated with H_2 at 400°C for 6 hrs) were tested in simultaneous dehydrogenation and dehydration of iso-PrOH, resp., to Me_2CO and $CH_2{:}CHMe$, in flow expts. at 0.2 ml/min., catalyst 4.5 ml. at 200°-550°C. Plots of the log of the degree of conversion of both reactions against 1/T°K were Arrhenius straight lines, giving the activation energies for the 7 prepns. in dehydrogenation of: 3.0, 4.6, 5.4, 5.4, 5.3, 7.8, 10.0 kcal; for dehydration, 5.3, 6.4, 7.6, 9.4, 10.5, 16.3, 14.8 kcal. By x-ray diffraction, all Cr_2O_3 catalyst heat-treated at 400°C were cryst.

10933. Bartholomé, E. and Sachsse, H. **Catalytic phenomena with aerosols.** *Z. Elektrochem.* 53, 326-31(1949).—*C.A.* 44, 2355*c*.

A synthesis-gas generator contained a burner for coal gas to form $CO + H_2$ and a Ni/MgO catalyst to convert residual CH_4 with H_2O into $CO + H_2$. Soot particles in the flame (diams. of about 2 μ) were nearly completely removed by reaction with H_2O catalyzed by Ni vapor originating from the catalyst bed or also from Ni salt solns. injected into the generator. Injection of solns. of alkali and alk. earth salts likewise suppressed the formation of soot.

10934. Bashkirov, A.N.; Kryukov, Yu. B., and Kagan, Yu. B. **Mechanism of the synthesis of hydrocarbons from carbon monoxide and hydrogen.** *Doklady Akad. Nauk S.S.S.R.* 67, 1029-31(1949).—*C.A.* 43, 9415*h*.

The reaction observed on Fe catalysts, $2\ CO + H_2 \rightarrow {:}CH_2 + CO_2$, in contrast to the reaction $CO + 2\ H_2 \rightarrow {:}CH_2 + H_2O$ occurring on Ni and Co, was interpreted as the sum of the second reaction and the subsequent reaction $CO + H_2O \rightarrow CO_2 + H_2$. Analyses of the gaseous products obtained on pptd. Fe catalyst with mixts. $CO{:}H_2 = 1{:}1$ in the presence of added H_2O vapor at 220-50°C, under atm. pressure and at space velocity ~ 100/hr corroborated this reaction scheme.

10935. Beck, Roland A. **Evaluation of fluid catalyst—development of laboratory scale units.** *Ind. Eng. Chem.* 41, 1242-3 (1949).—*C.A.* 43, 7217*d*.

A stirred unit and a baffled nonstirred unit were developed for evaluation of fluidized catalysts on a lab. scale. The stirred units were used where great flexibility in regard to reactant flow rates was desired. The nonstirred unit was less subject to mech. difficulties.

10936. Boreskov, G.K.; Ritter, L.G., and Volkova, E.I. **The heating-up temperature of vanadium sulfuric acid catalysts.** *Zhur. Priklad. Khim. (J. Applied Chem.)* 22, 250-60(1949).—*C.A.* 43, 8251*f*.

The lowest temp., T, of the gas mixt. that caused the temp. of the contact catalyst to rise spontaneously by at least 10°C, was detd. for mixts. contg. 7-95% SO_2 and 5-75% O_2. At const. O_2, an increase of SO_2 did not affect T; an increase of O_2 from 5 to 75% lowered T by 50°C. Pyrite roasting gas (SO_2 7, O_2 11%) had T of 423°C; the gas produced from S (SO_2 8.5, O_2 12.5%), T = 420°C. For mixts. of SO_2 with air, the optimum compn. was SO_2 14, O_2 18%, T = 410°C. T could be calcd. from the equil. of the reaction $V_2O_5 + SO_2 + SO_3 = 2VOSO_4$, if T was linked with the bend point of the curve of the log of the rate const. of the reaction $SO_2 + 1/2\ O_2 \rightarrow SO_3$ as a function of 1/T°K.

10937. Brötz, Walter. **Systematics of the Fischer-Tropsch catalysis.** *Z. Elektrochem.* 53, 301-6 (1949).—*C.A.* 44, 2358*d*.

The Fischer-Tropsch reaction: $CO + 2H_2 \rightarrow CH_2 + H_2O$ at atm. and 5-20 atm. gage pressure between 160° and 186°C was discussed. On tech. catalysts at pressures up to 10 atm. gage pressure the reaction rate was: $d[CO]/dt = k[H_2]^2/[CO]$, where k at 7 atm. gage pressure varied from 7.8×10^{-3} at 173° to 18.8×10^{-3} at 186°C, yielding an activation energy of 31 kcal/mole. At high pressures the reaction rate was: $d[CO]/dt = k_3([H_2]/[CO])(k_1[H_2]/(1 + k_2[H_2]))$. The CH_2 radicals were combined at the catalyst surface under formation of double bonds at the chains ends which were subsequently shifted by H exchange towards the center of the chains.

10938. Burtis, T.A.; Dart, J.C.; Kirkbride, C.G., and Peavy, C.C. **Economics of moving-bed catalytic-cracking processes.** *Chem. Eng. Progress* 45, 97-101(1949).—*C.A.* 43, 3180*b*.

When compared with the conventional Thermofor catalytic cracking design, the Houdriflow design, which had high catalyst to oil ratio, showed savings in investment, utility, and maintenance costs. Although catalyst attrition rates may be lower in the Houdriflow design than in the Thermofor Catalytic Cracking design, actual catalytic losses may be somewhat higher, depending upon the catalyst to oil ratios chosen.

10939. Butyagin, P. Yu. and Margolis, L. Ya. **Catalytic oxidation of hydrocarbons.** *Doklady Akad. Nauk S.S.S.R.* 66, 405-8 (1949).—*C.A.* 43, 6565*h*.

The proportions of the homogeneous and the heterogeneous rates of oxidation of C_2H_6, C_2H_4, and C_3H_6 by pure O_2 were detd. by simultaneous measurements of the temp. rise indicated by a thermocouple placed along the axis of the reaction vessel and one in contact with the wall coated with the catalyst. At low initial pressures, 0.1-10 mm Hg, with catalysts leading to deep oxidation (to CO_2 and H_2O) such as Pt on $BaSO_4$, (at 97°C) of MgO-Cr_2O_3 (at 300°C), the temp.-time curves showed a steep rise to a max., followed by gradual decrease.

10940. Caesar, C.H. **Catalytic effects in suspensoid cracking.** *Petroleum Processing* 4, 887-90 (1949).—*C.A.* 44, 1682*f*.

Product distribution indicated that this process was primarily a thermal one modified by typical catalytic reactions such as isomerization, H-transfer, polymerization, and intermol. condensation. Although the catalyst concn. was low (0.1% of that used in fluid catalytic cracking), it was essential to the process. Failure of the catalyst injector resulted in almost immediate shut-down.

10941. ČECH, JOSEF. **The chemical uses of methane.** *Chemie* (Prague) 5, 23-4(1949).—*C.A.* 46, 2781*g*.

CH_4 from coke plants was cracked to C_2H_2 in an elec. arc under 1.5 atm. and 1600°C. The semicom. partial oxidation of CH_4 to CH_2O in the presence of BaO_2 and O enriched with O_3, the combustion of CH_4 with NH_3 to form HCN by means of the catalyst Pt or silica gel, and the formation of CH_2Cl_2 from CH_4 and Cl_2 under actinic rays were also described.

10942. CHIRKOV, N.M. AND VERESHCHINSKII, I.V. **Ionic mechanism of the heterogeneous catalysis in the region of unimolecular adsorption. Depolymerization of paraldehyde in the gas phase under the action of acids.** *Doklady Akad. Nauk S.S.S.R.* 67, 317-20 (1949).—*C.A.* 43, 7801*e*.

Paraldehyde was depolymerized completely, in a 1st-order reaction, in the presence of acids (HCl, HBr, H_2SO_4, H_3PO_4) on quartz as carrier in the range 45°- 85°C and in the pressure range 5-80 mm Hg. With HCl and HBr, the reaction velocity at a const. surface area of the carrier ($2200\ cm^2$) was proportional to the pressure of the catalyst in the vapor phase.

10943. CHIZHIKOV, D.M.; FRENTS, G.S., AND TRATSEVITSKAYA, B. YA. **Mechanism and kinetics of the oxidation of lead sulfide by oxygen.** *Izvest Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* **1949**, 1352-60.—*C.A.* 45, 4536*e*.

The reactions (1) $PbS + 2O_2 = PbSO_4$, (2) $PbS + 3/2\ O_2 = PbO + SO_2$, and (3) $PbS + O_2 = Pb + SO_2$, proceeded practically to completion between 600° and 1200°K. Expts. were run with natural galenite ground to 0.060-0.074 mm, heated to 700°, 800°, or 900°C in a 450 ml/min. stream of a $N_2 + O_2$ mixt. with 1, 5, 10, 20, and 100% O_2, with direct analyses of the solid phase for $PbSO_4$, Pb, PbS, and PbO by the difference. At 800° and 900°C, with 5% O_2, the amt. of PbS decreased, and the amt. of PbO increased with time; the amts. of metallic Pb and of $PbSO_4$ first increased, passed through a max. at about 10 min., then fell. Expts. were also made with mixts. of galenite with $PbSO_4$, and of galenite with PbO in pure N_2.

10944. CONN, A.L. AND BRACKIN, C.W. **Cracking of high-sulfur stocks. Use of steam with natural catalyst.** *Ind. Eng. Chem.* 41, 1717-22(1949).—*C.A.* 43, 8656*e*.

In catalytic cracking with natural catalyst, the addn. of steam at different points had a retarding influence on the degree of poisoning caused by high-S stocks. Sufficiently large quantities of steam made it possible to maintain catalyst selectivity equal to that of fresh catalyst. Control of water, concn. of S in the rehydration, cracking, stripping, and regeneration zones, detd. the net poisoning in a complete cycle of operation.

10945. CORNUBERT, RAYMOND AND PHÉLISSE, JEAN. **New studies on Raney nickel and hydrogenation of α, β-unsaturated ketones.** *Compt. rend.* **229**, 460-2(1949).—*C.A.* 44, 1063*a*.

Reproducible catalysts of high activity were prepd.; their activity depended on the Ni content, the state of division, and extent of washing during prepn., etc. The prepn. of 2 of these, X20 (20%Ni) and X50(50%Ni), was described. With 5 g Ni involved in each case, 4 g PhCH:CHCO$_2$H in 100 ml EtOH at 1 atm. was hydrogenated with X20 in 7 min.; with X50 in 30 min.

10946. CREMER, ERIKA AND BALDT, RUDOLF. **New measurements of the catalytic dissociation of ethyl chloride for investigation of the relation between activation energy and activity.** *Z. Naturforsch.* 4a, 337-41 (1949).—*C.A.* 44, 8215*i*.

EtCl was dissocd. at temps. T, on chloride catalysts activated at temps. T_2. The order of the reaction $C_2H_5Cl = C_2H_4 + HCl$ and the relation between activity A and activation energy q in the Arrhenius equation were detd. First order const. reproduced the data up to about half decompn. of EtCl. Thereafter, the rate fell off owing to reversibility of the reaction. The catalysts $PbCl_2$, $BaCl_2$, $CoCl_2$, $NiCl_2$, $CaCl_2$, and $CdCl_2$ were preheated between 600°-900°K. The activation energies varied between 12 and 42 kcal/mol. and for a given catalyst usually increased linearly with T_2. All data showed an exponential relation between A and q.

10947. CROATTO, UGO. **Heterogeneous catalysis and reticular disorder of the catalyst.** *Ricerca Sci.* 19, 541-3(1949).—*C.A.* 45, 4123*i*.

In the catalyst system $(1 - p)CeO_2 + pLa_2O_3$ the no. of unoccupied anionic positions in the crystal lattices increased in proportion to p, but in $(1 - p)SrF_3 + pLaF_3$, the no. of new anionic positions increased with p. With 85 mol % CeO_2 and 15% La_2O_3 the energy of activation found was 30.16 kcal; 90 mol. % SrF_3 and 10% LaF_3 gave an activation energy of 21.02. With pure CeO_2 and LaF_3 the values were 30.62 and 22.85 kcal, resp. in the ranges 480°-700°C and 565°-700°C.

10948. DELEO, E.; INDOVINA, R., AND PARLATO, A. **Effect of deuterium oxide on the catalysis of hydrogen peroxide with solutions of colloidal platinum.** *Gazz. chim. ital.* 79, 451-3(1949).—*C.A.* 43, 8829*a*.

D_2O reduced the rate of decompn. of H_2O_2 by colloidal Pt; the concn. of H_2O_2 was always 0.05 N at 25°C. The water was replaced progressively by D_2O so that the same total vol. of reaction mixt. contained 0, 2.5, 5, 10, 20, and 40% D_2O, and the same concn. of colloidal Pt. The rate of decompn. (O_2 evolved) decreased with increase in the percentage of D_2O according to the relation: $K = (1/t)\,2.302 \log (A/(A - x))$, where K is the rate of decompn., t the time in min., A the ml of O_2 corresponding to complete decompn. (5.6), and x the cc. (760 mm and 0°C) of O_2 evolved in time t.

10949. DENT, F.J. AND HEBDEN, D. **Catalytic synthesis of methane as a method of enrichment in town-gas manufacture: with an account of Semi-scale experiments.** *Gas Research Board, Copyright Pub.* No. GRB 51, 41 pp. (1949); *Gas World* **130**, 1938-9(1949); **131**, 69-75; *Gas J.* **261**, 160-2, 167-9.—*C.A.* 44, 3236*g*.

Operating at a space velocity of 2000 vol. per vol. of catalyst per hr at atm. pressure, a gas with a heating value of 500 B.t.u. per ft^3 was produced, and at 20 atm. a gas of 700 B.t.u. The semiscale expt. was continued for at least 4 months without any appreciable deterioration in catalytic activity. The occurrence of difficulty at the high space velocity could be prevented by controlling the temp. of the surface of the Ni catalyst, by admitting steam when necessary, and by using a catalyst of suitable compn.

10950. D'HONT, M. AND JUNGERS, J.C. **The mechanism of heterogeneous catalysis. The activation of nitrogen by iron and nickel.** *Bull. soc. chim. Belges* 58, 450-9(1949).—*C.A.* 44, 9784*i*.

The catalyst (Fe or Ni) was heated to 175°C in the presence of HCN; after 30 min. the residual gas was removed and varying amts. of H_2 added at continually increasing temps.; the equil. mixts. were then analyzed. With Ni at 140°C after 1.5 hrs, there was present 94% NH_3, 1% CH_4, and 5% H, but after 15 hrs these were 7, 93, and 0%, resp. As the temp. increased, NH_3 decreased and CH_4 increased. The activation of N_2 seems to be the difficult stage in the catalytic synthesis of NH_3.

10951. EĬDUS, YA, T.; ZELINSKIĬ, N.D., AND PUZITSKIĬ, K.V. **Catalytic hydrocondensation of carbon monoxide with olefins. I. Hydrocondensation of carbon monoxide with ethylene.** *Izvest. Akad. Nauk S.S.S.R., Otdel, Khim. Nauk* 1949, 110-14.—*C.A.* 43, 4829*f*.

Mixts. of CO, H_2, and C_2H_4 were passed over a catalyst under atm. pressure at 190°-200°C mainly aliphatic hydrocarbons were formed. On a particularly active catalyst, a mixt. $1CO{:}2H_2{:}3C_2H_4$ gave, at a space velocity of 114-135, in 49 hrs, total oil 333-465 ml/m^3 total gas passed, or 33-49 ml oil/liter catalyst/hr, with a max. of 465.2 ml/m^3 or 49.2 ml/liter/hr, at a space velocity of 118; the yield of H_2O was 55-96 ml/m^3; the vol. ratio of light to heavy oil decreased during the operation from 1.42 to 0.85.

10952. ERDEY-GRÚZ, TIBOR. **Rate of hydrogenation in solutions and the mass of the catalyst.** *Nature* 163, 256-7(1949).—*C.A.* 43, 4551*c*.

Crotonic acid and Na cinnamate were hydrogenated in aq. soln. in contact with H_2 in the presence of Pd pptd. on finely dispersed $BaSO_4$. With moderate stirring the rate of H_2 absorption vs. the mass of catalyst showed a max. and min.; with vigorous shaking the rate was proportional to the amt. of catalyst. At low surface-vol. ratios, the addn. of NH_4Cl eliminated the max. and min. even with slow stirring.

10953. ERDEY-GRÚZ, TIBOR AND SZABÓ, JANOS. **Change of velocity of catalytic hydrogenations by the amounts of catalysts applied.** *Magyar Kem. Lapja* 4, 101-9 (1949).—*C.A.* 43, 8819*b*.

Crotonic and cinnamic acids were hydrogenated in the presence of finely dispersed Pd catalyst under application of different amts. of the catalyst. The hydrogenation was autocatalysed by the reaction product. The curve of reaction velocity obtained seemed to show a max. and a min. and definite correlation with the applied amounts of catalyst. The shape of this curve was significantly influenced by the presence of foreign ions and by change of ratio of the surface of the soln. to its vol.

10954. FUNASAKA, WATARU; YOKOKAWA, CHIKAO; HAYASHI, KATSUHIRO; KAWAMURA, TARO; FUJITA, HIDEO, AND SUGA, SOHEI. **Conversion of low-temperature tar into fuel oil. III. Catalytic reduction of aniline, pyridine, ethoxybenzene, and furfural under atmospheric pressure.** *J. Chem. Soc. Japan*, Ind. Chem. Sect., 52, 148-9 (1949).—*C.A.* 45, 2176*e*.

The catalytic reductions or decompn. and simultaneous hydrogenation of basic constituents of low-temp. tar, ethoxybenzene, and furfural were studied in H_2 under the atm. pressure between 400° and 500°C, with oxides or hydroxides of Fe, Mo, Co, Ni, and Cr as catalyzers. Aniline was converted to benzene with max. yield 76% when Fe_2O_3 was used, pyridine gave only traces of neutral oil.

10955. FUNASAKA, WATARU; YOKOKAWA, CHIKAO; HAYASHI, KATSUHIRO; KAWAMURA, TARO; FUJITA, HIDEO, AND SUGA, SOHEI. **Conversion of low-temperature tar into fuel oil. IV. Durability and regeneration of catalyzers of the iron family.** *J. Chem. Soc. Japan*, Ind. Chem. Sect., 52, 149-51(1949).—*C.A.* 45, 2176*f*.

The low-temp. tar consisting of neutral and acidic oils was reduced under atm. pressure between 400°C and 500°C by using catalyzers prepd. from Fe-Cr-kieselguhr, yellow ocher, etc. When the reduction was performed at 480°C with the yellow ocher from Niwasaka, Fukushima Pref., Japan, the low-temp. tar was easily converted to neutral and light oils and the catalyzers could be regenerated by repeated baking and reduction.

10956. GIOVANNINI, E. **Catalytic sulfurization of methane; preparation of carbon disulfide.** *Ann chim. applicata* 39, 671-81(1949).—*C.A.* 45, 9815*b*.

A mixt. of CH_4 and vapor of S was heated in a quartz tube at various temps. in presence and absence of catalysts. Without catalyst the yield of CS_2 rose fairly regularly to 54.4% (calcd. on CH_4) at 1050°C. With a W catalyst peak production was 61.5% at 650°C, falling to 34.3% at 750°C, with a Mo catalyst the peak was 69.4% at 850°C; with a mixed W-Cr catalyst the peak was 79.3%, also at 850°C.

10957. HALL, R.E. AND SMITH, J.M. **Design of gas-solid catalytic reactors.** *Chem. Eng. Progress* 45, 459-70(1949).—*C.A.* 43, 6471*h*.

Over-all effective thermal conductivities (K values) were found to be about 0.2 B.t.u./(hr)(ft)(°F) for the conditions employed in the integral reactor; K decreased as the tube wall was approached. There was little radial mixing of the gas in the reactor.

10958. HASKELL, VERNON C. AND HAMMETT, LOUIS P. **Rates and temperature coefficients in the hydrolysis of some aliphatic esters with a cation-exchange resin as the catalyst.** *J. Am. Chem. Soc.* 71, 1284-8 (1949).—*C.A.* 43, 6064*h*.

Sulfonated coal and two synthetic cation-exchange resins were used. The kinetics of the hydrolysis of methyl acetate, ethyl acetate, ethyl butyrate, ethyl caproate in 70% acetone were studied. The free energy of activation relative to the HCl-catalyzed reaction in each case increased almost linearly with chain length of the ester. The rates were lower than those for the HCl-catalyzed reaction and were accompanied by lower heats and entropies of activation for both methyl acetate and ethyl butyrate.

10959. HERGLOTZ, H. AND LISSNER, A. **Raney metals as desulfurization catalysts. I.** *Z. anorg. chem.* 260, 141-53(1949).—*C.A.* 44, 10474*a*.

Raney catalysts of Co and Cu were studied for conversion of org. S compds. (p-sulfanilic acid decompn. products) to H_2S. Cu was inactive. Co was active, resembling Pt on asbestos. Below 400°C the Co retained the S; above 400°C H_2 stripped off S as H_2S.

10960. HILL, FRED N. AND SELWOOD, P.W. **Structure and activity of supported nickel catalysts.** *J. Am. Chem. Soc.* 71, 2522-9(1949).—*C.A.* 43, 8831*d*.

Susceptibility isotherms were detd. for NiO supported on high-area magnesia (138 m^2/g), γ-alumina (230m^2/g), and rutile (126 m^2/g). The quant. reduction of the supported NiO by H_2, the sp magnetization (ferromagnetism) of the reduced Ni, and the measurement of catalytic activity were reported. The phenomenon of valence inductivity was shown to apply in these systems, leading to Ni oxidation states of 2, 3, and 4. The structure of Ni-γ-alumina catalysts was discussed and related to activity for the hydrogenation of C_2H_6.

10961. HOOG, H. **Selection and development of catalysts in industrial chemistry.** *Chem. Weekblad* 45, 433-41 (1949).—*C.A.* 43, 8074*c*.

The tech. requirements of a satisfactory contact catalyst were analyzed, special emphasis being placed on selectivity. Examples were: the catalytic cracking process, NH_3 oxidation with the aid of Pt-Rh alloy catalysts, and MeOH oxidation with Cu or Ag gauze catalysts.

10962. HUGHES, E.C.; STINE, H.M., AND DARLING, S.M. **Coprecipitated chromia-alumina catalysts for naphtha reforming with hydrogen.** *Ind. Eng. Chem.* 41, 2184-8 (1949).—*C.A.* 44, 827*c*.

The performance of a copptd. chromia-alumina catalyst agreed with published results with molybdena-alumina catalysts. The catalyst was prepd. with careful control of pH during pptn. and of the chromia-alumina mole ratio. The catalyst was resistant to high temps. and to the presence of water vapor and org. S compds. The use of moderate H_2 pressures resulted in an appreciable increase in liquid yield, and a corresponding decrease in carbon laydown. The process proved to be self-sufficient in H_2. Increase in the H_2 pressure had a repressive effect on the reactions.

10963. JUSTAT, A. **Fluid catalysts and a forgotten Polish patent.** *Przemyst Chem.* 28, 16-19 (1949).—*C.A.* 43, 8074*d*.

A description was given of fluid catalysis and its application in U.S. industry. A summary was also given of prewar Polish patent 27,665 on fluid catalysis.

10964. KAGAN, M. YA. AND FRIDMAN, S.D. **Causes of the inactivity of copper and iron in the hydrogenation of benzene.** *Doklady Akad. Nauk S.S.S.R.* 68, 697-9(1949).—*C.A.* 44, 917*a*.

The contrast between the activity of Fe and Cu in the hydrogenation of olefins, and their inactivity for C_6H_6 was interpreted by energy considerations. Chemisorption of either an olefin or of C_6H_6 was accompanied by the rupture of a π -bond. Experimentally, pure Cu and Fe on Al_2O_3 proved inactive in the hydrogenation of C_6H_6 at 150°-250°C, and in the dehydrogenation of cyclohexane at 270°-320°C. The same catalysts were found active both in the hydrogenation and dehydrogenation of cyclohexene which differed from C_6H_6 by the absence of resonance. The inactivity of Cu and Fe towards C_6H_6 was due to the energetic improbability of formation of the intermediate adsorption complex.

10965. KAGAN, M. YA. AND SHACHEGLOVA, N.A. **Kinetics and mechanism of the reactions of catalytic hydro-dehydrogenation. III. Dehydrogenation of cyclohexane on a platinum catalyst.** *Zhur. Fiz. Khim.* 23, 1203-14 (1949).—*C.A.* 44, 1313*c*.

Cyclohexane or its mixts. with benzene, H_2, or N_2 were passed through plugs of the catalysts (3g 4% Pt on pumice) used for conversion of cyclohexene. The vol. of H_2 liberated and the ratio cyclohexane: benzene in the condensate were detd. The efficiency of the catalysts did not change at 260°C, but at 292°C it fell after each expt. and the catalyst had to be regenerated by $N_2 + 2\% O_2$ at 350°C and then by H_2 at 290°C. The rate of dehydrogenation was 1/4500 that of disproportionation of cyclohexane; hence, if cyclohexane was an intermediate in the reaction cyclohexane → benzene, it was consumed in the disproportionation rather than in the dehydrogenation reaction.

10966. KARPACHEVA, S.M. AND ROZEN, A.M. **Oxygen^{18} as indicator in heterogeneous catalysis.** *Doklady Akad. Nauk S.S.S.R.* 68, 1057-60 (1949).—*C.A.* 44, 917*e*.

The fate of O^{18} incorporated into the catalyst by the exchange $H_2O^{18} + MO^{16} \rightleftarrows H_2O^{16} + MO^{18}$ was studied: (1) surface combustion of H_2 on grog, Fe_2O_3, quartz, or dunite, (2) oxidation of CO on MnO_2, (3) dehydration of EtOH on Cr_2O_3 10% + Al_2O_3 90% or on kaolin. The amts. of O^{18} incorporated in the catalyst were: (1) in quartz, 5, in grog, Fe_2O_3, and dunite, 14-17 γ/g, (2) 157-250 γ/g. In all 3 reactions, significant amts. of O^{18} were found in the products. All 3 catalysts were found to promote the exchange (4) $H_2O^{18} + 1/2\ O_2{}^{16} \rightleftarrows H_2O^{16} + 1/2\ O_2{}^{18}$, in the same order of activities as in reactions (1), (2), and (3). Exchange by a purely adsorptive mechanism was observed with a CuO catalyst, inactivated for the $H_2O^{18} + MO^{16}$ exchange by repeated treatment with H_2O.

10967. KOCH, HERBERT AND FILFERT, WILHELM. **Breaking down and building up of hydrocarbons under hydrogenating conditions over the cobalt catalyst used in Fischer-Tropsch syntheses.** *Brennstoff-Chem.* 30, 213-18 (1949).—*C.A.* 43, 7664*i*.

Various pure hydrocarbons in vapor form mixed with H_2 and CH_4 were recirculated at 200°C over a reduced Co catalyst used for Fischer-Tropsch syntheses.

10968. KODAMA, SHINJIRO; FUKUI, KENICHI, AND TESHIMA, TATSURO. **Errors in the temperature determination of a catalyst layer with jacketed thermo-couples.** *Repts. Inst. Chem. Research Kyoto Univ.* 17, 105-8(1949).—*C.A.* 46, 9963*b*.

The temp. distribution of a thermojunction moved from one end to the other of its jacket along the central axis was theoretically developed from the heat conds. of the inner stuffing, jacket material, and external film as a function of the tube length. The postulate was verified by detg. with jacketed thermocouples the temp. of ZnO-CrO_3 catalyst stuffed in a glass tube through which C_2H_2 gas was passed.

10969. KÖLBEL, HERBERT AND ENGELHARDT, FRIEDRICH. **The reaction mechanism of the Fischer-Tropsch synthesis.** *Erdol u. Kohle* 2, 52-9 (1949).—*C.A.* 43, 4828*i*.

An Fe catalyst (100 Fe, 0.5 Cu, 0.25 K_2CO_3) was studied under 4 different contact conditions: carbidic, 24-hr treatment with CO at 270°C; metallic, subsequent 24-hr treatment with electrolytic H_2 at 270°C; oxidic, reduction of catalyst with H_2 at 270°C; synthesis, treatment for 100 hrs at 1 atm. at 230°C, $CO/H_2O = 1:2$, space velocity 100. The optimum synthesis for a Co catalyst was below 180°C, while that for Fe was considerably higher. Expts. with a Co catalyst showed that lowering the space velocity from 100 to 10 at 180°C and changing the H_2/CO ratio from 2:1 to 2:3.55, H_2O concn. decreased progressively and almost parallel increase of CO_2 resulted.

10970. KÖLBEL, HERBERT; ACKERMANN, PAUL; JUZA, ROBERT, AND TENTSCHERT, HANS. **Reaction mechanism of the Fischer-Tropsch synthesis. II. Investigation of iron catalysts in the hydrogenation of carbon monoxide.** *Erdöl u. Kohle* 2, 278-85 (1949).—*C.A.* 43, 8117*a*.

Fe catalysts prepd. from $Fe(NO_3)_3$ (initially α-Fe_2O_3), promoted with Cu (0.001 to 0.16%), K_2CO_3 (0.0 to 0.25%), and $BaCO_3$ were investigated analytically, catalytically, magnetically, thermomagnetically, by means of x-rays, and by adsorption measurements. After exposure to synthesis, the catalyst consisted principally of magnetite (Fe_3O_4) and always contained Fe carbide. No free Fe was present. After longer synthesis exposure a second thermally stable carbide either replaced the first or was formed in addn. High alkali content, higher gas pressures, and CO content in combination with longer synthesis exposure favored the formation of Fe_2C stable up to 400°C.

10971. KÖLBEL, HERBERT AND LANGHEIM, ROBERT. **Reaction mechanism of the Fischer-Tropsch synthesis. III. Carbide formation on iron catalysts during carbon monoxide hydrogenation.** *Erdöl u. Kohle* 2, 544-50 (1949).—*C.A.* 44, 3235*h*.

Fe_2C was formed by treating pure, paramagnetic α-Fe_2O_3 prepd. from $Fe(CO)_5$ and O_2 with CO at a rate of 4 liters/hr at 265°C. Some elementary carbon was also deposited. In another sample, carbidic carbon was hydrogenated for 20 hrs at 265°C and the remaining carbon burned in O_2. Cu acted as a reduction accelerator both in carbide formation and Fe catalysts. Presence of both Cu and alkali appreciably increased rate of formation of both carbide and elementary carbon. Alkali catalyzed both reactions directly, and Cu did it indirectly through accelerating the reduction of Fe_2O_3.

10972. KRASS, WALTHER. **The catalytic ammonia oxidation on oxide contacts.** *Z. Elektrochem.* 53, 320-5 (1949).—*C.A.* 44, 2711*d*.

The formation of N_2O at 300°C in NH_3-air-O_2 mixts. on CoO, MnO, and NiO catalysts contg. excess "active" O was studied as a function of the active-O content of the catalysts and as a function of the O_2-NH_3 ratio. The amount of N_2O formed was proportional to the active-O concn. Up to 90% of the NH_3 was converted into N_2O. Analogous results were obtained with Fe_2O_3, Bi_2O_3 + KOH, and BaO_2 + CuO as catalysts. The catalytic action was due to O atoms.

10973. KRAUSE, A. **Mystery of contact catalysts.** *Przemyst Chem.* 5(28), 558-63(1949).—*C.A.* 45, 10019*i*.

Contact catalysts were looked upon as transitory radical structures, typified by a marked increase of paramagnetism and by a large amt. of energy. Free radicals were very reactive because their outermost electronic group did not form a complete octet. To set a catalytic reaction in motion, it was necessary for the contact catalyst to react with a foreign mol. *A* to give an activated radical *KA*, which in turn deformed or activated another mol. *B*. The radicals *A* and *B* formed a new compd. (*AB*), which then separated from the catalyst *K*.

10974. KRAUSE, A.; APPELT, K., AND KOTKOWSKI, ST. **Use of the benzidine reaction in the study of catalytic properties of metallic oxides.** *Przemyst Chem.* 5(28), 351-6(1949).—*C.A.* 45, 10019*a*.

The catalytic oxidation of benzidine by H_2O_2 in the presence of ferromagnetic and diamagnetic ferric oxides was used to study the catalytic properties of a no. of metallic oxides. A close dependence was noted between the occurrence of a pos. benzidine reaction and the ferromagnetism of ferric oxides. Dry FeOOH heated above 240°C became strongly ferromagnetic γ-Fe_2O_3 which gave an intense benzidine reaction.

10975. LAHUERTA CASAUS, PASCUAL AND SANCHEZ MARCO, GODOFREDO. **Conditions for the preparation of mixed catalysts for hydrogenation.** *Rev. açad. cienc. exact. fis.-quim. y nat. Zaragoza (2A)*, 4, 71-80(1949).—*C.A.* 44, 10215*d*.

A $Ni/Al_2O_3/Cr_2O_3$ catalyst was prepd.: 100 ml of 100 g $K_2Cr_2O_7$/liter, 105 ml of 100 g $NiSO_4 \cdot 6H_2O$/liter, 75 ml of 103 g $Al_2(SO_4)_3$/liter, and 95 ml of 25% K_2CO_3 soln. The ppt. which formed (pH = 8) had Ni 29.8, Cr_2O_3 7.0, and Al_2O_3 14.2% on a dry basis.

10976. LEIDHEISER, HENRY JR. **The importance of interatomic spacing in catalysis. A correlation between hydrogen overvoltage on metals and the distance between atoms.** *J. Am. Chem. Soc.* 71, 3634-6 (1949).—*C.A.* 44, 2353*h*.

The spacing between atoms was an important factor in catalysis. Values of the H_2 overvoltage were a min. at a distance of closest approach of atoms of approx. 2.7 A. for both the body-centered cubic and face-centered cubic metals.

10977. LEVERING, DEWEY R. AND LIEBER, EUGENE. **The promoter effect of platinic chloride on Raney nickel.** *J. Am. Chem. Soc.* 71, 1515(1949).—*C.A.* 43, 6498*a*.

Extremely minute quantities of $PtCl_4$ greatly enhanced the activity of the most active Raney Ni. Further promoter action was observed with the combination of Et_2N and $PtCl_4$. The combination was especially effective in hydrogenation of the ketone group.

10978. Lewis, W.K.; Gilliland, E.R., and Reed, W.A. **Reaction of methane with copper oxide in a fluidized bed.** *Ind. Eng. Chem.* 41, 1227-37 (1949).—*C.A.* 43, 7199*i*.

The reaction of CH_4 with CuO was investigated in a fluidized solid bed. With a molal O/C ratio of 1.0 or slightly greater, the reaction gave CO and H_2 in a molal ratio of about 1 to 2. In a lab. unit with a 4-ft bed at 1640°F and 1 atm. pressure, CH_4 was 94% decompd. with 92% selectivity. Cu was rapidly reduced with the simultaneous complete oxidation of part of the CH_4. The remaining CH_4 was reformed (rate-controlling step) with CO_2 and H_2O (both from the first step) to produce CO and H_2.

10979. Losson, Felix J. and Bloodgood, Don E. **Cyanide waste treatment by ion-exchange methods.** *Proc. 4th Ind. Waste Utilization Conf.; Purdue Univ., Eng. Bull., Extension Ser.* No. 68, 314-26(1949).—*C.A.* 44, 10553*f*.

The H_2O from rinse tanks following plating tanks,(contg. CN^- and metal ions such as Cu or Zn) was passed through a cation exchanger bed to remove the metal ions. The remaining soln. was passed through an aerator unit to remove the CN^- as HCN. The allowable rate of flow over the porous tube aerator was directly proportional to the surface area of the aerator.

10980. Marczewska, Kazimiera. **Oxidation of ammonia at lower temperatures by means of air enriched with oxygen.** *Roczniki Chem.* 23, 406-17(1949).—*C.A.* 44, 10473*a*.

The ripening of catalyst at low temps. was investigated with regards to N_2O as product of reaction.

10981. Mathieu-Lévy, Lucile S. **Catalytic oxidation of carbon monoxide.** *Ann. mines.* 138, 23-40(1949).—*C.A.* 44, 4764*f*.

Hopcalite-type catalysts were prepd. from anhyd. $MnSO_4$, $CuSO_4$, H_2SO_4, and H_2O. The washed ppt. was treated with $CuSO_4$ and $(NH_4)_2SO_4$ in NH_4OH. Two such catalysts, contg. 8.4% and 31% CuO, resp., compared favorably with a com. prepn. Numerous expts. indicated that CO was oxidized upon contact with chemisorbed O_2, a mechanism proposed earlier for the same reaction with Ag as catalyst.

10982. Maxted, E.B. and Moon, K.L. **The nature of chemisorptive bonds. II. The catalytic toxicity of organometallic compounds.** *J. Chem. Soc.* 1949, 2171-4.—*C.A.* 44, 3778*b*.

Toxicity tests were conducted with compds. in which the *s* and *p* bands were involved in bond formation with another element. Data were obtained for $HgMe_2$ and $PbMe_4$ on hydrogenation of cyclohexene with Pt black, the poisons being added in cyclohexane soln. Graphs of effective (poisoning vs. total poison) and true (poisoning vs. amt. of poison actually adsorbed) toxicities of $HgMe_2$ and $PbMe_4$ were plotted alongside values for Hg, Pb, and In ions for comparison. $PbMe_4$ is less toxic than $HgMe_2$.

10983. McKim, F.L.W. and Cambron, A. **The catalytic oxidation of ethylene to ethylene oxide.** *Can. J. Research* 27B, 813-27(1949).—*C.A.* 44, 2836*g*.

With a finely divided Ag catalyst promoted with Ca oxalate and SnO and supported on a Ag sheet for close temp. control, the selectivity (% yield of ethylene oxide based on C_2H_4 reacted) increased from about 25% with C_2H_4 in large excess to about 55% with O_2 in excess. The rate of the reaction was proportional to the square root of the C_2H_4 concn. when air was in excess and to the O_2 concn. when C_2H_4 was in excess. With both promoted and unpromoted catalysts, the addn. of CH_4, C_2H_6, or propane depressed the rate of conversion to ethylene oxide but increased the rate of conversion to CO_2 and water.

10984. Melville, H.W. and Robb, J.C. **The kinetics of the interaction of atomic hydrogen with olefins. I. Apparatus and use of parahydrogen techniques.** *Proc. Roy. Soc.* (London) A-196, 445-65(1949).—*C.A.* 44, 1784*h*.

A special reaction vessel was described in which the path length offered to a H atom before removal on the oxide layer could be varied. A very sensitive colorimetric technique for measuring the rate of addn. of H atoms to the oxide surface was described. The addn. of a very small amt. of H atoms could be detected. The para-H conversion technique was applied to illustrate how the collision efficiency of a H atom with a satd. hydrocarbon mol. could be obtained. The para-conversion was used to demonstrate the efficiency of the removal of a H atom on the oxides of Mo and W.

10985. Miyazaki, Shozo. **Catalytic decomposition of ammonia. II. The decomposition on molybdenum.** *J. Chem. Soc. Japan, Pure Chem. Sect.*, 70, 373-6(1949).—*C.A.* 45, 2759*b*.

The catalytic decompn. of NH_3 on a heated Mo filament was observed over the range 680° to 820°C. The behavior was entirely similar to the decompn. of NH_3 on W. The mechanism of the decompn. was identical in the 2 cases within the observed temp. range. The energy of activation accompanying the decompn. on the heated Mo was 45.6 kcal/mole.

10986. Miyazaki, Shozo. **Catalytic decomposition of ammonia. III. Decomposition on platinum.** *J. Chem. Soc. Japan, Pure Chem. Sect.*, 70, 439-42(1949).—*C.A.* 45, 2759*c*.

The catalytic decompn. of NH_3 with Pt as a catalyst was studied over the range 650° to 750°C. In the initial stage of decompn., the velocity was independent of the partial pressure of NH_3, but as the decompn. products were formed, the velocity decreased very rapidly. The equal inhibition by H_2 and N_2 was confirmed by expts. with the addn. of these gases at the beginning. The heat of activation of the decompn. was calcd. as 47.0 kcal/mole.

10987. Nahin, P.G. and Huffman, H.C. **Alumina and alumina-supported catalysts.** *Ind. Eng. Chem.* 41, 2021-7(1949).—*C.A.* 44, 3342*f*.

Electron micrographs of hydrous Al_2O_3 gel, gibbsite, bayerite, boehmite, diaspore, γ-Al_2O_3, θ-Al_2O_3, and κ-Al_2O_3 showed individual characteristics. The active state in molybdena-alumina and cobaltia-molybdena-alumina catalysts for hydroforming and hydrodesulfurization was assocd. with γ-Al_2O_3 microcrystals, 50 to 200 A. in size. Catalytic activity decreased with loss of surface area and progressive metal-oxide-promoted destruction of the γ-phase in the crit ranges, 875°-900° and 925°-950°C, resp.

10988. NATTA, G. **Solid-state reactions in the formation and the aging of catalysts.** *Bull. soc. chim. France* 1949, D161-6.—*C.A.* 43, 6897*c*.

In catalysts of the same chem. compn., well-crystd. samples had a greater activity than those formed with very small grains. The best catalysts for gaseous reactions were obtained by decompn. or reduction in the solid state with a diminution of mol. vol. but without a change in the exterior vol. of each grain of the catalyst. In many cases the function of a promoter was to prevent recrystn. The importance of the aging of $MgO-SiO_2$ catalysts used for the manuf. of butadiene from alc. was discussed.

10989. NEĬMARK, I.E. AND SHEĬNFAĬN, R. YU. **Effect of the type of porosity of silica gel catalyst on the reaction of vapor-phase hydrolysis of chlorobenzene.** *Zhur. Fiz. Khim.* 23, 595-604(1949).—*C.A.* 43, 7313*e*.

Ten specimens of dry silica gel of different porosity were prepd. Mixts. of steam 1, and PhCl 0.8-1.1 parts were passed through 50 ml at a rate 25 g PhCl/hr. The yield of PhOH and HCl at 500°C was highest (about 5%) for the catalysts having the greatest apparent sp. gr., *p*, (in Hg, 1.4-1.5), the smallest pore vol., *v* (0.23-0.30), and no pores of medium size. At 550°C, specimens with $v = 0.6-0.7$, and at 600°C those with $v = 0.7-0.9$ were most active. Heating of silica gels below 600°C had little effect. Heating at 700°-900°C reduced the adsorption capacity for MeOH; it did not close the pores but caused formation of big pores at the expense of fine pores.

10990. OBOLENTSEV, R.D. **The "order" of the contact-catalytic reaction of aromatization of heptane on chromium catalysts.** *Doklady Akad. Nauk S.S.S.R.* 66, 215-18(1949).—*C.A.* 43, 6062*e*.

The dependence of the yield *M* on the time of contact *t* was represented by $M = D [1-exp(-a_t b)]$ Consts. (d,a,b, resp.) for the conversion of C_7H_{16} into aromatic products at 480°C were 17, 0.097, 1.20; for the concn. of aromatic products in the catalyzate, 20, 0.034, 1.41; for the concn. of unsatd. hydrocarbons in the catalyzate, 12, 0.290, 1.02. Exptl. data on aromatization of 2-methyl-2-hexene were described by the same kinetic equation, with 35, 0.303, 0.54. Variation of the activity of the catalyst did not alter the type of the kinetic curve; it only shifted the log [log D - log (D - M)] line, plotted as a function of log *t*, parallel to itself.

10991. OGG, CLYDE L. AND COPPER, FRANCES J. **Determination of unsaturation by microhydrogenation method and apparatus.** *Anal. Chem.* 21, 1400-2(1949).—*C.A.* 44, 2884*i*.

Place 4 ml HOAc, 20 mg Pd catalyst, and a stirring bar (Fe filings sealed in glass) in the 20-ml reaction flask. Weigh the sample equiv. to 3-5 ml H_2 into an Al cup 6 mm diam. and 8 mm long and suspend it above the reagents in the flask. Flush out the app. with H_2. Stir the catalyst and HOAc with a magnetic stirrer for 5 min. after diminution of gas vol. ceased, remove the stirrer, allow the app. to equilibrate for 15 min. and record the vol., temp., and pressure. Drop the sample into the mixt. and stir for 15 min. after the reaction ceased, keeping the pressure nearly const. throughout. Allow the app. to equilibrate and record the vol., temp., and pressure. A standard deviation of 0.6 was obtained for the H_2 no. of 10 samples of maleic acid.

10992. OHTA, NOBUTO. **Effect of proton-donating intensity of catalyst on the butanol-acetone (or acetaldehyde) reaction.** *J. Chem. Soc. Japan, Ind. Chem. Sect.* 52, 161-2(1949).—*C.A.* 45, 1857*i*.

Catalysts chosen were: $H_3PO_4.SiO_2$(PD 70), $Al_2(SO_4)_3$, (PD 25) and Al_2O_3 (No. 410). An equimol. mixt. of BuOH with acetone or with AcH, when passed over Al_2O_3 No. 410 at 250-300°C, gave a condensation product consisting mostly of higher ketones in 25-32% yields along with some liquid unsatd. hydrocarbons as a by-product. With the first catalyst, only butylene was formed.

10993. OLSEN, C.R. AND STERBA, M.J. **Effect of reactor temperature on product distribution and product quality in fluid catalytic cracking.** *Chem. Eng. Progress* 45, 692-700(1949).—*C.A.* 44, 826*h*.

These tests were made at 3 temp. levels: 800°, 900°, and 950°F with synthetic catalyst. All the tests were once-through, and the conversions at each temp. level varied from approx. 45 to 75 vol. % gas-oil disappearance. Product distribution among individual light hydrocarbons through the C_4 fraction was shown, the C_5 fraction was split into olefins, and paraffins, and the depentanized gasoline was resolved into 3 groups of hydrocarbon types. The general effect of increasing reactor temp. at a given conversion was to produce less deposit on catalyst, less debutanized gasoline, and greater quantities of light hydrocarbon fractions having higher olefin contents.

10994. PALADINO, SALVATORE. **Fluid catalysts and catalytic cracking.** *Rend. ist. super. sanita* 12, 452-66 (1949); *Ann. chim. applicata* 39, 208-21(1949).—*C.A.* 44, 7050*g*; 45, 7781*i*.

The principles of fluid catalysts were applied to catalytic cracking. The types used, regeneration, effect of temps. employed and vapor velocities and types of deposits occurring in the petroleum industry were covered.

10995. PATRICK, T.M., JR. AND EMERSON, WILLIAM S. **Unsaturated long-chain aliphatic esters. Catalytic oxidation.** *Ind. Eng. Chem.* 41, 636-41 (1949).—*C.A.* 43, 3611*g*.

Catalytic liquid-phase air oxidation of oleic acid and its Me and Et esters was studied: (1) with air under pressure in the presence of 1% CrO_3 catalyst, and (2) with O_2 in AcOH soln. at atm. pressure with a mixt. of the acetates of Co, Mn, and Pb as catalysts. At 110°-120°C and 200 p.s.i. for 6 hrs, scission products 22.0, high-boiling products 40.2, tar 18.7, and recovered Et oleate 6.2% were obtained. At 105°-115°, O_2 was passed 1.5, 3, 6, or 9 hrs through equal wts of Et oleate and AcOH contg. 1% each of the acetates of Mn, Pb, and Co in a vertical tube. At the end of the reaction AcOH was removed in vacuo, the metal compds. were washed out as chlorides and the product was treated as in the pressure oxidation.

10996. PAVLYUCHENKO, M.M. **Reactions involving solids in the absence of any catalytic action of the reaction products.** *Zhur. Fiz. Khim.* 23, 800-8 (1949).—*C.A.* 43, 8820*c*.

The corners of a cube were its most reactive points. If the reaction started from the corners and proceeded along the diagonals of the cube, the area of the reactive surface increased; this explained the usual "autocatalytic" acceleration of reactions involving solids. The theory was applicable also to reactions starting at crystal edges.

10997. PAVLYUCHENKO, M.M. **The fundamental equation of topochemical reactions which are not catalyzed by the solid reaction product.** *Zhur. Fiz. Khim.* 23, 809-12 (1949).—*C.A.* 43, 8820*d*.

If a reaction that started on a crystal face were propagated at equal rates along the surface and normal to it, the rate v of reaction was proportional to t^2 (t = time). If the reaction spread over the surface more rapidly than it penetrated into the crystal, v was max. at $t = 0$.

10998. PICHLER, HELMUT AND ZIESECKE, KARL H. **High-pressure hydrogenation of carbon monoxide to predominantly isoparaffinic hydrocarbon compounds (isosynthesis). I.** *Brennstoff-Chem.* 30, 13-22(1949).—*C.A.* 44, 814*h*.

Hydrocarbon synthesis was carried out at 300-600 atm. at 450°C; ThO_2 was the best single catalyst, ZrO_2 and CeO_2 were suitable, Al_2O_3 was considerably poorer. Gaseous and liquid hydrocarbons were formed; of these the C_4 hydrocarbons were predominantly (80-90%) branched. At pressures over 600 atm. and temps. under 400°, significant quantities of O-compds. (especially isobutanol methanol, and Et_2O) were formed.

10999, PICHLER, HELMUT AND ZIESECKE, KARL H. **High-pressure hydrogenation of carbon monoxide to predominantly isoparaffinic hydrocarbon compounds (isosynthesis). II. Experiments with mixed catalysts and conversion of dimethyl ether.** *Brennstoff-Chem.* 30, 60-8, 81-4 (1949).—*C.A.* 44, 815*a*.

ZnO plus ThO_2 favored the yield of liquid hydrocarbons and the addn. of Al_2O_3 plus ThO_2 the formation of isobutane. The yield of isobutane was greatly increased when 3% K_2CO_3 was added to the ppt. of ThO_2 + 20% Al_2O_3, amounting to 57% of the hydrocarbons formed at 300 atm. and 450°C. A similar alkali-free catalyst at 600 atm. and 450°C yielded 130 g of liquid hydrocarbons and "gas oil" per m^3 of CO-H_2 mixt.

11000. PSHEZHETSKIĬ, S. YA. AND KAMENTSKAYA, S.A. **Kinetics of oxidation of isopropyl alcohol to acetone on a silver catalyst.** *Zhur. Fiz. Khim.* 23, 136-55 (1949).—*C.A.* 43, 5272*e*.

Mixts. of isopropyl alc., O_2, and N_2 were passed through a 1-cm-thick layer of pumice on which Ag (0.35 g per 10 ml) was deposited from $AgNO_3$. The concn. of acetone in the outgoing gas was detd. The main part of adsorbed O_2 was energetically uniform. Presumable isopropyl alc. and acetone were adsorbed on the O_2 film.

11001. QUARTAROLI, A. AND DEL CARRATORE, A. **The oxidizing action of hydroxides on ferrous hydroxide. The copper subgroup.** *Ann. chim. applicata* 39, 527-34(1949).—*C.A.* 45, 4121*g*.

The hydroxides or oxides of the Cu subgroup tended to form suboxides and to function as oxidants with respect to $Fe(OH)_2$. Evidence of this interaction was obtained by magnetic-susceptibility studies of ferrous-ferric hydroxides formed as intermediate oxidation products.

11002. RAMSER, J.H. AND HICKEY, J.W. **A catalyst loss recorder for catalytic cracking units.** *Ind. Eng. Chem.* 41, 1244-7 (1949).—*C.A.* 43, 7217*e*.

The instrument continuously indicated and recorded the amt. of catalyst carried away with the flue gas in fluid-catalytic cracking units. The catalyst concn. was measured by an optical device; the flue-gas velocity by a flowmeter, and a mechanism coupled these 2 devices, automatically multiplying catalyst concn. by rate of gas flow, and thus detg. the instantaneous loss of catalyst per unit time. Automatic integration gave the accumulative loss of catalyst.

11003. REITZ, O. **Effect of particle size and density of catalyst particles on the activity of commercial high-pressure catalysts.** *Chemie Ing. Tech.* 21, 413-17(1949).—*C.A.* 44, 2836*d*.

Mineral oils were hydrogenated in a 1-liter autoclave at 250 atm. H_2 and 350°-400°C over compressed WS_2 tablets and a compressed mixt. of WS_2 + NiS on activated clay. The reaction rates for both catalysts indicated that surface diffusion to the core was a contributing factor. In the case of the unsupported WS_2 catalyst, which had a pore vol. of less than 50%, it was possible that an increased diffusion of the smaller oil mols. took place to the core of the pellets. The supported catalyst which had a larger pore vol. of about 65% did not show any evidence of preferential diffusion of smaller mols. to the interior.

11004. RICHARDSON, C.B.; JOHNSON, F.B., AND ROBBINS, L.V. JR. **Fluid catalyst cracking with silica-magnesia.** *Ind. Eng. Chem.* 41, 1729-33 (1949).—*C.A.* 43, 8656*c*.

Over-all results with silica-magnesia in lab. and in large scale fluid catalyst pilot plants indicated that with respect to gasoline yield, this catalyst was superior to silica-alumina and natural clay catalysts. Carbon formation was equiv. to that with silica-alumina, but dry gas and butane-butene yields were lower; silica-magnesia was superior to silica-alumina from the standpoint of activity maintenance.

11005. RIDGE, D. AND EMBLEM, H.G. **A new method for the preparation of contact catalysts.** *Chemistry & Industry* 1949, 500.—*C.A.* 43, 8074*e*.

Sillimanite was incorporated with a mixt. of aq. EtOH, Et silicate, and piperdine and a slurry formed which set to a solid mass on standing. The catalytic agent, or a precursor which formed the catalyst on ignition, was added to this slurry. The mass was air-dried and fired at 700°-1000°C in order to form a hard bonded refractory material, not contaminated by inorg. bases. V_2O_5 and Pt catalysts prepd. in this manner were found to have excellent activity in the combustion of SO_2 to SO_3.

11006. RIENÄCKER, GÜNTHER. **The effect of additives on oxide catalysts. I. Oxidation of carbon monoxide over mixed catalysts of oxides of copper, cerium, and iron.** *Z. anorg. Chem.* 258, 280-95 (1949).—*C.A.* 44, 1314*d*.

The mixts. were prepd. by decompn. of nitrates and calcining 4-5 hrs at 700°C. Air contg. 5% CO was passed over 1 g of mixt. The amt. of CO_2 in the efflux gas was detd. by the elec. cond. of a suspension of $BaCO_3$ at 60°C. The conversion of CO, usually less than 65%, was used as a measure of rate. Data were obtained with $CuO\text{-}Al_2O_3$, $CuO\text{-}Cr_2O_3$, $Cu_2O.Cr_2O_3$, $CeO_2\text{-}Al_2O_3$, and $Fe_2O_3\text{-}Al_2O_3$.

11007. RIENER, THOMAS W. **An improved laboratory preparation of copper-chromium oxide catalyst.** *J. Am. Chem. Soc.* 71, 1130 (1949).—*C.A.* 43, 6062*i*.

A soln. (260 g of $Cu(NO_3)_2.3H_2O$ in 900 ml water) at 80°C was added with stirring to a soln. of 178 g of $Na_2Cr_2O_7.2H_2O$ and 225 ml of 28% NH_4OH made up to 900 ml at 25°C. The ppt. was filtered, washed by slurring in water 3 times, and dried at 75°-80°C overnight. The catalyst was powd., slowly added to a heated glass vessel over a period of 15 min., and heated at 350°C with stirring for 15 min. It was sifted through a 200-mesh screen.

11008. ROGINSKIĬ, S.Z. **Relation between the electronic properties of solids and their catalytic activity.** *Doklady Akad. Nauk S.S.S.R.* 67, 97-9 (1949).—*C.A.* 43, 8251*d*.

Reactions involving electronic transitions, such as deep oxidation by O_2, decompn. of O-compds., hydrogenation and dehydrogenation, and aromatization, were catalyzed by solids with mobile electrons and often characterized by strong absorption of visible light. A 2nd group of reactions, such as isomerizations, cracking, hydration and dehydration, were catalyzed by solid dielectrics, e.g., SiO_2, Al_2O_3, clays, and by homogeneous catalysts such as $AlCl_3$, BF_3, $ZnCl_2$, which had no variable valency but were capable of forming complexes. Catalysts of the 1st class, but not those of the 2nd class, were very sensitive to impurities and to lattice imperfections.

11009. RUBINSHTEIN, A.M. AND KULIKOV, S.G. **Polymorphism and catalytic properties of titanium dioxide.** *Doklady Akad. Nauk S.S.S.R.* 67, 1053-6(1949).—*C.A.* 43, 8828*a*.

Catalytic activities (in ml gas/ml EtOH) under identical conditions and selectivities (ratio of the amt. of H_2, both evolved and spent on hydrogenation of C_2H_4 to C_2H_6, and the sum of $H_2 + C_2H_4 + C_2H_6$) were detd. in the decompn. of EtOH at 360°, 380°, and 400°C for 12 TiO_2 catalysts. One of the catalysts was pure anatase, one obtained by heating anatase 20 hrs at 900°C, pure rutile, the rest mixts. of the 2 forms. All catalysts, mixts. of anatase and rutile, had a higher activity than either pure form, which indicated that active centers were preferably located at boundaries between the 2 phases.

11010. SANDERS, M.T. AND HALES, R.A. **Performance of electrolytic cells in the reduction of glucose.** *J. Electrochem. Soc.* 96, 241-53 (1949).—*C.A.* 44, 51*d*.

Effects of varying c.d., initial sugar concn., ratio of cathode area to vol. of catholyte, alky. of catholyte, and temp. were given. The first 3 variables were combined as wt of initial sugar/amp. The instantaneous rate of reduction was discussed and the limiting rate was proportional to the concn. of sugar in the catholyte. Mg behaved as a cathode poison.

11011. SCHALL, J.W.; DART, J.C., AND KIRKBRIDE, C.G. **Moving bed catalytic cracking correlations. Product distribution and process variables.** *Chem. Eng. Progress* 45, 746-54 (1949). —*C.A.* 44, 1682*c*.

A pilot-plant investigation gave the effect of space rate, catalyst-to-oil ratio, and temp. on product distribution, and product quality in moving bed catalytic cracking. Data were obtained from once-through cracking of an East Texas heavy gas oil over plant-aged-silica-Al_2O_3 bead catalyst.

11012. SCHENCK, RUDOLPH. **Catalytic activity and equilibrium.** *Z. anorg. Chem.* 260, 154-60(1949). —*C.A.* 44, 10473*e*.

Catalyst activity was detd. by equil. properties of the catalyst. Activation energies calcd. from published rate data for oxidation of CO over CuO and promoted $CuO\text{-}Cr_2O_3$ catalysts were found proportional to log O_2 pressure of these catalysts.

11013. SCHWAB, GEORG-MARIA. **Catalysts in theory and practice.** *Trans. Chalmers Univ. Technol., Gothenburg* No. 81, 35pp.(1949).—*C.A.* 44, 3777*e*.

Some metallographical problems were studied by means of catalytic measurements. The hardness of martensite was basically an electronic effect. In the system Au-Fe the electron concn. was first increased upon solution of small amts. of Fe, and subsequently decreased; the compd. $AuFe_3$ did not exist. In the system Au-Sb, the compd. $AuSb_2$ contained Sb anions with homopolar bonds; in the system Cu-Mg, the compd. Cu_2Mg had metallic bonds, the compd. $CuMg_2$ had a little-filled Brillouin zone.

11014. SCHWAB, GEORG-MARIA AND AGALLIDIS-SCHWAB, ELLY. **Selective catalysis.** *J. Am. Chem. Soc.* 71, 1806-16 (1949).—*C.A.* 43, 6497*h*.

Activation energies and frequency factors were given for the simultaneous dehydration and dehydrogenation of EtOH and HCOOH vapors on several prepns. of ZnO, TiO_2, Cr_2O_3, Al_2O_3, CaF_2, $Ca_3(PO_4)_2$, CeO_2, ThO_2, carbon, NaCl, $BaSO_4$, Na_2CO_3, Na_2SO_4, KI, FeS, and SiO_2. For EtOH, the energy of activation was greater for dehydration than for dehydrogenation; for HCOOH, the reverse was true. Variations in selectivity of catalysts were due mainly to differences in frequency factors.

11015. SEKERA, ALEŠ. **The Raney catalysts.** *Chemie* (Prague) 5, 5-7(1949).—*C.A.* 46, 2717*c*.

In hydrogenation the use of the catalysts Co, Fe, Cu instead of Ni did not permit uniform conclusions. These catalysts required a longer reaction time, higher temps., and higher pressures, but they produced fewer side reactions than Ni and consequently purer products.

11016. Selwood, P.W. **Magnetism and catalysis.** *Bull. soc. chim. France* 1949, D489-506; *Colloques intern. centre natl. recherche sci., Polarisation matière* No. 17, 122-39(1949).—*C.A.* 44, 6690*d*.

Catalytically active inorg. solids, such as supported oxides, were characterized by a great increase in susceptibility at low concn., especially at low temp. Information was obtained on (1) the oxidation state of the paramagnetic ion, (2) evidence for intercation covalence, and (3) effectiveness of dispersion of the paramagnetic ions.

11017. Selwood, P.W.; Moore, T.E.; Ellis, Marylinn, and Wethington, Kathryn. **Supported oxides of manganese.** *J. Am. Chem. Soc.* 71, 693-7 (1949).—*C.A.* 43, 5654*b*.

The susceptibility isotherm method was extended to supported oxides of Mn. It was found that in favorable cases supported transition group oxides may imitate the crystal structure of the support even to the extent of changing oxidation state.

11018. Shapiro, M. Ya. **New catalytic test for detecting copper and silver.** *Zhur. Anal. Khim.* 4, 199-200(1949).—*C.A.* 44, 2887*i*.

The reaction was based on the accelerated rate of oxidation of resorcinol induced by Cu and Ag: To 1 ml of soln. add 1 ml of 1% NaOH or KOH + 1 ml of 1% resorcinol soln. and shake. Run a blank with distd. H_2O. After 5-6 min. if the soln. contains Cu or Ag it will be colored more than the control soln. By this test 0.04 γ of Cu or Ag in a 1:25,000,000 diln. could be detected.

11019. Shcheglova, N.A. and Kagan, M. Ya. **Kinetics and mechanism of reaction of the catalytic hydro-dehydrogenation. II. Kinetics of disproportionation of hydrogen in cyclohexene on a platinum catalyst.** *Zhur. Fiz. Khim.* 23, 1083-94(1949).—*C.A.* 44, 916*b*.

Conversion of cyclohexene into benzene and cyclohexane (1:2 mol.) was studied. Mixts. of cyclohexene with x mol. N_2 were passed over 1 g of pumice stone contg. 4% Pt. A new portion of the catalyst was used for every expt. A catalyst regenerated by N_2 + 2% O_2 at 100°-250°C and then H_2 was more active than the original sample. Cyclohexene was adsorbed preferentially to benzene, and benzene to cyclohexane. The surface of the catalyst was permanently covered with cyclohexene mols. causing the reaction to be of zero order.

11020. Shekhter, A.B.; Echeistova, A.I., and Tret'yakov, I.I. **Role of the surface mobility of metal atoms in the preparation of contact catalysts supported by carriers.** *Doklady Akad. Nauk S.S.S.R.* 68, 1069-72(1949).—*C.A.* 44, 915*d*.

Electron-microscope photographs of asbestos fibers impregnated with a chloroplatinate soln. showed a sheath of nonuniform thickness, with occasional coarser aggregates. The picture changed very markedly after heating at 600°C. Similar shifts of distribution of the metal were observed after heating of Ag, Au, or Pd, deposited on asbestos, ZnO, or lamp black by vacuum evapn. The intensity of the creep over the surface increased with the temp. The distribution of the metal was very heterogeneous, grains up to 1000 A. diam., fairly distant from each other, being observed along with close fine grains unresolvable under the electron microscope (less than 50 A.).

11021. Shekhter, A.B. and Moshkovskii, Yu. Sh. **Catalytic properties and structure of active zinc oxide.** *Izvest. Akad. Nauk S.S.S.R., Otdel, Khim. Nauk,* 1949, 354-63.—*C.A.* 44, 25*i*.

ZnO was obtained by thermal decompn. of $ZnCO_3$ at 350°C and by combustion of Zn in an elec. arc (120 v., 5 amp.) in an air stream. The B.E.T. surface area of the first was not less than $80 m^2/g$ and the second approx. $12 m^2/g$. The catalytic activities in the decompn. of MeOH adsorbed on the outgassed catalysts at 180°C were 8.6×10^{-3} and 3.5×10^{-3}, resp. The kinetic curves were fairly well represented by $v = At^{0.8}$ (t = time and v = vol. gas evolved).

11022. Shimeha, Jiro and Suzuki, Kenji. **Organic silica resins.** *Bull. Research Inst. Teikoku Jinzo Kenshi Kaisha Ltd.* 1, No. 1, 54-9(1949).—*C.A.* 45, 383*h*.

$MeSiCl_3$ was synthesized from Si and MeCl with a Si-Cu alloy as the catalyst, and after mixing in various proportions with $MePhSiCl_2$ derived from it by Grignard's reaction, hydrolyzed by heating to polymerize to resins. Et was introduced into $SiCl_4$ by Grignard's reaction and the products were polymerized similarly to resins.

11023. Shushunov, V.A. and Aurov, A.P. **Kinetics of the reaction of magnesium with alkyl halide vapors.** *Doklady Akad. Nauk S.S.S.R.* 68, 713-16 (1949).—*C.A.* 44, 911*c*.

In the reaction between solid Mg and gaseous EtX(X = Cl, Br, or I), formation of Mg org. compds. accounted for 95-100% of the observed pressure drop Δp; with MeX, it accounted for only 40-50%; the remaining 60-50% of MeX was evidently consumed by the Wurtz reaction.

11024. Shushunov, V.A. and Fedyakova, K.G. **Kinetic method of physicochemical analysis. VI. Kinetics of the catalytic decomposition of hydrogen peroxide by alloys.** *Zhur. Fiz. Khim,* 23, 936-41(1949).—*C.A.* 44, 26*g*.

A metal cylinder (2 × 2 cm) was immersed in a H_2O_2 soln. (x%), and the vol., V, of O_2, liberated was detd. V increased with time and with x (5-25%) as for a first-order reaction. The activation energy, E, was independent of x. Between 30 and 60°C E was 15,600 cal/mol. for Bi, about 9000 for Sn, about 9200 for Cd, and 8200 for Sb. In Bi-Sn alloys E varied with concn. without any singular point.

11025. Smith, Hilton A.; Bedoit, Wm. C., Jr., and Fuzek, John F. **The preparation and aging of Raney nickel catalysts.** *J. Am. Chem. Soc.* 71, 3769-71 (1949).—*C.A.* 44, 2353*i*.

The method of prepn. of the catalyst from the alloy was studied. Different temps. of soln. of the alloy, different temps. and times of digestion, and different methods of washing had little effect on catalytic activity as measured by the rate of hydrogenation of d-limonene. Although the original specific surface of a catalyst had little effect on its initial activity, the change in surface with time was closely paralleled by the change in catalytic activity.

11026. SMITH, HILTON A. AND FUZEK, JOHN F. **Catalytic hydrogenation of furan and substituted furans on platinum.** *J. Am. Chem. Soc.* 71, 415-19 (1949).—*C.A.* 43, 5657*d*.

The kinetics of catalytic hydrogenation were studied for furan, 2-methylfuran, 2, 5-dimethylfuran, furfuryl alc., furoic acid, dibenzofuran, furfural benzyl alcohol, and benzoic acid. The reactions were carried out at pressures up to 5 atm. abs. in acetic acid soln. with Adams Pt catalyst. The rate consts., activation energies, and frequency factors were considerably higher for the furan compds. than for the corresponding benzene derivs.

11027. SMITH, HILTON A.; FUZEK, JOHN F., AND MERIWETHER, HENRY T. **The catalytic hydrogenation of terpenes.** *J. Am. Chem. Soc.* 71, 3765-9 (1949).—*C.A.* 44, 2480*a*.

Dipentene, *d*-limonene, terpinolene, *α*- and *β*-pinenes, and camphene were hydrogenated over Adams Pt or Raney Ni catalyst, and the results subjected to kinetic analysis.

11028. SMITH, HILTON A. AND MERIWETHER, HENRY T. **Catalytic hydrogenation of the benzene nucleus. V. Hydrogenation of benzene, the cyclohexadienes, and cyclohexene.** *J. Am. Chem. Soc.* 71, 413-15(1949).—*C.A.* 43, 5752*e*.

The catalytic hydrogenations of C_6H_6, the cyclohexadienes, and cyclohexene on Pt were studied from a kinetic viewpoint. Rate consts. and activation energies were detd. for each of these reactions. The low value for the activation energy of the hydrogenation of C_6H_6, when compared with the resonance energy of the mol., indicated the probability that such resonance was destroyed when the C_6H_6 was adsorbed on the catalyst.

11029. SMITH, HILTON A.; ALDERMAN, D.M., JR.; SHACKLETT, COMER D. AND WELCH, CLARK M. **The catalytic hydrogenation of the benzene nucleus. VI. The hydrogenation of compounds with two benzene rings.** *J. Am. Chem. Soc.* 71, 3772-6 (1949).—*C.A.* 44, 2354*h*.

The kinetics of the catalytic hydrogenation were investigated: Ph_2, Ph_2CH_2, Ph_2CHMe, $(PhCH_2)_2$, $(PhCH_2\text{-}CH_2CH_2)_2$, Ph_3CH, phenylcyclohexane, phenylcyclohexylmethane, 1-phenyl-1-cyclohexylethane, cyclohexyldiphenylmethane, $Ph_2CHCOOH$, di(phenylpropyl) acetic acid, benzilic acid, mandelic acid, phenylcyclohexylacetic acid, and phenylcyclohexylglycolic acid. All hydrogenations were made in HOAc soln. with Adams Pt catalyst; first-order rate consts. referred to 1 g of standard catalyst were obtained. In general, the rate of hydrogenation decreased with the number of Ph groups present.

11030. STEFFENS, JACK H.; ZIMMERMAN, MARLIN U., AND LAITURI, M. JOHN. **Correlation of operating variables in catalytic polymerization.** *Chem. Eng. Progress* 45, 269-78(1949).—*C.A.* 43, 4839*c*.

The polymerization of propylene and butylene streams in tubular-type catalytic polymerization units with Cu pyrophosphate catalyst showed that conversion of the olefins increased with: (1) increase in catalyst activity; (2) increase in reactor temp.; (3) decrease in olefin space velocity; (4) decrease in total space velocity; and (5) decrease in olefin compn. ratio (wt of propylene plus normal butylenes to isobutylene). A chart was given to predict the wt % conversion of the olefins in the total feed for a wide range of operating conditions.

11031. STRICKLAND-CONSTABLE, R.F. **The synthesis of methane from carbon monoxide and hydrogen on a nickel catalyst. Study of the mechanism of the reaction.** *Gas Research Board, Copyright Pub.* No. GRB46, 30 pp. (1949); *Gas World* 130, 626-31.—*C.A.* 43, 7666*h*.

The reaction of 3 H_2 + CO with a dehydrated catalyst (3 parts hydrated $Al(NO_3)_3$ and 1 part hydrated $Ni(NO_3)_3$, with a small quantity of china clay), began with measurable speeds at about 250°C. The reaction was slightly retarded by increasing the partial pressure of CO, but the products did not retard it. The first step in the reaction was instant adsorption of H_2 and CO in considerable amts. Balances on the products in the gas phase and on the surface of the catalyst were detd. throughout the course of the reaction.

11032. SUEHIRO, YOSHIYUKI; KUWABARA, MICHIO, AND AYUKAWA, YAICHI. **Preparation of alumina-silicate catalyst for the isomerization of butene.** *J. Chem. Soc. Japan.* Ind. Chem. Sect. 52, 43-4 (1949).—*C.A.* 45, 1704*c*.

Alumina-silicate catalysts of various compns. were prepd. and their catalytic action on the isomerization of butene into isobutene was studied. The deposited carbon was eliminated by igniting the catalyst at 550°C and passing in air. The aluminosilicate having the mol. ratio of 1:1 was the best with respect to isomerization activity as well as for reactivation.

11033. TATIEVSKAYA, E.P.; ZHURAVLEVA, M.G., AND CHUFAROV, G.I. **Kinetics of the reduction of copper oxides by carbon monoxide and by hydrogen.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* 1949, 1235-41.—*C.A.* 45, 4537*c*.

Finely powd. CuO and Cu_2O, (0.20 and 0.17 m^2/g, resp.) were reduced in a stream of H_2 or of CO circulating in a closed system. The reduction was autocatalytic. In the reduction of CuO with H_2 at 300°C, the rate, at all stages, increased with the initial pressure up to 400 mm. The apparent activation energies for the reduction of CuO by CO and by H_2 are 10.7 and 13.4 kcal/mole, resp. In contrast to CuO, reduction of Cu_2O was, at any temp. and initial pressure, faster with H_2 than with CO. The apparent activation energies for the reduction of Cu_2O by CO and H_2 were 10.0 and 13.7 kcal/mole, resp.

11034. THOMAS, ALBERT. **The synthesis of hydrogen cyanide gas from mixtures of ammonia, air, and methane.** *Ann. Chim.* [12], 4, 258-85(1949).—*C.A.* 43, 9391*h*.

A pure Pt mesh catalyst gave a max. yield of HCN at a 1.5 ratio of O_2/NH_3 and a 1.08 ratio of CH_4/NH_3. Max. yield of 65.1% was attained at a contact time of 1.22×10^{-3} sec. Essentially the same results were obtained with Pt-Rh catalysts of 2%, 5%, and 10% Rh content, and with an annealed Pt-Ir catalyst contg. 2% Ir. The reaction was not catalyzed by sponge Pt, or Pt black on asbestos, or pumice. Pt was lost from the catalyst during reaction, but the loss was retarded by up to 10% of Rh, thereby increasing the catalyst life 5-fold. Catalyst life was longer in the presence of C_2H_2 up to 3% of total gases.

11035. Thomas, Charles L. **Chemistry of cracking catalysts.** *Ind. Eng. Chem.* 41, 2564-73(1949).—*C.A.* 44, 2218*i*.

Catalytic activity was attributed to H^+ which served to balance the valence and coördination no. within an at. network contg. 2 different metals and O. The catalytic activity (*A*) and ability to neutralize KOH (*B*) was detd. for a series of SiO_2-Al_2O_3 gels prepd. by hydrolyzing graded solns. of Al isopropoxide in ethyl orthosilicate. *A* reached a max. at an Al/Si at. ratio of 1 to 2 and *B* reached a max. at Al/Si = 1. SiO_2-MgO, SiO_2-ZrO_2, Al_2O_3-boria, and titania-boria catalysts were briefly discussed and a carbonium ion mechanism for catalytic cracking presented.

11036. Tikkanen, Matti. **Theory of the reduction of magnetite with hydrogen.** *Valtion Tek. Tutkimuslaitos, Julkaisu* No. 12, 92 pp.(1949).—*C.A.* 46, 3379*a*.

The rate of reduction with H_2(320 liters/hr) was studied as a function of temp. on small disks pressed at 5 tons/cm². When log *V*(reaction velocity) was plotted as a function of 1/T°K, the heat of activation of 16.6 kcal/mol. was obtained from the slope of the straight line of the plot. The reduction rate followed this law up to 550 °C, but decreased above this temp., showing 2 distinct minima, one at 700°-750°C, and the other at 900°C. The diffusion of thoron was studied in the sample. The rate of diffusion of thoron decreased above 550 °C in the same manner as the reduction rate.

11037. Trambouze, Yves and Perrin, Marcel. **Preheating of nickel catalysts in the course of thermal reduction. Influence on efficiency in the Fischer synthesis.** *Compt. rend.* 228, 837-9 (1949).—*C.A.* 43, 8831*c*.

Preheating in N_2 for 48 hrs at 220 °C increased the activities of 2 Ni-Si-Al catalysts. A poor catalyst was improved to the extent that it was better than any unpreheated catalyst.

11038. Trambouze, Yves and Perrin, Marcel. **Influence of the state of combination of the constituents of nickel catalysts upon their activities in the Fischer synthesis.** *Compt. rend.* 228, 1015-17 (1949).—*C.A.* 43, 2853*b*.

The properties of Ni-Si-Al catalysts were measured by the initial hydrogenation activity and the Fischer activity. Both were defined, and the factors affecting them discussed.

11039. Tsutsumi, Shigeru. **Catalytic hydrogenation in the presence of water. II. Unsaturated fatty oil and rice-bran oil having high acid numbers.** *J. Chem. Soc. Japan*, Ind. Chem. Sect., 52, 191-3(1949).—*C.A.* 45, 4063*b*.

Satisfactory hydrogenation of chrysalis oil (I_2 no. 124.5, acid no. 1.6) could not be obtained with a catalyst contg. Ni oxide + H_2O, or Ni oxide + Japanese acid clay. The reaction went smoothly with a catalyst contg. H_2O, Japanese acid clay, and Ni oxide. The best catalyst contained 2% Ni oxide + 2.5% H_2O + 3% Japanese acid clay. The hydrogenation of rice-bran oil was complete within 1.5 hrs with a catalyst contg. Ni oxide and the clay. The resulting oil had an I_2 no. 2.0 and acid no. 175.3.

11040. Tuszynski, Kazimierz. **Nitrous oxide as a product of oxidation of ammonia on platinum catalyst.** *Roczniki Chem.* 23, 397-405(1949).—*C.A.* 44, 10472*i*.

Investigations were made in the range 218°-555°C and under various times of contact with the catalyst. The formation of N_2O was favored by low temp. and low rate of flow of gases. The yield of NO rose with increasing rate of flow and increasing temp. The free N_2 at const. temp. fell as the rate of flow increased, and also with increasing temp.

11041. Watson, Roger, W. and Tom, Theodore B. **Relation of structure and effectiveness in copper deactivators.** *Ind. Eng. Chem.* 41, 918-23 (1949).—*C.A.* 43, 6063*c*.

Cu deactivators served to protect against the catalytic action of Cu (sol. or metallic) in the oxidation of hydrocarbons. Their effectiveness depended to a large extent on chelation, ring size, inner complex salt formation, electron-donating tendency of hetero atoms, and tendency to coplanar configuration. Some effective Cu deactivators were N,N' -disalicylidene-1,2-propanediamine, and dimethyldithioöxamide.

11042. Weller, Sol. **Effect of operating variables upon the Fischer-Tropsch synthesis.** *U.S. Bur. Mines, Repts. Invest.* No. 4405, 8 pp(1949).—*C.A.* 43, 3167*c*.

The operating variables and the role of metal carbides as intermediates in the synthesis were discussed.

11043. Wendlandt, R. **New experiences with the catalytic ammonia combustion. The catalytic processes of ammonia oxidation and hydrocyanic acid production from ammonia and methane.** *Z. Eletrochem.* 53, 307-19(1949).—*C.A.* 44, 2711*b*.

The technical experiences in Germany since 1930 support the hydroxylamine theory of the NH_3 oxidation modified to exclude an intermediate formation of peroxynitric acid. The following reactions in technical operations yielded 97% NO, 3% N_2, and traces of N_2O: (1) $NH_3 + O \rightarrow NH_3O$; $NH_3O + O_2 \rightarrow HNO_2 + H_2O$; $4HNO_2 \rightarrow 4NO + 2H_2O + O_2$; (2) $NH_3O + NH_3 + O_2 \rightarrow N_2 + 3H_2O$; $HNO_2 + NH_3 \rightarrow N_2 + 2H_2O$; (3) $NH_3O + HNO_2 \rightarrow N_2O + 2H_2O$. HCN was formed from NH_3, CH_4, and air in the following way: $NH_3O + CH_4 \rightarrow H_2NCH_3 + H_2O$; $H_2NCH_3 \rightarrow HNCH_2 + H_2$; $HNCH_2 \rightarrow HCN + H_2$.

11044. Wicke, E. and Brötz, W. **Diffusion, fluid flow, and reaction velocity in the interior of porous catalyst bodies.** *Chem. Ing. Tech.* 21, 219-26(1949).—*C.A.* 43, 7313*i*.

The gas entrance was limited to the upper end section of porous cylindrical bodies. The efficiency was detd. as a function of the total pressure, the temp., and inert gas content. The efficiency of the para-ortho H_2 conversion with Ni was inversely proportional to the square root of the total pressure below efficiencies of 37.5%. Inert gases reduced the efficiency and a factor that took this effect into account was developed. The temp. dependence of the velocity of conversion corresponded to the true activation energy of the reaction only at low temps.

11045. WINNICKI, WITOLD. **Nitrous oxide as a product of oxidation of ammonia on oxide catalysts.** *Roczniki Chem.* 23, 388-96(1949).—*C.A.* 45, 55*h*.

NH_3 was oxidized on CuO 32.58 plus MnO_2 65.62%, and Fe_2O_3 79.45, Bi_2O_3, 11.53, and MnO_2 7.21%. The first gave higher yields of NO than did the second, which gave N_2O as the main product. With increase of temp. the yield of N_2O rose, passed a max., and decreased on both catalysts. Increase in rate of flow increased constantly the yield of N_2O on the second catalyst; on the first with increasing rate of flow. The yield of N_2O reached a max. at higher temps.

11046. WRIGHT, MAURICE M. AND TAYLOR, HUGH S. **The interaction of methane and methane-d_4 on nickel and the state of the catalyst surface.** *Can. J. Research* 27B, 303-17(1949).—*C.A.* 43, 7802*f*.

Mass-spectrometer studies of the exchange reaction and the reaction of H_2 with catalyst surface residues supported the concept of dissociative adsorption. Evidence of fragments such as CX_3, CX_2, CX, C (X = H or D) was obtained. Temp. increased the concn. of the more hydrogenated fragments and equil. between the fragments depended on the heats of adsorption of the fragments and H on the catalyst surface, and also on the strength of CH bonds formed.

11047. YAMANAKA, TATSUO. **Active center of hydrogenating catalysts. II.** *Repts. Sci. Research Inst.* (Japan) 25, 329-36 (1949).—*C.A.* 45, 1857*d*.

Pd-Kieselguhr (1:500) kneaded with Hg and dried in air and then in a stream of H_2 at 100°C showed its extremely active centers inhibited. C_2H_2 mixed with H_2 (1:2) passed over it at 170°C and the rate 5 liter/hr was hydrogenated to 86.3% C_2H_4 and 11.8% C_2H_6 (11.7 and 85.9%, resp., without the inhibition) with little accompaniment of polymerization yielding unwanted products. $HgCl_2$ gave a similar effect, but inhibited the activity totally when added beyond a certain amt. Particularly $Pb(AcO)_2$ made a mild and uniformly active catalyst.

11048. ADKINS, HOMER; BURGOYNE, EDWARD E., AND SCHNEIDER, HENRY J. **The copper-chromium catalyst for hydrogenation.** *J. Am. Chem. Soc.* 72, 2626-9(1950).—*C.A.* 44, 8564*g*.

The $CuCr_2O_4$ catalyst produced by the thermal decompn. of basic Cu ammonium chromate (contg. also Ba from $Ba(NO_3)_2$) contained CuO and $CuCr_2O_4$, but neither alone was the effective catalyst. By increasing the ratio of Cr to Cu in the catalyst, its activity was enhanced in the reduction of Me laurate and Me palmitate at 6000 p.s.i. and 175°C.

11049. AKHMEDLI, M. K. AND NEGRETOV, B. P. **Products of the thermal decomposition of chromium formate.** *Zhur. Obshchei Khim* (J. Gen. Chem.) 20, 1974-80(1950).—*C.A.* 45, 3745*b*.

Evolution of gas on heating dried $(HCO_2)_3Cr$ in a stream of N_2 began at about 300°, and was practically completed at 300-320°, 320-330°, and 330-340°C, within ~ 38, 30-31, and 22-23 min., resp. Analysis of the gaseous and the solid products corresponded closely to $2(HCO_2)_3Cr \rightarrow 2CrO_2 + 2\ CO_2 + 4CO + 3H_2$; however, the ratio CO/CO_2 was only ~ 1, instead of the expected 2. When heated to 600°C in a stream of N_2, the solid product ignited; $2CrO_2 \rightarrow Cr_2O_3 + O$.

11050. AMEMIYA, T.; SAITO, H., AND SAKAMOTO, S. **Pine-root oil and α-pinene. I. Catalytic reforming of the gasoline fraction of pine-root oil.** *Repts. Fuel Research Inst., Japan* No. 64, 1-33(1950)—*C.A.* 45, 6397*b*.

In order to obtain a high-grade gasoline from the Japanese pine-root oil, the fraction boiling below 200°C was catalytically treated in the vapor phase in the presence of acid clay, activated acid clay, Kanuma earth, etc., and also hydrogenated in the presence of Ni. When treated with H_2 in the vapor phase in the presence of active yellow earth (a Japanese göthite, $Fe_2O_3.H_2O$), the same reforming effect was obtained. The catalytic hydrogenation under atm. pressure was not a preferable method.

11051. ANDERS, HEINZ. **The individualities of the catalysts for the Fischer-Tropsch synthesis in regard to the composition and properties of the reaction product.** *Chem. Tech.* 2, 27-9(1950).—*C.A.* 44, 5566*f*.

11052. ANDERSON, ROBERT B.; SHULTZ, J. F.; SELIGMAN, BERNARD; HALL, W. KEITH, AND STORCH, H. H. **The Fischer-Tropsch synthesis. VII. Nitrides of iron as catalysts.** *J. Am. Chem. Soc.* 72, 3502-8(1950).—*C.A.* 44, 10299e.

The conversion of Fe in reduced synthetic-NH_3-type catalysts to nitrides by NH_3 treatment greatly increased their activity in the Fischer-Tropsch synthesis. Catalysts converted to ε-phase nitrides yielded a product of lower av. mol. wt contg. greater yields of gaseous hydrocarbons and oxygenated mols. than those products obtained from corresponding reduced catalysts.

11053. APEL'BAUM, L. AND TEMKIN, M. I. **Oxidation of ammonia on platinum under low pressures.** *Doklady Akad. Nauk S.S.S.R.* 74, 963-6 (1950).—*C.A.* 45, 1856*h*.

The reaction was carried out on a Pt wire 0.1 mm in diam., 10 cm long, heated to 820°C, in a static system under const. supply of NH_3 from solid NH_3 kept at -140°C. The over-all reactions were: $4\ NH_3 + 5\ O_2 = 4\ NO + 6\ H_2O$ and $4\ NH_3 + 3\ O_2 = 2\ N_2 + 6\ H_2O$. No NH_2OH was formed at 820°C. The oxidation of NH_3 occurred through collisions of NH_3 mols. with a Pt surface practically entirely covered with O_2 mols., with approx. one in 20 collisions effective.

11054. ATWOOD, KENTON; ARNOLD, M. R., AND APPEL, E. G. **Water-gas shift reaction. Effect of pressure on rate over an iron oxide-chromium oxide catalyst.** *Ind. Eng. Chem.* 42, 1600-2 (1950).—*C.A.* 44, 9137*a*.

The influence of pressure on the rate of the water-gas shift reaction over a com. Fe oxide-Cr oxide catalyst was studied in the pressure range

1-30 atm. at 346° and 404°C. The activity of the catalyst approx. doubled as the pressure was raised to 10 atm., and increased only slightly as the pressure was increased further. Plots of catalyst activity vs. pressure gave curves similar in shape to Langmuir isotherms.

11055. BAUKLOH, W.; CHATTERJEE, B., AND DAS, P. P. **Decomposition of carbon monoxide in the presence of iron, cobalt, and nickel as catalysts.** *Trans. Indian Inst. Metals* 4, 271-8 (1950).—*C. A.* 46, 7415*c*.

The max. decompn. of CO by Fe, Co, and Ni as catalysts took place at 550°, 700°, and 350°C, resp. The speed of the decompn. reaction increased up to an hr and then decreased. The decrease in reaction speed was due to the formation of metal carbides which had a lower activity than the pure metal. Decompn. of the metal carbide by H_2 restored the activity of the metal.

11056. BEECK, OTTO. **Hydrogenation catalysts.** *Discussions Faraday Soc.* **1950**, No. 8, 118-28. —*C. A.* 45, 9986*h*.

The rate of hydrogenation of C_2H_4 over evapd. porous metal films of the transition elements depended strongly on the heat of adsorption of C_2H_4, which, except for much higher abs. values, paralleled that of H_2. Smooth curves were obtained when the *d*-character of the metallic single bond was plotted against both the heats of adsorption and the rates of hydrogenation. Depending on the heat of adsorption for C_2H_4, the initial irreversible poisoning by acetylenic adsorption complexes formed by self-hydrogenation of C_2H_4 rendered the surface more or less inactive for hydrogenation. A 3rd type of fast reaction with low *E* appeared not to necessitate empty crystallographic sites for the sep. adsorption of C_2H_4, but resulted from the activated state on a surface already covered with H_2.

11057. BEECK, OTTO AND RITCHIE, A. W. **The effect of crystal parameter on hydrogenation and dehydrogenation.** *Discussions Faraday Soc.* **1950**, No. 8, 159-66.

The surfaces of oriented and unoriented evaporated porous Ni films were detd. by the B.E.T. method, using Ne, Kr, CH_4 and C_4H_{10}. By measuring the number of crystallographic sites through the adsorption of H_2 at 78°K, direct proof was obtained that (110) oriented Ni films also exposed (110) planes to the gas phase. The hydrogenation of C_6H_6 over oriented and unoriented Ni and Fe films showed no difference in rate. The dehydrogenation of cyclohexane over unoriented Pt was found to be 10 times faster than over partially (110) oriented Pt films.

11058. BELCHER, R. AND GOULDEN, R. **Analysis for industry. Determination of carbon monoxide.** *Ind. Chemist* 26, 320-2(1950).—*C. A.* 46, 7937*h*.

CO was detd. by (1) the rise in temp. of a Hopcalite catalyst (MnO_2 50-60, CuO 30-40%, with or without Co_2O_3 and Ag_2O) during oxidation of the CO to CO_2, (2) oxidation by (*a*) Hopcalite at 100°C and absorption in aq. $Ba(OH)_2$, (*b*) $AgMnO_4$, and (*c*) Pt black, and (3) absorption by hemoglobin,

11059. BINDER, GEORGE G. AND WHITE, ROBERT R. **Synthesis of methane from carbon dioxide and hydrogen.** *Chem. Eng. Progress* 46, 563-74 (1950).—*C. A.* 45, 331*b*.

Rate of formation of CH_4 from CO_2 and H_2 was measured by passing feed gas ranging in compn. from 80% H_2 and 20% CO_2 to 30% H_2 and 70% CO_2 over a reduced Ni catalyst in a continuous app. Several runs were made in which the feed gas contained CH_4. The space time was varied from 0 to 8×10^{-5} hr and temp. from 500-750°F; the pressure was one atm. in all runs. Av. rates of CH_4 formation obtained by differentiation of the data vary from 0 to 5.60 lb-moles/(day) (lb-catalyst). The major resistance to the over-all process was offered by the reaction of one adsorbed CO_2 with at least two adsorbed H_2.

11060. BORESKOV, G. K. AND DZIS'KO, V. A. **Porosity and activity of catalysts. I. Hydrolysis of chlorobenzene on silica gels of various structures.** *Zhur. Fiz. Khim.* 24, 1135-46(1950).—*C. A.* 45, 2759*g*.

Catalytic activity and catalyst porosity was studied on various silica gels (wt of unit vol. of catalyst, pore vol., surface area, av. pore radii): (I) 0.83g/ml, 0.31 ml/g, 350 m^2/g, 10 A; (II) 0.64 g/ml, 0.51 ml/g, 640 m^2/g, 15-20 A; (III) 0.49 g/ml, 0.8 ml/g, 400 m^2/g, 35-40 A. The pressure was maintained const. between 100 and 150 mm in a flow system. Before each run, lasting 4-6 hrs, fresh catalyst was used. PhOH and HCl was sampled and titrated at 20-min. intervals. The activity decrease was due to stopping of the pores by carbonaceous material. The higher activation energy E corresponded to the kinetic range, the lower E to the diffusion range. The activity per unit surface was the same for all catalysts in the kinetic range, but varied from catalyst to catalyst in the diffusion range owing to different pore structures.

11061. BOSE, R. AND ROY, D. K. **Palladinized nickel as a hydrogenation catalyst.** *Science and Culture* 16, 164(1950).—*C. A.* 45, 4377*e*.

The catalyst was prepd. by the addn. of a 1% aq. soln. of Pd chloride to a suspension of freshly prepd. Raney Ni and pptd. chalk. H_2 was bubbled through the mixt. for 10-15 min. before use. A soln. contg. 60% dextrose could be hydrogenated to *d*-sorbitol in 98-100% yield within 2-2.5 hrs at 140°C and 250 lb H_2 pressure.

11062. BOUDART, MICHEL. **The mechanism of the decomposition of nitrous oxide on zinc oxide as catalyst.** *J. Chem. Phys.* 18, 571-2(1950). —*C. A.* 44, 6250*a*.

The activation energy of the adsorption process was required by the solid adsorbent. The important factor was not the sp cond. but rather the energy necessary to send a bound electron into the conduction layer.

11063. BOUDART, MICHEL. **Pauling's theory of metals in catalysis.** *J. Am. Chem. Soc.* 72, 1040(1950).—*C. A.* 45, 2297*i*.

Metallic radii were correlated with the percentage of *d*-character of the metallic bond. The log of the activity was found to be a steadily increasing function of the percentage *d*-character for all data, including Cr, with the exception of W.

11064. BROTZ, WALTER AND SPENGLER, HERBERT. **The physicochemical behavior of the Fischer-Tropsch catalysts.** *Brennstoff-Chem.* 31, 97-102(1950).—*C.A.* 44, 6249*f*.

The particle vol. and the skeleton vol. of the unreduced catalyst were detd. and the pore vol. and the porosity calcd. The mean pore radius of the macropores was detd. by means of a flow method. The excess flow found with CO and H_2, attributed to surface diffusion explained the complete utilization of the catalyst particle. The internal surface was detd. from an adsorption isotherm and the heats of adsorption of CO and H_2 calcd. from the adsorption isotherms.

11065. BROWN, F. E.; MENZEL, RALPH E.; STEWART, MEREDITH M., AND LEFRANCOIS, PHILIP A. **Cuprous oxide as a catalyst. I. Preparation and promotion by metallic oxides.** *J. Am. Chem. Soc.* 72, 5602-5(1950).—*C.A.* 45, 3529*i*.

Cu_2O prepd. by reduction in soln. and dried below 85°C was a hydrogenation catalyst for furfural. This catalyst was promoted by alk. earth oxides, especially CaO, and Cu_2O + CaO was further promoted by the addn. of Cr_2O_3, or V_2O_5 reduced by glucose. The catalysts were made by prepg. the oxides separately and grinding them together in a mortar at room temp.

11066. BROWNING, L. C.; DEWITT, T. W., AND EMMETT, P. H. **Equilibria in the systems Fe_2C-Fe-CH_4-H_2 and Fe_3C-Fe-CH_4-H_2.** *J. Am. Chem. Soc.* 72, 4211-17(1950).—*C.A.* 45, 1861*d*.

Equil. consts. for the reaction $CH_4 + 2Fe(\alpha) = Fe_2C + 2H_2$ were reported in the range 295°-350°C and for the reaction $CH_4 + 3Fe(\alpha) = Fe_3C(\beta) + 2H_2$ in the range 320-468°C. Free energies of formation of Fe_2C and Fe_3C calcd. from the data led to the conclusion that the formation of all monoölefins and of satd. hydrocarbons contg. more than 6 C atoms by the direct reduction of Fe_2C and Fe_3C in the temp. range 450-650°K was thermodynamically unfavorable.

11067. BRUIJN, H. DE. **The kinetics of catalytic reactions on inhomogeneous surfaces.** *Discussions Faraday Soc.* **1950**, No. 8, 69-79; *Chem. Weekblad* 46, 818-21(1950).—*C.A.* 45, 9986*d*.

By use of the NH_3 synthesis as a model process, a theory was developed starting from an entirely arbitrary distribution of the more or less active sites on the surface. The adsorption of the velocity-detg. reactant, *N*, was of an at. character and unrestricted migration occurred on the surface. An inhomogeneity factor in the reaction-rate relation, whose value was detd. by the frequency of those sites active under synthesis conditions, was essential. These sites, characterized by their heats of adsorption, depended on the temp., total pressure, and gas compn. The testing of activity of catalysts for high-pressure processes indicated that the synthesis test at 1 atm. might in many cases lead to wrong conclusions, whereas the decompn. test at 1 atm. will frequently yield a more accurate result.

11068. BUTYAGIN, P. YU. AND ELOVICH, S. YU. **Mechanism of the catalytic oxidation of propylene.** *Doklady Akad. Nauk S.S.S.R.* 75, 711-14(1950).—*C.A.* 45, 3229*e*.

On Pt (on $BaSO_4$) between 0°-200°C, C_3H_6 was oxidized completely to CO_2 and H_2O in the pressure range 0.01 to 1 mm. If Pt was first treated with O_2, and then, after short pumping, C_3H_6 was admitted alone, the 1st stage of the reaction, characterized by a very rapid fall of the pressure *p*, corresponded to an adsorption of C_3H_6 by the "oxidized" Pt. That stage of oxidation of the *surface* compd. of C_3H_6 by the *surface* O_2 was also governed by the exponential rate law. The sequence of processes was (1) activated adsorption of O_2, (2) formation of a surface compd. between the adsorbed O_2 and C_3H_6, (3) formation of a more highly oxidized intermediate product; from here, the process may branch out either into (4) complete oxidation to CO_2 and H_2O at the surface, of (4′) escape of peroxide-intermediates into space and completion of the oxidation in space.

11069. COLETTE, F. AND SCHEEPERS, L. **Catalytic oxidation of sulfur dioxide with vanadic anhydride.** *Chimie & industrie* 63, 246-51(1950).—*C.A.* 44, 7636*e*.

The exptl. arrangement and the detn. of SO_2 in the gas mixts. between 425° and 727°C was described. The gas mixt. contained SO_2 5.4, O_2 19.9, and N_2 74% by vol. With a gas flow of 100 ml/min. and a catalyst wt of 6.58 g (4.45% V deposited as V_2O_5 on porous SiO_2) the max. yield was 98.78% at 442°C. When the catalyst wt was reduced to 0.845 g at the same gas-flow rate (contact period 7.8 times shorter than the 1st), the max. yield was 83.6% at 537°C. With porcelain in place of the V catalyst, but under otherwise identical conditions, max. transformation was 36% at 690°C. The most favorable gas compn. was probably independent of the nature of the catalyst.

11070. COUSSEMANT, F. AND JUNGERS, J. C. **Kinetics of the catalytic hydrogenation of phenols.** *Bull. soc. chim. Belges* 59, 295-326(1950).—*C.A.* 45, 4124*b*.

A theoretical and exptl. study of the catalytic hydrogenation of PhOH on Ni showed that the reaction proceeded in 2 steps with the intermediate formation of cyclohexanone. The reaction was studied with H_2 and H donors (secondary alcs.). The activation energy for the formation of PhOH was 8500 cal/mol.; for cyclohexanol from cyclohexanone, 6500 cal/mol.

11071. CREMER, E. **Relation between the energy and the entropy factor of the Arrhenius equation for heterogeneous reactions.** *J. chim. phys.* 47, 439-45(1950).—*C.A.* 44, 9783*d*.

For catalytic reactions, the const. *A* in the equation $k = A \exp(-q/RT)$ frequently increased exponentially with *q*, where *k* was the sp. reaction velocity const. and *q* the measured energy of activation. Frequently, *q* was a linear function of the temp. of prepn. of the catalyst. The leak of electrons by a tunnel effect on the catalyst surface may account for the exponential relation between *A* and *q*.

11072. CREMER, E. AND KULLICH, E. **Catalytic surface activity of burned magnesite.** *Radex Rundschau* **1950**, 176-9—*C.A.* 45, 5011*e*.

The catalytic surface activity was detd. for the decompn. of HCOOH from 310° to 450°C over MgO (made from magnesite at temps. from 370° to 900°C). The pressure increase due to H_2 and CO_2 was detd. The activation energies of the reaction depended on the temp. at which the preliminary treatment was made and ranged between 15 and 52 kcal/mol. The catalytic effect increased gradually with temp. up to a max, at 800°C; above 800°C it decreased sharply.

11073. CROWELL, J. H.; BENSON, H. E.; FIELD, J. H., AND STORCH, H. H. **Fischer-Tropsch oil circulation processes.** *Ind. Eng. Chem.* **42**, 2376-84(1950).

Catalyst cementing was circumvented by employing a moving bed of catalyst in which lifting action of the circulating oil was used to expand the catalyst bed and keep the particles in motion. Details of induction and synthesis operations, operating data, analyses of gas and liquid streams, calcd. yields, and a typical product distribution were given for various expts.

11074. DELEO, E.; INDOVINA, R., AND PARLATO, A. **Catalytic decomposition of hydrogen peroxide in the presence of deuterium oxide.** *Ann. chim.* (Rome) 40, 251-6(1950).—*C.A.* 45, 10019*c*.

The catalytic effect of colloidal Pt and of KI on H_2O_2 in presence of 20% D_2O was studied at 14°-40°C where the following reactions were stipulated: $H_2O_2 + D_2O = HDO_2 + HDO$; $H_2O_2 + D_2O = D_2O_2 + H_2O$; $H_2O_2 + HDO = HDO_2 + H_2O$. D_2O inhibited the catalytic action of colloidal Pt and the observed effect on the rate was due to D_2O_2 formation.

11075. DOWDEN, D. A. **Heterogeneous catalysis. II. Hydrogenation by binary alloys.** *J. Chem. Soc.* **1950**, 265-71.—*C.A.* 44, 7635*b*.

The activity of the Ni in Ni-Cu catalysts declined in parallel with the filling of the holes in its 3d-band by the valency electrons of the Cu. This occurred while the crystal lattice was expanding slightly in the direction of increased activity on the simple geometric view. Magnetic susceptibilities of the catalysts were measured at a field strength of 4000 oersteds.

11076. DOWDEN, D. A. AND REYNOLDS, P. W. **Some reactions over alloy catalysts.** *Discussions Faraday Soc.* **1950**, No. 8, 184-8, discussion 189-90.—*C.A.* 45, 9988*c*.

Activity of Ni-Fe alloys in multiple-bond hydrogenation should increase rapidly in the region where the energy density of electron levels at the Fermi surfaces rises. Moreover, reactions controlled by the rate of transfer of an electron from metal to substrate should, in the Ni-Cu alloys, decrease in rate as the *3d*-band begins to empty. Results on *styrene hydrogenation over Ni-Fe catalysts* and *H_2O_2 decompn. on Ni-Cu alloy foils* confirmed the predictions. Methanol and formic acid decompns. on the Ni-Cu alloys decreased in speed as the *3d*-band holes were filled.

11077. ECKSTROM, HARTLEY C. AND ADCOCK, WILLIS A. **A new iron carbide in hydrocarbon synthesis catalysts.** *J. Am. Chem. Soc.* 72, 1042-3(1950).—*C.A.* 45, 2649*c*.

The new Fe carbide appeared along with Fe_3O_4 and Fe_2C during the course of a fluidized synthesis run at 27 atm. pressure and 360°C. Eventually it constituted approx. 90% of the total catalyst charge and was ferromagnetic.

11078. EĬDUS, YA. T. AND GUSEVA, I. V. **Effect of ammonia in the incoming gas on the catalytic hydrogenation of carbon monoxide to higher hydrocarbons.** *Izvest. Akad. Nauk, Otdel. Khim. Nauk* **1950**, 287-90.—*C.A.* 44, 8087*d*.

Addn. of NH_3 to a mixt. of 1 $CO:2H_2$ flowing 5 hrs at 80-90 liters/liter catalyst/hr at 190°C under atm. pressure over a Co catalyst (5g metal over 35 cm) resulted in marked decrease of the yield of higher hydrocarbons. The percentage of CO reacted decreased in the same degree as the yield of hydrocarbons. A ppt. of $(NH_4)_2CO_3$ was formed at the end of the reactor. As soon as the NH_3 was shut off, the yield reverted to its original high level. The inhibition by NH_3 was not due to a reaction $NH_3 + CH_2 \rightarrow MeNH_2$.

11079. EĬDUS, YA. T.; ZELINSKII, N. D., AND PUZITSKII, K. V. **Catalytic hydrocondensation of carbon monoxide with olefins. III. Polymerization and hydropolymerization of ethylene under the conditions of hydrocondensation catalysis.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* **1950**, 98-109.—*C.A.* 44, 6100*g*.

C_2H_4 alone and in mixt. with H_2 was passed at 190°C, under atm. pressure, over the catalyst after it had been used for 120 hrs in hydrocondensation of 1 $CO:2\ H_2:3\ C_2H_4$. Passage of H_2 alone over a catalyst having been used in runs with $CO + H_2 = C_2H_4$, produced no significant amts. of liquid, and no light oil. Passage of 1 $H_2:1\ C_2H_4$ on a fresh catalyst produced practically no oil, only hydrocarbons C_4. The main mass of the C_2H_4 was hydrogenated to C_2H_6. These results were thought due to the presence of CH_2 radicals at certain points of the lattice of the metallic catalyst surface having been used with $CO + H_2 + C_2H_4$.

11080. EPSHTEĬN, D. A. **Mechanism of the catalytic oxidation of ammonia.** *Doklady Akad. Nauk. S.S.S.R.* 74, 1101-4(1950).—*C.A.* 45, 1856*d*.

A 100-fold increase of the time of stay of the $NH_3 + O_2$ reaction mixt. in the catalyst zone did not change the relative rates of the reactions $4\ NH_3 + 5\ O_2 = 4\ NO + 6H_2O$ and $4\ NH_3 + 3\ O_2 = 2\ N_2 + 6\ H_2O$. Catalysts for the oxidation of NH_3 were good chemisorbents for O_2, and oxidation of NH_3 to NO required a 1.3-1.4-fold excess of O_2 over the amt. given by the 1st stoichiometric equation; this was evidence that the oxidation took place on O_2 adsorbed on the catalyst surface. NH_3 reacted with the adsorbed O_2 forming an activated complex in which O was bound directly with the N atom, and which decompd. directly into NO and H_2 which, in turn was oxidized to H_2O.

11081. EUCKEN, A. **The hydrogenation of unsaturated hydrocarbons on nickel contacts. II. Kinetic investigations.** *Z. Elektrochem.* 54, 108-20(1950).—*C. A.* 44, 9785*g*.

The hydrogenation of cyclohexene and of ethylene was studied on Ni at 0°C and total pressures below 0.2 tor in a static system. The catalysts used were Ni foil, Ni powder prepd. by reduction of $NiCO_3$ or Ni formate, Raney Ni, and Ni films prepd. by evapn. The surface of the powder catalysts was detd. by A adsorption measurements at 90°K: Ni-powder, 2 m^2/g, and Raney Ni about 20 m^2/g. The catalytic activity remained fairly const. upon heating the catalysts in H_2 with or without preceding oxidation up to 280°C. Cyclohexene was chemisorbed on Ni and cyclohexane by van der Waals forces only.

11082. EUCKEN, A. AND HEUER, K. **Catalytic dehydrogenation and dehydrogenation of alcohol on oxides.** *Z. physik. Chem.* 196, 40-55(1950). —*C. A.* 45, 8864*b*.

The oxides, followed by % dehydrogenation of EtOH at 300-400°C (the remainder was dehydrated), were: Cu_2O 100, CuO 100, MgO 69, MnO (fresh) 67, MnO (incipient reduction) 95, CdO 52, FeO 50, SnO 57, ZnO 92, BeO 56, TiO_2 31, SnO_2 46, UO_2 45, ZrO_2 45, La_2O_3 45, Cr_2O_3 5, V_2O_3 3, Fe_2O_3 (fresh) 1, Fe_2O_3 (incipient reduction) 9, Fe_2O_3 (strongly reduced) 32, α-Al_2O_3 2, γ-Al_2O_3 2, $ZnAl_2O_4$ 17, WO_3 0. Expts. were also made with ZnO, BeO, and La_2O_3, coated with H_2O, acetone, Cl^-, H_2, and K^+. Adsorption isobars were detd. for H_2 on free and on H_2O-coated ZnO and La_2O_3; isotherms were detd. for H_2 on free and on H_2O-coated BeO at 175°C. Adsorption of polar mols. on the catalyst surface decreased the dehydrogenating activity.

11083. FENIMORE, CHARLES P. AND KELSO, JOHN R. **Chemiluminescence of the sodium- or sodium halide-catalyzed oxidation of carbon monoxide by nitrous oxide.** *J. Am. Chem. Soc.* 72, 5045-8(1950).—*C. A.* 45, 2780*e*.

At 550°-600°C in reaction vessels coated with NaCl or NaBr and possessing temp. inequalities, the slow reaction of CO and N_2O was catalyzed by the alkali halide with simultaneous emission of the Na resonance lines. The mechanism of the formation of Na atoms from NaCl or NaBr was uncertain. The slow N_2O- CO reaction did not excite the metal lines in KCl- or NaI-coated vessels. It did, however, briefly excite the red Li line in a LiCl-coated vessel.

11084. FILIPPOV, YU. V.; LEBEDEV, V. P.; ZALAMAN, V. V., AND KOBOZEV, N. I. **Synthesis and decomposition of ammonia in electrical discharges. II. Sensitized synthesis of ammonia in a glow discharge.** *Zhur. Fiz. Khim.* 24, 1009-15(1950).—*C. A.* 45, 1882*f*.

The synthesis of NH_3 in the presence of vapors of Hg, Zn, and Cd in a glow discharge was studied. The effect of Hg was pos., while Zn and Cd gave neg. effects. An explanation of the observed phenomena was offered on the basis of the energies of the reacting mol. and radicals. A mechanism, occurring by means of excited N and at. H, was proposed for the electrosynthesis of NH_3.

11085. FLAMME, M. L. R. **Detailed study of a Raney nickel reduction.** *Chimie & industrie* 63, No. 3bis, 489-91(1950).—*C. A.* 47, 392*h*.

The optimum conditions for the hydrogenation of $PhNO_2$ with Raney Ni were detd. by variation of the H_2 pressure, temp., quantity of catalyst, batch size, and storage conditions for the catalyst. The optimum quantity of Raney Ni for the reduction of $PhNO_2$ was 0.5 ml apparent vol. at 25 atm. pressure. The reaction had to be initiated by heating to 150°C and proceeded best at 200-20°C and a const. pressure of 20-25 atm. in 40-50 min. to completion to yield at least 97% $PhNH_2$.

11086. FLID, P. M. AND KAGAN, M. YA. **Kinetics and mechanism of catalytic (de)hydrogenation. IV. Kinetics of cyclohexane dehydrogenation on nickel and chromium oxide.** *Zhur. Fiz. Khim.* 24, 1409-15(1950).—*C. A.* 45, 4124*c*.

The prepn. of a Ni catalyst on Al_2O_3 (23.6% Ni) was described. An Fe-free silica gel was also impregnated with a soln. of CrO_3, dried, heated up to 480°C during 7-8 hrs in H_2. The catalyst contained 20% Cr_2O_3. The reaction was studied in a flow system (±0.5°). The Ni catalyst was reduced by H_2 at 10-15° above the temp. of the run during 1.5 hrs, and the chromia catalyst was first treated with O_2 during 3 hrs at up to 500°C, then reduced by H_2 at 400-420°C during 2 hrs. The findings were explained on the basis of a retardation of the reaction by adsorption of C_6H_6 for the Ni catalyst and H_2 for the Cr_2O_3 catalyst.

11087. FOLKINS, HILLIS O.; MILLER, ELMER, AND HENNIG, HARVEY. **Carbon disulfide from natural gas and sulfur. Reaction of methane and sulfur over a silica gel catalyst.** *Ind. Eng. Chem.* 42, 2202-7(1950).—*C. A.* 45, 1309*i*.

The formation of CS_2 by the reaction of CH_4 and S vapor over a silica gel catalyst was studied at 500°-650°C. The CH_4-S system, the thermodynamics of the reaction, the effect of varying reactant ratio, the life of the catalyst, and the quality of the CS_2 produced were discussed.

11088. FØRLAND, KATRINE S. **Final surface structures and surface effects.** *Tids. Kjemi, Bergvesen Met.* 10, 260-3(1950).—*C. A.* 45, 2298*b*.

Surface structures and surface effects during and after catalysis were illustrated by the adsorption of Ag^+ on metal and glass surfaces, by the surface action of SiO_2 and Al_2O_3 or SiO_2 and $Mg(OH)_2$ as cracking catalysts, and by the oxidation of hexamethyltriaminotriphenylmethane over TiO_2 contg. Ta_2O_5.

11089. GIRELLI, A. AND SINIRAMER, C. **Catalytic desulfurization of gasoline from Middle Eastern crude oils.** *Riv. combustibili* 4, 152-63(1950).—*C. A.* 44, 9664*a*.

Removal of all (0.03 to 0.11%) but the cyclic S compds. from two gasolines was accomplished by passing the vapors over bauxite at 300°-550°C (350°-400°C optimum) at atm. pressure. An improvement in octane number of 1-2 units resulted in the unleaded gasolines; of 5-8 units in the leaded product.

11090. Givaudon, J.; Nagelstein, E., and Leygonie, R. **Thermal and chemical effects observed with chromium oxide catalyst on alumina.** *J. chim. phys.* 47, 304-9(1950).—*C.A.* 44, 7636c.

A catalyst consisting of 10% Cr_2O_3 on Al_2O_3 was subjected to cycles of H_2, N_2, and air at 250°-550°C. Temp. rises in the catalyst were observed when either H_2 or air was passed over the catalyst; the rise was greater in the case of H_2. CrO_3 was formed in air and this compd. was reduced to Cr_2O_3 by H_2. A pilot plant using a fluidized Cr_2O_3-Al_2O_3 catalyst was described for the formation of toluene from heptane.

11091. Gross, H. W. **Gas detoxification.** *Gas- u. Wasserfach* 91, No. 3 *(Gas)*, 44(1950).—*C.A.* 44, 5079*h*.

The CO content (20%) of gas from the Lurgi pressure producer was reduced by passage over a Ni, Co, or Fe catalyst, with accompanying increase in CH_4 content, production of solid and liquid hydrocarbons, and increase in heating value. The original gas had a heating value of 4200 kcal/m^3; use of a Ni or Co catalyst increased this to 7200 kcal/m^3 and an Fe catalyst to 4800 kcal/m^3. It was not economical to remove all of the CO in one step. Careful removal of S compds. and gum formers by means of an active carbon filter was necessary before conversion.

11092. Gross, H. W. **Production of detoxicated pipe-line gas through pressure gasification and synthesis over iron catalysts.** *Erdol u. Kohle* 3, 218-22(1950).—*C.A.* 44, 7513*g*.

Fe catalysts rather than Ni or Co were preferred because the heating value and burning properties of the final gas was not changed appreciably. In practice a two-step conversion was advocated. A modern synthesis unit had a daily capacity of 40 tons of liquid products and 640,000 m^3 of detoxicated gas. Gases of higher heating value may be obtained by introducing a second synthesis step.

11093. Gryaznov, V. M.; Frost, A. V., and Yufit, S. S. **Temperature dependence of the degree of hydrogenation of benzene on palladium catalysts.** *Vestnik Moskov. Univ.* 5, No. 6, *Ser. Fiz.-mat. i Estest. Nauk* No. 4, 35-9(1950).—*C.A.* 45, 4540*h*.

Two catalysts (Pd 1.48% and 0.18%) were prepd. by impregnating silica gel with $Pd(NH_3)_4Cl_2$ and reduction with H_2. On both catalysts, the reaction was zero-order with respect to C_6H_6 in the presence of excess H_2. On the first catalyst (column 11 cm long) at const. feed rate of C_6H_6 = 18, H_2 = 56 millimole/hr, the degree of hydrogenation remained const. and temp.-independent, ~60%, between 120° and 220°C, then fell to 26% at 267°C. On the second catalyst at the const. feed rate C_6H_6 = 9, H_2 = 27 millimole/hr, the degree of conversion increased (3.3, 5, 7.5, and 9.2%, at 145°, 168°, 192°, and 208°C, resp.). In this range, the activation energy was 6.4 kcal/mole.

11094. Guillemin, A. and Vincent-Genod, J. **Catalytic effects observed in the aromatization of paraffinic cuts.** *J. chim. phys.* 47, 483-8(1950).—*C.A.* 44, 10307*d*.

The activities of 10% Cr_2O_3-90% Al_2O_3 and 12% MoO_3-88% Al_2O_3 catalysts were detd. for the aromatization of paraffinic petroleum-cuts at about 500°C. In a few expts., 1% V_2O_5 or 1% KVO_3 was added as a promoter. Fixed-bed and fluid-bed techniques were both employed. The MoO_3-Al_2O_3 catalyst proved to be the more satisfactory. A total liquid yield of 70 wt-% with an aromatic content of 75% to 85% was obtained. A German Al_2O_3 with an area of 222 m^2/g was slightly more effective as a catalyst support than a French sample having an area of 80 m^2/g.

11095. Hays, Harrison L. and Dolezal, Edward. **The commercial dehydrogenation of normal butane.** *Quart. Colo. School of Mines* 45, No. 2A, 31-58(1950).—*C.A.* 44, 5086*b*.

Preheated feedstock contg. 98% butane was dehydrogenated over a chromia-alumina catalyst in reactors at 1100°F and 20 p.s.i. The product was a mixt. of 1- and 2-butenes in approx. equil. concn. The ultimate yields averaged 82% at conversions of 31% and space velocities of 600-700 standard ft^3 per hr of butane vapor per ft^3 of catalyst. To regenerate the catalyst, a mixt. of N_2, CO_2, and 2.5% O_2 at 800°F and 130 p.s.i. was blown through the tubes at a space velocity of 2500-3000 vols. gas/vol. catalyst/hr to burn off the accumulated carbon. The catalyst life was 200-250 days.

11096. Herbo, Cl. **The mechanism of catalytic hydrogenation and dehydrogenation over solid catalysts.** *J. chim. phys.* 47, 454-73(1950).—*C.A.* 44, 9785*b*.

The initial rate of hydrogenation of Me_2CO over a 50:10:40 Ni:ZnO:Cr_2O_3 catalyst as detd. in a flow system was independent of the partial pressure of Me_2CO and H_2. The energy of activation was 12 kcals between 140° and 170°C. The apparent temp. coeff. became neg. above 200°C. At 246°C the rate of reaction was proportional to the product of the partial pressures of Me_2CO and H_2. The hydrogenation of C_6H_6 to cyclohexane gave similar results to those obtained for Me_2CO hydrogenation except that the energy of activation was 11 kcals.

11097. Herglotz, H. **Relation between the constants of the Arrhenius equation for heterogeneous catalysis.** *Monatsh.* 81, 1162-4(1950).—*C.A.* 46, 1854*a*.

A Raney-Co catalyst was studied for conversion of organically bound S to H_2S. On contact, the heterogeneous equil. $mCoS_x + nH_2 \rightleftharpoons nH_2S + mCo$, where $mx = n$, showed a measurable H_2S pressure above 400°C. Measurements made using Raney Co having different contents of active component showed that the slope of the log k line as a function of $1/T$ was greater, the larger the amt. of active component in the catalyst.

11098. Holman, Orlo B. **Cyclic catalytic reforming.** *Gas* 36, No. 12, 36-7(1950).—*C.A.* 45, 1323*d*.

The superheater of a water-gas set was modified for catalytic reforming of natural gas by blanking off from the rest of the set and installing a combustion chamber, preheat bed, and catalyst bed. The output gas could be varied as regards inert and H_2 content as desired, and was mixed with natural gas, etc. to give the desired heating value.

11099. Kagan, M. Ya. **Some foundations of the multiplet theory of catalysis.** *Doklady Akad. Nauk S.S.S.R.* 74, 61-3(1950).—*C.A.* 45, 426*f*.

The multiplet theory of heterogeneous catalysis was in conflict with the principle of microscopic reversibility. As an example, the dehydrogenation of EtOH to AcH and the reverse hydrogenation of AcH to EtOH, as represented by the doublet theory, must occur on different pairs of points of the catalyst, and, consequently, the 2 reverse processes on the same catalyst proceed over different intermediate states, in contradiction of the activated-complex theory. The decisive factor was not the geometry, but the energy factor due to the nonlocalized double bonds.

11100. Karpacheva, S. M. and Rozen, A. M. **Oxygen exchange between oxide catalysts and water vapor.** *Doklady Akad. Nauk S.S.S.R.* 75, 55-8(1950).—*C.A.* 45, 1855*b*.

Rates of exchange of O^{18} between metal oxides, MO, and H_2O vapor were detd. both in the forward direction, $MO^{16} + H_2O^{18} \rightarrow MO^{18} + H_2O^{16}$, and in the reverse direction by measurements of the O^{18} content in the initial and the reacted H_2O. On a Cr_2O_3 10% + Al_2O_3 90% contact, on active Al_2O_3, on MnO_2, and on granulated CuO, the exchange was characterized by a sharp slowing down with progressing satn. The analogy between the isotopic exchange and activated adsorption was plausible on account of the large surface area of the oxides (100-300 m^2/g). On the other hand, activated adsorption involved also some amt. of bulk sorption.

11101. Karpacheva, S. M. and Rozen, A. M. **Exchange between some oxides and liquid water, alcohol, and gaseous oxygen.** *Doklady Akad. Nauk S.S.S.R.* 75, 239-42(1950).—*C.A.* 45, 3228*i*.

Effective forward ($MO^{16} + H_2O^{18} \rightarrow MO^{18} + H_2O^{16}$) and back exchange ($MO^{18} + H_2O^{16} \rightarrow MO^{16} + H_2O^{18}$) between liquid H_2O and metal oxides MO, at room temp., were observed with a $Cr_2O_3.Al_2O_3$ catalyst, active Al_2O_3 (a dehydration catalyst), active ZnO (also a dehydration catalyst), and SiO_2 gel. The rates of exchange were lower than with H_2O vapor at higher temps. Back exchange between a tagged oxide and gaseous O_2 was observed, with MnO_2 at as low as 70-80°C, $CaCO_3$ at 350°C. V_2O_5 at 450°C, and with natural dunite at 800°C. If the catalytic activity of an oxide was characterized by the lowest temp. at which it was able to catalyze an oxidation, the order of activities of MnO_2 (room temp.), V_2O_5 (350°-450°C), and CuO (600°-800°C), coincided with the order of ease of exchange of O^{18} with O_2.

11102. Kastens, Merritt L. and Sutherland, Robert. **Platinum reforming of gasoline.** *Ind. Eng. Chem.* 42, 582-93(1950).—*C.A.* 44, 5085*f*.

Hydrocracking can be considered as a simultaneous cracking-isomerization-hydrogenation reaction which produced fragments from a parent mol. of higher mol. wt in general than the products of thermal or catalytic cracking. Isomerization proceeded faster than hydrocracking and reached a max. at a space velocity of 5.0; lower space velocities giving excessive amts. of C_3 and C_4 gases. The S removal was predominantly as H_2S. Catalyst temps. of 800-900°F and pressures of 500-900 p.s.i.g. were employed.

11103. Katz, Morris; Grant, G. A., and Riberdy, R. **Oxidation of carbon monoxide by solid silver permanganate reagents. II. Kinetic studies with silver permanganate-zinc oxide.** *Can. J. Research* 28B, 799-814(1950).—*C.A.* 45, 3695*g*.

The kinetic equations of the adsorption wave were applied to the oxidation of CO in an air stream by granular $AgMnO_4$-ZnO reagent. The relations between concn. of escaping gas and time, column length and breakdown time, and flow rate and breakdown time agreed with the theory; but the predicted linear relations between the crit. column length and the reciprocal of the crit. flow time with the log of the initial concn. were not confirmed. Diffusion of gas mols. to the surface of the granules detd. the rate, since the rate const. varied directly with the flow rate.

11104. Katz, Morris and Halpern, Sophie. **Oxidation of carbon monoxide in air by silver permanganate.** *Ind. Eng. Chem.* 42, 345-52 (1950).—*C.A.* 44, 3341*i*.

Flow system and prepn. of $AgMnO_4$-metallic oxide catalysts were described. For an initial CO concn. of approx. 0.50 in air, the mole % and breakdown time (to 90% efficiency) were: MoO_2 59.5, 106; MnO_2 71.0, 89 (here given to 92% efficiency); Fe_2O_3 48.3, 122; TiO_2 65.3, 100; ZrO_2 63.2, 92.5; CeO_2 57.0, 88; SiO_2 71.0, 53; SnO_2 50.0, 117; $Al_2O_3.2SiO_2.2H_2O$ 36.5, 112; Co_2O_3 56.0, 99; CuO 80.8, 73; Sb_2O_3 33.5, 82; CdO 54.0, 43; Pb_3O_4 35.0, 51; V_2O_5 54.0, 41; Al_2O_3 54.0, 29. $AgMnO_4$-ZnO catalyst (oxide mol. compn. 69%) was outstanding. Life of a granular bed of a $AgMnO_4$-kaolin catalyst increased from 76.5 min. at 1.5° to 126 min. at 24°C.

11105. Kearby, K. K. **Catalytic dehydrogenation of butenes.** *Ind. Eng. Chem.* 42, 295-300 (1950).—*C.A.* 44, 3874*d*.

A catalyst having the compn. 72.4% MgO, 18.4% Fe_2O_3, 4.6% CuO, 4.6% K_2O was selected as promising for the steam-diln. butene dehydrogenation process for the production of butadiene. The catalyst combined a K promoter with a satisfactory dehydrogenating compd. The stability of the catalyst to heating at high temps. varied considerably with its method of prepn. The performance characteristics were compared with other catalysts contg. the active oxides of Cr, Co, Mn, Cu, Ni, V, Mo, and W, and as the promoter, oxides of Li, Na, Rb, Cs, Ca, Sr, and Ba.

11106. KOIKE, DENZO. **Vanadium-phosphoric acid catalyst. I. Polymerization of 1-butene by phosphoric acid-vanadium oxide-kieselguhr catalyst.** *J. Chem. Soc. Japan.*, Pure Chem. Sect. 71, 595-6(1950).—*C.A.* 45, 6774*f*.

The catalyst employed was prepd. by heating at 200°C a mixt. of 90% H_3PO_4 (82 g) and 1 g of V_2O_5, obtained by heating ammonium metavanadate at 440-450°C for 20.5 hrs, and by heating further the resulting mixt. with addn. of 18 g of kieselguhr. Another catalyst without the addn. of V_2O_5 was similarly prepd. Polymerization took place with the first catalyst to 92%, the optimum temp. being 150-170°C, and with the second catalyst to 52%, the optimum temp. being 200°C.

11107. KOIZUMI, MASAO. **Catalytic isotopic exchange reaction of hydrogen between different olefinic hydrocarbons. II.** *J. Inst. Polytech., Osaka City Univ.* 1, No. 2, 1-9(1950) (in English).—*C.A.* 46, 1339*f*.

The exchange reaction of D between heavy ethylene and C_3H_6 over 1.8 g Ni catalyst at 45°C was studied. The methylene H atoms were most easily exchanged, followed by the single H on the central C atom which exchanged several times more slowly; the total time required was about 100 hrs. The H atoms of the Me group were also replaced, but extremely slowly.

11108. KÖLBEL, HERBERT AND ACKERMANN, PAUL. **Reaction mechanism of the Fischer-Tropsch synthesis. IV. The molecular size of the aliphatic hydrocarbons from the catalytic hydrogenation of carbon monoxide.** *Brennstoff-Chem.* 31, 10-14(1950).—*C.A.* 44, 3697*a*.

When higher mol. liquid aliphatic hydrocarbons (C_{15} to C_{19} hydrocarbons from Kogasin) were introduced into the Fischer-Tropsch synthesis, they formed solid hydrocarbons by chain lengthening under synthesis conditions that normally led to the predominant formation of high mol. hydrocarbons, solid at normal temps. The rate of this chain lengthening was directly related to the building up activity of the catalyst.

11109. KÖLBEL, HERBERT AND ENGELHARDT, FRIEDRICH. **Reaction mechanism of the Fischer-Tropsch synthesis.** *Chemie-Ing. Tech.* 22, 97-104(1950).—*C.A.* 44, 5566*g*.

In place of Franz Fischer's carbide theory, a working hypothesis for the mechanism of CO hydrogenation was presented based on chemisorption concepts.

11110. KÖLBEL, HERBERT AND ENGELHARDT, FRIEDRICH. **Reaction mechanism of the Fischer-Tropsch synthesis. VI. The function of water vapor in the carbon monoxide hydrogenation.** *Erdol u. Kohle* 3, 529-33(1950).—*C.A.* 45, 2177*a*.

Curves of CO conversion in per cent *vs.* space velocity (Fe-Cu-kieselguhr catalyst aged for 100 hrs, $CO/H_2O = 1:1$, atm. pressure) showed a rapid reduction of conversion with increasing space velocity at 180°-200°C. At 240°C and space velocity 100 (Fe-Cu catalyst) was completely inactivated at $CO/H_2O = 4:4$ while at 4:2 and 4:1 remained active for more than 1000 hrs. Fe-Cu catalyst became inactive in 9-16 hrs between 200 and 240°C while a Co-Th-Mg-kieselguhr catalyst was not affected below 190°C. The oxidized Fe catalyst could not be reactivated by means of H_2, CO, or a mixt. of the two. A large portion of the Fe catalyst became permanently deactivated at normal space velocities and at high H_2 concn. The mechanism of the synthesis was explained as chemisorption.

11111. KRASNOVSKIĬ, A. A. AND GUREVICH, T. N. **Photocatalytic action of some metal oxides.** *Doklady Akad. Nauk S.S.S.R.* 75, 715-18(1950). —*C.A.* 45, 2782*b*.

The rate of oxidation by O_2 of linseed oil and of linoleic acid in toluene or EtOH soln., heterogeneously catalyzed by metal oxides was accelerated by simultaneous illumination with long-wave ultraviolet (400-410 mμ or shorter) absorbed by the solid oxide but not by the reactant and solvent. The effects of illumination on the rate of the catalytic decompn. of H_2O_2 at 40°C were given by the following oxides: ZnO, TiO_2, Fe_2O_3, Cr_2O_3, Pb_3O_4, PbO. The photocatalytic effect was pronounced with TiO_2 and Pb_3O_4 and PbO, to a lesser extent on ZnO.

11112. KRAUSS, WALTHER. **The catalytic oxidation of ammonia. I. The kinetics of the primary reaction and the contact lifetime of hydroxylamine.** *Z. Elektrochem.* 54, 264-72 (1950).—*C.A.* 45, 29*h*.

The oxidation of NH_3 on Pt and Pt-10% Rh catalysts was studied in a flow system at pressures of the order of 10^{-2}mm and at 740° to 1250°C. The primary reaction was the combination of NH_3 with O atoms dissocd. on the catalyst surface ($NH_3 + O \rightarrow NH_2OH$). The heat of adsorption of NH_2OH on Pt was 23 kcal and the mean lifetime of NH_2OH was 3×10^{-12} exp. (5000/RT) sec. The rate of NO formation was given.

11113. LESOKHIN, I. G. AND MUKHLENOV, I. P. **Arsenic poisoning of vanadium catalysts in the production of sulfuric acid.** *Zhur. Priklad. Khim.* (J. Applied Chem.) 23, 449-59 (1950).—*C.A.* 47, 276*i*.

The degree of oxidation of SO_2 to SO_3 was detd. in SO_2 + air mixts. contg. known concns. *c* of As_2O_3, flowing at a space velocity of 185-200 ml (S.T.P.)/ml catalyst/hr, at 485 and 500°C. At any given *c*, the catalyst retained only a fraction of the As_2O_3 passed until a satn. amt. was reached. On further prolonged poisoning, absorption of As_2O_3 by the catalyst decreased and stopped at 11-12% As_2O_3 (of the wt of the satd. catalyst). Catalysts poisoned with small amts. of As_2O_3 could not be regenerated by an air blast at 450-575°C; only the As_2O_3 retained at higher *c* and over longer times could be removed in a hot-air stream.

11114. LESOKHIN, I. G.; TRABER, D. G., AND MUKHLENOV, I. P. **Influence of iron sulfates on vanadium catalysts in the production of contact sulfuric acid.** *Zhur. Priklad. Khim.* (J. Applied Chem.) 23, 345-9(1950); *Chem. Tech.* (Berlin) 3, 145-7(1951).—*C.A.* 44, 7030*h*; 45, 10517*f*.

Mech. deposition of $FeSO_4$, up to 7%, on the catalyst caused some lowering of its activity only at 450°C, none at 485° and 500°C. The formation of rings at points of contact of the catalyst with the heat-exchange pipes was due to condensation of H_2SO_4 which, at lower temps., dissolved the active components of the catalyst. At higher temps., H_2SO_4 evapd. and left a solid ring of catalyst granules cemented by sulfates. If $FeSO_4$ or $Fe_2(SO_4)_3$ was incorporated into the catalyst at its prepn., its activity was lowered proportionally to the Fe content.

11115. LEVERING, DEWEY R.; MORRITZ, FRED L., AND LIEBER, EUGENE. **The promoter effect of platinic chloride on Raney nickel. I. General effects on type W-6 catalyst.** *J. Am. Chem. Soc.* 72, 1190-4(1950).—*C.A.* 44, 5199g.

The activating effects of $PtCl_4$, Et_3N and $PtCl_4$, and $(Et_3NH)_2PtCl_6$ on the more active forms of Raney Ni in the hydrogenation of several functional groups were studied. A rapid method was described for estg. the amt. of Ni in wet Raney Ni catalyst.

11116. LÖPMANN, B. **Gas detoxification.** *Gas- u. Wasserfach* 91, No. 3 *(Gas)*, 44(1950).—*C.A.* 44, 5079*i*.

The larger part of the CO from coke-oven gas was removed by passing the S-free gas over a Co catalyst at 120°-130°C. Little CH_4 was formed; the products were predominantly higher hydrocarbons (40 g per liter of gas), consisting largely of liquid and solid paraffin hydrocarbons. CO_2 removal was not necessary; the residual CO content was 1-1.5%, but this could be further reduced by a two-step process. The vol. contraction was about 15% and the increase in gas heating value about 200 kcal per m^3 per hr.

11117. MARGOLIS, L. YA. AND TODES, O. M. **Modification of catalysts for complete oxidation. I.** *Zhur. Obshcheĭ Khim.* (J. Gen. Chem.) 20, 1981-90(1950); *J. Gen. Chem. U.S.S.R.* 20, 2053-62(1950)(Engl. translation).—*C.A.* 45, 2758*c*; 46, 5414*a*.

The kinetics of isoöctane oxidation on $MgCr_2O_4$-MgO (65 m^2/g), $CuCr_2O_4$-CuO and V_2O_5 was studied. The catalysts were impregnated with known amts. of impurities (0.5-10%), supported on asbestos and dried at 100°C. The impurities on the first two catalysts were H_3PO_4, H_3BO_3, $BaSO_4$, Na_2SiO_3, $Ba(NO_3)_2$, and HF. Up to 20% of these impurities failed to catalyze when supported directly on asbestos. The order and the activity changed abruptly at some crit. concn. of the impurity. A given "modifier" may be either a promoter or a poison according to its concn. It may change the order of the catalyzed reaction.

11118. MARGOLIS, L. YA. AND KRYLOV, O. V. **Modification of catalysts for complete oxidation. II.** *Zhur. Obshcheĭ Khim.* (J. Gen. Chem.) 20, 1991-8(1950); *J. Gen. Chem. U.S.S.R.* 20, 2063-70(1950)(Engl. translation).—*C.A.* 45, 2758*f*; 46, 5414*a*.

The complete oxidation of C_2H_4 on $MgCr_2O_4$ + MgO contg. various amts. of Na_2SiO_3 was investigated between 260° and 470°C. The concn. of Na_2SiO_3 was varied between 1.5 and 5% of $MgCr_2O_4$ + MgO; the concn. of the catalyst on the asbestos (3g), between 1 and 3%. The rate const. was proportional to the catalyst concn. on the support. The complete oxidation of isoöctane on WO_3 on asbestos (50%) was also studied, with NaOH as an impurity. Pure H_2WO_4 was put into soln. by means of an excess of a concd. soln. of NH_4OH. The soln. was evapd. to dryness in a porcelain crucible; the resulting white crystals were decompd. by heating 2 hrs in air at 450°C. The yellow catalyst was supported on asbestos (50%). The following catalysts were inactive: (a) asbestos 50, WO_3 50, NaOH 17.3; (b) asbestos 50, NaOH 50; (c) asbestos 99, NaOH 1%.

11119. MARIANI, EUGENIO AND BALDASS, FELIX V. **Effect of the anionic ion-exchange resins in the hydrolysis of ethyl acetate.** *Ricerca sci.* 20, 324-5(1950).—*C.A.* 45, 3222*b*.

At 25 and 35°C Amberlite IR4B 1 g and 1, 2, and 3 g, resp., in 25 ml of 0.2 and 0.4 *N* EtOAc, resp., rapidly hydrolyzed EtOAc to a small nearly const. amt. per amt. of resin, namely 0.33, 0.37 mg/g. The same value applied to Amberlite IRA-400, and was not changed by letting the mixt. stand 25-35 hrs.

11120. MAY, D. R.; SAUNDERS, K. W.; KROPA, E. L., AND DIXON, J. K. **The mechanism of the catalytic cracking of unsymmetrical diarylethanes.** *Discussions Faraday Soc.* 1950, No. 8, 290-5, discussion 295-6.—*C.A.* 45, 9990*e*.

The catalytic cracking of substituted 1, 1-diarylethanes on siliceous catalysts to form a substituted styrene was studied as a function of temp., contact time, diluent, catalyst particle size and area. At low contact times of 0.001-0.1 sec at 500°C the reaction was essentially without side reactions and had a low temp. coeff. The rate of cracking was dependent on the no. of collisions of the diarylethane with the external area of the particles. The rate of cracking decreased as the electronegativity of the substituents increased. A carbonium-ion mechanism seemed to be involved in this fast reaction. About 0.1% of the collisions with the catalyst surface were effective.

11121. MERKEL, HEINRICH. **Iron catalysts for Fischer-Tropsch syntheses.** *Brennstoff-Chem.* 31, 208-12(1950).—*C.A.* 44, 8564*i*.

Fe catalysts with and without the addn. of Cu were investigated thermomagnetically after pptn. and in different stages of drying at 105°C. The pptn. was strongly ferromagnetic immediately after pptn., but the temp.-magnetization curve was irregular. After drying for many hours, the Cu-contg. Fe catalyst uniformly gave magnetization curves with a Curie point of 470-475°C. The magnetization intensity was as great as when the catalyst was first formed. Drying (and oxidation) for 29 hrs failed to change the Curie point. However, this Curie point was not maintained at synthesis temps. Heating for 3.5 hrs at 220°C caused the complete decompn. of the compd.; a magnetically equiv. amt. of Fe_3O_4 was formed. In contrast with the behavior of the Cu-Fe catalyst, a copper ferrite prepd. by a different method showed a strong increase in magnetization after heating to 800°C.

11122. Milliken, T. H. Jr.; Mills, G. A., and Oblad, A. G. **The chemical characteristics and structure of cracking catalysts.** *Discussions Faraday Soc.* 1950, No. 8, 279-90.—*C.A.* 45, 9990*b*.

The silica-alumina gel catalyst had a surface containing ions which were disposed to move to a certain extent. Certain substances were able to induce a structural shift in the component atoms or ions of the surface, creating, thereby, complexes which undergo reaction. The decompn. of the complex involved a reverse of the previous reaction. These structural shifts involved coordination changes of strategically located ions. The apparent heterogeneity of a surface was real because the ions active for adsorption were not all exactly predisposed in the same way. It was more difficult to cause coordination shifts of some of the surface ions than others.

11123. Mills, G. A. **Aging of cracking catalysts. Loss of selectivity.** *Ind. Eng. Chem.* 42, 182-7(1950).—*C.A.* 44, 3244*b*.

Petroleum-cracking catalysts may lose selectivity for the max. production of gasoline owing to the presence of min. amts. of heavy metals in active form, especially Fe, Ni, V, and Cu. These metals may be present in charge stocks and accumulate in the catalyst, poisoning either clay or synthetic type. Com. clay catalyst usually contained Fe which was made catalytically active by reaction with S compds. in the charge, thus poisoning the catalyst. The presence of steam retarded this reaction.

11124. Mills, G. A.; Boedeker, E. R., and Oblad, A. G. **Chemical characterization of catalysts. I. Poisoning of cracking catalysts by nitrogen compounds and potassium ion.** *J. Am. Chem. Soc.* 72, 1554-60(1950).—*C.A.* 44, 6611*f*.

Organic N compds., such as quinoline, were adsorbed on SiO_2-Al_2O_3 (-MgO,-ZrO_2) catalysts. At 250°-500°C the physically held quinoline could be distinguished from that chemically held. At a given temp. the amt. of physically-held N compd. increased with an increase in its partial pressure; the amt. chemisorbed decreased with an increase in temp. The cracking activity of the catalysts studied was proportional to their capacity to chemisorb quinoline at cracking temps. Catalysts which had basic N compds. chemisorbed or which had K added by base exchange were poisoned for cracking. A relatively small fraction of the total surface of silica-metal oxide cracking catalysts was responsible for catalytic activity.

11125. Miyazaki, Shozo. **The catalytic decomposition of ammonia. IV. Decomposition by means of nickel.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 71, 77-80(1950).—*C.A.* 45, 5011*d*.

The decompn. of NH_3 gas on Ni metal was studied at 700°-775°C. The NH_3 pressure was 150-350 mm Hg. The reaction was retarded by H_2 produced in the reaction. The calcd. activation energy from these initial reaction velocities was 47.2 kcal per mol.

11126. Miyazaki, Shozo. **Catalytic decomposition of ammonia gas. VI. The equation of reaction rates.** *J. Chem. Soc. Japan*, Pure Chem. Sect., 71, 372-5(1950).—*C.A.* 45, 6473*a*.

The theoretical relation between the NH_3 pressure and the reaction rates was derived by statistical mechanics. The structure of the adsorbed or activated NH_3 gas mol. was examd.

11127. Miyazaki, Shozo. **The catalytic decomposition of ammonia gas. IX. Decomposition on platinum.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 71, 549-51(1950).—*C.A.* 45, 7864*i*.

The thermal decompn. of NH_3 on Pt from 670° to 740°C was observed in the NH_3 pressure range of 3-15 mm Hg. The relations between the observed reaction rates and the reaction gas pressures were expressed theoretically. The activation energy of NH_3 and the heat of adsorption of the retarding gas were calcd. to be 28.4 kcal/mol. and 30.0 kcal/mol.

11128. Monrow, G. S. and Fischer, L. E. **Low-temperature hydrogen production.** *Ind. Eng. Chem.* 42, 92-4(1950).—*C.A.* 44, 3221*i*.

Expts. were conducted on the direct catalytic conversion of CH_4 and H_2O to H_2 and CO_2 at about 500-800°C, and at atm. and 250 p.s.i. Space velocities of CH_4 of about 120 per hr and mole ratios of H_2O:CH_4 of about 5 at atm. pressure and 32 at high pressure were used. The most effective catalysts were NiO or NiO and CuO on kieselguhr, and the optimum concns. about 7% CuO, 70% NiO, and 23% kieselguhr. This gave 55-92% conversion of CH_4. Increase of temp. increased H_2 yield and formation of CO. Increase of pressure decreased CO formation and H_2 yield, but the latter effect was nullified by increasing the H_2O:CH_4 mole ratio.

11129. Mooi, John and Selwood, Pierce W. **Catalytic decomposition of hydrogen peroxide over supported oxides of manganese.** *J. Am. Chem. Soc.* 72, 4333-4(1950).—*C.A.* 45, 2298*c*.

The mechanism of the heterogeneous catalysis of H_2O_2 over high-area γ-Al_2O_3-supported Mn oxides was studied by suspending the catalyst in H_2O contg. H_2O_2 and measuring the rate of O_2 evolution. The catalysts were prepd. by impregnating Al_2O_3 with $Mn(NO_3)_2$, drying, and igniting at 200°C. Each catalyst contained 4.60 mg of Mn. A max. activity of the catalyst was observed between 3 and 4 wt-% Mn and at an av. Mn oxidation state of 3.6.

11130. Moritani, Ichiro. **Contact cracking power of synthetic alumina-silicate catalyst for acetone. I. Composition of catalysts and the methods of preparation.** *J. Chem. Soc. Japan*, Ind. Chem. Sect. 53, 353-5(1950).—*C.A.* 46, 11505*c*.

The contact decompn. of acetone was studied at 300°C in the presence of Al_2O_3-SiO_2 catalyst prepd. by various methods. The catalyst with the compn. Al_2O_3:SiO_2 = 1:5 had the best activity.

11131. Murata, Yoshio; Matsumoto, Eiichiro, and Hoshino, Shohei. **Gasoline synthesis from carbon monoxide and hydrogen. LXXIII. Action of carbon monoxide on iron catalysts.** *J. Chem. Soc. Japan,* Ind. Chem. Sect. 53, 298-300(1950).—*C.A.* 46, 11632*e*.

The influence of the pretreatment with pure CO on the activity of Fe catalysts was studied. The longer the time of pretreatment, the smaller the gas velocity and the higher the temp. The effect of pretreatment could be enhanced by adding alc.

11132. Murata, Yoshio and Hara, Isao. **Gasoline synthesis from carbon monoxide and hydrogen. LXXIV. The influence of water vapor on iron catalysts.** *J. Chem. Soc. Japan,* Ind. Chem. Sect. 53, 338-40(1950).—*C.A.* 46, 11632*e*.

The influence of water vapor on the activity of Fe catalysts was studied under various conditions. Moisture contained in reacting component gases, however small the quantity may be, spoiled the activity of Fe catalysts in almost all cases.

11133. Naragon, E. A. **Catalytic isomerization of 1-hexene.** *Ind. Eng. Chem.* 42, 2490-3 (1950).—*C.A.* 45, 2185*g*.

The vapor phase isomerization of 1-hexene over several fixed-bed catalysts was reported. Activated alumina (low soda content), boria-alumina, phosphoric acid, acid-treated Doucil, and Universal Oil Products cracking catalyst (Type B) were the most active catalysts tested. Isomerization and hydrogenation both occurred when 1-hexene was treated over molybdena-boria-alumina at 600° to 775°F in the presence of H_2.

11134. Niclause, Michel and Duval, Xavier. **Thermal decomposition of acetaldehyde in the presence of a platinum filament at 1250°K.** *J. chim. phys.* 47, 850-65(1950).—*C.A.* 45, 9350*a*.

The decompn. of AcH at 1200-1300°K occurred only above pressures of 10 mm Hg. The reaction order was 3/2 at 100 mm Hg, and increased slightly at lower pressures. The energy of activation was 53 kcal. At higher pressures the filament acted only as a source of heat and not as a catalyst.

11135. Niclause, Michel; Duval, Xavier, and Letort, Maurice. **Thermal decomposition of acetaldehyde in the presence of a platinum filament at 1250°K.** *Compt. rend.* 231, 491-3 (1950).—*C.A.* 45, 3226*h*.

The pyrolysis of CH_3CHO took place in the gas phase in the heated zone near the filament, and was independent of any catalytic process.

11136. Nobori, Hiroso; Anzo, Hideo; Kobashi, Tokuo, and Tahira, Tsuyoshi. **Preparation of higher fatty alcohols from sperm blubber oil by catalytic hydrogenation.** *J. Chem. Soc. Japan,* Ind. Chem. Sect. 53, 74-7(1950).—*C.A.* 46, 8877*e*.

Among various hydrogenation catalysts, CuO-diatomaceous earth contg. ZnO was found to be effective. At max. pressure of 190 atm., a product of hydroxyl value 203.7 was obtained. Addn. of a small amt. of Cr_2O_3 or NiO increased the activity and durability of the catalyst.

11137. Obolentsev, R. D. and Gryazev, N. N. **Dealkylation of isopropylbenzene on an aluminosilicate catalyst.** *Doklady Akad. Nauk S.S.S.R.* 73, 121-4(1950).—*C.A.* 44, 9224*d*.

In a flow system at 350°C (space velocities 0.5-4.0 liter/liter catalyst/hr), 400°C (1.0-12.0), and 450°C (1.0-15.0), iso-PrPh formed gaseous products consisting mainly of C_3H_6 with some admixt. of C_3H_8. At 350°C, there was also some amt. of CH_4, increasing with the contact time (up to 4.4 vol. %); at 400-50°, the gas also included small amts. of H_2, C_2H_4, C_2H_6, C_4H_8, and C_4H_{10}. The rate of the dealkylation was described by: $\mathrm{In}(D/(D - x)) = at^h$, where D = max. degree of dealkylation, in %, at the given temp.; x = observed degree of dealkylation; t = contact time in sec.

11138. Ohta, Nobuto. **Solid catalyst of the proton-donating type. II. Intensity of the catalyst.** *Bull. Govt. Chem. Ind. Research Inst. Tokyo* Spec. No., 14-18(Mar., 1950).—*C.A.* 46, 7859*b*.

The intensity of the catalyst was detd. by passing *n*-BuOH or iso-BuOH at 350°C fairly rapidly over the catalyst and analyzing (in %) the isomerized butylene in the primarily produced gas. If such a content was below 37%, *n*-butylene from iso-BuOH, and if above 37%, isobutylene from *n*-BuOH gave accurate values. The intensity was weakened by adding an inert substance or carrier.

11139. Olson, R. W.; Schuler, R. W., and Smith, J. M. **Catalytic oxidation of sulfur dioxide. Effect of diffusion.** *Chem. Eng. Progress* 46, 614-24(1950).—*C.A.* 45, 937*h*.

The importance of diffusion in the catalytic oxidation of SO_2 was detd. by measuring the rate of oxidation in a flow reactor operated at various mass velocities. The catalyst consisted of Pt, coated on 1/8-in. cylindrical pellets. The mass velocity was varied from 147 to 514 lb/hr-ft^2 and the temp. from 350° to 480°C. Use of available data for the diffusion rates to the catalyst surface gave a satisfactory method of accounting for the effect of diffusion.

11140. Owen, L. W. **Removal of oxygen from commercial cylinder hydrogen by means of palladized asbestos.** *J. Soc. Chem. Ind.* (London) 69, 272-5(1950).—*C.A.* 45, 2735*c*.

The optimum temp. for the removal of O_2 from cylinder H_2 with 5% palladized asbestos was 650°C. Twelve g of catalyst in a 6-in. length removed 90% of the O_2 from 50 liters of H_2 per hr. Efficiencies of 70-75% were obtained at room temp.

11141. Parravano, Giuseppe. **Polymerization induced by catalytic decomposition of hydrazine at palladium surfaces.** *J. Am. Chem. Soc.* 72, 3856-60(1950).—*C.A.* 45, 1858*d*.

The catalyzed decompn. of N_2H_4 salt solns. at the surface of Pd black in the presence of Me methacrylate initiated polymerization of the monomer. Polymerization was proportional to the

Pd, to the N_2H_4 and monomer concns. at low values of these, becoming independent of these at higher concns. The degree of polymerization was proportional to the monomer concn. and insensitive to N_2H_4 concn. and amt. of Pd used. Chain initiation of polymerization occurred in only a very small fraction of the processes of catalyzed N_2H_4 decompn.

11142. Parravano, Giuseppe. **Polymerization induced by catalytic decomposition of formic acid at platinum surfaces.** *J. Am. Chem. Soc.* 72, 5546-9(1950).—*C. A.* 45, 5501*e*.

The initiation of the polymerization of monomer Me methacrylate by the decompn. of formic acid solns. was studied in presence of O_2, and of a Pt sol as a catalyst. No decompn. of acrylonitrile was observed, under the same conditions. The rate of polymerization of the methacrylate was proportional to (1) amt. of the Pt sol, (2) concn. of formic acid, and (3) concn. of monomer. The av. degree of polymerization increased linearly with the concn. of the monomer, decreased linearly with the formic acid concn., and was independent of the amt. of the Pt sol.

11143. Pattison, John N. and Degering, E. F. **Some factors influencing the activity of Raney nickel catalyst. I. Preparation of Raney nickel from nickel-magnesium alloy.** *J. Am. Chem. Soc.* 72, 5756(1950)—*C. A.* 45, 3530*i*.

Raney Ni showed an activity comparable to W-4 catalyst based on the rate of reduction of styrene at ambient temp. in an Adams reductor. Variation in the mesh size of the alloy and the amt. of acid used in the activation step had little effect on the activity. Decrease in Ni content from 50% to 30% decreased the activity by one-half.

11144. Perrin, Marcel. **The thermal reduction treatment of Fischer catalysts.** *J. chim. phys.* 47, 262-8(1950).—*C. A.* 44, 7638*h*.

A catalyst contg. 26.3% Ni, small amts. of Mn and Al, and using kieselguhr as a support was studied. The total loss in wt, and the amts. of water and CO_2 formed were detd. during successive reductions at 120°, 225°, 360°, and 450°C. The total loss in wt (32.50%) consisted of water 26.36, CO_2 3.24, and presumably CH_4 2.90%. All the CO_2 evolved was formed at or below 225°C.

11145. Plate, A. F. and Tarasova, G. A. **Mechanism of catalytic reactions of hydrocarbons on a vanadium catalyst. VI. Comparison of the behavior of 1-heptene and 3-heptene.** *Zhur. Obshchei Khim.* 20, 1092-1101(1950); *J. Gen. Chem. U.S.S.R.* 20, 1133-42(1950)(Engl. translation).—*C. A.* 44, 8215*d*; 46, 1854*e*.

Expts. were made in a flow system on 20 ml of a V_2O_3 catalyst on Al_2O_3 (1:10), length of column 220 mm in a tube (11 mm diam.). Under the conditions of the expts., PhMe was not hydrogenated. Dehydrocyclization of 1-heptene and 3-heptene, measured by the evolution of gas, proceeded at a const. rate at a given temp. in the range 400°-480°C. Plots of the log of the rate of evolution of gas against 1/T were straight lines, giving for the apparent activation energies of the total dehydrocyclization 39.5 and 40.0 kcal/mole, resp.

11146. Postovskaya, A. F. **The kinetics of the hydrogenation of ethylene over platinized silica gel.** *Zhur. Fiz. Khim.* 24, 1083-9 (1950).—*C. A.* 45, 1414*a*.

The kinetics over various structures of platinized silica gels were studied at 100°C and a surface concn. of Pt of 0.1%. The rate of the reaction was proportional to the concn. of H_2, and not relative to the C_2H_4 concn. as long as that concn. was above 3%, nor to the C_2H_6 concn. The energy of activation of the reaction in the range 44°-138°C was 4300 ± 300 cal/mol. Varying the Pt concn. in the range 0.1-0.01% and the silica gel structure did not change the energy of activation.

11147. Pshezhetskiĭ, S. Ya. and Vlodavets, M. L. **Kinetics of the oxidation of hydrogen at a silver catalyst.** *Zhur. Fiz. Khim.* 24, 353-65 (1950).—*C. A.* 44, 6712*f*.

Mixts. of H_2 and O_2 were passed through a silica gel (particle size 2-3 mm) charged with 1.1% Ag (from $AgNO_3$). The degree a of transformation was detd. by measuring the air current behind the catalyst and the amt. of O_2 in it. The following equation was valid: $a - \ln(1 - a) = 3kSX/v$, SX was the vol. of voids in the catalyst (about 5 ml) and v the rate of gas flow (ml/sec). The const. k was independent of v (0.5-1.8) and increased with temp. of 0.0032 at 98° to 0.02 and 0.08 at 145° and 192°C, resp.; hence, the energy of activation was 11,700 cal. No poisoning by H_2O appeared in the present expts. because of high temp.

11148. Rabó, Gyula. **Aromatization of petroleum distillates with tungstic acid catalyst.** *Magyar Kem. Folyóirat* 56, 31-6(1950).—*C. A.* 45, 3584*f*.

Catalysts (A contg. 0.001, B contg. 0.01, and C contg. 0.05 atom W for each Al atom of the carrier, Alcoa F. 10) were used at 550°, 565°, and 580°C; the activity was very low below 550°C. Yields diminished quickly above 580°C; rapid coke formation seemed to inhibit activity considerably. In the case of catalyst C the increase of output of aromatic products was 11% at 550-65°C and 5% at 565-80°C at a contact interval of 58 sec. Further increase of W concn. caused only slight increases of output.

11149. Rienacker, Gunther; Birckenstaedt, Margarete, and Burmann, R. **The effect of additives on oxide catalysts. II. Catalytic oxidation of carbon monoxide and hydrogen on thoria-ceria mixtures.** *Z. anorg. Chem.* 262, 81-94(1950).—*C. A.* 44, 10473*g*.

H_2 or CO, mixed with excess air, was passed over $ThO_2.CeO_2$, made by calcining oxalate mixts. As a function of oxide compn., the activation energy for CO oxidation showed a pronounced min. (11 kcal) at 1.0% CeO_2, a max. (22.8) at 5%, then remained nearly const. at 16-17 over the range 10-100%; for H_2 oxidation, the values were 24 kcal for 0% CeO_2, a very sharp min. (2 kcal) at 1.0%, a max. (15) at 3%, another min. (2.6) at 5%, and values of 7.1-7.8 over the range 10-100%.

Pure H_2 reduced CeO_2 (pure or mixed with ThO_2) at 300°C, in contradiction to published data.

11150. Rigamonti, Rolando and Spaccamela, Elena. **Catalytic oxidation of alkaline chromites to chromates with oxygen at low temperature.** *Atti accad. sci. Torino, Classe sci. fis. mat. e nat.* 85, 364-79(1950-51).—*C. A.* 46, 4411*b*.

The oxidation, with gaseous O_2 of $Cr(OH)_3$ in alk. media, represented by $Cr(OH)_3 + 3NaOH \rightleftarrows Cr(ONa)_3 + 3H_2O$, and $2Cr(ONa)_3 + H_2O + 1.5\ O_2 \rightarrow 2Na_2CrO_4 + 2NaOH$, was studied with several metallic hydroxides present as catalysts. The behavior as catalysts of Mn, Fe, Ag, Cu, Co, and Ni hydroxides with respect to the method of pptn. either separately or in binary mixt. was investigated.

11151. Rodier, Georges Mme. and Rodier, Georges. **Study of diamagnetic catalysts through deposits of paramagnetic oxides.** *Compt. rend.* 230, 93-5(1950).—*C. A.* 44, 4764*e*.

Two samples of Al_2O_3 differing in catalytic activity were exposed for 15 hrs to solns. of $Mn(NO_3)_2$ that varied in compn. from 0.5 to about 4 *M*. The samples were then dried, powd., and heated at 200°C. The magnetic susceptibility of the resulting powders was much higher when the adsorber was the more active catalyst. Graphs of the specific susceptibility of the manganese oxide deposited on the Al_2O_3 vs. the % of Mn in the sample showed min. at 8% and at 19% Mn for the less and more active catalysts, resp.

11152. Rubinshteĭn, A. M. and Kulikov, S. G. **Selective action in the catalysis of ethyl alcohol and its relation with the phase transition of titanium dioxide.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* 1950, 84-97. —*C. A.* 44, 7632*g*.

Dehydrogenation and dehydration of EtOH were investigated in flow expts. at 360°, 380°, and 400°C (0.3 ml liquid EtOH/min.) with 12 different prepns. of the TiO_2 catalyst (2.5 g each): $TiCl_4$ hydrolyzed with NH_4OH, fine fraction, $TiCl_3$ (15% aq. soln.) hydrolyzed with NH_4OH, fine fraction, $Ti(OMe)_4$ hydrolyzed with humid air, $Ti(OEt)_4$, in the same way, $Ti(isoPr)_4$, in the same way, $TiCl_3$, in the same way, coarse fraction, $Ti(OBu)_4$, in the same way, $TiCl_4$, with NH_4OH, coarse fraction, Na_2TiO_3, with boiling H_2O, $Ti(OMe)_4$, hydrolyzed by humid air in mixt. with NaCl, $Ti(OMe)_4$, pure ester, isolated by extn., hydrolyzed in humid air, first catalyst heated 20 hrs at 900°C. All catalysts were dried at 110-20°C and heated in an air stream 3 hrs at 300°C.

11153. Russell, W. Walker and Miller, Glenn H. **Catalytic hydrogenation of carbon dioxide to higher hydrocarbons.** *J. Am. Chem. Soc.* 72, 2446-54(1950).—*C. A.* 44, 8616*b*.

Several types of Cu-activated, Co catalysts for the synthesis of higher hydrocarbons from CO_2 and H_2 were studied at atm. pressure and from 175° to 300°C. Catalysts contg. no alkali produced no liquid hydrocarbons or only traces, but did yield small amts. of liquid hydrocarbons after a suitable poisoning. Alkalizing with K_2CO_3 or K_3PO_4 was necessary in order to produce catalysts active for liquid hydrocarbon synthesis. Small addns. of Ce oxides to the alkalized catalysts were very effective in increasing synthesis life and catalyst stability. Raising synthesis temp. some 25° to 100°C for several hrs produced a selective poisoning of catalyst hydrogenation centers. The apparent activation energy for the over-all synthesis was 23.1 kcal.

11154. Saito, Hirotaro. **Catalytic oxidation reaction of ethanol vapor with various metal oxides as catalysts. I. Copper oxide catalyst.** *J. Chem. Soc. Japan*, Pure Chem. Sect., 71, 133-5 (1950).—*C. A.* 45, 4541*e*.

Two kinds of Cu oxide catalysts were prepd. by adding KOH to $Cu(NO_3)_2$ soln. and drying the ppt. at 120°C and by decompg. the $Cu_2(NO_3)_2$ crystal adhering to the surface of silica grains at 310°C. The catalytic oxidation of EtOH vapor was investigated at 181°-360°C from the measurements of both the vol. O_2 consumed and the yield of AcH and AcOH.

11155. Saito, Hirotaro. **Catalytic oxidation reaction of ethanol vapor with various metal oxides as catalysts. II. Comparison of the activities of various metal oxide catalysts.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 71, 257-8(1950).—*C. A.* 45, 4541*f*.

The activities of the oxides of Mn, Fe, Co, Ni, V, Ag, Mo, and Al for the catalytic oxidation of EtOH vapor were studied by measuring the O_2 consumed. The reactions were classified into the following 3 groups according to the kinds of the catalysts used: (1) violent reaction by direct oxidation of EtOH in the case of Mn, Co, Ni, V, and Fe oxides, (2) comparatively rapid reaction via dehydrogenation of EtOH in the case of Ag, Cu, and Cd oxides, and (3) slow reaction via dehydration of EtOH in the case of Al and Mo oxides.

11156. Sakikawa, Noriyuki. **Organic geochemical reactions. IV. The reciprocal reactions between humic acid and rocks, soils, and mineral waters.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 71, 356-8(1950).—*C. A.* 45, 5082*d*.

The mechanism of fireclay formation in contact with coal seams by the corrosive action of humic acid on rocks was discussed. The origin of dispersed carbonaceous matter or graphite in shales, black soils, and other soils or rocks were supposed to be the same.

11157. Sarge, T. W. **Apparatus for turbidimetric study of polymerization activators.** *Anal. Chem.* 22, 1435-8(1950).—*C. A.* 45, 1824*d*.

The app. was used to study the effect of catalyst concn., effect of inhibitors, or influence of comonomers on polymerization rate. The over-all polymerization rate was related to the turbidimetric data as follows: rate of polymerization (observed) $= k \times 1/P_1 \times dI/dt(T_1$, catalyst) where dI/dt was the change of intensity of light transmission which was proportional to the rate of polymerization at the interval under examn.

11158. Sasaki, Kazuo. **Oxidizing catalyst of ammonia. VII. Relation between the ammonia concentration and the catalytic activity. VIII. Relation between abnormally high tem-**

perature and the catalytic activity of cobalt oxide. IX. Industrial test of the cobalt catalyst and the appraisal of the operation from an economic viewpoint. *Repts. Govt. Chem. Ind. Research Inst. Tokyo* 45, 172-7, 178-80, 181-90(1950).—*C.A.* 46, 2246*g*.

The activity of the best catalyst, Co_3O_4, for the reaction $4NH_3 + 5O_2 = 4NO + 6H_2O$ was max. (oxidation 93%) with 11% NH_3 in air and decreased with higher concn. of NH_3. The spent catalyst contained CoO. Co_3O_4 lost no catalytic action when the reaction temp. was kept below 830°C. Above 980°C, it sintered and changed to CoO, thus losing its activity. On a semi-industrial scale 9.57-10.27% NH_3 in air passed through a layer of granular Co_3O_4 in a converter at 680°-750°C was oxidized 92-4%.

11159. Schmid, Gerhard and Keller, Norwin. **Cobalt oxide as catalyst for decomposition of nitrous oxide.** *Naturwissenschaften* 37, 42-3 (1950).—*C.A.* 44, 8214*c*.

Catalysts were prepd. by mixing the powder with 50% MeOH, pressing through a 1-mm screen, drying, and heating to 600° to 900°C. With the catalyst in a 25-mm quartz glass tube, 8 cm high, N_2O (99.0% N_2O, 0.86% N_2, 0.1% O_2, 0.04% H_2O) was passed over at a 30 ml per min. rate. With CoO the gas formed at 265°C and contained 50% permanent gases; with CuO 370°C was required. Other oxides tested such as MgO, CeO_2, CaO, BeO, Al_2O_3, ZnO, Fe_2O_3 required 510° to 740°C for 50% decompn. of N_2O.

11160. Schwab, Georg Maria. **Alloy catalysts in dehydrogenation.** *Discussions Faraday Soc.* 1950, No. 8, 166-71.—*C.A.* 45, 9987*h*.

In homogeneous Hume-Rothery alloys, the activation energy, *E*, of the formic acid dehydrogenation increased in proportion to the square of the increase of the electron concn. caused by the multivalent solute metal. In general, *E* and electric resistance ran parallel. The catalytic activation involved an entrance of substrate electrons into empty levels of the first Brillouin zone of the metal. The frequency factors of the dehydrogenation on different catalysts increased logarithmically with increasing *E*.

11161. Selwood, Pierce W. and Schroyer, F. K. **Proton relaxation and catalyst accessibility.** *Discussions Faraday Soc.* 1950, No. 8, 337-44. —*C.A.* 45, 9991*c*.

The accessibility of a solid catalyst was the ratio of activity shown by a fixed wt to that of the same wt of catalyst in true soln. in the reacting medium. The proton relaxation time in H_2O was detd. for supported iron oxide on alumina and then the catalytic accessibility, *a*, found by relating the measured relaxation time to that observed in aq. solns. of $Fe_2(SO_4)_3$. The nuclear induction expt. gave the same kind of information as obtained from magnetic-susceptibility measurements on the same systems, but the effects were related to the surface ions rather than to the whole mass of paramagnetic ions.

11162. Shalya, V. V.; Piontkovskaya, M. A., and Polyakov, M. V. **Mechanism of the "mild" catalysis.** *Doklady Akad. Nauk S.S.S.R.* 74, 1113-15(1950).—*C.A.* 45, 1855*h*.

Oxidation of $C_3H_8 + C_4H_{10}$ with the vol. ratio gas to O_2 = 1 to 1, in a static system, was followed by detns. of the intermediate peroxides and aldehydes produced by incomplete oxidation. The temp. rise produced in the center of the reaction bulb was also measured with the capillary carrying the thermocouple coated on the outside with NaCl to ensure a catalytically inactive surface. Both methods gave, in all cases, practically coinciding curves of the rate of pressure increase against time, characterized by an initially slow rise of the rate of the incomplete oxidation, passage through a max., and subsequent fall. If all of the glass wall was coated with Pt, no intermediate peroxides and no temp. rise in the center of the bulb was observed with an initial pressure of 200 mm and an initial temp. of 300°C. Coating of the wall with V_2O_5 had the same effect as coating with Pt.

11163. Shima, Goro and Uchida, Hiroshi. **Catalysts for synthesis of ammonia. II. Examination of the catalysts in current use and a procedure of preparing a good catalyst.** *Repts. Govt. Chem. Ind. Research Inst. Tokyo* 45, 369-77(1950)(English summary).—*C.A.* 46, 2245*f*.

The catalytic activity of 4 Japanese and 2 German com. Fe_2O_3-Al_2O_3 catalysts in synthesizing NH_3 from N_2 and H_2 (1:3) at 350-550°C/50 kg/cm^2 and at 700°C/atm. was lowered by impurities and imperfect diffusion of the promoters. A catalyst prepd. from powd. Fe_2O_3 and Al_2O_3 by thoroughly mixing, sintering into porous rods in a stream of H_2, and after adding aq. KNO_3, burning in O_2 was highly catalytic and thermostable.

11164. Sittig, Marshall. **Catalytic cracking. IV.** *Petroleum Refiner* 29, No. 11, 125-32 (1950).—*C.A.* 45, 1755*i*.

The following subjects were reviewed: (1) suspensoid cracking, (2) hydroforming, (3) fixed-bed *vs.* moving-bed processes, (4) effect of process variables on conversion, (5) product distribution and quality, (6) catalytically cracked gasolines, (7) compn., properties, and manuf. of natural and synthetic cracking catalysts, and (8) lab. work on catalytic cracking.

11165. Sliepcevich, C. M. and Brown, G. G. **Catalytic reactions at high pressures and temperatures.** *Chem. Eng. Progress* 46, 556-62 (1950).—*C.A.* 45, 394*h*.

Continuous operation at 1200°F and 10,000 p.s.i. confirmed the applicability of this equipment for studying chem. reactions. The decompn. of 1-butanol over an alumina-silicate catalyst was investigated at 760°F, at pressures of 1 atm., 750, 2500, and 9000 p.s.i., and a feed rate of 0.2 to 1.5 lb moles of feed/(hr)(lb of catalyst). The decompn. of 1-butanol first increased with increasing pressures and thereafter decreased with increasing pressures. The results indicated that the major decompn. reaction was the direct dehydration of 1-butanol to mixed butenes and water.

11166. Smith, Hilton A. and Fuzek, John F. **The influence of certain additives on the rate of catalytic hydrogenation of terpenes on nickel.** *J. Am. Chem. Soc.* 72, 3454-8(1950).—*C.A.* 45, 1857*f*.

The effect of the following compds. on the rate of hydrogenation on Raney Ni catalyst of *d*-limonene, α-pinene, β-pinene, terpinolene, camphene, and dipentene was investigated: butyl, heptyl, and ceryl alcs. and 1-tetradecanol and 1-octadecanol; palmitic acid, phenyl-ethylacetic acid, normal carboxylic acids in the 1 to 26 C-atom range; ω-phenyl-substituted and ω-cyclohexyl-substituted carboxylic acids in the 7-13 C-atom range. The Ni was an active catalyst for hydrogenation under conditions such that the metallic surface was covered with a unimol. layer of adsorbed material that took no apparent part in the reaction.

11167. Sokol'skii, D. V. and Druz, V. A. **Potentiometric method of investigation of catalytic hydrogenation reactions.** *Doklady Akad. Nauk S.S.S.R.* 73, 949-52(1950).—*C.A.* 44, 10467*c*.

Liquid-phase hydrogenation in an electrolyte soln. on a metallic catalyst was followed by measurements of e.m.f., *E*, between the catalyst-electrolyte electrode and a 0.1 *N* calomel half-cell. In the hydrogenation of $Me_2(CH:C)COH$ at room temp. on a H_2-satd. Raney Ni catalyst, in 0.1 *N* NaOH, the initial *E* = 1080 mv. fell, in the very beginning of the reaction, to 960 mv., and remained const. until the triple bond was completely satd. With beginning hydrogenation of the double bond, *E* rose by 20 mv. and remained const. as long as a double bond was left in the reaction mixt.; at the final stages of the satn. of the double bond, *E* rose slowly until, at the end of the hydrogenation, it reached the equil. value of 1080 mv.

11168. Tamaru, Kenzi. **Selective catalysis. The catalytic reaction between acetylene and hydrogen.** *Bull. Chem. Soc. Japan* 23, 64-6 (1950).—*C.A.* 45, 2298*e*.

The hydrogenation of C_2H_2 on a $Pd\text{-}Al_2O_3$ catalyst was studied in a static system from 30° to 74°C. Reaction occurred in two steps: (1) production of ethylene and acetylene polymers, and (2) hydrogenation of ethylene. Setp (2) did not occur until all acetylene was consumed; this was attributed to difference in adsorbability of C_2H_2 and C_2H_4. Step (2) was first order with activation *E* of 9 kcal.

11169. Tamaru, Kenzi. **The retardation of catalysis. The catalytic reaction between acetylene and hydrogen.** *Bull. Chem. Soc. Japan* 23, 180-4(1950)(in English).—*C.A.* 46, 2384*h*.

Hydrogenation of C_2H_2 on a $Pd\text{-}Al_2O_3$ (1:100) catalyst was retarded by the deposition of polymers formed during reaction and by poisons such as $Pb(OAc)_2$ and $HgCl_2$. Washing the catalyst with $Pb(OAc)_2$ solns. retarded ethane formation much more than ethylene formation. Solns. of $HgCl_2$ poisoned the catalyst approx. equally for both reactions.

11170. Tamaru, Kenzi. **Dispersity of catalyst and catalytic activity. Catalytic hydrogenation of acetylene on the palladium-kieselguhr catalyst.** *Bull. Chem. Soc. Japan* 23, 184-6 (1950)(in English).—*C.A.* 46, 2384*f*.

Catalysts having ratios of Pd/kieselguhr of 1:50 to 1:750 were prepd. by addn. of $PdCl_2$ solns. to the kieselguhr and reduction to metal with HCHO. Reactions were carried on in a static system at 30° and 74°C. The reaction-rate const. for the formation of ethylene decreased linearly with increase in Pd content. The reaction-rate const. for the formation of ethane exhibited a max. at a ratio of 1:100.

11171. Tarama, Kimio and Kubota, Toshiaki. **Catalytic action of aluminum chloride.** *Bull. Inst. Chem. Research, Kyoto Univ.* 20, 59 (1950).—*C.A.* 47, 3493*c*.

The conductivities of the catalyst layers in isomerization, decompn., and alkylation of heptane catalyzed by $AlCl_3$ were measured. They did not change under anhyd. condition, but changed remarkably with an increase of water content of $AlCl_3$. The greatest change took place when the mol. ratio of $H_2O/AlCl_3$ was 0.015, where $AlCl_3$ was most active for isomerization.

11172. Teǐs, R. V. **Isotopic composition of the oxygen of carbonates and its temperature dependence.** *Doklady Akad. Nauk S.S.S.R.* 72, 73-6(1950).—*C.A.* 45, 2275*e*.

H_2CO_3 liberated by HCl from a mineral (calcite, dolomite, limestone) was changed to water over a Ni catalyst with H_2 (Zn + HCl). The water was frozen out with a mixt. of solid CO_2 and acetone and, after purification customary in isotopic analysis, its d. was detd. by the method of detn. of flotation temp. of a quartz float in relation to standard water. Data were given of isotopic compn. of O_2 of carbonates with temps. of formation not over 25°, 180-300°, and over 300°C.

11173. Temkin, M. I. **Kinetics of ammonia synthesis under high pressures.** *Zhur. Fiz. Khim.* 24, 1312-25(1950).—*C.A.* 45, 3699*d*.

Departure from gas ideality was taken into account, but not the possible effect of diffusion. The rate consts. at 100 and 300 atm. (475°C) were then equal, resp., to 0.91 and 0.75 times the value at 1 atm. Diffusion may be neglected at 300 atm. and the rate const. changed by a factor less than 2 for pressures in the ratio 300:1. A simplified expression for the rate was also given with the purpose of simplifying calcns.

11174. Temkin, M. I.; Kiperman, S. L., and Luk'yanova, L. I. **Flow-circulation method of investigation of the kinetics of heterogeneous catalytic reactions.** *Doklady Akad. Nauk S.S.S.R.* 74, 763-6(1950).—*C.A.* 45, 1854*f*.

The reacting gas was admitted to the catalyst zone at a const. velocity *v*, circulated through the reaction zone, and led out at exactly the velocity *v*. The method was applied to the synthesis of NH_3 from a stoichiometric N_2 + 3 H_2 gas mixt. on 1 ml of a synthetic-ammonia catalyst at 451°C, with rates of circulation of 360-500 liters gas/hr, and *v* varied between about 9 and 110 liters gas (STP)/hr.

11175. Ternisien, J. **Catalytic oxidation and combustion without flame.** *Tech. moderne* 42, 291-3(1950).—*C.A.* 46, 330*f*.

Highly refractory combustion catalysts, suitable for use as wall material for combustion chambers in rocket or jet engines, was made by ignition of appropriate ZrO_2-base refractories that had been soaked in solns. contg. salts of Ni and Pt.

11176. Thomas, Charles L.; Hickey, John, and Stecker, Glen. **Chemistry of clay cracking catalysts.** *Ind. Eng. Chem.* 42, 866-71(1950).—*C.A.* 44, 7050*h*.

Raw montmorillonite clays had some petroleum-cracking catalytic activity. Cold acid treatment removed Ca, Na, K, and part of the Mg from the clays without increasing the catalytic activity. Regulated hot-acid treatment removed Al from the central layer of the montmorillonite crystals, and as the Al was progressively removed, the catalytic activity increased to a max. and then decreased. The remaining Al atom was left in tetrahedral coordination and the change from octahedral to tetrahedral coordination left the crystal lattice with a neg. change which was balanced by a H ion. Catalysts with greater acidity were more active.

11177. Thomas, E. Jackson. **Fluid catalytic cracking of high-sulfur stocks with natural catalysts.** *Oil Gas J.* 48, No. 46, 221, 224, 228(1950).—*C.A.* 44, 6611*e*.

Ordinary natural catalyst deteriorated rapidly when used for stocks contg. about 2.0% S. Steam added to the regenerated catalyst sandpipe lessened this effect, but operating difficulties prevented adding enough steam. A S-resistant natural catalyst, low in Fe, was used, and made a satisfactory product at a makeup rate comparable with those of available synthetic catalysts.

11178. Thornton, D. P. Jr. **Atomic energy applied to measurement of catalyst level in cracking units.** *Petroleum Processing* 5, 941-5(1950).—*C.A.* 45, 338*e*.

The catalyst level in a Houdriflow catalytic cracking unit was recorded and controlled by variations in the intensity of γ-rays emitted by fixed $RaCl_2$ sources located in the catalyst surge tank. The γ-rays were recorded by means of a fixed Geiger counter having a Cu cathode and a W anode and filled with chemically pure H_2. The useful life of this tube under variations to 1100°F was much longer than the conventional tube. The impulses from the Geiger counter were amplified and fed into the recorder-controller unit, a modified com. pyrometer.

11179. Topchieva, K. V. and Panchenkov, G. M. **Cracking of cumene on aluminosilicate catalysts of different compositions.** *Doklady Akad. Nauk S.S.S.R.* 74, 1109-12(1950).—*C.A.* 45, 1858*g*.

In a flow system at 400°C with space velocities varying from 0.5 to 2.0 liter/liter catalyst/hr the rate of cracking of iso-PrPh (to C_6H_6 as final product) was given by: $k = n[-\ln(1 - x) - x]$, where n = moles fed per hr, x = fraction converted. The plots of nx against $-n \ln(1 - x)$, were linear and showed the same slope for different compns. of the $Al_2O_3 + SiO_2$ mixt. used as catalyst, and the intercept gave k. The surface area of the various mixed catalysts was approx. 375 m^2/g, = 15%, whereas for the pure SiO_2 it was 550, and for the pure Al_2O_3, 255 m^2/g.

11180. Trambouze, Yves. **Chemical changes in Fischer catalysts during their preparation.** *J. chim. phys.* 47, 258-60, discussion, 260-1 (1950).—*C.A.* 44, 7638*g*.

Ni, Al, Mn, kieselguhr catalysts were prepd. The prepn. and the % Ni removed by ammoniacal treatment, extn. with HNO_3, and extn. with HCl, resp., were: pptn. at low temp., 100, —, —; boiling of the ppt. 63, 37, —; desorption under vacuum at 150°C to const. wt, 63, 37, —; heating for 2 hrs at 220°C in N_2, 59, 13, 28; heating at 320°C to const. wt in N_2, 18, 46, 36; heating at 450°C to const. wt in N_2, 16, 40, 44; heating for 48 hrs at 220°C in N_2, 33, 59, 8; heating at 450°C after the preceding treatment 20.5, 59.5, 20. X-ray diffraction results were summarized.

11181. Trambouze, Yves and Perrin, Marcel. **Effect of the chemical composition of Fischer catalysts and their constituents on the synthesis activity.** *J. chim. phys.* 47, 474-82 (1950).—*C.A.* 44, 9783e.

A Ni-Al_2O_3-kieselguhr catalyst was shown to contain Ni aluminate and Ni silicate after being heat-treated to 450°C. The aluminate was active in synthesizing higher hydrocarbons; the silicate formed CH_4 primarily. The distance between the Ni atoms accounted for the specificity of their catalytic properties.

11182. Troesch, André. **The dissociation of methane in the presence of a nickel catalyst.** *J. chim. phys.* 47, 274-83, discussion, 283-5 (1950).—*C.A.* 44, 7637*c*.

Studies made in the absence and presence of a Ni catalyst indicated that no reaction took place between CH_4 and Ni at 112°-287°C. No intermediate carbide was necessary to explain the decompn.

11183. Tsyskovskiĭ, V. K. **The influence of the cation that is part of quasi-heterogeneous catalysts upon the oxidation of kerosine.** *Zhur. Priklad. Khim.* 23, 754-8; *J. Applied Chem. U.S.S.R.* 23, 797-801(1950)(Engl. translation).—*C.A.* 46, 4207*c*.

The catalytic oxidation of kerosine to produce internal esters of hydroxycarboxylic acids as the desired by-product was carried out in the presence of naphthenates of Mn, Fe, Co, Cu, Ba, and Pb as catalysts. The naphthenates were obtained from pure naphthenic acids of 218.4 acid no. and dissolved in the kerosine. Manganese naphthenate and Pb naphthenate gave the best results.

11184. Tsyskovskiĭ, V. K. and Kiseleva, N. A. **Mechanism of the action of colloidal quasi-heterogeneous catalyst in the process of liquid-phase oxidation of kerosine fractions.** *Zhur. Priklad. Khim.* (J. Applied Chem.) 23, 1001-6(1950).—*C.A.* 46, 4777*g*.

A colloidal Mn naphthenate catalyst in kerosine was prepd. by exchange of $MnSO_4$ with an equiv. amt. of Na salts of a redistd. naphthenic-acid fraction of acidity 231.3 mg/KOH/g, free from hydrocarbons and mineral impurities. A const. stream of air was passed through 250g of the substrate with 0.16, 0.12, 0.08, and 0.04% catalyst, and the change of color was recorded with a photoelec. cell. The max. of absorption of light was shown to correspond to a transition of the catalyst from the colloidal to the cryst. state.

11185. Twigg, G. H. **The mechanism of the catalytic hydrogenation of ethylene.** *Discussions Faraday Soc.* **1950**, No. 8, 152-9.—*C. A.* 45, 9987*d*.

Ethylene was hydrogenated on Ni at -78°C with: (*a*) a mixt. of $H_2 + D_2$, and (*b*) the equil. mixt. of $H_2 + HD + D_2$. Infrared spectra of the ethanes showed that the mixts. from (*a*) and (*b*) were identical and different from an equimol. mixt. of C_2H_6 and $C_2H_4D_2$. In the mechanism H_2 was not adsorbed directly on the catalyst, but through reaction with chemisorbed C_2H_4 to form an adsorbed ethyl radical, an adsorbed H atom resulted.

11186. Uchida, Hiroshi. **Catalysts for synthesis of ammonia. I. Change of the catalytic activity of mixed powder of ferric oxide and alumina with the progress of its sintering.** *Repts. Govt. Chem. Ind. Research Inst. Tokyo* 45, 355-68(1950)(English summary).—*C. A.* 46, 2245*f*.

A mixt. of powd. Fe_2O_3 and Al_2O_3 upon sintering showed microscopically at 1200°C nearly complete mutual diffusion and formed at 1400° a solid soln. It was sufficiently catalytic for synthesizing NH_3 from N_2 and H_2. Above 1400°C a solid soln. was formed both catalytic and thermostable.

11187. Uchida, Hiroshi and Sato, Toshio. **Catalysts for synthesis of ammonia. V. Adsorption of hydrogen by the catalysts in current use and that of carbon dioxide and hydrogen by the catalysts containing alumina, potassium, and calcium oxides.** *Repts. Govt. Chem. Ind. Research Inst. Tokyo* 45, 103-13(1950).—*C. A.* 46, 2245*i*.

In 4 com. catalysts and 4 others contg. Al_2O_3, K_2O, and CaO, the activity was higher with more H_2 adsorption at lower temp. (the max. H_2 isobars above 0°C tended to shift toward lower temp.). The CaO increased the B.E.T. surface area. The activity thus heightened was counteracted when the area became coated by K_2O.

11188. Uchida, Hiroshi and Ogawa, Kiyoshi. **Catalysts for synthesis of ammonia. VI. Relation between the conversion efficiency and the promoter.** *Repts. Govt. Chem. Ind. Research Inst. Tokyo* 45, 114-24(1950).—*C. A.* 46, 2246*e*.

The conversion efficiency (NH_3 formed from N_2 and H_2 at 300-550°C under 50-200 kg/cm^2 passed at the space velocity 5000 and 10,000) was lowered under higher pressure in 1 of 3 com. catalysts tested. In 7 catalysts contg. promoters the efficiency was not much affected by increasing pressure when K_2O seemed to accumulate on the surface, but was lowered under higher pressure when K_2O was absent or prevented from accumulating.

11189. Uchida, Hiroshi and Todo, Naoyuki. **Catalysts for synthesis of ammonia. VIII. Resistance of the catalysts containing various promoters to carbon monoxide poisoning.** *Repts. Govt. chem. Ind. Research Inst. Tokyo* 45, 213-24(1950).—*C. A.* 46, 2246*g*.

At 350°-450°C under 100 kg/cm^2, the mixts. of Fe_2O_3 with $5Al_2O_3$, $4Al_2O_3 + 1CaO$, and $2Al_2O_3 + 2SiO + 1\%\ K_2O$ showed less lowering of the activity when exposed to CO than the mixts. of Fe_2O_3 with $5Al_2O_3 + 1K_2O, 4Al_2O_3 + 1CaO + 1K_2O$, $4Al_2O_3 + 1MgO + 1K_2O$, and $4Al_2O_3 + 1SiO_2 + 1\%\ K_2O$.

11190. Uzumasa, Yasumitsu and Okura, Takeshi. **Catalytic action of adsorbed ions. I. The catalytic behavior of the adsorbed ions on some oxidation-reduction reactions.** *J. Chem. Soc. Japan, Pure Chem. Sect.*, 71, 48-52(1950).—*C. A.* 45, 4540*d*.

Reactions studied were: (1) effect of Cu^{++} adsorbed in filter paper or silica gel on the reaction $2Fe^{3+} + 2S_2O_3{}^{2+} = 2Fe^{2+} + S_4O_6{}^{2+}$, (2) I_2 adsorbed in filter paper or starch on the oxidation of $S_2O_3{}^{--}$ by H_2O_2 soln. at 60°C. The adsorbed ion shows its catalytic activity only after being set free into the homogeneous reacting system.

11191. Uzumasa, Yasumitsu and Okura, Takeshi. **Catalytic action of adsorbed ions. II. The catalytic behavior of the adsorbed ions on the reaction between sodium azide and iodine and on the oxidation of sulfite ion by air.** *J. Chem. Soc. Japan, Pure Chem. Sect.* 71, 112-14(1950).—*C. A.* 45, 4540*e*.

The catalytic behavior of the minute quantity of adsorbed ion in various reactions was studied: (1) thiosulfate ion adsorbed in pptd. $CaCO_3$ on the reaction $2NaN_3 + I_2 + 3N_2 + 2NaI$, (2) Cu^{++} adsorbed in filter paper on the oxidation of sulfite by air bubbles, (3) vanadate adsorbed in filter paper or silica gel on the color reaction of $KBrO_3$ with HCl soln. of *p*-phenetidine. The adsorbed ion showed its catalytic activity after being liberated from the adsorbent into the homogeneous reaction system.

11192. Vaĭnshteĭn, F. M. and Turovskiĭ, G. Ya. **Isotopic study of the mechanism of oxidation of carbon monoxide on manganese dioxide.** *Doklady Akad. Nauk S.S.S.R.* 72, 297-9(1950).—*C. A.* 44, 7129*c*.

With 2 types of MnO_2 contg. $MnO_2{}^{18}$, no O^{18}-O^{16} exchange was observed in a stream of air, but there was some exchange in the catalytic oxidation of CO at 90-97°C. The observed exchange was due solely to some H_2O retained by the catalyst. The reaction involved not merely a small fraction of the surface of the MnO_2, but its main mass, and failure to detect isotopic exchange was not simply due to the smallness of the amts. involved.

11193. Valentin, F. H. H. **Equilibrium and thermodynamic relation in the vapor-phase catalytic dehydration of ethyl alcohol to ethyl ether.** *J. Chem. Soc.* **1950**, 498-500.—*C. A.* 44, 7133*d*.

Equil. consts. were detd. for the dehydration of EtOH in the range 392° to 509°K in a steel autoclave at about 3 atm. pressure. An alum catalyst and a new catalyst consisting of H_2SO_4 promoted by $CuSO_4$ and supported on a silica gel carrier were used. Thermodynamic functions for both the reaction and ether were derived.

11194. VARGA, JÓZSEF AND FREUND, MIHÁLY. **Catalytic dehydrogenation of butane.** *Magyar Kém. Folyóirat* 56, 21-4(1950).—*C.A.* 45, 1332*b*.

An exptl. tube furnace was constructed from Cr steel with inner vol. of 1000 ml; a spiral Cu tube served as the preheater. Both tubes were located vertically and heated by an elec. current to 525-75°C (pre-heater), 560-80°C (furnace). Butane 83.9, isobutane 15.6, and propane 0.5 vol. % was introduced at the lower end of the vertical system. Various amts. of a catalyst were used, with Cr_2O_3 as the active substance and γ-Al_2O_3 as the carrier. A medium amt. of catalyst gave the best results; the dehydrogenated gas after 45 min. treatment contained butylene and propylene 23.0, ethylene 0.8 vol. %.

11195. VILAND, C. K. **Selection of cracking catalysts with aid of laboratory aging.** *Petroleum Processing* 5, 830-4(1950).—*C.A.* 45, 339*b*.

Data were given for the design and operation of a lab. app. for studying the change in the activity of cracking catalysts with continued use.

11196. VISSER, G. H. **Chromium oxide-aluminum oxide-base aromatization.** *Bull. assoc. franc. tech. petrole* No. 80, 3-15(1950).—*C.A.* 44, 7636*a*.

In a catalyst consisting of 70% Cr_2O_3 and 30% Al_2O_3, which was the most active one used in the aromatization of n-heptane, the mixed crystals formed were slightly lower in Cr, namely about 65:35. Possibly Al_2O_3 slowed down crystn. into the hexagonal form, so that Cr_2O_3 may be present in the active γ-cubic form as mixed crystals with γ-Al_2O_3. In ternary Cr_2O_3-Al_2O_3-K_2O catalysts, max. improvement in activity was observed with 12 atoms of K per 100 atoms of Cr, regardless of the Cr_2O_3:Al_2O_3 ratio.

11197. VOLKENSHTEĬN, F. F. **Effect of small quantities of impurities on the catalytic activity of ionic catalysts.** *Zhur. Fiz. Khim.* 24, 1068-82(1950).—*C.A.* 45, 2297*e*.

Chemisorbed atoms or mols. and promoters or poisons were characterized by impurity levels lying between the valence and the conduction band. They were ionized to a certain extent depending on the Fermi level of the system. The latter depended on the no. of impurities of both kinds, donors and acceptors, and on the temp. When increasing amts. of a donor were adsorbed on the surface, the degree of ionization of the donor decreased with coverage. This decrease corresponded to the interaction between adsorbed species. These principles lead to the computation of the rate of a catalyzed reaction as a function of the no. of electrons in the conduction band and of the various parameters defining the spectrum of the semiconductor.

11198. WAGNER, CARL. **The mechanism of the decomposition of nitrous oxide on zinc oxide as catalyst.** *J. Chem. Phys.* 18, 69-71(1950).—*C.A.* 44, 5674*d*.

For the decompn. of N_2O on metals and oxides, a tentative mechanism was in accordance with exptl. facts such as retardation by adsorbed O, a fractional order of the reaction with respect to N_2O in the case of indium oxide as catalyst, and the decrease of the elec. cond. of ZnO due to the presence of N_2O. A mixt. of ZnO and Ga oxide, however, had about the same catalytic activity as pure ZnO, although the elec. cond. of the mixed catalyst was about 50 times that of pure ZnO.

11199. WYNKOOP, RAYMOND AND WILHELM, RICHARD H. **Kinetics in tubular flow reactor. Hydrogenation of ethylene over copper-magnesia catalyst.** *Chem. Eng. Progress* 46, No. 6, 300-10 (1950).—*C.A.* 44, 6712*i*.

The catalytic hydrogenation of C_2H_4 over Cu-magnesia catalyst was studied experimentally and theoretically in a continuous-flow tubular reactor. Exptl. conditions were varied over the following ranges; H_2 32.6 to 95.2%; temp. 9° to 79°C; space velocity: 0.20×10^{-4} to 32.0×10^{-4} total moles/ml sec; catalyst particle size; 0.108 to 0.279 cm diam. Because of small conversions, a high-precision analysis for H_2 by means of thermal cond. cells was developed. An effect of reversible poisoning of the catalyst by water vapor was encountered.

11200. YANG, E. H. AND HOUGEN, O. A. **Determination of mechanism of catalyzed gaseous reactions.** *Chem. Eng. Progress* 46, No. 3, 146-57(1950).—*C.A.* 44, 3746*f*.

Methods were given for eliminating, minimizing, or evaluating the temp. and concn. gradients in gas films and in catalyst pellets. The selection of reaction mechanism from the effects of pressure, feed compn., and extent conversion and temp. was discussed, especially with reference to the visual appearance of rate curves. After the mechanism of a reaction was established, the various consts. in the appropriate rate equations could be obtained from the exptl. data by graphical and statistical methods.

11201. ZAWADZKI, J. **The mechanism of ammonia oxidation and certain analogous reactions.** *Discussions Faraday Soc.* 1950, No. 8, 140-52. —*C.A.* 45, 9987*c*.

The high efficiency of the oxidation depended on the velocities of a no. of successive and simultaneous reactions, which took place in the system NH_3-O_2-catalyst, as well as on the suppressing of the reactions between reagents, intermediates and final products of reactions before and after the catalyst. The roles of N_2O and chemisorbed O were discussed.

11202. AGRONOMOV, A. E. **Kinetics of the dehydrogenation of isopropyl alcohol on zinc oxide catalysts prepared by different methods.** *Vestnik Moskov. Univ.* 6, No. 2, *Ser. Fiz.-Mat. i Estestven. Nauk* No. 1, 109-23(1951).—*C.A.* 46, 4341*g*.

Different ZnO catalysts were prepd. by decompn. of pptd. $ZnCO_3$ at 400°C, kneading the preceding with MeOH and drying at 110°C, kneading catalyst *1* with H_2O and drying at 110°C, dehydration at 400°C of $Zn(OH)_2$ obtained by pptn. with NH_4OH and drying at 110°C, as the foregoing, but from $Zn(OH)_2$ pptd. with KOH, decompn. of Zn oxalate at 400°C, decompn. of $Zn(NO_3)_2$ at 450°C. All these catalysts dehydrogenate iso-PrOH smoothly at 320-90°C, to the extent of 92-97% dehydrogenation with respect to the amt. reacted, with no carbonization below 390°C, and only 2-5% unsatd. products and a very small amt. of CO_2 (but no CO) in the gas, in addn. to H_2.

11203. AGRONOMOV, A. E. **Kinetics of dehydrogenation of isopropyl alcohol on zinc oxide catalysts prepared by different methods. II. Causes of the dependence of the catalytic activity on the method of preparation.** *Vestnik Moskov. Univ.* 6, No. 11, *Ser. Fiz.-Mat. i Estestven. Nauk* No. 7, 41-50(1951).—*C.A.* 46, 8488*d*.

ZnO catalysts [(1) decompn. of $ZnCO_3$, (2) the foregoing with MeOH, (3) catalyst 1 with H_2O, (4) decompn. of $Zn(OH)_2$ pptd. with NH_4OH, (5) decompn. of $Zn(OH)_2$ pptd. with KOH, (6) decompn. of ZnC_2O_4, (7) decompn. of $Zn(NO_3)_2$] differed in their catalytic activity *A* in dehydrogenation of iso-PrOH at 370°C; in the above order, $A = 44.5$, —, 50.0, 39.0, 38.0, 43.0, 21.0. By adsorption of MeOH vapor, the surface areas *S* of catalysts 1, 3, 6, 7, were detd. to be 9.22, 14.91, 7.52, 0.28 m^2/g. There was a definite parallelism between *A* and *S*, but no simple proportionality. The adsorption detns. of *S* were confirmed by electron microscopy.

11204. ANDERSON, R. B.; FRIEDEL, R. A., AND STORCH, H. H. **Fischer-Tropsch reaction mechanism involving stepwise growth of the carbon chain.** *J. Chem. Phys.* 19, 313-19(1951).—*C.A.* 45, 9241*b*.

The observed isomer and C no. distribution of products from Fe and Co catalysts in the Fischer-Tropsch synthesis were predicted. The expressions were based on three schemes; (a) addn. at only one end of the growing chain on only one end C atom if two were present or on the adjacent-to-end C; (b) at only one end of the growing chain on any end or adjacent-to-end C; (c) at either end of the growing chain on any end or adjacent-to-end C. Scheme (a) was in closest agreement with exptl. facts.

11205. ANDERSON, ROBERT B.; HOFER, L. J. E.; COHN, ERNST M., AND SELIGMAN, BERNARD. **The Fischer-Tropsch synthesis. IX. Phase changes of iron catalysts in the synthesis.** *J. Am. Chem. Soc.* 73, 944-6(1951).—*C.A.* 45, 6032*h*.

Phase changes in a reduced fused-Fe catalyst were studied during the Fischer-Tropsch synthesis with 1 H_2 and 1 CO gas at 7.8 atms. In the first few days of the synthesis, α-Fe was converted to Hagg carbide (Fe_2C) which increased to a max. of 29% at 200 hrs of synthesis, and then decreased slowly throughout the remainder of the test. Magnetite increased at a slower rate than Hagg carbide, apparently chiefly at the expense of the α-Fe phase.

11206. ANDRUSSOW, LÉONID. **Catalytic oxidation of sulfur dioxide to sulfur trioxide and the theory of rapid catalytic processes. I. Oxidation of sulfur dioxide with excess oxygen.** *Z. Elektrochem.* 55, 428-37(1951).—*C.A.* 46, 2893*b*.

The kinetics and yields of fast, surface-catalyzed, reversible and irreversible reactions were discussed. Equations for dil. systems and corrections for concd. systems were given and the reaction $2\ SO_2 + O_2 \rightleftharpoons 2SO_3$ used as an illustration.

11207. ANDRUSSOW, LÉONID. **The catalytic oxidation of ammonia and the rapid catalytic processes. XII.** *Angew Chem.* 63, 21-7(1951). —*C.A.* 45, 4413*g*.

A comprehensive review of available information covering the mechanism of the oxidation and reaction processes, reduction of NO, expts. on Pt screens, explosive range, and catalytic oxidation at low temp.

11208. ANDRUSSOW, LÉONID. **Catalytic oxidation of ammonia and the rapid catalytic processes. XIII. Catalytic synthesis of hydrocyanic acid and the catalytic oxidation of ammonia. XIV. Catalytic oxidation of ammonia, hydrocyanic acid, and cyanogen and the theory of very rapid catalytic processes.** *Bull. soc. chim. France* 1951, 45-50, 51-9.—*C.A.* 45, 6353*b*.

In the reaction between NH_3, CH_4, and air at 1020°C, 60% of the NH_3 was converted to HCN, 10% lost as N_2H_4, and 30% was unreacted. The oxidation mechanisms for NH_3, HCN, and C_2N_2 were very similar and based upon the intermediate formation of HNO, HNO, and CNNO, resp.

11209. ANDRUSSOW, LÉONID. **The catalytic oxidation of ammonia and the rapid catalytic processes. XV. Calculation of conversion in gases flowing through tubes and networks.** *Angew. Chem.* 63, 350-5(1951).—*C.A.* 45, 10517*b*.

It was assumed that the gas reaction catalyzed by the metal wall took place instantaneously and that equil. resulted in a complete reaction. Equations related conversion, gas velocity, dimensions of tubes, and the diffusion coeff. of the smaller reaction component. Catalysts in honeycomb shapes and screens placed in series were treated. The NH_3 oxidation on fine-mesh screens with insufficient O_2 showed that the oxidation of NH_3 was predominantly effected by O_2.

11210. ANDRUSSOW, LÉONID. **The catalytic oxidation of ammonia and the rapid catalytic processes. XVI. Influence of pressure and vacuum.** *Bull. soc. chim. France* 1951, 981-3 —*C.A.* 46, 5273*c*.

Catalysts which gave a high yield of NO must be capable of activating O_2 and dehydrogenating HNO which formed as the result of reduction of NO by NH_3.

11211. ANTIPINA, T. V. AND FROST, A. V. **Relation between the kinetics of heterogeneous reactions and adsorption on catalysts. II. Determination of the adsorption coefficient of ethylene on aluminum oxide and its temperature dependence from kinetic data.** *Vestnik*

Moskov. Univ. 6, No. 8, *Ser. Fiz.-Mat. i Estestven. Nauk* No. 5, 69-78(1951).—*C.A.* 46, 3382*e*.

The flow-system dehydration of EtOH to H_2O + C_2H_4, undild. or dild. with C_2H_4 or with A, obeyed the kinetic law: $v_0 \ln [1/(1 - y)] = \alpha + \beta v_0 y$, where v_0 = feed rate in millimoles/min./ml catalyst, y = degree of conversion in millimoles C_2H_4 produced/millimole EtOH passed, $1/\alpha$ was proportional to the surface reaction rate const., and $\beta = 1.0$ (empirically). In all cases, $1/\alpha$ increased linearly with δ. From the kinetic data, the adsorption coeffs. for C_2H_4, at 380°, 415°, 450°C, were calcd. to 16.0, 12.2, 11.0 atm.$^{-1}$, resp.

11212. AUDRIETH, L. F. AND JOLLY, WM. L. **Catalytic decomposition of highly concentrated hydrazine by Raney nickel.** *J. Phys. & Colloid Chem.* 55, 524-31(1951).—*C.A.* 45, 6029*b*.

Com. Raney Ni catalyst decompd. 90-5% NH_2NH_2 at an av. rate of 8.6 ml/min./g catalyst at 25°C. The activation energy for NH_2NH_2 decompn. was 17.1 kcal/mol. Diln. with H_2O increased the decompn., the max. rate being observed with 6-10 *M* solns. The primary decompn. reaction was dehydrogenation, N_2 and H_2 being the chief products. Pt increased the activity of the Ni catalyst. Sulfides and cyanides had a poisoning effect on the catalyst.

11213. BALLOD, A. P.; GURVICH, L. V.; KOROBOV, V. V., AND FROST, A. V. **Kinetics of hydrocarbon conversions in a broad range of space velocities.** *Vestnik Moskov. Univ.* 6, No. 2, *Ser. Fiz.-Mat. i Estestven. Nauk* No. 1, 57-66 (1951).—*C.A.* 46, 4340*h*.

Cracking of decahydronaphthalene on activated Askan clay (30 min. runs) was found to obey a specified rate equation at 300°C; the apparent activation energy was 5.0 kcal/mole. The first reaction was an isomerization to products contg. cyclopentane rings. The subsequent cracking yielded in the gaseous cracking products more isobutane than butane. The isomerization products suffered cracking only at sufficiently low space velocity and then the reaction was inhibited by the cracking products. The amt. of deposit on the catalyst with respect to the unreacted decahydronaphthalene increased with decreasing space velocity 3 times as fast as the amt. of deposit relative to the amt. of the liquid decompn. products. The rate of the redistribution of H in the unsatd. gasoline fraction remained independent of space velocity at high space velocity, but inhibition appeared at low space velocity.

11214. BALLOD, A. P.; PATSEVICH, I. V.; FEL'DMAN, A. S., AND FROST, A. V. **Catalytic activity and selectivity of aluminosilicates.** *Doklady Akad. Nauk S.S.S.R.* 78, 509-12(1951).—*C.A.* 45, 7861*a*.

The reaction was to C_6H_6 and C_3H_6, followed by hydrogenation of C_3H_6 to C_3H_8 through redistribution of H; the cracking gas at 500°C was 94% C_3H_8 + C_3H_6. The catalyst, Al_2O_3 33.9 + SiO_2 66.1%, was heated to 500°C, treated with 0.01-0.5 *N* solns. of alkali, dried and again heated at 500°C. Poisoning was not selective with respect to either of the 2 consecutive reactions, dealkylation and hydrogenation. The sp surface area played a relatively minor role in the poisoning. The poisoning by Na^+ and Ca^{++} ions was due only to replacement of the H^+ ions by the metal ions.

11215. BAL'YAN, KH. V. **Action of inhibitors in the catalytic hydrogenation of some acetylenic and ethylenic alcohols. II.** *Zhur. Obshcheĭ Khim.* 21, 720-9(1951); *J. Gen. Chem. U.S.S.R.* 21, 793-802(1951)(English translation).—*C.A.* 46, 8945*i*.

In the presence of colloidal Pd, acetylenic γ-glycols added only 2 H atoms, whereas acetylenic alcs. added 4 H atoms and were rapidly hydrogenated to satd. alcs. Inhibition of the hydrogenation of acetylenic alcs. was, therefore, attributed to an action of the inhibitor, not on the catalyst but on the alc. It was expected that an inhibiting effect would be exerted by compds. contg. atoms with unshared electron pairs, susceptible of assocn. with the substrate. Expts. with a no. of unsatd. alcs., in a stream of H_2, were made at 20°C with 0.01 mole of the alc., 50 ml solvent (mainly EtOH), and 3 or 5 mg Pd. Generally, the same inhibitor was more effective in slowing down the hydrogenation of the ethylenic than of the acetylenic alc.

11216. BAL'YAN, KH. V. **Action of inhibitors in the catalytic hydrogenation of some acetylenic and ethylenic alcohols. III.** *Zhur. Obshcheĭ Khim.* 21, 729-34(1951).—*C.A.* 46, 8946*g*.

The ethers $Me_2C(OMe)C \equiv CH$ and $Me_2C(OMe)CH{:}CH_2$ were synthesized. Hydrogenation of these ethers in the presence of Pd was much slower than the corresponding alcs. At 57.6% hydrogenation of $Me_2C(OMe)C \equiv CH$, the reaction for the triple bond was neg., i.e. the triple bond was hydrogenated first.

11217. BAL'YAN, KH. V. **The action of inhibitors in catalytic hydrogenation with palladium. III.** *J. Gen. Chem. U.S.S.R.* 21, 803-7(1951) (Engl. translation).—*C.A.* 46, 6476*a*.

The Me ethers, $MeOC(Me)_2C \equiv CH$, and $MeOC(Me)_2$-$CH{:}CH_2$ were synthesized for the first time. The hydrogenation with colloidal Pd was much slower than that of their alcs., owing to the Me group's screening of the triple or double bond. The inhibitory effect of phenyl mustard oil, *p*-thiocyanoaniline, and *p*-thiocyanochlorobenzene on the hydrogenation of these ethers with colloidal Pd was established.

11218. BASHKIROV, A. N.; KAGAN, YU. B., AND KRYUKOV, YU. B. **Mechanism of the synthesis of hydrocarbons from carbon monoxide and hydrogen.** *Doklady Akad. Nauk S.S.S.R.* 78, 275-6(1951).—*C.A.* 45, 7861*g*.

The primary act in the Fischer-Tropsch synthesis was $CO + 2\ H_2 \rightarrow CH_2 + H_2O$, and not $2CO + H_2 \rightarrow CH_2 + CO_2$. CO_2 was formed only as a result of the secondary reaction $CO + H_2O \rightarrow CO_2 + H_2$. A very short contact time prevented the secondary reaction from taking place to any appreciable extent in one single pass, and the H_2O formed in each pass was removed by condensation between passes in repeated recirculation. The expts. were conducted with a CO:H_2 = 1:2 mixt. at 300°C under 20 atm., at a gaseous space velocity of 150,000 liters/liter catalyst/hr; practically complete conversion was ensured by repeated recycling, with the fresh gas admitted at the rate of 44 liters/hr.

11219. BEEK, JOHN JR. AND SINGER, EMANUEL. **A procedure for scaling-up a catalytic reactor.** *Chem. Eng. Progress* 47, 534-40(1951).—*C.A.* 46, 299*e*.

Toluene was produced by the dehydrogenation of methylcyclohexane, and toluene and recycle H_2 preheated to 860°F, were passed through tubes contg. catalyst pellets. The tubes were heated on the outside by flue gas at 1200°F. Variables considered were: tube size, ratio of H_2 to hydrocarbons, and toluene in the feed. Final working charts were in terms of volumetric production rate *vs.* conversion for various tube sizes, recycle ratios and feed compns., and tube lengths *vs.* space velocity for various pressure drops.

11220. BLOCH, F. **Nuclear relaxation in gases by surface catalysis.** *Phys. Rev.* 83, 1062-3(1951). —*C.A.* 45, 10057*b*.

To obtain a nuclear relaxation time near 1 sec, the O_2 must have a partial pressure of 10 atm. A fine powder of a paramagnetic substance with O_2 + He filling the spaces will act as a catalyst. Finely powd. Fe_2O_3 used with Xe was calcd. to have an "equiv. O_2 pressure" of 10 atm. The exptl. value was 30 atm.

11221. BRAUMAN, PIERRE AND TSANGARAKIS, CONSTANTIN. **An apparatus for measuring the catalytic activity of nickel.** *Mém. services chim. état* (Paris) 36, No. 2, 195-200(1951).—*C.A.* 47, 4140*d*.

The activity of a Ni catalyst, used for hydrogenation, was detd. by measuring the flow of H_2 into and out of the reaction vessel. The H_2 was dried over $CaCl_2$ and traces of O_2 burned over Pd at 300°C. After a second drying over $CaCl_2$ and P_2O_5 the H_2 was satd. with vapors of the substance to be hydrogenated (e.g. benzene) in a glass spiral, kept at const. temp. The accuracy of the flow measurements was to ± 2%.

11222. BRENET, JEAN AND BRIOT, ANNE MARIE. **State of valence of the manganese atom in so-called "manganese dioxide" compounds.** *Compt. rend.* 232, 726-7(1951).—*C.A.* 45, 5502*f*.

Magnetochem. and crystallographic results indicated that the formula MnO_2 could not be applied to all the O compds. supposed to have this compn. The interpretation of reactions catalyzed by these oxides or of reactions with isotopic exchange must be revised.

11223. BRENET, JEAN AND BRIOT, ANNE MARIE. **Mechanism of the depolarizing and catalytic activity of manganese dioxide.** *Compt. rend.* 232, 1300-2(1951).—*C.A.* 45, 7859*i*.

A cryst. phase other than pyrolusite was responsible for the depolarizing and catalytic activity of MnO_2.

11224. BRILL, R. **The rate equation of ammonia synthesis on iron-type catalysts of different composition.** *J. Chem. Phys.* 19, 1047-50(1951). —*C.A.* 46, 812*i*.

The results agreed in a general way with the rate equation of Temkin and Pyzhev. An improvement of this equation led to a better agreement between observed and calcd. synthesis rates. Expts. at low temps. showed that the rate equation was the same for the 3 catalysts that were investigated: (1) pure Fe, (2) Fe contg. 3% Al_2O_3, and (3) Fe contg. 3% Al_2O_3 and 2% K_2O.

11225. BRITTON, E. C.; DIETZLER, A. J., AND NODDINGS, C. R. **A calcium-nickel phosphate dehydrogenation catalyst.** *Ind. Eng. Chem.* 43, 2871-4(1951).—*C.A.* 46, 1668*d*.

An effective catalyst for dehydrogenation of *n*-butenes to 1,3-butadiene with superheated steam was a calcium-nickel-phosphate catalyst [$Ca_8Ni(PO_4)_6$], promoted with Cr oxide. Ultimate 93 to 97% yields were obtained in lab. units at conversion levels of 20 to 45%. In plant operations, ultimate yields of 86 to 88% were obtained at 35% *n*-butene conversion. PhEt was selectively dehydrogenated to PhC_2H_3 over this catalyst. The selectivity of the catalyst did not change during 3.5 months of continuous operation in the lab. unit.

11226. BRUNS, B. P. **Effect of reactions on catalysts.** *Doklady Akad. Nauk S.S.S.R.* 78, 79-82(1951).—*C.A.* 45, 6912*a*.

The proportions of areas of different crystal faces may vary in the course of a catalytic gas reaction. The fact that the habit of a crystal was not const., but varied with the medium, was linked with the dependence of the surface energy of each crystal face on the adjoining medium. If the distribution of the areas of different crystal faces was variable, the concept of a const. no. of "active centers" on a catalyst lost its meaning.

11227. CLARK, IRA T.; HICKS, JAMES R., AND HARRIS, ELWIN E. **Hydrogenation of Douglas fir lignin.** *Tappi* 34, 6-11(1951).—*C.A.* 45, 4445*f*.

Douglas fir lignin was hydrogenated in decahydronaphthalene suspension at 300°C with Raney Ni, Cu chromite, and CaO as catalysts. The H_2 absorbed amounted to 1 mole/32.5 g lignin. Products recovered were: neutral oils 26.3; low-boiling acids and phenols 3.8; H_2O-sol. materials 1.2; low-boiling tars 7.3; and pitch 11.6; H_2O 4.8; gas and loss 15.7; and unreacted residue 29.3%.

11228. CORNUBERT, RAYMOND; KAZIS, CLAUDE, AND THOMAS, PHILIPPE. **New studies on the selective hydrogenation of ethylenic ketones by means of Raney nickel.** *Compt. rend.* 232, 1166-8(1951).—*C.A.* 46, 442c.

The selectivity of the catalyst remained practically const. after repeated use; only the velocity of the hydrogenation decreased (18 min. in the 1st and 123 min. in the 8th run). HCOOH retarded the hydrogenation to the same degree as HCl, whereas HOAc was less effective; Et_3N retarded slightly the hydrogenation of the double bond, but increased the reduction of the CO.

11229. Cremer, E. and Marschall, E. **Heterogeneous decomposition of nitrous oxide on catalysts with varying activities.** *Monatsh.* 82, 840-6(1951).—*C. A.* 46, 3383*e*.

With CuO or La_2O_3, the reaction was of 1st order during its early stages. Preheating of CuO between 450° and 700°C resulted in a linear increase of the activation energy from 11 to 42 kcals. The results were not so conclusive for La_2O_3. If A = const. in the Arrhenius equation and q = activation energy, log A = const. + q/a, where $a = 3200$ and $a/2.3R = 710$°K for both catalysts. The elec. cond. of pressed catalyst powders decreased linearly with temp. of prepg. the catalysts.

11230. Csuros, Zoltán; Géczy, István, and Nógrádi, Tamás. **Investigation on catalysts. VII. The role of the hydrogen pressure in the kinetics and mechanism of catalytic hydrogenation.** *Acta. Chim. Hung.* 1, 168-81(1951).—*C. A.* 45, 10023*c*.

When maleic and fumaric acids were hydrogenated in proportions of 1 mol. substrate to 1 mol. H_2, the reaction order and the rate const. as functions of the amt. of catalyst showed fluctuations following max.-min. curves. The overall order varied from 1.0 to 6 except where very small amts. of catalyst were used. The order with reference to H_2 was detd. by hydrogenating 6.7 mol. substrate with 1 mol. H_2, in which case the distance between the extreme points on the curve became less.

11231. Dixon, Joseph A. and Schiessler, Robert W. **The exchange of deuterium for hydrogen in heptane.** *J. Am. Chem. Soc.* 73, 5452-3(1951).—*C. A.* 46, 9396*i*.

Ni and Pt catalysts were ineffective for the catalysis of H exchange between water and a straight-chain paraffin in the liquid phase. Vapor-phase interchange of H isotopes between D_2O and a normal paraffin took place readily over a kieselguhr-supported Ni catalyst. Exchange proceeded at 135°C in the vapor and did not take place at 150°C in the liquid. The exchange was accompanied by scission of the C—C bonds, and therefore was not practical for the prepn. of perdeuteriated compds.

11232. Egerton, Alfred C. and Warren, D. R. **Kinetics of the hydrogen-oxygen reaction. I. The explosion region in boric acid-coated vessels.** *Proc. Roy. Soc.* (London) A204, 465-76(1951).—*C. A.* 46, 4897*d*.

The region of low-pressure (up to 250 mm) explosion of H_2 and O_2 mixts. in B_2O_3-coated vessels was observed over the range from 400° to 550°C in various sizes of vessels and at varied mixing ratios. An analysis of the kinetic data led to the postulation of the following 2nd-order chain-branching process: $H + HO_2 \rightarrow OH + OH$, which did not occur in salt-coated vessels. B_2O_3 coatings preserved peroxidic substances. A mechanism was outlined that accounted for the observed results.

11233. Foresti, Bruno. **The effect of the pH on the velocity of the hydrogenation of benzene in the presence of platinum progressively poisoned with thiophene.** *Ann. chim.* (Rome) 41, 425-37 (1951).—*C. A.* 46, 330*g*.

The velocity of the hydrogenation of C_6H_6 and of cyclohexene in aq. medium in the presence of platinized Pt depended on the pH of the medium. The velocity of the hydrogenation of C_6H_6 decreased with increasing pH to about 1/10 of the initial value at pH 7. An increase of the pH had the same effect as a selective and reversible catalyst poison. This effect was attributed to the increase of the potential difference between the Pt and the soln. with increasing pH (owing to an increase of the cation d. at the metal-soln. interface) and the blocking of the most active centers of the heterogeneous catalyst surface. The Pt showed the same behavior as in the blocking of the C_6H_6 hydrogenation with thiophene, which did not affect its activity for the olefin hydrogenation.

11234. Forney, R. C. and Smith, J. M. **Kinetics of catalytic sulfurization of methane.** *Ind. Eng. Chem.* 43, 1841-8(1951).—*C. A.* 45, 10013*i*.

Kinetics of reaction $CH_4 + 4S = CS_2 + 2H_2S$ were correlated by the equation $r = kp_{CH_4}p_{S_2}$, where $k = 0.26$ g mole of CS_2/(g of catalyst)(hr) (atm.)^2 at 600° and 1 atm. pressure over 6-8-mesh silica gel catalyst. Bed depth, mol. ratio, and feed rate were varied. Diffusional resistances had only a negligible effect at the mass velocities employed (0.1-0.9 g mole/(hr)(30 mm outside diam. cylindrical reactor); the reaction was simple second order involving CH_4 and S_2.

11235. Frampton, Vernon L.; Edwards, Joseph D. Jr., and Henze, Henry R. **The preparation of a platinum oxide catalyst of reproducible activity.** *J. Am. Chem. Soc.* 73, 4432-4(1951).—*C. A.* 46, 6776*a*.

The prepn. depended upon the instantaneous heating of $PtCl_4$ to 520°C in the presence of $NaNO_3$. Add 10 ml of a 10% soln. of $H_2PtCl_6.6H_2O$ to 9 g of $NaNO_3$ and evap. to dryness with const. stirring over an open flame. The mixt. was then added all at once to 100 g of $NaNO_3$ heated to 500-40°C. The cooled magma was dissolved in 2 liters water, and the catalyst filtered, washed with water without allowing it to dry, and then stored *in vacuo* over $CaCl_2$.

11236. Francis, W. and Lepper, G. H. **Recovery of sulfur from flue gases.** *Engineering* 172, 36-7(1951).—*C. A.* 46, 708*g*.

At least 92% of the S oxides contained in flue gases were removed by noneffluent-type gas-washing plants: (1) $CaSO_4$ in sludge resulting from washing flue gases with lime or chalk was converted to $(NH_4)_2SO_4$ by digesting it with a soln. of the $(NH_4)_2CO_3$ produced as a by-product of the gas and coke-oven industries, (2) $CaSO_4$ and $CaSO_3$ in sludge were roasted in a kiln with coal ash, clay, or a mixt. of both, (3) $(NH_4)_2SO_4$ and S were recovered by scrubbing with $(NH_4)_2CO_3$ solns., (4) Na_2SO_3 and Na_2SO_4 were produced by scrubbing with Na_2CO_3.

11237. Freĭdlin, L. Kh. and Levit, A. M. **Kinetics of dehydration of formic acid on phosphate catalysts and on aluminum oxide.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* **1951**, 625-30.—*C. A.* 46, 3840*f*.

Flow expts. were made at a feed rate of 0.16 ml HCO_2H (82 or 100%)/min., on 20 ml catalyst (wt 9-11 g, length of column 6 cm). The gas evolved in all cases was 100% CO. The activation energies *E* (kcal/mole) and preëxponential factors k_0 were (with 82% HCO_2H), on $Ca(H_2PO_4)_2$, 17.6 and 4.8×10^9, and on $Ca_3(PO_4)_2$, 15.2 and 5.2×10^8. These catalysts were, consequently, highly selective in the sense of dehydration of HCO_2H as against dehydrogenation, and highly active. The activity of Al_2O_3 was both lower and less selective than that of the Ca phosphates. Treatment of Al_2O_3 by impregnation with K_2O lowered the selectivity still further; with 7% K_2O, at 263°C, the activity was decreased by 30%, and the amt. of CO in the gas from 93 to 73%.

11238. FREĬDLIN, L. KH.; NEIMARK, I. E.; FRIDMAN, G. A., AND SHEINFAIN, R. YU. **Promotion of silica gels of different porosities.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* **1951**, 86-94.—*C.A.* 45, 5502*i*.

The catalytic activity of a silica gel in the gas-phase hydrolysis of $PhCl + H_2O \rightarrow PhOH + HCl$ was linked with the presence of medium-size pores. Promotion by $CuCl_2$, resulting in increased thermal stability, greater selectivity, and regeneration of poisoned silica gel, was attributed to an action on readily accessible portions of the surface, not normally active in the unpromoted gel. The 6 samples of silica gel had the characteristics (total pore vol. in ml/g, micropore vol. in ml/g, vol. of C_6H_6 sorbed in the liquid state at $p/p_s = 1$, vol. of intermediate pores in ml/g, B.E.T. area in m^2/g): (1) 0.60, 0.23, 0.60, 0.39, 390; (2) 0.46, 0.26, 0.45, 0.19, 450; (3) 0.45, 0.32, 0.46, 0.14, 560; (4) 1.23, 0.25, 1.19, 0.94, 490; (5) 0.93, 0.23, 0.95, 0.72, 420; (6) 0.93, 0.18, 0.94, 0.76, 325.

11239. FREĬDLIN, L. KH. AND RUDNEVA, K. G. **Kinetics of depromotion of a skeleton nickel catalyst and relative velocity of activation of hydrogen.** *Doklady Akad. Nauk S.S.S.R.* **81**, 59-62(1951).—*C.A.* 46, 1854*g*.

Depromotion of a hydrogenation catalyst through extn. of the dissolved H_2 from the catalyst by the reactant, with the activation of the H_2 of the gas phase lagging behind the deactivation, was illustrated by liquid-phase hydrogenation of *p*-$C_6H_4O_2$ in dioxane soln. Ni was preliminarily satd. with H_2. At room temp., with 0.3112 g *p*-$C_6H_4O_2$ in 10 ml dioxane, and 1.04 g Ni paste, absorption of H_2 came to a stop when 37.6 ml H_2 had been absorbed, instead of the 64.5 ml H_2 necessary for complete reduction to *p*-$C_6H_4(OH)_2$; however, *p*-$C_6H_4O_2$ was reduced completely. The balance of H_2 necessary for the complete reduction was drawn from the catalyst.

11240. FREĬDLIN, L. KH. AND ZIMINOVA, N. I. **Poisoning of hydrogenation-dehydrogenation catalysts in the light of the theory of their active structure.** *Doklady Akad. Nauk S.S.S.R.* 76, 551-4(1951).—*C.A.* 45, 3698*g*.

The poisoning of a great variety of hydrogenation-dehydrogenation catalysts (Pd, Pt, Ni, Co) with a great variety of catalyst "poisons" (O, S, Se, Te, P, As, Sb, Bi, Cl_2, Br_2, I_2, and their compds.) did not consist in adsorptive "blocking" of active centers. It was due to removal of dissolved H_2 that was an essential promoter of the catalysts. The poisons listed were all highly reactive towards H_2. The very strong poisoning effect of H_2S was explained by a chain reaction of the type $H_2S + H \rightarrow H_2 + HS$; $2HS \rightarrow H_2 + 2S$; $S + H \rightarrow HS$, etc. Superficially adsorbed H_2 was only loosely bound and, being consumed first, protected active centers against depromotion, as long as H_2 was supplied from without.

11241. FRIDMAN, S. D. AND KAGAN, M. YA. **Kinetics and reaction mechanism of catalytic hydrogenation-dehydrogenation. V. Catalytic reactions of cyclohexene in the presence of copper and iron.** *Zhur. Obshcheĭ Khim.* (J. Gen. Chem.) 21, 874-84(1951); *J. Gen. Chem. U.S.S.R.* 21, 959-69(1951)(Engl. translation).—*C.A.* 45, 9347e; 46, 7415*e*.

The thermodynamic functions were calcd. for the 3 possible reactions of cyclohexene. All 3 reactions were probable: the hydrogenation predominated at low temps., dehydrogenation at higher temps., and disproportionation being very nearly temp. independent. Pure Cu catalysts were prepd. by deposition on activated Al_2O_3. In flow expts. on 25 ml of the Cu catalyst, with 1.3-1.5 moles H_2/mole cyclohexene, the degree of conversion at 152°C was 22.5% (exclusively by hydrogenation), increasing to 98% at 233°C. Disproportionation became increasingly noticeable with increasing temp. Dehydrogenation became distinct (23.6%) at 280°C.

11242. GABRIELSON, C. O. **Heat transfer from catalyst surfaces. I. Heat transfer during ethylene hydrogenation on a platinum wire.** *Svensk Kem. Tid.* 63, 145-66(1951).—*C.A.* 46, 29*c*.

The heat transfer from a catalyst surface (Pt-wire) was found to be 14% higher than normal during hydrogenation of C_2H_4. Heat transfer was measured both during hydrogenation of ethylene and during passage of ethane over the Pt wire, the temp. being kept the same in both cases, as measured by the cond. of the wire. C_2H_6 was chosen for the noncatalytic expts. The increase in heat transfer during the hydrogenation showed that the newly formed C_2H_6 mols. were desorbed from the catalyst surface with an energy in excess of that corresponding to the av. catalyst temp.

11243. GALLAK, V. M. **Method for the separate catalytic preparation of oxygen and chlorine from calcium hypochlorite.** *J. App. Chem. U.S.S.R.* 24, 909-17(1951)(Engl. translation); *Zhur. Priklad. Khim.* 24, 798-806(1951).—*C.A.* 47, 4233*e*.

Co and Fe salts contg. about 0.8 g of metal and giving a final Co:Fe ratio of 3:2 were dissolved in 10 ml of H_2O, 10 g of dry powd. $Ca(ClO)_2$ was stirred in, and, after completion of the reaction, the mass was dried and ground. A mixt. of $Ca(ClO)_2$ 25, catalyst 1-5 g, and H_2O 15 ml was heated at 70-100°C, giving about 2200 ml of O_2. When CaO was added in 20:25 ratio with the $Ca(ClO)_2$, the external heating could be eliminated, the heat from the slaking of CaO being sufficient.

11244. Gellner, O. H. and Richardson, F. D. **Reduction of ferrous oxide.** *Nature* 168, 23-4 (1951).—*C.A.* 46, 326*c*.

$Fe_{0.95}O$ was prepd. by the passage of a mixt. of H_2 and H_2O vapor over strips of Fe at 900° and 950°C and reduction by H_2. At 700°C the reduction proceeded from the surface inwards. At 900°C and above a very thin film of Fe formed on the oxide surface, but this formation soon ceased. The reduction then proceeded outwards from the metal-oxide interphase. At intermediate temps., reduction proceeded simultaneously inwards from the surface and outwards from the metal.

11245. Giovannini, Erminio. **The catalytic preparation of hydrocyanic acid.** *Chimica e industria* (Milan) 33, 480-3(1951).—*C.A.* 46, 3225*e*.

The reaction of CH_4, NH_3, and O_2 (air) was studied over Mn-Al and Fe-Al oxide catalysts supported on silica. The latter catalyst was better. Optimum conditions were 600°C, a contact time of 5-6 sec, and vol. ratios of CH_4:NH_3:air = 5.5:1:14. The yield of HCN, based on NH_3, was 36%. Advantages of this process were the relatively low temp. and the low concn. of CO_2 in the product.

11246. Goss, Alexander E. **Catalytic combustion of atmospheric contaminants in effluent from wire-enameling ovens.** *Wire and Wire Products* 26, 1051-5,1089, 1090(1951).—*C.A.* 46, 1267*e*.

Oleo-resin, a natural base enamel, Form-var, a synthetic enamel of the PhOH-CH_2O type, and nylon were the enamels used in the test. The principle of catalytic combustion, a description of the installation, and the collection and analysis of effluent gases were discussed. The general method of catalytic combustion should have possibilities for use in the field of atm.-pollution control wherever the contaminants were combustible or readily oxidized to less irritant compds.

11247. Greensfelder, B. S. **Process in petroleum technology. The mechanism of catalytic cracking.** *Advances Chem. Ser.* No. 5, 3-12(1951).—*C.A.* 45, 10556*i*.

The catalytic cracking of the 4 major types of hydrocarbons was surveyed in terms of cracked gas compn. to establish a basic pattern of the mode of cracking which in the case of aromatics was different from that of *n*-paraffins, *n*-olefins, and cyclohexane-type naphthenes. This pattern was correlated with the acid-catalyzed low temp. reverse reactions of olefin polymerization and aromatic alkylation. The Whitmore carbonium-ion mechanism was applied.

11248. Grote, H. W.; Hoekstra, J., and Tobiasson, G. T. **Midget fluid catalytic cracking units.** *Ind. Eng. Chem.* 43, 545-50(1951).—*C.A.* 45, 3586*d*.

Bench-scale, fluid, catalytic-cracking units permitted continuous operation with full catalyst circulation on approx. 1 liter of catalyst, and employed continuous debutanization and automatic batch fractionation. Essential operating conditions of the larger-scale units were duplicated.

11249. Heilmann, René and Gaudemaris, Gabriel de. **General kinetics of catalytic liquid-phase hydrogenation on Raney nickel.** *Compt. rend.* 233, 166-8(1951).—*C.A.* 46, 1854*f*.

The role of pressure and solvents in the catalytic liquid-phase hydrogenation of 1-heptene, acetone, 2-butanone, and isobutyraldehyde was investigated. The solvents were EtOH, MeOH, dioxane, and cyclohexane. The rate of hydrogenation was proportional to the mass of the catalyst but independent of the quantity of acceptor.

11250. Heinemann, Heinz. **Dehydrogenation of methylcyclopentane over chromia-alumina catalyst.** *Ind. Eng. Chem.* 43, 2098-2101(1951).—*C.A.* 46, 6369*h*.

The dehydrogenation at atm. pressure of methylcyclopentane over Cr_2O_3-Al_2O_3 catalyst in the presence of H_2 and small amts. of C_6H_6 gave better yields of mono-olefins and lower coke deposits than either dehydrogenation at reduced pressure in the absence of H_2 and C_6H_6 or dehydrogenation in the presence of H_2 or C_6H_6 individually. Pretreating of the catalyst with C_6H_6 with the feed gave larger yields of desired products. At conversions of 30.5%, coke was reduced by the addn. of small amts. of C_6H_6 from 7 to 3%, and at a conversion level of 35% the coke was reduced from 6.5 to 3.8%.

11251. Heinemann, H.; Schall, J. W., and Stevenson, D. H. **Houdriforming for aromatics.** *Petroleum Engr.* 23, No. 12, C40-2(1951).—*C.A.* 46, 1238*a*.

Houdriforming was a continuous catalytic reforming process for producing both aromatic concentrates and high-octane gasolines from low-octane straight-run naphthas. The reactions involved were selective and consist predominately of dehydrogenation, isomerization, aromatization, hydrocracking, and desulfurization. Dehydrogenation and dehydroisomerization of naphthenes formed aromatic concentrates such as benzene, toluene, and xylenes from fractions rich in naphthenes.

11252. Hofer, L. J. E.; Anderson, R. B.; Peebles, W. C., and Stein, K. C. **Chloride poisoning of iron-copper Fischer-Tropsch catalysts.** *J. Phys. & Colloid Chem.* 55, 1201-6 (1951).—*C.A.* 46, 233*b*.

Catalysts prepd. from Fe^{+2}, Fe^{+3}, and Cu^{+2} solns. were active only when they contained sizeable amounts of Fe^{+2}. The β-$Fe_2O_3.H_2O$ catalysts contained up to 0.92% Cl, the poisoning effect of which accounted for the inactivity of this catalyst.

11253. Horsfield, S. W. **Reforming natural gas by the continuous catalytic cracking process.** *Am. Gas Assoc., Proc.* 33, 591-601(1951).—*C.A.* 47, 2458*c*.

The equipment and operation of a continuous catalytic cracking process for the conversion of natural gas into a gas completely interchangeable with carbureted water gas were discussed.

11254. Horsfield, S. W. **Continuous catalytic cracking process used to reform natural gas.** *Am. Gas J.* 175, No. 4, 17-20(1951).—*C.A.* 46, 235*h*.

The Glenwood Landing plant was initially designed to convert 20 million ft^3 of natural gas into 37 million ft^3 of interchangeable 540 B.t.u. gas/day. A change in the type of catalyst made it possible to convert 25 million ft^3 of natural gas/day, and further increase in production was expected. Three Surface Combustion cracker furnaces were used, each contg. 32 vertical tubes completely filled with small pieces of alundum rock impregnated with Ni oxide catalyst.

11255. HUTTIG, G.F.; ZAGAR, L., AND HONAK, E.R. **Catalytic capacity of sintered iron material.** *Monatsh.* 82, 183-6(1951).—*C.A.* 45, 5502*d*.

The energy of activation for the decompn. of NH_3 by Fe was 23,600 cal for Hametag Fe (reduced and sintered in H_2) and 15,700 cal for carbonyl Fe. It was independent of the degree of sintering and the sintering temp. The activity of the catalyzing centers in carbonyl Fe was superior, but Hametag Fe had more such centers. If Hametag Fe was reduced and sintered in a stream of NH_3, its catalytic activity was improved considerably.

11256. IRVIN, H.B.; OLSON, R.W., AND SMITH, J.M. **Design of fixed-bed catalytic reactors. II.** *Chem. Eng. Progress* 47, 287-94(1951).—*C.A.* 45, 6437*c*.

Temps. were measured at various catalyst bed depths and radial positions in a 2-in. inner-diam. reactor through which SO_2 and air were passed. The catalyst consisted of 1/8-in. Al_2O_3 pellets coated with 0.2% Pt. The reactor was cooled by boiling water in a surrounding jacket in order to induce large radial temp. gradients. The conversion of SO_2 to SO_3 was detd. Good agreement with the observed temp. and conversion data was obtained when this method was applied to the SO_2 reaction, despite the fact that mass transfer in the radial direction was neglected.

11257. ISHIBASHI, SATORU. **The recovery of nickel oxide and molybdenum oxide from the waste catalyzer. I. The recovery of nickel oxide.** *J. Electrochem. Soc. Japan* 19, 185-9 (1951).—*C.A.* 46, 1725*b*.

The roasted powder of the waste mixed catalyzer composed of NiO, MoO_3, and clay, used for hydrocracking of petroleum, was treated first with 40% HNO_3 at 80°C. By adding $Fe(NO_3)_3$ at pH 4.0-4.2, a small quantity of molybdic acid which was dissolved in this $Ni(NO_3)_2$ soln. was removed. The ammonium nickel nitrate complex salt soln. was formed by adding excess NH_4OH. More than 98% of $Ni(OH)_2$ was obtained from the boiling mixt. About 92% of NiO in the waste catalyzer was recovered, including only 0.05% Fe_2O_3 + Al_2O_3, 0.03% MoO_3, and a trace of SO_3.

11258. JANZ, G.J. AND HAWKINS, P.J. **Activity of the chromium-aluminum oxide catalyst system in the nitrile-diene and heptane cyclizations.** *Nature* 168, 387-8(1951).—*C.A.* 46, 7859*c*.

The activity-compn. relation of the Cr oxide-Al oxide catalyst, over the range 0.34-34.2 wt % of Cr, found in the more complex reaction of benzonitrile + butadiene → 2 phenylpyridine + H_2 was very similar to that observed in the simple case of heptane → toluene + H_2. In each case there was a noticeable change of slope at about 6% Cr.

11259. KANDINER, H.J.; HITESHUE, R.W., AND CLARK, E.L. **Catalyst evaluation and middle-oil preparation in an experimental high-pressure coal-hydrogenation plant. I.** *Chem. Eng. Progress* 47, 392-6(1951).—*C.A.* 45, 8737*c*.

The coal hydrogenation pilot plant of the Bureau of Mines was described. Five operating runs at 460°C and 3500 p.s.i. with 35% coal paste were reported. Results produced in liquid-phase hydrogenation of bituminous coal by Sn, Zn, Ni, and Fe catalysts and also in the absence of any added catalyst were compared. The exceptional activity of Sn catalysts could be closely duplicated in regard to liquefaction and "asphalt" formation by $NiCl_2$ catalyst impregnated on the raw coal from aq. soln.

11260. KARPACHEVA, S.M. AND ROZEN, A.M. **Oxygen exchange between alcohol vapor and dehydration catalysts.** *Doklady Akad. Nauk S.S.S.R.* **81**, 425-6 (1951).—*C.A.* 46, 3382*b*.

EtOH vapor was led at 200° and at 400°C over active Al_2O_3 tagged with 150-300 γ/g of heavy O^{18} by way of exchange with H_2O vapor contg. O^{18}. Dehydration of the EtOH took place at 400°, not at 200°C. At both temps., there was exchange of O between the solid and the EtOH vapor, at a rate governed by the exponential law $dq/dt = \exp(-aq)$, where q = amt. of O^{18} exchanged. The exchange of Al_2O_3 with H_2O was 2-3 times as fast as with EtOH vapor. Exchange of O^{18} between the EtOH and the catalyst was observed at 300°C on kaolin, Al_2O_3 + Cr_2O_3 (10%), and ZnO; the reaction on the first two catalysts was dehydration, and on ZnO, dehydrogenation.

11261. KATZ, MORRIS; WILSON, L.G., AND RIBERDY, R. **The oxidation of carbon monoxide by solid silver permanganate reagents. IV. Chemical composition in relation to activity.** *Can. J. Chem.* 29, 1059-62, 1065-8(1951).—*C.A.* 47, 5306*f*.

The activity after progressive aging and thermal treatment of $AgMnO_4$ supported on ZnO and BeO was found to be closely related to the extent of decompn. of the cryst. $AgMnO_4$. The Ag salt decompd., with loss of active O. From a mass balance of solid-gas reactants in a reacting column, it was demonstrated that in the most active stage, during which the efficiency of oxidation did not fall below 90%, the course of the reaction was about evenly divided between stoichiometric and catalytic processes.

11262. KIPERMAN, S.L. AND GRANOVSKAYA, V. SH. **Change in reaction order for ammonia synthesis. I. Reaction kinetics on an osmium catalyst.** *Zhur. Fiz. Khim.* 25, 557-64 (1951).—*C.A.* 45, 9346*h*.

The kinetics of NH_3 synthesis at atm. pressure was studied between 420° and 600°C in a dynamic system on an osmium-on-silica gel catalyst. The catalyst (2 ml; 1.63 g) was reduced at 450°C in the synthesis gas; reduction was completed at 475°C until const. activity was reached. Three sets of data were reported. The 1st and the 2nd set were obtained with a $p_{H_2}:p_{N_2}/= 3:2$ mixt. The data of the 3rd set gave a straight line passing through the origin in a plot p_{NH_3}, p_{N_2}. The change in reaction order was not observed on other catalysts because the values of $x = [p_{NH_3}/(p_{NH_3})_{equil.}]$ were too high.

11263. KIRKBRIDE, C.G. **The new process of catalytic reforming (hydroforming).** *Riv. combustibili* 5, 317-28(1951).—*C.A.* 46, 4775*g*.
Houdriforming was a catalytic process to obtain aromatics and benzenes of high octane no. from naphthas. The catalysts developed for this process were highly selective for the hydrogenation of C_6-ring naphthenes, the hydroisomerization of alkyl cyclopentanes, and the isomerization of straight-chain paraffins. The catalysts were not poisoned by S compds., thiophenes included, and were usually not regenerated. The feed was preheated before combination with a recycle gas stream rich in H_2. The combined streams went to the catalyst chamber where reforming took place. The effuent was cooled and flowed to a separator from which excess gas was vented and the remainder recycled. The partial pressure of H_2 in the reaction chamber greatly influenced the effuent compn.

11264. KISTIAKOWSKY, G.B. AND NICKLE, A. GORDON. **Ethane-ethylene and propane-propylene equilibria.** *Discussions Faraday Soc.* 1951, No. 10, 175-87.—*C.A.* 46, 3380*f*.
The equil. were approached from both sides on a reduced chromic hydroxide catalyst. For $C_2H_6 \rightarrow C_2H_4 + H_2$, the equil. consts. were $5.13 \pm 0.13 \times 10^{-4}$ atm. at 723.2°K and $4.04 \pm 0.17 \times 10^{-5}$ atm. at 653.2°K; for $C_3H_8 \rightarrow C_3H_6 + H_2$, the consts were $5.17 \pm 0.15 \times 10^{-4}$ atm. at 648.2°K and $3.67 \pm 0.17 \times 10^{-5}$ atm. at 583.2°K.

11265. KLINKENBERG, A. **Choices among the types of catalytic reactors.** *Chem. Weekblad* 47, 472-8(1951).—*C.A.* 46, 1305*c*.
The difficulties of scaling up lab. app. were enumerated. The direct calcn. of reactor design, without reference to smaller-scale app., was discussed for fixed- and fluid-bed reactors.

11266. KOCH, HERBERT AND RAAY, HANS VAN. **Individual branched hexenes and their isomerization equilibria.** *Brennstoff-Chem.* 32, 161-74 (1951).—*C.A.* 45, 8238*f*.
A Co gasoline-synthesis catalyst permitted equilibrium to take place smoothly in an autoclave at 190°C between 2,3-dimethyl-1-butene and 2,3-dimethyl-2-butene while the isomerization of the 2-methylpentenes did not progress under similar conditions. However, starting from 2-methyl-1-pentene and 2-pentene using a circulating apparatus (in part also using Al_2O_3 catalysts,) it was possible to approx. the equil. of the 2-methylpentene. The dehydration of pinacolone over activated Al_2O_3 at 330°C led directly to the equil. mixt. of the three dimethylbutenes. A silica gel catalyst apparently permitted the equil. isomerization reaction to take place between the tertiary olefin pairs.

11267. KODAMA, SHINJIRO; FUKUI, KENICHI, AND MAZUME, AKIRA. **Optimum gas ratio in ammonia synthesis.** *J. Chem. Soc. Japan,* Ind. Chem. Sect. 54, 157-9(1951).—*C.A.* 47, 1905*b*.
Based on the kinetic equation for the ammonia synthesis from H_2 and N_2, a math. method was developed to calc. the optimim ratio of H_2 and N_2 for the max. ammonia yield.

11268. KODAMA, SHINJIRO; FUKUI, KENICHI; TANAKA, HIDEO, AND MAZUME, AKIRA. **The optimum temperature distribution in catalyst beds for the maximum yield.** *Chem. Eng.* (Japan) 15, 85-7 (1951).—*C.A.* 45, 5464*c*.
The optimum temp. distribution was based on the assumption that rate equation, rate const., and equil. const. were known at any temp. An example for the NH_3 synthesis was calcd.

11269. KOIZUMI, MASAO. **Catalytic polymerization reaction of olefins.** *Chem. Researches* (Japan) 9, 1-51(1951)(English summary, 52).—*C.A.* 45, 7421*h*.
Nickel oxide adsorbed on kielselguhr or SiO_2-Al_2O_3 gel was an excellent catalyst for polymerization at room temp. The polymerization proceeded step by step between 2, 3, 4 mols. and so on. Lower olefins polymerized more readily than did higher ones; the ratio of reaction velocities of ethylene, propylene, and butylene was approx. 100:10:1. Olefin mols. were adsorbed on the definite positions on the catalyst and then reached active spots, where polymerization took place. Finally the polymerization products removed to other places on the catalyst. The rate-detg. step was the process in which olefin mols. arrived at the active spots.

11270. KOK, W.J.C. DE AND WATERMAN, H.I. **Preparation of metals in a finely divided state for use as catalysts.** *J. Applied Chem.* (London) 1, 196-8(1951).—*C.A.* 45, 7726*i*.
Ni, Ni-Cr alloy, Monel, and V_4A steel were each prepd. in a finely divided state by atomizing the melted material. The catalyst particles had to be activated after prepn., and for this purpose treatment with 5% NaClO soln. acidified with dil. HCl was found best. Tests showed a difference in activity of these catalysts in the hydrogenation of several materials.

11271. KOLAROV, NIKOLA. **The catalytic decomposition of hydrogen peroxide by a solid catalyst.** *Bulgar. Akad. Nauk., Otdel, Geol.-Geograf. i Khim. Nauki, Izvest. Khim. Inst.* 1, 185-203(1951)(German Summary).—*C.A.* 46, 7858*f*.
The rate of decompn. of H_2O_2 in the presence of different salts and catalysts was detd. Catalysts (salts) were: MnO_2 (Na_2SO_4, NaOAc, NaCl, $NaNO_3$, NaBr, K_2SO_4, KOAc, KCl, KNO_3, KBr); charcoal (Na tartrate, NaOAc, Na_2SO_4, NaCl, NaBr, K tartate, KOAc, KNO_3, KCl, KBr) and Ag powder (NaOAc, $NaSO_4$, $NaNO_3$, NaCl, NaBr, KOAc, K_2SO_4, KNO_3, KCl, KBr). A previous irradiation of the Ag powder and the MnO_2 by ultraviolet caused a rapid aging of these catalysts. The activity of the charcoal was increased by ultraviolet radiation.

11272. KÖLBEL, HERBERT; ACKERMANN, PAUL; RUSCHENBURG, ERNST; LANGHEIM, ROBERT, AND ENGELHARDT, FRIEDRICH. **The Fischer-Tropsch synthesis with iron catalysts. II. Conditioning and starting-up of iron catalysts, behavior during synthesis, and results obtained in various synthesis processes.** *Chem. Ing. Tech.* 23, 183-9 (1951).—*C.A.* 45, 6365*e*.

The catalyst prepn. and effect of operating conditions upon the catalyst efficiency were described. Hydrocarbon synthesis for fixed bed vapor phase and liquid phase operation was discussed.

11273. Kotelkov, N.Z. **Compound helix as a catalyst carrier.** *J. Applied Chem. U.S.S.R.* 24, 223-6(1951)(Engl. translation).—*C.A.* 46, 6292*b*.

Compd. helixes of Cu, Fe, Al, and nichrome were coated with Pt, Pd, Al_2O_3, and various clays in an effort to increase the active area of the catalyst per unit mass. The efficiency of dehydrogenation of cyclohexane, oxidation of H_2, dehydration of isopropyl alc. were increased many fold over the same catalyst in pelleted form or deposited on asbestos.

11274. Kotelkov, N.Z. **Dehydrating properties of some clays and opokas.** *Zhur. Priklad. Khim.* 24, 576-82; *J. Appl. Chem. U.S.S.R.* 24, 641-7 (1951)(Engl. translation).—*C.A.* 46, 7859*d*; 47, 2568*h*.

Alc. dehydration over clay and opoka (rock consisting of SiO_2 and plastic material) catalysts were studied at 250°-450°C, with alc. flow of 0.05-0.3 ml/min. The extent of dehydration varied directly with the amt. of catalyst; it was nearly 100% for 14 g catalyst. The rate of reaction followed the Arrhenius equation. The energy of activation was about 4150 cal/mole. The process proceeded without side reactions. A temp. of 350°C was about the optimum. The catalysts were easily regenerated with air.

11275. Kummer, J.T.; Podgurski, H.H.; Spencer, W.B., and Emmett, P.H. **Mechanism studies of the Fischer-Tropsch synthesis. The addition of radioactive alcohol.** *J. Am. Chem. Soc.* 73, 564-9(1951).—*C.A.* 45, 4907*i*.

Methyl-labeled and methylene-labeled radioactive EtOH were added to a 1:1 CO-H_2 synthesis gas being passed at 1 atm. pressure over an Fe catalyst at about 230°C. Measurement of the radioactivity of the hydrocarbon products showed negligibly small activity for CH_4 formed and an approx. const. activity of 2150 ± 100 counts per min. per ml S.T.P. for the C_5 to C_{10} hydrocarbons. Either EtOH or some surface complex formed by the adsorption of EtOH behaved like an intermediate in hydrocarbon synthesis over Fe Fischer-Tropsch catalysts and at least the first of the added C atoms attached itself principally to the α-C atom of the surface complex.

11276. Lavrovskaya, G.K. and Voevodskii, V.V. **Reactions of hydrogen and oxygen atoms on solid surfaces.** *Zhur. Fiz. Khim.* 25, 1050-8 (1951).—*C.A.* 46, 2893*c*.

Partially dissocd. H_2 or O_2 from a discharge tube (3000 v.) flowed toward a capillary contg. a thermocouple (temp. T), coated with a catalyst and surrounded by walls kept at a temp. T_0. The probability of at. recombination was obtained from the heat-balance equation. MgO (from combustion of Mg) recombined with O but not H. When fresh, MoO_3 was inefficient but it became blue, active, and stable after some use. For $ZnO.Cr_2O_3$ in particular the true surface was much larger (~100-fold) than the geometrical surface.

11277. Lund, Vibeke. **Corrosion of silver by potassium cyanide solutions and oxygen.** *Acta Chem. Scand.* 5, 555-67(1951)(in English).—*C.A.* 46, 3373*h*.

In the initial stage of the soln., H_2O_2 was formed as an intermediate. When the CN^- concn. becomes sufficiently low, the H_2O_2 decompd. on the Ag surface. The Ag dissolved in an amt. equiv. to the CN present and formed $Ag(CN)_2^-$. The rate of O_2 consumption was independent of initial CN^- concn. within the range 0.05 to 0.2 *M*. The activation energy was 3.2 kcal from 15° to 25°C. The velocity was detd. by rate of diffusion in the soln.

11278. Mackenzie, H.A.E. and Milner, A.M. **Isotopes. IV. Catalysis of isotopic exchange between gaseous oxygen and liquid water.** *J. S. African Chem. Inst.* [N.S.] 4, 79-82(1951).—*C.A.* 47, 5742*f*.

No appreciable isotopic exchange took place between oxygen (O^{18}) and liquid water in the presence of metallic oxides, hydroxides, or org. substances. Introduction of H_2O_2, or of substances capable of catalyzing the decompn. of H_2O_2, such as finely divided Pt or catalase, catalyzed the exchange.

11279. Maeda, Shiro and Kawazoe, Kenjiro. **Heat transfer in granular beds. VII. Temperature distribution in the catalyst beds for sulfur dioxide oxidation.** *Chem. Eng.* (Japan) 15, 312-16(1951).—*C.A.* 46, 7377*c*.

Theoretical equations regarding the temp. distribution in catalyst beds were satisfactorily checked by the data obtained in the oxidation of SO_2(V_2O_5 catalyst) under conditions (low rates of gas flow and low degree of conversion) that were not realized in the former expts. on the oxidation of NH_3.

11280. Mastagli, Pierre; Austerweil, Geza, and Dubois, Edith. **Chemical action of cation exchangers.** *Compt. rend.* 232, 1848-9 (1951).—*C.A.* 46, 2874*e*.

Formation from an org. acid and alc. by cation exchange in the presence of an acid and a dehydrating agent was extended to include ether oxides. By heating an aryl alc. in a hydrocarbon soln. in the presence of an ion-exchange resin (phenol-HCHO sulfonic acid resin), $(C_6H_5CH_2)_2O$ was formed followed by $C_6H_5CH_3$ + C_6H_5CHO.

11281. Maxted, E.B. **Catalysis and the poisoning of catalysts.** *Chemistry & Industry* 1951, 242-6.—*C.A.* 45, 5340*e*.

Spent Ni catalyst used for hydrogenation of phenol contg. thiophenol was regenerated completely by washing with dil. soln. of Na permolybdate followed by water wash and reduction by H_2. Applicability to industrial use was discussed.

11282. McGeer, James Peter and Taylor, Hugh S. **Ammonia decomposition and related phenomena on rhenium catalysts.** *J. Am. Chem. Soc.* 73, 2743-51(1951).—*C.A.* 45, 8337*c*.

Kinetic measurements between 380° and 440°C showed that NH_3 decompd. over Re at a rate proportional to $(NH_3)^{0.53}$and $(H_2)^{-0.89}$ with an energy of activation of 32 ± 3 kcals. Adsorption of H_2 was measurable between - 196° and 330°C and resembled adsorption on Fe. Dissociative adsorption of N_2 on Re begins at about 250°C as with Fe. N_2 adsorbed in the range — 196°to — 154°C was slow in equilibrating and, in contrast to A, was not readily desorbed. Isotopic exchange between NH_3 and D_2, H_2 and D_2, and H_2O and D_2 occurred over Re between 0° and 100°C. Isotopes of N_2 exchanged readily over Re only above 500°C.

11283. Miyazaki, Shozo. **The catalytic decomposition of ammonia gas. X. Decomposition on nickel.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 71, 605-6(1951).—*C.A.* 45, 7865*a*.

The thermal decompn. of NH_3 gas on Ni at 650°-750°C was observed in the NH_3 pressure range 3-15 mm Hg. The retarding action of H_2 was lost and a linear relation held between pressure and vol. at the temp. range. The heat of activation was calcd. to be 31.0 kcal/mol.

11284. Miyazaki, Shozo. **The thermal decomposition of ammonia gas. XI. Decomposition of ammonia gas on various metals at low pressure.** *J. Chem. Soc. Japan*, Pure Chem. Sect., 72, 1-3(1951).—*C.A.* 46, 3383*d*.

The decompn. of NH_3 on W, Mo, Pt, and Ni was studied at 650°-800°C in the range $0.5\text{-}1.0 \times 10^{-1}$ mm Hg. In each case the retarding action disappeared and the relation between pressure and vol. was represented as the 1st-order reaction with the lowering of pressure.

11285. Miyazaki, Shozo. **Thermal decomposition of nitrous oxide gas on platinum.** *J. Chem. Soc. Japan*, Pure Chem. Sect., 72, 723-6(1951). —*C.A.* 46, 5944*h*.

The thermal decompn. of N_2O gas on Pt was studied at 850°-875°C. The reaction was retarded by O_2 formed as decompn. product. From the exptl. results the heat of activation of N_2O gas on Pt was calcd. to be 31.8 kcal $mol.^{-1}$.

11286. Moritani, Ichiro. **Contact cracking power of synthetic alumina-silicate catalyst. II. Influence of addition compounds on catalysts and reaction temperature. III. Life and regeneration of catalysts.** *J. Chem. Soc. Japan*, Ind. Chem. Sect. 54, 18-21;21-3(1951).—*C.A.* 47, 1309*b*.

The influence of various metallic oxides upon the catalytic activity of $Al_2O_3\text{-}SiO_2$ was studied for the formation of isobutylene from acetone. At 400°C, the presence of SnO_2 and Cr_2O_3 gave a yield of 28.5%.

11287. Murray, Christopher A. **Thermofor catalytic cracking gas plant corrosion survey.** *Corrosion* 7, 98-108(1951).—*C.A.* 45, 3579*c*.

Severe corrosion was experienced in a Thermofor catalytic cracking gas plant over several years. Some NH_4 acid salts were present which dissocd. at reboiler temps. to give acid conditions which caused rapid attack of reboiler tubes. Measures were suggested to remove water, which would also remove the principal corrosive constituents at appropiate points in the system.

11288. Nagiev, M.F. **Kinetics of catalytic cracking.** *Zhur. Fiz. Khim.* 25, 29-40(1951).—*C.A.* 46, 2898*g*.

The general equations expressing the kinetics of the catalytic conversion of a complex mixt. in a flow system were derived on the assumption that the contact reactions were unimol.

11289. Nakatani, Fumitada. **Free carbon precipitation from carbon monoxide gas in the presence of iron oxide.** *Tech.-nol. Repts. Osaka Univ.* 1, 261-77(1951)(in English).—*C.A.* 46, 4339*f*.

When CO was passed over Fe_2O_3 at 600°-800°C, carbon deposits were formed. The catalytic decomp. of CO into CO_2 + C may take place only when Fe_2O_3 was reduced to lower oxides which corresponded to a certain concn. of CO in CO + CO_2 mixt.

11290. Norman, Noel E. and Johnstone, H.F. **Catalysis in fused-salt systems.** *Ind. Eng. Chem.* 43, 1553-8(1951).—*C.A.* 45, 9349*e*.

The decompn. of C_2H_2 and the dehydrogenation of EtOH were investigated. The effects of molten chlorides on the decompn. of C_2H_2 agreed with the effects of the corresponding metals. All expts. were made at 600°C, and the metals were used in the compact state except Pt and Pd. Those active in the decompn. were Li, Na, Fe, Co, Ni, Cu, Mn, and finely divided Pt and Pd. C_2H_2 was bubbled through the melt for 5 min., after which it was examd. for carbon. The results with $ZnCl_2$ were unique; at 400°C slight decompn. occurred, at 450°C the reaction was vigorous, and at 600°C it had again subsided. No melt was found that catalyzed the synthesis of hydrocarbons from CO and H_2.

11291. Obolentsev, R.D. **Kinetics of the isomerization of normal butane in the liquid phase on aluminum chloride.** *Zhur. Obshcheĭ Khim.* (J. Gen. Chem.) 21, 73-7(1951).—*C.A.* 45, 3697*h*.

Isomerization of C_4H_{10} to iso-C_4H_{10} was followed in sealed tubes with C_4H_{10} (20-21g), $AlCl_3$ (4 g), and HCl (1 mole/7 moles C_4H_{10}). With M = amt. of C_4H_{10} reacted, expressed in % of the initial amt. of C_4H_{10}, D = limit of M at the given temp. (highest degree of isomerization attainable, and τ = time in min., the law $\ln [D/(D-M)] = a\tau^b$ was verified, b was dimensionless, and a had the dimension τ^{-b}. The rate of polymerization $w = (dM/d\tau)(100/D) = d\xi/d\tau$ (where ξ = amt. of C_4H_{10} reacted up to the time τ, expressed in percentage of the completed reaction) was $w = (100 - \xi)ab\tau^{b-1}$. The isomerization of C_4H_{10} did not obey Semenov's 2nd law. It was assumed that the isomerization in the range 55°-100°C involved a neg. chain interaction, in the sense of Semenov.

11292. Obolentsev, R.D. and Gryazev, N.N. **Kinetics of dealkylation of isopropylbenzene on an aluminosilicate catalyst.** *Zhur. Obshcheĭ Khim.* (J. Gen. Chem.) 21, 860-8(1951); *J. Gen. Chem. U.S.S.R.* 21, 943-50(1951)(Engl. translation).—*C.A.* 46, 32*c*; 7413*i*.

The reaction of iso-PrPh at 300°, 350°, 400°C was studied on a com. catalyst activated at 480°-500°C in air passing at 200-300 liter/liter catalyst/hr and then flushed with N_2, at space velocities s ranging from 0.125 to 15 liter/liter catalyst/hr. Coke formation varied between 2 and 3.8%, The formation of satd. hydrocarbons was attributed to disproportionation of H_2. Dismutation accompanied the dealkylation, iso-PrPh = C_3H_6 + C_6H_6. In the range of 350°-400°C, the extent of the dismutation increased with increasing contact time. With the temp. rising to 450°C, the curve of the extent of dismutation as a function of the contact time passed through a max. With the C_6H_6 formed by dismutation deducted, the amts. of C_3H_6 and C_6H_6 corresponded to each other.

11293. OBOLENTSEV, R.D.; VERSHININA, K.A., AND SKVORTSOVA, E.V. **Reactions of hydrocarbons in the presence of oxide catalysts. IV. Dehydrogenation of butanes on a chromia catalyst.** *Zhur. Obshcheĭ Khim.* (J. Gen. Chem.) 21, 1800-6 (1951).—*C.A.* 46, 10816*e*.

On a Cr_2O_3-Al_2O_3 catalyst prepd. by simultaneous pptn., C_4H_{10} and iso-C_4H_{10} underwent both dehydrogenation and some isomerization. Flow expts. were run with the same total amt. of reactant (4.5 liters), the 1st half-hr's products were discarded. The Cr_2O_3 + Al_2O_3 catalyst had a "dehydroisomerizing" action. Whether the C_4H_{10} obtained from iso-C_4H_{10}, and the iso-C_4H_{10}, obtained from C_4H_{10}, were primary or secondary products was not yet settled. This partial isomerization could be accounted for by an intermediate formation of a 3-membered ring.

11294. OHASHI, KUMAO AND SUZUKI, SHIGENARI. **Uhde catalyst. I.** *J. Chem. Soc. Japan.* Ind. Chem. Sect. 54, 353-5(1951).—*C.A.* 47, 5045*c*.

Fe introduced into the catalyst as an impurity during the prepn. gave rise to catalytic activity. An effective catalyst was prepd. from $K_4Fe(CN)_6$, $AlCl_3$, and $FeCl_3$.

11295. OHTA, NOBUTO. **Catalytic hydrolysis of chlorobenzene to phenol in the vapor phase. I. Relationship between the method of preparing the silica gel-cupric chloride catalyst and its catalytic activity.** *Repts. Govt. Chem. Ind. Research Inst. Tokyo* 46, 163-72(1951) (English summary).—*C.A.* 46, 1855*e*.

The catalytic action of silica gel in the hydrolysis of PhCl to PhOH in the vapor phase increased with its larger proton-supplying power. SiO_2 dried first at 110°-250°C and then impregnated with 1-5% (in wt) of $CuCl_2$ was 3 to 4 times as effective as silica gel loaded on acid clay.

11296. OHTA, NOBUTO AND TEZUKA, TAKASHI. **The catalytic hydrolysis of chlorobenzene in the gas phase. I. Relation between the method of preparation of catalyst silica gel-cupric chloride and the catalytic activity.** *J. Chem. Soc. Japan,* Ind. Chem. Sect. 54, 297-9(1951).—*C.A.* 47, 2910*c*.

Prepn. of the proper catalyst for the catalytic hydrolysis of chlorobenzene into phenol was studied. Newly pptd. silica gel, dried at 100~300°C, cooled, and soaked with $CuCl_2$ and then dried at 300°C was very active.

11297. OHTA, NOBUTO AND TEZUKA, TAKASHI. **Catalytic hydrolysis of chlorobenzene to phenol in the vapor phase. II. Influence of temperature, space velocity. The reaction between chlorobenzene and ammonia water.** *J. Chem. Soc. Japan,* Ind. Chem. Sect. 54, 328-30(1951).—*C.A.* 47, 3100*f*.

By use of silica gels contg. $CuCl_2$, the gas-phase hydrolysis of chlorobenzene was studied under various conditions. The reaction velocity increased rapidly with temp. As hydrolysis agent NH_4OH was better than water below 500°C when the space velocity of reactants was small.

11298. OHTA, NOBUTO AND TEZUKA, TAKASHI. **The catalytic hydrolysis of chlorobenzene in the gas phase. IV. The method of addition of the copper component to the catalyst.** *J. Chem. Soc. Japan,* Ind. Chem. Sect. 54, 509-11 (1951). —*C.A.* 47, 6070*f*.

$Cu(OH)_2$ hydroxide was added to silica gel in order to prevent aging. When the silica gel dried at 120°C was mixed with wet $Cu(OH)_2$, the resulting catalyst showed a superior activity in the range 5-20% CuO.

11299. PARTINGTON, J.R. AND NEVILLE, H.H. **Thermal decomposition of carbonyl sulfide.** *J. Chem. Soc.* **1951**, 1230-7.—*C.A.* 45, 7461*c*.

The rate of the reaction $2\ COS \rightleftharpoons CO_2 + CS_2$ at 450°C was sensitive to the nature of the wall, being faster when the vessel was filled with silica. The activation energy was 28,450 cals for the silica surface. By prior addn. of CO_2 the above reaction was repressed and the reactions $COS \rightleftharpoons CO + S$, $2\ COS \rightleftharpoons 2\ CO + S_2$, or $2\ CO + S_2 \rightleftharpoons 2\ COS$ could be studied.

11300. PATTISON, JOHN N. AND DEGERING, E.F. **Some factors influencing the activity of Raney nickel catalyst. II. The role of oxygen in the aging of Raney nickel catalyst.** *J. Am. Chem. Soc.* 73, 486-7(1951).—*C.A.* 46, 4144*g*.

O_2 was responsible for the major part of the loss of activity of Raney nickel catalyst. The catalyst was suspended in hardened cottonseed oil so that it could be handled dry and weighed out accurately. The activities of 2 samples of W-4 type catalyst were approx. 0.093 and 0.056 p.s.i./min. 2 days after prepn. and the activities fell to approx. 0.027 at 12 days after prepn. A sample stored in N_2 retained its original activity whereas a sample stored in air was much less active after the same period of time. Storage in O_2 was even more harmful to the catalyst.

11301. PATTISON, JOHN N. AND DEGERING, E.F. **Some factors influencing the activity of Raney nickel catalyst. III. The poisoning of Raney nickel by halogen compounds.** *J. Am. Chem. Soc.* 73, 611-13(1951).—*C.A.* 45, 10188*d*.

Raney Ni was poisoned by HCl and by Am, *sec*-Am, *tert*-Am, Bu, *sec*-Bu, *tert*-Bu, Pr, Et, Ph, and $ClCH_2CH_2$, chlorides, bromides, and iodides; *m*-$ClC_6H_4NH_2$, 6,2-$Cl(H_2N)C_6H_3Me$, *m*-ClC_6H_4Me, CCl_4, $CHCl_3$, CCl_3CH_2OH, $ClCH_2CO_2H$, Cl_2CHCO_2H, Cl_3CCO_2H, AcCl, $CH_2{:}CHCH_2Cl$, BzCl, $(ClCH_2CH_2)_2O$, and $CCl_3CHO.H_2O$ indicated that there were at least 2 distinct types of active surface present on this catalyst.

11302. PAUL, RAYMOND; BUISSON, PAUL, AND JOSEPH, NICOLE. **Alkaline borohydrides in the preparation of hydrogenation catalysts.** *Compt. rend.* 232, 627-9 (1951).—*C.A.* 45, 10436*h*.

An aq. 5% $NiCl_2.6H_2O$ soln. (121 ml) was added with stirring to a 10% soln. of NaH_4B (27 ml); the black ppt. was filtered, washed, dried, and preserved under abs. EtOH; 7.7% B was found (theoretical for BNi_2 = 8.5%). $NiSO_4$ may be used, and MeOH may replace H_2O. The catalyst was only slightly less active than Raney Ni, but if the chloride or sulfate was replaced by $Ni(AcO)_2$, the catalyst was as active as Raney Ni. With Co a similar black ppt. contg. 7.9% B was obtained, but it was less active than the previous catalyst. Complex Ni-Cr catalysts were much more active than Raney Ni. Co-Cr and Co-W complexes contg. 2% Cr and W, resp., were more active than the simple Co catalyst.

11303. Pavlyuchenko, M.M. and Gurevich, E. **Kinetics of the decomposition of silver oxide.** *Zhur. Obshcheĭ Khim.* (J. Gen. Chem.) 21, 467-73 (1951)—*C.A.* 45, 5006*f*.

The rate of decompn. of Ag_2O powder, measured by the rate of change of the pressure of the O_2 evolved, in a preliminarily evacuated vessel, at 118°, 150°, 160°, and 170°C, was greatest at the initial stage and fell with the progress of the decompn. With progressing decompn., and increasing surface coverage, the adsorbed Ag atoms interacted to form cryst. Ag, and the adsorbed O atoms formed O_2 which was desorbed. To some extent, adsorbed Ag and O will interact to reform Ag_2O (s), and adsorbed O will react according to $Ag_2O + O \rightarrow 2\ Ag\ (\text{adsorbed}) + O_2$. With the heats of adsorption of Ag and O atoms assumed equal, this latter reaction was exothermal by 47.5 kcal.

11304. Riesz, C.H.; Dirksen, H.A., and Kirkpatrick, W.J. **Sulfur poisoning of nickel catalysts.** *Inst. Gas Technol. Research Bull.* No. 10, 23 pp. (1951).—*C.A.* 46, 2780*g*.

The catalyst life (capacity before regeneration became necessary) and the catalyst conversion efficiency varied widely and independently with the kind and amt. of S compd. present. The performance of Ni catalysts in the presence of S could be improved considerably by appropriate selection of feed rates, steam concns., and operating temps. It was always possible to restore the catalyst to its original effectiveness if excessive temps. during regeneration were avoided.

11305. Rigamonti, Rolando and Spaccamela, Elena. **Catalytic oxidation of alkaline chromites to chromates with oxygen at low temperature. II. Experiments with silver oxide.** *Atti. accad. sci. Torino, Classe sci. fis. mat. e nat.* **86**, 129-37 (1951-52).—*C.A.* 47, 3739*h*.

The efficiency of Ag_2O as a catalyst was detd. Unlike Mn, Fe, Co, and Cu hydroxides examd. previously, Ag_2O accelerated the process with smaller concns. of catalyst. It not only affected the oxidation of $Cr(ONa)_3$, but it favored the transition of $Cr(OH)_3$ to $Cr(ONa)_3$.

11306. Roginskiĭ, S.Z. and Element, N.I. **Experimental verification of the statistical theory of poisoning. I. Poisoning of nickel oxide by boric acid.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* 1951, 350-60.—*C.A.* 45, 9934*h*.

Complete combustion of iso-C_8H_{18} vapor was studied in the range 370-550°C in a flow mixt. with O_2 on a NiO catalyst supported on asbestos. The catalyst was partially poisoned by impregnation with an aq. soln. of B_2O_3 and dried. The rate of the oxidation (decrease of the concn. c of iso-C_8H_{18}) was 0.5-order in iso-C_8H_{18}, and zero-order in O_2. The rate decreased with increasing B_2O_3 (0.1 to 1.5 wt %). The linear dependence of E on the B_2O_3 corresponded to uniform distribution of active portions over activation energies, with a possible narrowing at highest E. Uniform distribution should give a relation of the form $k = ae^{-a\gamma}$. The poisoning action of B_2O_3 consisted in selective blocking.

11307. Rohrer, C.S.; Rooley, J., and Brown, O.W. **Catalytic activity of reduced nickel tungstate.** *J. Phys. & Colloid Chem.* 55, No. 2, 211-14 (1951). —*C.A.* 45, 4540*g*.

$NiWO_4$ was prepd. by pptn. from aq. $NiNO_3$ with Na_2WO_4 and reduced as 1/4 in. granules in H_2 at 375°C. This material, packed in a vertical column, was used at 212°C to hydrogenate 1-nitropropane to *n*-propylamine. A yeild of 94.5% of *n*-propylamine was obtained.

11308. Rubinshteĭn, A.M. and Pribytkova, N.A. **Hydrogenation and dehydrogenation reactions on α- and β- cobalt.** *Izvest Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* 1951, 70-80.—*C.A.* 45, 5010*b*.

Catalysts without carrier were prepd. by decompn. of pure $Co(NO_3)_2$ at 300°C, and reduction of the CoO in H_2, 10 hrs at 350°, 375°, 420°, 450°, 600°, and 800°C. Catalysts on activated charcoal (washed with HCl) were made by impregnation with $Co(NO_3)_2$, drying at 200°C (accompanied by spontaneous heating-up), and reduction with H_2, 8 hrs at 350°, 600°, and 800°C. All expts. were made in a flow system with 1 g Co. In the hydrogenation of C_6H_6 in excess H_2 (space velocity of 4 ml/g Co/hr) the catalytic activity remained const. with time in all expts. at 140° and 160°C. In hydrogenation of cyclohexene (3.2 ml/g Co/hr) using catalysts on charcoal, the degrees of conversion in 12 min. at 120°, 140°, 160°, were: α, 92, 48, 44.5%; β, 9, 0, 0%. Hydrogenation of Me_2CO to Me_2CHOH, C_2H_4 (gas compn. C_2H_4 30.6, H_2 69, CO_2, 0.2, CO 0.6%), CO (gas compn. CO 25, H_2 62.8, CH_4 7.8, N_2 4%) and dehydrogenation of cyclohexane, and EtOH were studied.

11309. Ruff, R.J. **Catalytic combustion of hydrocarbon vapors.** *Org. Finishing* 12, No. 1, 20-3 (1951).—*C.A.* 45, 3532*b*.

The construction was intended to provide a high catalyst-surface exposure, turbulence in passage through the element, and reasonable min. resistance to flow. Combustion-sustaining temps. at the entry side of the catalyst varied inversely as the fume concn., so that combustion could be maintained with 70°F fume entry temp. providing the energy equiv. was at least 15 B.t.u./ft^3. Use of the catalyst was limited to fumes substantially free of unburnable solids. The catalytic element became deactivated after about 4000 hrs of service, but could be reactivated for a reasonable cost.

11310. Ruff, R.J. **Catalytic combustion in wire enameling.** *Wire and Wire Products* 26, 936-9, 987, 988 (1951).—*C.A.* 46, 1267*d*.

The catalytic combustion and the application to wire-enameling ovens were reviewed. The catalyst elements exceeded expectations in active life and freedom from necessity for service. When activity of the catalyst declined, elements could be reactivated.

11311. Saito, Hirotaro. **The manganese oxide catalysts. II. Catalytic oxidation of carbon monoxide by several kinds of oxides of manganese.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 72, 333-6 (1951).—*C.A.* 46, 812*h*.

Manganous oxides were prepd. by the reduction of MnO_2 and Mn_2O_3 and their catalytic activities for the oxidation of CO were detd. The relation between the structure and catalytic activity was discussed. The chemisorption of O_2 by the catalyst was a dominant factor for reaction.

11312. Sakaki, Tomohiko. **Catalytic hydration by metal oxides in gaseous systems. III. Catalytic hydration of hydrogen cyanide.** *J. Chem. Soc. Japan*, Pure Chem. Sect., 72, 165-6 (1951).—*C.A.* 46, 3383*g*.

Biuret was among the products of hydration of HCN catalyzed by ZnO at 200°C. Its occurrence was attributed to the thermal condensation of urea. The hydration took place as follows: (1) $HCN + H_2O = NH_2CHO$, (2) $2NH_2CHO + H_2O = (NH_2)_2CO + CO_2 + 2H_2$, (3) $2(NH_2)_2CO = (NH_2CO)_2NH + NH_3$.

11313. Sakikawa, Noriyuki. **Organic geochemical reactions. VIII. Catalytic dehydration and polymerization of butanol by clays under high pressure.** *J. Chem. Soc. Japan*, Pure Chem. Sect., 72, 227-30(1951).—*C.A.* 46, 1238*g*.

BuOH was treated with Japanese acid clay in an autoclave at 100-200 atm. and 300°-400°C. The product was mainly olefin hydrocarbons when alumina was used as a catalyst, while acid clay produced olefins and about 17% aromatic hydrocarbons; activated clay prepd. from acid clay produced about 70% aromatic hydrocarbons with about 30% olefins.

11314. Schlesinger, M.D.; Crowell, J.H.; Leva, Max, and Storch, H.H. **Fischer-Tropsch synthesis in slurry phase.** *Ind. Eng. Chem.* 43, 1474-9(1951).—*C.A.* 45, 8227*f*.

Pilot-plant studies were made in which the finely divided catalyst was suspended in oil and synthesis gas (equal parts CO and H_2) passed through the slurry. Gas velocities of 0.1-0.2 ft/sec were used, and the catalyst consisted of Fe promoted with Cu and alkali (100 Fe, 10 Cu, 1 K_2O). The catalyst was activated by treatment with synthesis gas at gradually increasing temp. until a gas contraction of 65%, equiv. to 70% H_2 and CO conversion, was reached. Synthesis was conducted at 255-76°C and pressures from 200 to 250 p.s.i. at a space velocity of 300. Increase in temp. resulted in an increase in C_3-C_5 hydrocarbons from 25 to 33%, while the gasoline (400°F end point) yield remained approx. const.

11315. Scipioni, Andrea. **The activities of copper and chromium in hydrogenation catalysts.** *Chimica e industria* (Milan) 33, 285-7(1951).—*C.A.* 46, 7252*d*.

The hydrogenation of furfural (300g) at 175°C and 25 atm. with Cu chromite catalyst (6g) was studied. Excessive heat treatment of the catalyst reduced its activity greatly. The catalyst activity was directly proportional to the content of CuO of the catalyst which could be reduced by CO. The stabilizing effect of Cr_2O_3 on CuO or on the active Cu centers formed during reduction was the active principle.

11316. Sherburne, R.K. and Farnsworth, H.E. **Activation of a solid nickel catalyst for the hydrogenation of ethylene by heat-treatment in a high vacuum.** *J. Chem. Phys.* 19, 387-8 (1951).—*C.A.* 45, 6912*c*.

Electropolished sheet Ni was heated *in vacuo* and then used as a catalyst for hydrogenating C_2H_4. The highest activity was obtained after heating 3.5 hrs at dull redness; the activity was higher, the lower the pressure at which the heating occurred. A clean gas-free surface was necessary for highest catalytic activity per unit area. This could be obtained only by heating at temps. considerably above the usual baking temp.

11317. Shur, A.S. and Demenev, N.V. **Catalytic activity of platinum films prepared from solutions of platinum salts by means of a gaseous reducing agent.** *Zhur. Fiz. Khim.* 25, 136-42 (1951).—*C.A.* 45, 5501*h*.

The catalytic hydrogenation of C_2H_4 was used to det. the activity of Pt films prepd. from aq. solns. of Pt salts reduced with H_2. A film (600 cm^2 surface) absorbed up to 1.24 ml of H_2 and 1.55 ml of C_2H_4. The catalytic activity depended on the film thickness. The effect of temp. was studied for 2 films (75 A. and 150 A.) with initial pressure of 50 mm. In both cases, the % conversion/min. first was const. up to 50°C, then increased, reached a plateau at 175°C, and finally dropped to very low values at 275°-280°C. The electron microscope revealed that the films were extremely porous.

11318. Shushunov, V.A. and Aurov, A.P. **Kinetics of the reaction between magnesium and ethyl bromide.** *Zhur. Fiz. Khim.* 25, 13-19 (1951).—*C.A.* 45, 5009*f*.

An evapd. film of 99.99% pure Mg reacted with gaseous halides (MeCl, MeBr, MeI, EtCl, EtBr, EtI) in a static glass system. Kinetic data were obtained for EtBr and EtCl. The pressure drop (Δp) changed with time t in the manner characteristic of autocatalytic topochem. processes. During the 1st stages of the reaction, $-\Delta p = at^3$. An induction period τ was defined as the time required for $-\Delta p = 0.2$ mm Hg. At 40° and 60°C, the relation τp = const. was verified for $2<p<30$ mm Hg.

11319. Shushunov, V.A.; Aurov, A.P., and Gorinov, V.A. **Catalysis by ethers of the reaction between magnesium and ethyl bromide.** *Zhur. Fiz. Khim.* 25, 20-3 (1951).—*C.A.* 45, 5009*h*.

The effects of Et_2O, MeEtO, and iso-Pr_2O on the reaction between Mg and gaseous EtBr were investigated. The induction period decreased with increasing amts. of ethers. The energy of activatio E became very low: values of E (kcal/mole) for the EtBr + Mg reaction were 13, 12, 12, 2.5, 1.9, 1.5, <1.5, <1.5, <1.5 when one added, resp., 0.0, 0.5, 1.5,, 2.6, 6.1, 12, 18, 26, 100 mol. % of MeEtO to EtBr. The low values of E indicated that diffusion through the layer of product became the rate-detg. step.

11320. SLOVOKHOTOVA, T.A. AND IVANOV, A.P. **Catalytic reactions of cyclohexane in the presence of water on nickel.** *Vestnik Moskov. Univ.* 6, No. 2, *Ser. Fiz.-Mat. i Estestven. Nauk* No. 1, 125-35(1951).—*C.A.* 46, 4340*a*.

Expts. were run with a Ni/Al_2O_3 catalyst (3 g) at a feed rate of cyclohexane of 0.2 ml/min., without or with H_2O (vol. ratio H_2O/cyclohexane = 7), at 250, 275, 300, 325, and 350°C. The rate of evolution of gas was const. in all expts., which indicated no poisoning of the catalyst. Presence of H_2O inhibited dehydrogenation and the rate was reduced by a factor of 5. Dehydrogenation and hydrogeno-cracking involved different orientations of the adsorbed cyclohexane mols. H_2O inhibited the C—C bond rupture much more strongly than the rupture of the C—H bond. Nevertheless, the over all rate of hydrogeno-cracking was increased in the presence of H_2O by a factor of 1.6-2.4.

11321. SMITH, DONALD P. **Catalysis by metal powders.** *J. Applied Phys.* 22, 1291-2(1951).—*C.A.* 46, 1854*d*.

Finely divided metals were regarded as strained metals in small masses, and owed certain characteristics to their dis-structure or rifted condition. Their activity as catalysts was ascribed to the presence of widened lattice intervals.

11322. SMITH, HILTON A. AND BEDOIT, WILLIAM C. JR. **Kinetics of the catalytic hydrogenation of the nitro group on platinum.** *J. Phys. & Colloid Chem.* 55, 1085-1104 (1951).—*C.A.* 46, 31*e*.

The kinetics of catalytic hydrogenation of the nitro group were studied. All of the reduction were accomplished in AcOH as solvent with the Adams Pt catalyst. The hydrogenations were performed in a modified Parr, low-pressure catalytic reduction app. The hydrogenation of $EtNO_2$ proceeded smoothly to the amine. For both $PhNO_2$ and $NO_2C_6H_2Me_3$, the nitro group was first reduced, and then the benzene ring was subsequently hydrogenated. The hydrogenation of $NO_2C_6H_4C_2H_3$ was interrupted after 1.5 mols. of H_2 had been consumed, and the intermediates were isolated.

11323. SMITH, N.L. AND AMUNDSON, N.R. **Intraparticle diffusion in catalytic heterogeneous systems.** *Ind. Eng. Chem.* 43, 2156-67 (1951).

Intraparticle diffusion was postulated to be the controlling factor. Equations were derived which related the physical and chemical parameters of the system to the operating variable. The hydrolysis of ethyl formate was studied, using a strongly acidic cation exchange resin as catalyst. Batch and continuous operation studies were performed with various resin particle sizes. The equations developed were useful in theoretical kinetic studies as well as in the design of commercial reactors.

11324. SOKOL'SKIĬ, D.V. **Active carriers in hydrogenation.** *Doklady Akad. Nauk S.S.S.R.* 79, 823-6 (1951).—*C.A.* 46, 1958*h*.

Rates of hydrogenation of $Me_2C(OH)C:CH$ in 90% alc. were detd. in 30-min. expts., by the amt. of H_2 adsorbed on Pt supported on $BaSO_4$, Pt supported on Os-Coated $BaSO_4$, Pd supported on $BaSO_4$, and Pd supported on Ru-coated $BaSO_4$; the carriers without Pt or Pd had no catalytic activity of their own. The presence of Os evidently promoted [illegible] the hydrogenation of the double bond. Potentiometric detns. showed that in the hydrogenation of the triple bond the potential of Pt fell sharply, and H_2 was desorbed from the surface.

11325. SOKOL'SKIĬ, D.V. AND SHMONINA, V.P. **Catalytic reduction of nitrobenzene.** *Doklady Akad. Nauk S.S.S.R.* 78, 721-4 (1951).—*C.A.* 45, 8337*f*.

The uptake of H_2 by $PhNO_2$ in 0.1 *N* soln. of NaOH and in neutral alc., in the presence of a skeleton Ni catalyst, unpromoted and promoted with Rh, was followed along with measurements of the potential *E* of the catalyst against a 0.1 *N* calomel electrode. Both the inhibition of the reduction and the fall of *E* were due to strong adsorption of $PhNO_2$ on the Ni. On a catalyst promoted with 0.0019 g Rh (introduced in the form of $RhCl_3$), in alk. alc. soln., the rate curve became smoother and more nearly zero-order. Alkali poisoned the unpromoted catalyst, but with the Rh-promoted catalyst it increased the rate. Reduction of $PhNO_2$ formed PhNO which underwent no further reduction as long as $PhNO_2$ was still present in the soln., there was no evidence of an intermediate formation of PhNHOH in alk. soln.

11326. SUZUKI, SHIGENARI AND HASEGAWA, MASAHARU. **Uhde catalyst. II.** *J. Chem. Soc. Japan,* Ind. Chem. Sect. 54, 437-9(1951).—*C.A.* 47, 5581*b*.

An active catalyst was prepd. by the combination of 1 mole $K_4Fe(CN)_6$, 0.8 mole $AlCl_3$, and 0.2 mole $FeCl_3$.

11327. SUZUKI, SHIGENARI AND SUZUKI, HIROSHI. **Uhde catalyst. III.** *J. Chem. Soc. Japan,* Ind. Chem. Sect. 54, 487-9(1951).—*C.A.* 47, 6070*c*.

By means of chem. analysis, it was found that the principal constituents of the active Uhde catalyst were $KAl[Fe(CN)_6]$ and a proper amt. of $KFe[Fe(CN)_6]$.

11328. SZABO, ZOLTAN G. AND BARTHA, LAJOS. **Catalysis in analytical chemistry. I. Silver catalysts in the reduction of nitrates by ferrous hydroxide.** *Acta Chim. Hung.* 1, 116-23 (1951)(in German).—*C.A.* 45, 10123*c*.

The reduction process was in 2 steps: (1) nitrates reacted with $Fe(OH)_2$ to form $Fe(OH)_3$ and nitrite, and (2) the nitrite and $Fe(OH)_2$ reacted to give $Fe(OH)_3$, NH_3, and alkali hydroxide. The 1st reaction was accelerated by Ag catalysts. In the presence of I^-, IO^-, or IO_3^-, AgI formed, and in the presence of S^{2-} and $S_2O_3{}^{2-}$, Ag_2S formed, both of which adsorbed Ag^+ and reduced the catalytic activity. The mechanism of the catalysis was the formation of metallic Ag pptg. from homogeneous soln. in a colloidal form and reacting with the nitrate instantaneously.

11329. TAYLOR, T.I. AND DIBELER, V.H. **Catalyzed reactions of unsaturated hydrocarbons with hydrogen and deuterium.** *J. Phys. & Colloid Chem.* 55, 1036-65, discussion 1065-6 (1951).—*C.A.* 46, 30*g*.

Ni-catalyzed hydrogenation, the isomerization, and the D-exchange with the butenes were discussed. The 2-butene was 99% pure and 85% *cis* isomer. The catalyst consisted of 0.25-mm Ni wire, activated by 1st heating to 600°C in 100 mm air for 5 min., air removed, H_2 admitted, and the Ni again heated to 500°C for 5 min. This cycle was repeated 8 times. The H_2 was removed, C_4H_8 admitted and then condensed with liquid N_2, H_2 again admitted, the reactor quickly warmed to room temp. and immersed in a thermostat at desired temp. H_2 or D_2 must be added to the reaction vessel before the C_4H_8 to obtain reproducible results. The rate of double-bond shift from 1-butene with D was equal to the rate of D-exchange.

11330. Thompson, Sydney O.; Turkevich, John, and Irsa, Adolph P. **Reaction of deuterium with hydrocarbons over a cobalt-thoria Fischer-Tropsch catalyst.** *J. Am. Chem. Soc.* 73, 5213-15 (1951).—*C.A.* 46, 1850*h*.

H-exchange reactions were observed between D_2, C_2H_6, C_3H_8, and *n*- and *iso*-C_4H_{10} when a mixt. of 6 vols. of D_2 and 1 vol. of each of the hydrocarbons was passed over the catalyst with conditions of temp. and flow rate similar to those for hydrocarbon synthesis. The exchanged products were extremely deuteriated. Cracking of the hydrocarbons to produce deuteriated methane was observed.

11331. Tiratsoo, E.N. **Europe's first modern catalytic cracker is completed.** *Petroleum Refiner* 30, No. 10, 155-6 (1951).—*C.A.* 46, 243*g*.

Data were given for various units at the Shell Pernis refinery near Rotterdam, Holland, including the new 28,000-barrel-per-day catalytic cracking plant.

11332. Tolstopyatova, A.A. **Catalytic properties of fluorides of alkali and alkaline-earth metals.** *Vestnik Moskov. Univ.* 6, No. 3, *Ser. Fiz.-Nat. i Estestven. Nauk* No. 2, 49-57 (1951).—*C.A.* 46, 3382*g*.

Dehydrogenation-dehydration of EtOH passed at the rate of 0.2 ml/min. over 15 g of ThO_2 gave the following % decompn. and gas (% CO_2, C_nH_{2n}, CO, H_2): at 287°C, 4.1% (1.5, 11.5, 3.1, 84.2); at 338°C, 5.8 (3.6, 24.5, 6.8, 65.1); at 348°C, 10.4 (4.6, 27.3, 10.9, 57.5); at 360°C, 14.8 (5.2, 31.3, 9.1, 54.4); at 420°C, 43.3 (9.2, 39.1, 6.9, 44.8). Dehydrogenation to AcH predominated at lower temps.; dehydration to C_2H_4 increased with the temp. The apparent activation energies E_{H_2} and E_{H_2O}, for dehydrogenation and dehydration, resp., were 14.7 and 21.8 kcal/ mole. Despite its identical structure with ThO_2, and the near equality of the cation and anion radii, the catalytic activity of CaF_2 was considerably lower, and the part of dehydration was very much smaller.

11333. Tolstopyatova, A.A.; Kheĭfits, L.A., and Patrikeev, V.V. **Pressure dependence of the rate of dehydrogenation of methylcyclohexane.** *Vestnik Moskov. Univ.* 6, No. 2, *Ser. Fis-Mat. i Estestven. Nauk* No. 1, 47-56(1951).—*C.A.* 46, 4339*i*.

On a 28% Pt catalyst, the rate of evolution of H_2 from methylcyclohexane (0.08 ml/min.) did not vary with the pressure between 27 mm Hg and 1 atm. With 0.05 g catalyst, the rates were, at 289° and 304°C, resp., 9.5 and 13.0 ml (S.T.P.)H_2/3 min. This independence of the pressure indicated probably complete surface coverage.

11334. Tomita, Akira. **Zinc catalysts for methanol synthesis. IV. Catalytic activity of bare zinc oxide with no combined water molecules.** *J. Chem. Soc. Japan*, Ind. Chem. Sect. 54, 367-8(1951).—*C.A.* 47, 5045*a*.

ZnO without hydrated water mols., prepd. by the thermal decompn. of $Zn(NO_3)_2$ or by the combustion of Zn, had smaller catalytic activity. The hydrated water mol. played an important part as a promoter in the catalytic decompn. of MeOH.

11335. Tomita, Akira. **The zinc catalyst for methanol synthesis. VIII. The promoter action of copper to zinc catalyst. IX. Methanol synthesis with the catalyst ZnO-CuO-ThO$_2$.** *J. Chem. Soc. Japan*, Ind. Chem. Sect. 54, 504-5; 505-7(1951).—*C.A.* 47, 6070*d*.

The catalysts were prepd. by adding K_2CO_3 to the mixt. of *N* $Zn(NO_3)_2$ and *N* $CuSO_4$. The compn. (Zn:Cu = 75:25) was found excellent. Addn. of a certain amt. of ThO_2 to the catalyst was found effective. The addn. of Al_2O_3 or Cr_2O_3 gave no particular effect. The methanol synthesis from the gas mixt. consisting of water gas and H_2 was studied by using the catalyst ZnO-CuO-ThO_2.

11336. Topchieva, K.V. **Absolute rate constants of reactions of hydrocarbons on aluminosilicates of different compositions.** *Doklady Akad. Nauk S.S.S.R.* 80, 635-8 (1951).—*C.A.* 46, 813*a*.

Surface areas of aluminosilicates of the compns. Al_2O_3:SiO_2 = 0:100, 10:90, 16:84, 30:70, 50:50, 72:28, and 100:0 were detd. both by the B.E.T. method of adsorption of MeOH, C_6H_6, and Me_2CHPh, and by the "CC" method of capillary condensation of MeOH and C_6H_6; the B.E.T. detns. gave the total surface area of the catalyst skeleton, including the fine pores which were not included in the sp surface detd. by the CC method and corresponding to the adsorption film formed at the beginning of sorption hysteresis. These characteristics were compared with the catalytic activities in cracking of hydrocarbons.

11337. Topchieva, K.V.; Battalova, Sh., and Panchenkov, G.M. **Reactions of hydrocarbons on alumino-silicates of different compositions.** *Doklady Akad. Nauk S.S.S.R.* 78, 501-4 (1951).—*C.A.* 45, 7860*f*.

Cracking of decahydronaphthalene, cetane, and gas oil was investigated at 400°, 470°, and 400°C, resp., in a flow system at liquid space velocities *v* from 0.5 to 3.0 liters/liter catalyst/hr, on catalysts made by heating mixtures of Al_2O_3 + SiO_2 in the proportions 10:90, 16:84, 30:70, 50:50, 72:28, 100:0, 0:100%. Decahydronaphthalene (at v = 1.0) gave the degrees of conversion 0.13, 0.20, 0.44, 0.48, 0.34, 0, 0; cetane (at $v = 0.7$) 0.13, 0.19, 0.56, 0.46, 0.29, 0.09, 0; gas oil (at v = 0.7) 0.37, 0.43, 0.49, 0.41, —, 0.08, 0. The surface area, detd. by adsorption of MeOH, did not change with the Al_2O_3:SiO_2 ratio.

11338. Treszczanowicz, Edward. **Iron-zinc catalysts in the dehydrogenation process of cyclohexanol.** *Prace Głównego Inst. Chem. Przemysł.* No. 4, 1-51 1951(English summary).—*C.A.* 46, 9398*i*.

An increase in the Fe content of the Fe-Zn catalyst increased the optimum temp. of the reaction. In the presence of 86.9% Fe at about 420°C, there was an appreciable decompn. of cyclohexane. The best range was 10-20% Fe because of the heat stability of the catalyst and low order of side reactions. The rate of reaction of the dehydrogenation of cyclohexanol was somewhat greater when 12.5% Fe, rather than 18.6% Fe, was present in Fe-Zn catalyst.

11339. Treszczanowicz, Edward and Jaworska, I. **Activity of zinc-manganese catalysts in the production of acetone.** *Przemysł Chem.* 30, 686-90(1951).—*C.A.* 46, 10825*b*.

The activity of Zn-Mn catalyst used in the prepn. of acetone from C_2H_2 was investigated. The activating component (MnO) should be pptd. first and the ZnO after it. Masses with good mech. and catalytic properties were obtained when $Mn(OH)_2$ was pptd. from a 5% soln. of $Mn(NO_3)_2$ with NH_4OH at room temp. and pH 9. After washing, the ppt. was then immersed in a soln. of $Zn(NO_3)_2$, and the $Zn(OH)_2$ was pptd. at 70°C and pH 7.5. Activation with H_2 at 500°C increased the life of the catalyst.

11340. Tsyskovskiĭ, V.K. and Kiseleva, N.A. **Passage of the catalyst into the heterogeneous state and the causes underlying that phenomenon.** *Zhur. Priklad. Khim.* (J. Applied Chem.) 24, 527-31 (1951); *J. Applied Chem. U.S.S.R.* 24, 577-81 (1951)(Engl. translation).—*C.A.* 46, 5414*f*, 7415*a*.

Kerosine fractions of different group compns. were oxidized in the presence of the same catalyst (acid Mn naphthenate) at the same concn., and the period (τ) of primary state of the catalyst was detd. photo-colorimetrically. The length of τ depended on the group compn. of the substrate; it was longer, the greater was the amt. of aromatic compds. in the kerosine. Passage of the catalyst from the primary to the heterogeneous state was observed also with naphthenates of Co, Fe, and Ni. The change in the nature of the catalyst was the result of the formation, in the 1st stages of the oxidation of low-mol. org. acids which then reacted with the catalyst.

11341. Tsyskovskiĭ, V.K. and Kiseleva, N.A. **Development of the oxidation process after removal of the catalyst from the reaction sphere.** *Zhur. Priklad. Khim.* (J. Applied Chem.) 24, 672-4 (1951); *J. Appl. Chem. U.S.S.R.* 24, 759-62 (1951)(Engl. translation).—*C.A.* 47, 31*b*, 2583*g*,

In catalytic liquid-phase oxidation of a petroleum fraction by air, practically the same yields of oxidation products were obtained when the catalyst was left in the reacting system all the time, and when the catalyst was removed by filtration, and the system allowed to complete the reaction without catalyst; at equal total lengths of time, there were only very minor differences in the yields. The continued development of the oxidation reaction, after removal of the catalyst, was not due to accumulated acidity. It took place also if the acid was neutralized. The catalytic oxidation process was thus shown to consist of 2 periods, one catalytic, the other autocatalytic and independent of the presence of the catalyst.

11342. Turovskiĭ, G. Ya. and Vaĭnshteĭn, F.M. **Use of heavy oxygen in the study of the mechanism of oxidation catalysis.** *Doklady Akad. Nauk S.S.S.R.* 78, 1173-5(1951).—*C.A.* 45, 8336*a*.

In the flow-system oxidation of CO by O_2 on CuO tagged with O^{18} (109 γ/g) at 300°C, no isotopic exchange was found between the solid CuO and O_2; after 28 hrs, during which the amt. of O bound in the CuO increased from 0.2 to 1.4 g, the O^{18} content of the solid remained unchanged. A mixt. of CO with N_2, in the absence of O_2, reduced the CuO rapidly. Subsequent admission of air reoxidized it as rapidly to CuO. After these operations, analysis of the solid showed absence of excess O^{18}. The mobility of O atoms on the solid was proved by oxidizing metallic Cu at 300°C first with O_2 tagged with O^{18} (126 γ), then with ordinary O_2. The CuO thus produced was then reduced with H_2 in 2 steps, and the 2 fractions of H_2O formed showed only a minor difference of isotopic compn.

11343. Tutumi, Shigeru, and Nagao, Shiro. **The alloy catalysts for hydrogenation. I. Activity tests of some alloys.** *J. Chem. Soc. Japan,* Ind. Chem. Sect. 54, 165-7 (1951).—*C.A.* 47, 1569*a*.

The Ni-Al alloy, which was used as the material for Raney Ni, had a noticeable catalytic activity. Nitrobenzene could easily be hydrogenated with Ni-Al (1:1) and CuAl (57:43) alloys even in the absence of water. The hydrogenation of acetone, phenol, o-nitrotoluene, and BzH could be easily carried out with Ni-Al (1:1) alloy in the presence of water.

11344. Uchida, Hiroshi. **Catalysts for synthesis of ammonia. III. Effect of the addition of lime and magnesia on the catalytic activity.** *Repts. Govt. Chem. Ind. Research Inst. Tokyo* 46, 1-10(1951).—*C.A.* 46, 2245*f*.

Addn. of K_2O to Fe_2O_3 and Al_2O_3 dispersed the 2nd more homogeneously in the 1st, increasing the catalytic activity. Further addn. of MgO or CaO increased the activity still more, but CaO produced a less homogeneous and less thermostable catalyst.

11345. Uchida, Hiroshi; Todo, Naoyuki, and Ogawa, Kiyoshi. **Catalysts for synthesis of ammonia. IV. Effect of the addition of silica on the catalytic activity.** *Repts. Govt. Chem. Ind. Research Inst. Tokyo* 46, 11-19(1951).—*C.A.* 46, 2245*f*.

Addn. of SiO_2 along with Al_2O_3 along with Al_2O_3 and K_2O to Fe_2O_3 decreased the activity by interfering with the accumulation of K_2O on the catalyst surface. Further addn. of MgO or CaO increased the activity still more.

11346. Uenaka, M. **Sugars and polysaccharides. V. Cleavage of benzyl radical by catalytic reduction.** *Sci. Papers Osaka Univ. No.* 27, 17-19 (1951).—*C.A.* 46, 8883*d*.

Catalytic cleavage of benzyl sugars by hydrogenation with Pt-black and Pd-black catalysts showed that the latter was preferable. Hydrogenation of the benzyl radical occurred irregularly when the former was used.

11347. Varga, József; Rabó, Gyula, and Steingaszner, Pál. **Comparative examination of the contact surfaces and activities of three dehydrogenation catalysts.** *Acta Chim. Hung.* 1, 94-102 (1951)(in English).—*C.A.* 45, 10019*e*.

The catalytic activities (various amounts of MoO_3, Cr_2O_3, and WO_3 on a carrier of Al_2O_3) were detd. at atm. pressure in aromatization reactions. The B.E.T. area of the catalyst varied with each metallic oxide in a different manner. MoO_3 and WO_3 covered the carrier surface more uniformly than did Cr_2O_3. The diminution of the active surface of Cr_2O_3 was due to the formation of large crystal aggregates. The various catalysts satd. in the same manner promoted the formation of aromatic hydrocarbons in the order: MoO_3, Cr_2O_3, and WO_3. When, however, these values were referred to the active surface, the promoting effect of Cr_2O_3 was 6.5% lower, and of WO_3 25% lower, than that of the MoO_3 catalyst.

11348. VARGA, JÓZSEF; RABÓ, GYULA, AND STEINGASZNER, PÁL. **The arrangement of the active centers of chromium oxide alumina catalysts.** *Acta Chim. Hung.* 1, 146-8(1951).—*C.A.* 45, 10022*e*.

Expts. were conducted with catalysts contg. Cr oxide and Mo oxide on an Al_2O_3 carrier. The catalysts were prepd.; one in the usual way from chromic acid soln., and the other from an alk. soln. of NH_4 chromate. The surface ratios for various amounts of Cr_2O_3 were almost alike for Cr oxide catalysts prepd. by both methods. The no. of MoO_3 mols. formed by drying and igniting the product obtained from solns. of $(NH_4)_6Mo_7O_{24}$ was nearly equal to the no. of mols. forming a pile in Cr oxide catalysts.

11349. VARGA, JÓZSEF; RABÓ, GYULA, AND ZALAI, A. **Comparative study of the promotors for dehydrogenation catalysts.** *Acta Chim. Hung.* 1, 137-45(1951).—*C.A.* 45, 10022*a*.

Al_2O_3 was the carrier with various amounts of Cr_2O_3 activated with K_2O, with oxides of K and Ce, with Th oxide, and with oxides of K and Th. A catalyst contg. Mo oxide was also tested. The selectivity, indicated by a decrease in the extent of cracking reactions and the efficiency of production of mainly toluene, increased with the amount of Cr_2O_3, up to an optimum proportion. Catalysts contg. Cr_2O_3 were sensitive to variations of temp. or of space velocity. Catalysts contg. Cr_2O_3 became less sensitive against influences of temp. and space velocity when the Th oxide was used as the promoter. Catalysts contg. Mo were the most suitable of all of the 10 catalyst types tested.

11350. VERESHCHAGIN, L.F.; FREIDLIN, L. KH.; RUBINSHTEIN, A.M., AND NUMANOV, I.U. **Effect of very high pressures on the catalytic properties of aluminum oxide.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* 1951, 809-18.—*C.A.* 46, 3839*h*.

Dehydration runs of EtOH to C_2H_4 were made in a flow system on 12 ml of catalyst (tube diam. 15 mm) in the range 283-320°C, at a feed rate of 0.16 ml/min. Stability of the catalysts was tested by the constancy of the gas evolution. Fresh Al_2O_3 pptd. from $Al(NO_3)_3$ with NH_4OH, washed, and dried at 100°C showed a low initial activity; after activation with air, (2 hrs at 525°C), the activity rose, E falling to 16.0. There was no deactivation if the products were removed quickly; after 48-hrs stay under N_2, the catalyst showed almost the original activity, with $E = 17.5$. With Al_2O_3 dehydrated 10-11 hrs at 360°C and then compressed under 20,000 atm., activation at 525°C doubled the activity. Further regeneration produced no further change.

11351. VLODAVETS, I.N. AND PSHEZHETSKII, S. YA. **Kinetics of methanol oxidation to formaldehyde on a silver catalyst.** *Zhur. Fiz. Khim.* 25, 612-23 (1951).—*C.A.* 45, 10013*a*.

The kinetics of the oxidation of H_2 and of iso-PrOH on a Ag catalyst suggested that the oxidation of MeOH on the same catalyst proceeded through direct oxidation by adsorbed O_2. This was verified by a kinetic investigation in a flow system using small Ag spheres (2 mm diam.), between 321° and 517°C, at various flow rates and with different initial concns. The reaction products were: CH_2O, CO_2, H_2, and H_2O (small amts. of CO). No CH_4 was formed. The apparent activation energy was about 16 kcal/mole.

11352. VOL'KENSHTEĬN, F.F. **Modification of catalysts.** *Zhur. Fiz. Khim.* 25, 1214-27(1951).—*C.A.* 46, 5944*f*.

By introducing the rule of Meyer and Neldel exchanging activation energy for cond. ϵ and a preëxponential factor G $[\sigma = G \exp.(-\epsilon/RT)]$, $\log G = c + b\epsilon$, where b was an empirical const. (0.15 to 0.30 mole/kcal). This relation immediately led to the well-known relation: $\log k_0 = a + bE$ between activation energy E and preëxponential factor k_0 for the catalytic reaction. The meaning of b was the same as in the rule for cond. For a variety of catalysts and reactions, $b = 0.2$ to 0.5 mole/kcal., in good agreement with the theoretical value.

11353. WARD, C.C.; SCHWARTZ, F.G., AND ADAMS, N.G. **Composition of Fischer-Tropsch Diesel fuel. Cobalt catalyst.** *Ind. Eng. Chem.* 43, 1117-19 (1951).—*C.A.* 45, 5903*e*.

A Fischer-Tropsch Diesel fuel (from a Co catalyst) having a cetane no. of 80 was analyzed: paraffins 88% by vol.; polar compds. 2; α-type olefins 1.5; internal-type olefins 8.5.

11354. WATANABE, SHIRO. **Bench-scale studies of the Fischer-Tropsch synthesis over iron, nickel, and nickel-cobalt catalysts.** *U.S. Bur. Mines, Inform. Circ.* No. 7611, 26 pp.(1951).—*C.A.* 45, 8227*i*.

The max. oil yields obtained in bench-scale equipment were: with 100 Ni: 20 Mn: 100 kaolin: 200 diatomaceous earth catalyst, a max. yield of 133.8 ml/m³ of pure $CO + 2H_2$ was obtained from 1 pass of the feed gas. With a Ni:Co mixed catalyst (Ni:Co = 3:7) having the compn. 100 (Ni + Co): 8MgO:$5ThO_2$: 200 diatomaceous earth, a max. of 172.2 ml/m³ of pure $CO + 2H_2$ was obtained. In continuous tests with Fe catalysts carried out in semiindustrial scale app. single-pass operation over a period of 20 days resulted in virtually no decrease in catalytic activity.

11355. WATT, GEORGE W.; ROPER, WILBUR F., AND PARKER, SIDNEY G. **The catalytic activity of metals produced by the reduction of salts in liquid ammonia. II. Nickel.** *J. Am. Chem. Soc.* 73, 5791-3(1951).—*C.A.* 46, 2384*d*.

Hydrogenation catalysts prepd. by reduction of $NiBr_2$ with K in liquid NH_3, W-6 Raney Ni, and Ni from the reduction of NiO with H_2 were compared in terms of surface areas, adsorbed H_2, and rate of hydrogenation of allyl alc. Studies of the compn. and activity of the catalysts prepd. in liquid NH_3 indicated that the NH_3-insol. reduction products included Ni, Ni amide, and a K-contg. substance of unknown compn.

11356. WEBB, MAURICE. **Production of sulfur from hydrogen sulfide.** *Oil Gas J.* 49, No. 36, 71-2 (1951).—*C.A.* 45, 2639*d*.

In a S recovery plant the feed (22 CO_2, 70 H_2S, and 8% H_2O) was mixed with air and burned to convert 1/3 of the H_2S to SO_2. This mixt. reacted over bauxite at 430-655°F (in admixt. with more or less unoxidized feed gas) to produce elemental S. The S was condensed out at 290°F; the residual gas was reheated to 460°F and entered a second reactor. About 85% of the coversion occurred in the first reactor.

11357. WEBER, JOSEPH AND LAIDLER, KEITH J. **Kinetics of the ammonia-deuterium exchange by a micro-wave method.** *J. Chem. Phys.* 19, 381-2 (1951).—*C.A.* 45, 6911*f*.

NH_3 and D_2 were brought into contact with a singly-promoted Fe catalyst and the rate of disappearance of NH_3 was followed by detg. the microwave spectrum of the gases. For D_2 pressures up to 150 mm.Hg the rate of exchange was proportional to $p_{D_2}{}^{1/2}$, but above 300 mm the dependence was almost linear. The variation of rate with p_{NH_3} was small, but there was a definite max. that moved toward lower pressures as the temp. increased. The activation energy of the exchange reaction was approx. 13 kcal/mole.

11358. WHEELER, H.K. JR. **New design features in catalytic cracker.** *Petroleum Engr.* 23, No. 11, C-5-10(1951).—*C.A.* 46, 243*h*.

A new fluid catalytic cracking unit was described.

11359. YÜ, T.H. **Preparation of vanadium catalyst.** *Chinese Chem. Ind. Eng.* 2, No. 2, 3-9 (1951)(English summary).—*C.A.* 47, 1344*g*.

A catalyst for H_2SO_4 manuf. was prepd.: 13.1 parts of V_2O_5 (contg. 84% V_2O_5) moistened with 10 parts of H_2O, was dissolved in a KOH soln. contg. 8.0 parts of 85% KOH in 10 parts of H_2O. To this soln. were added in succession 6.4 parts of 93% H_2SO_4 and a soln. contg. 25.8 parts of 95% KNO_3 in 10 parts of H_2O. Six parts of S and 115.0 parts of kieselguhr were then added to this mixt. together with enough water to give a consistency suitable to be extruded. The wet pellets which were about 5 mm in diam. and 5-8 mm in length were dried at 700°C for one hr.

11360. ZAĬDENMAN, I.A. AND KHOMYAKOV, K.G. **The initial stages of the interaction of carbon monoxide and hydrogen with the nickel catalyst at the temperatures of synthesis of gasoline.** *Doklady Akad. Nauk S.S.S.R.* 78, 901-4 (1951).—*C.A.* 45, 8336*f*.

The heat evolved on contact between CO or a mixt. 1 CO:1 H_2 and a skeleton Ni catalyst (by leaching Ni-Al) reduced by H_2 2-4 hrs at 190-200°C was detd. in an Al calorimeter. First contact of CO with a freshly prepd. Ni catalyst evolved over 85 kcal/mole gas disappeared. This was attributed only to a change within the catalyst itself, specifically to partial recalescence. On consecutive admissions of CO, each time after reduction of the catalyst with H_2, the heat effect dropped to and remained const. at about 34 kcal/mole gas disappeared. The same heat effect was found in contact with a 1 CO:1 H_2 mixt., on a catalyst previously exposed to CO.

11361. ZAWADZKI, J.; JURECKA, J., AND TRESZCZANOWICZ, E. **Use of zinc-vanadium catalysts in the production of acetone.** *Przemysł Chem.* 30, 731-3(1951).—*C.A.* 46, 10825*c*.

The influence of the method of prepn. on the activity and the life of Zn-V catalysts for the prepn. of acetone from C_2H_2 was investigated. Best results were obtained with catalysts prepd. by simultaneously pptg. the components with NH_4OH from a soln. of NH_4 vanadate and Zn acetate. The Zn-V catalysts were found superior to the Zn-Mn catalysts reported earlier.

11362. ACONE, G. **Methane: hydrogen and carbon monoxide.** *Riv. combustibili* 6, 697-707(1952).—*C.A.* 47, 4581*g*.

The steam, CO_2, and O_2 processes for the conversion of CH_4 to synthesis gases were reviewed. C_2H_6 and C_3H_8 could be tolerated in CH_4 only with an excess of steam; C_4H_{10} and higher hydrocarbons must be excluded altogether. Propylene and butylene were limited to a max. of 2-3%. Diolefins and ethylene should be eliminated. H_2S and the org. sulfides were the main contaminants, owing to formation of NiS. Org. S should be below 14 mg/m^3. H_2, CO_2, CO, and N_2 should not be grouped as inerts.

11363. ALCHUDZHAN, A.A. AND FROST, A.V. **Kinetics and mechanism of catalytic hydrogenation of hydrocarbons. VII. Study of the palladium-hydrogen system as a hydrogenation catalyst.** *Zhur. Fiz. Khim.* 26, 1007-13(1952).—*C.A.* 47, 956*i*.

The hydrogenation of benzene on Pd black was studied (H_2:C_6H_6 = 4:1). The % conversion was 12, 21, 29, 31, 39, 49, 38, 24, and 16 at 153°, 168°, 184°, 200°, 216°, 228°, 247°, 262°, and 276°C, resp. The first 3 data gave an activation energy E = 11,660 cal/mole on the assumption of zero-order kinetics from an Arrhenius plot. The next 3 values gave E = 6970, and the last 3 gave a neg. value of "E" = 19,850. Thus the rate passed through a max. between 228° and 247°C.

11364. ALCHUDZHAN, A.A. AND FROST, A.V. **Kinetics and mechanism of catalytic hydrogenation of hydrocarbons. VIII. Study of the solid system palladium-hydrogen as a hydrogenation catalyst.** *Zhur. Fiz. Khim.* 26, 1015-23(1952).—*C.A.* 47, 957*b*.

Benzene was hydrogenated on 3 different Pd black catalysts pretreated in H_2 at 276°, 303°, and 350°C, resp. In general, const. rates were reached rapidly when the temp. was changed. However, around 200°C, the rate decreased continuously during a long time (about 100 min.) at const. temp. On one sample, the rate did not change between 168° and 220°C. This did not mean that the activation energy E was zero in this temp. interval, but that a transformation took place in the Pd-H_2 system.

11365. ALCHUDZHAN, A.A. **Kinetics and mechanism of catalytic hydrogenation of hydrocarbons. IX. The solid system Pd-H_2 as hydrogenating catalyst.** *Zhur. Fiz. Khim.* 26, 1591-9(1952).—*C.A.* 47, 6235*e*.

The activity, *A*, of Pd sponge (1 g) was expressed in % conversion in the hydrogenation of C_6H_6, in a mixt. C_6H_6:H_2 = 1:4, under 1 atm. at a feed rate of H_2 of 1 liter/hr at the stated temp. Pd having attained *A* = 22.7% and then kept in H_2 86 hrs at room temp., showed practically no *A* at the beginning of hydrogenation at 200°C; *A* rose with time, attained a const. *A* of about 35%, and then remained at that level. A catalyst (*A* = 16%) was exposed first 10 min. to a stream of air, and then 36 hrs to H_2; *A* at 224°C rose from an initial 6% to about 27%, and then decreased slowly to a const. value of about 21%. The effect of air did not consist in a combustion of the H_2 dissolved in the Pd. The smallness of the effects of either C_6H_6 or cyclohexane on *A* of Pd contrasted with their strong depressing effects on *A* of Ni.

11366. ALCHUDZHAN, A.A. **Kinetics and mechanism of catalytic hydrogenation of hydrocarbons. X. Effect of the treatment with hydrogen or nitrogen at 300-350°C on the catalytic activity of Pd-H.** *Zhur. Fiz. Khim.* 26, 1600-9 (1952).—*C.A.* 47, 6236*d*.

One-hr treatment of Pd of const. activity (*A* = 12%) with H_2 at 350°C resulted in a sharp fall of the initial *A* in hydrogenation of C_6H_6 at 224°C, followed by a steady, almost linear recovery with time, ending in const. *A* somewhat higher than the original. If, after the deactivation with H_2 at 350°C, the catalyst was treated with H_2 90 min. at room temp., subsequent hydrogenation at 224°C began at once with *A* = 7, and rose again to the original level, or higher. Fresh Pd black (0.75 g) showed *A* = 76.4% at 200°C. This catalyst was converted to Pd sponge by 1 hr treatment with H_2 at 350°C followed by 18 hrs rest in H_2 at room temp., and then showed at 200°C a very low initial *A* of about 3%. The deactivation by H_2 was due to an interaction with H_2, and not merely to the high temp. of 350°C.

11367. ALCHUDZHAN, A.A. **Kinetics and mechanism of catalytic hydrogenation of hydrocarbons. XI. Palladium black.** *Zhur. Fiz. Khim.* 26, 1730-5(1952).—*C.A.* 47, 6236*i*.

Fresh Pd black (0.75 g) showed a high and const. activity (*A*) of 87% in the hydrogenation of C_6H_6 at 200°C from the very start. This fell only to 83.4 and 78%, resp., after 40 and 90 hrs standing in H_2 at room temp. The slight deactivating effect of H_2 at room temp. was attributed to the very fine and highly imperfect crystallinity of Pd black as compared with spongy Pd, and more difficult conversion of the α into the β phase. In further contrast to spongy Pd, the rates of hydrogenation of C_6H_6 on Pd black at different temps. were reproducible on going from higher to lower temps. and vice versa. Plots of log *A* as a function of $(1/T)$ were not linear. With Pd black, the max. rate of hydrogenation was around 190°C, whereas with the less active Pd sponge it was markedly higher.

11368. AMEMIYA, TŌZŌ; SUZUKI, MASOAMI, AND KOGUCHI, KATSUYA. **Preparation of pyridine by the catalytic decomposition of higher bases.** *Coal Tar* (Japan) 4, 183-7(1952).—*C.A.* 46, 8830*b*.

Higher tar bases, such as α-, β- and γ-picoline, 2,6-lutidine, and collidine mixt., were decompd. by flowing into H_2 contg. a little H_2S at 800°C. The catalytic treatment in the presence of Ni, Se, etc., at the lower temps. was not promising.

11369. ANDERSON, ROBERT B.; SELIGMAN, B.; SHULTZ, J.F.; KELLY, R., AND ELLIOTT, M.A. **Fischer-Tropsch synthesis. Some important variables of the synthesis on iron catalysts.** *Ind. Eng. Chem.* 44, 391-7(1952).—*C.A.* 46, 5291*a*.

The activity and selectivity of 4 different types of Fe catalysts was studied as a function of total gas pressure, particle size of the catalyst, alkali content of the catalyst, temp. and space velocity of the 50-50 CO:H_2 mixt. The ratio of H_2 to CO consumed during the synthesis was independent of particle size and varied between a value of 1 to 1.5 for low conversions to a value of about 0.75 for medium conversions and up again to a value of about 0.85 for higher conversions. Fused Fe catalyst D-3001 contg. MgO 6.8, SiO_2 1.05, Cr_2O_3 0.96, and K_2O 0.85% as promoters showed an increase in activity with increasing external area per g of catalyst particles.

11370. ANNABLE, D. **Application of the Temkin kinetic equation to ammonia synthesis in large-scale reactors.** *Chem. Eng. Sci.* 1, 145-54(1952).—*C.A.* 46, 10807*i*.

The Temkin kinetic equation was applied to plant data obtained at 370-550°C and at pressures of 245 and 300 atm. The apparent activation energy for NH_3 decompn. was 45,800 cal/mol. at 245 atm. and 47,900 cal/mol. at 300 atm.

11371. ANON. **Platforming and Udex.** *Chem. Eng.* 59, No. 5, 242-5(1952).—*C.A.* 46, 6817*c*.

A description was presented of the Platformer-Udex plant at Houston, Texas. Platforming was a method for catalytic (Pt) reforming of selected petroleum naphthas to produce aromatics. Udex was a process for sepn. of the aromatic products by extn. with diethylene glycol and water.

11372. ARNOLD, M.R.; ATWOOD, KENTON; BAUGH, H.M., AND SMYSER, H.D. **Nickel catalysts for hydrocarbon-steam reaction.** *Ind. Eng. Chem.* 44, 999-1003 (1952).—*C.A.* 46, 9746*i*.

The semimicro reactor was constructed of 1/4-in. Ascoloy pipe, mounted vertically in an electrically heated furnace. A bundle of 6 reactors could be placed in each furnace. Catalysts were reduced for 18 hrs at 1500°F with H_2 entering the saturator at a rate of 5 liters per hr. After reduction H_2 was replaced with CH_4 and gas samples were taken after CH_4 had flowed for 3 hrs. Above 1500°F percentages reaction and theoretical reaction were essentially equal. The effect of high temp. was studied in reactors of ceramic tubes 33 in. long and 1 in. inside diam. In general, the catalysts with higher Ni contents had higher activities. Rapid inactivation of the com. catalyst took place above 1900°F.

11373. ASTLE, M.J.; ZASLOWSKY, J.A., AND ETHERINGTON, R.W. **Reactions catalyzed by anion exchange resins.** *Ind. Eng. Chem.* 44, 2867-72 (1952).

Anion exchange resins (Amberlite IR-4B, Deacidite, and Amberlite IRA-400) were excellent catalysts at 15°-45°C for promoting Knoevenagel condensations between aldehydes and esters. Weakly basic anion exchangers in the free base or acetate form were found to be quite effective. Strongly basic resins were readily inactivated. The same resins were also effective in the catalysis of aldol type condensations. The cyanoethylation of alcs. by a strongly basic anion exchanger was also performed.

11374. BAKER, R.W.; WONG, H.N., AND HOUGEN, O.A. **Catalytic oxidation of nitric oxide on silica gel.** *Chem. Eng. Progress Symposium Ser.* 48, *No. 4, Reaction Kinetics and Transfer Processes*, 103-9(1952).—*C.A.* 47, 2025*h*.

The rate of the forward reaction in the oxidation of NO diminished with increase in temp. for the reaction catalyzed by silica gel. The surface reaction between the complex nitric oxide $(NO)_2$ with unadsorbed O_2 was rate-controlling. The complex $(NO)_2$ in the gas phase was assumed to be in equil. with the NO in the gas phase. The adsorption of the product, NO_2, was negligible.

11375. BALACEANU, J.C. AND JUNGERS, J.C. **Dehydration of alcohols with alumina.** *Bull. soc. chim. belges* 60, 476-511 (1952).—*C.A.* 47, 2683*b*.

In the interval 260°-400°C, the dehydration of EtOH took place in 2 steps: formation of Et_2O, and decompn. of Et_2O to C_2H_4 and EtOH. Direct formation of C_2H_4 from EtOH took place only to a minor degree. The same held true for the dehydration of MeOH, iso-PrOH, and BuOH.

11376. BATTALOVA, SH.; PANCHENKOV, G.M., AND TOPCHIEVA, K.V. **Kinetics of the cracking of cetane by aluminosilicate catalysts of various compositions.** *Zhur. Fiz. Khim.* 26, 903-9(1952). —*C.A.* 46, 10811*f*.

The catalyst was prepd. by mixing fresh ppts. of $Al(OH)_3$ and $Si(OH)_4$. At 470°C for 0, 10, 30, 50, 72, and 100 wt % Al_2O_3, 0, 13, 56, 46, 29, and 9%, resp., of cetane were cracked. The apparent activation energy was 29.1-30.5 cal/mol. The difference between various catalysts could not be attributed to their surface areas, *S*, detd. from the adsorption of palmitic acid from heptane. It was 151, 163, 169, and 163 m^2/g for 16%, 30%, 50%, and 72% Al_2O_3 in $Si(OH)_4$, i.e. almost independent of the ratio Al:Si.

11377. BÉNARD, JACQUES. **The causes of catalytic power in certain metallic oxides.** *Ind. chim. belge* 17, 553-9(1952).—*C.A.* 46, 8944*d*,

The catalytic activities of oxides of Ni, Cd, Zn, Fe, Co, etc., were traced to defects in the crystal lattice. A given defect may be due to the absence of an ion or the insertion of a supplemental or foreign ion. The resultant abnormal charge on these ions caused perturbations which accounted for the catalytic activity of the crystal. NiO prepd. from the carbonate in the presence of O_2 contained Ni(III) defects which accounted for its catalytic activity.

11378. BERTIL HAMMAR, C.G. **Reaction kinetics of the catalytic vapor-phase oxidation of benzene to maleic anhydride.** *Svensk Kem. Tid.* 64, 165-76(1952)(in English).—*C.A.* 46, 8945*d*.

The oxidation of C_6H_6 to maleic anhydride was detd. by a flow method with air over the catalyst which occupied the annular space between 2 concentric tubes, both temp.-controlled with Dowtherm. The V-Mo catalysts (1:0.3 ratio) were supported in various percentages on metallic Al. The first reaction to form maleic anhydride was extremely fast, being limited only by the mass-transfer rate. The reaction rate had a high temp. coeff. The reaction rate for the complete combustion was almost independent of mass transfer, the rate-detg. step being either the readsorption of maleic anhydride or the surface reaction.

11379. BLUE, R.W.; HOLM, V.C.F.; REGIER, R.B.; FAST, EDWIN, AND HECKELSBERG, L.F. **Effect of granule size in dehydrogenation of butane and in a hydrogen-transfer reaction.** *Ind. Eng. Chem.* 44, 2710-16(1952).—*C.A.* 47, 852*b*.

In the dehydrogenation of butane and the H-transfer from decahydronaphthalene to isobutene, mass transfer rate rather than "intrinsic" activity was the limiting factor for granule sizes greater than 0.02 in. The inner portions of the catalyst granules were less effective than the outer portions. Reaction- and diffusion-rate constants were calcd. and compared to each other.

11380. BOND, G.C. AND SHERIDAN, J. **Heterogeneous catalysis. I. Hydrogenation of methyl-acetylene.** *Trans. Faraday Soc.* 48, 651-8(1952).—*C.A.* 47, 393*a*.

The reaction was largely simple hydrogenation with the production of propene. The over-all apparent activation energies per mole were 14.2 kcal, 16.5 kcal, and 17.3 kcal over Ni, Pd, and Pt, resp. The activation energies for hydrogenation and hydropolymerization were roughly equal over Pd, but over Ni they were about 14 kcal and 16 kcal, resp. There were indications that a van der Waals layer of MeC≡CH, above the chemisorbed layer, played a part in the polymerization.

11381. BOND, G.C. AND SHERIDAN, J. **Heterogeneous catalysis. II. Hydrogenation of allene.** *Trans. Faraday Soc.* 48, 658-63 (1952).—*C.A.* 47, 393*d*.

The reaction was principally hydrogenation, but reduced polymers of allene, were also formed, especially over Pd. The main reaction was selective propene formation, which was slower than the hydrogenation of propene to propane which occurred over Ni and Pt when almost all allene was removed. The apparent activation energies for initial reaction were 12.9, 12.3, and 17.1 kcal/mole over Ni, Pd, and Pt, resp.

11382. BOND, G.C. AND SHERIDAN, J. **Heterogeneous catalysis. III. Hydrogenation of mixtures of hydrocarbons.** *Trans. Faraday Soc.* 48, 664-8 (1952).—*C.A.* 47, 393*e*.

Added propene was a diluent in the hydrogenation of MeC≡CH or allene over Ni, Pd, or Pt. Mixts. of pairs of the hydrocarbons, C_2H_2, MeC≡CH, and allene, were simultaneously hydrogenated, which indicated that these substances were adsorbed in comparable quantities.

11383. Bond, G.C. and Sheridan, J. **Heterogeneous catalysis. IV. Hydrogenation of cyclopropane.** *Trans. Faraday Soc.* 48, 713-15(1952).—*C.A.* 47, 2583*h*.

The reaction over Ni, Pd, and Pt differed fundamentally from normal olefin hydrogenation in being of 1st order with respect to the hydrocarbon and of zero order with respect to H_2. The surface was covered with chemisorbed H_2 and the rate-detg. step of the reaction involved physically adsorbed (or gaseous) cyclopropane. Two alternative mechanisms were: (1) addn. of 2 H atoms in one step; (2) successive addns. of 2 H atoms singly.

11384. Bond, G.C.; Sheridan, J., and Whiffen, D.H. **Heterogeneous catalysis. V. Exchange reactions involving dideuterioacetylene.** *Trans. Faraday Soc.* 48, 715-23 (1952).—*C.A.* 47, 2583*i*.

The reaction $C_2H_2 + C_2D_2 = 2C_2HD$ proceeded to equil. over a Ni catalyst in a few hrs at 60°C. The expts. gave $K = 3.58$ (350°K) and 3.62 (400°K) which may be expressed as a temp.-independent value of 3.6 ± 0.3 in the range 80°-130°C. The rate varied as the 0.65 power of the total pressure, and the activation energy was 10.7 kcal.

11385. Boreskov, G.K. and Slin'ko, M.G. **Kinetics of reversible catalytic reactions in the internal diffusion range.** *Zhur. Fiz. Khim.* 26, 235-8(1952).—*C.A.* 47, 4714*e*.

On porous catalysts, the observed rate of reaction, *W*, was related to the true rate. For the oxidation of SO_2 on a V catalyst, in a mixt. of the initial compn. SO_2 7, O_2 11, N_2 82%, the optimum temp. for a degree of conversion of 0.7 and 0.5, was, in the kinetic region, 572° and 636°C, resp., and in the diffusional region, 552° and 600°C, resp.

11386. Browning, L.C. and Emmett, P.H. **Equilibrium measurements in the Ni_3C-Ni-CH_4-H_2 and Co_2C-Co-CH_4-H_2 systems.** *J. Am. Chem. Soc.* 74, 1680-2(1952).—*C.A.* 46, 6908*b*.

Equil. consts. were detd. for the reaction $3Ni + CH_4 = Ni_3C + 2H_2$ in the range 226°-285°C and for the reaction $2Co + CH_4 = Co_2C + 2H_2$ in the range 190°-444°C. The amts. of satd. hydrocarbons and normal monoölefins that could be formed by the direct reduction of bulk Ni_3C by H_2 were large at 500°K and increased with increasing mol. wt of the hydrocarbon. In the reduction of bulk Co_2C by H_2 to form hydrocarbons, the amts. of hydrocarbons having more than six C atoms and of all monoölefins at both 500° and 600°K, were small at equil.

11387. Calderbank, P.H. **Catalytic oxidation of naphthalene.** *Ind. Chemist* 28, 291-5 (1952).—*C.A.* 47, 3549*f*.

The oxidation with O_2 of naphthalene to α-naphthoquinone and to phthalic anhydride by using a com. V_2O_5 catalyst, was investigated over the range of 310-360°C and up to 10% conversion of naphthalene. The rate-detg. step under the conditions chosen was the chemisorption of O_2; the energy of activation was 26 kcal.

11388. Campbell, W.M. and Johnstone, H.F. **Reactions of hydrogen and carbon monoxide in a tubular reactor with iron-copper catalyst.** *Ind. Eng. Chem.* 44, 1570-5(1952).—*C.A.* 46, 8349*f*.

The Fischer-Tropsch reactions were studied under highly simplified conditions with a porous tube impregnated with Fe-Cu catalyst. Most of the catalysts used produced CO_2 and were active for the water-gas shift reaction. Heating the catalysts to 310°C in the presence of H_2 and CO destroyed the synthesis reaction activity, but did not affect the shift-reaction activity. H_2S destroyed the activity for both reactions.

11389. Chamberlain, G.H.N. and Walsh, A.D. **The inhibiting effect of tetraethyllead. I. The effect of lead compounds on the vapor-phase slow oxidation of diisopropyl ether and on the ignition of diethyl ether.** *Proc. Roy. Soc.* (London) A215, 175-86(1952).—*C.A.* 47, 4588*f*.

The inhibiting effect was found to persist after prolonged evacuation, owing to the deposition of Pb oxide. PbO gave an inhibiting effect profound, persistent and in every way similar to that of tetraethyllead. It did this by a surface destruction of chain centers. On oxidation, tetraethyllead gave rise to a fog of particles (probably PbO). Its inhibiting effect was then exerted either by these colloidal particles or by the film of PbO to which they gave rise on the walls of the vessel.

11390. Collier, Donald W. **Flow-system kinetics; continuous catalytic conversion of ethylene to ethane.** *Univ. Microfilms* (Ann Arbor, Mich.), *Pub.* No. 2929, 72 pp. (microfilm $1.00, paper enlargements $7.20); *Dissertation Abstracts* (formerly *Microfilm Abstracts*) 12, 248(1952).—*C.A.* 46, 8944*b*.

11391. Dart, J.C.; Oblad, A.G., and Scholl, J.W. **Houdriforming at low pressure.** *Petroleum Engr.* 24, No. 9, C-32-3(1952).—*C.A.* 46, 11655*a*.

West Texas sweet mixed-base naphtha was reformed at 275 p.s.i. and essentially 100% conversion of all naphthenes to aromatic hydrocarbons was achieved. No adverse effect on the catalyst was noted.

11392. Dart, J.C.; Oblad, A.G., and Scholl, J.W. **Houdriforming at low pressure.** *Oil and Gas J.* 51, No. 28, 386, 388, 391-2(1952).—*C.A.* 47, 1919*i*.

Houdriforming catalyst was used to reform com. available naphthas at low pressure. Very high yields of aromatics were produced by conversion of naphthene hydrocarbons and by substantial conversion of paraffin hydrocarbons to aromatic hydrocarbons.

11393. Dean, John G. **Nickel compounds as catalyst raw materials.** *Ind. Eng. Chem.* 44, 985-90 (1952).—*C.A.* 46, 9747*g*.

Several million pounds of Ni compds. were used yearly in the U.S. in the production of catalysts, largely for hydrogenation reactions. $Ni(NO_3)_2$ was particularly suited for the prepn. of impregnated catalysts, while $(HCO_2)_2Ni$ was used in making liquid-process catalysts. Raney Ni was unique in that intermetallic compds. were involved.

11394. Dijk, J.A. van and Voogd, J.G. de. **Catalytic conversion of heavy oil with steam to town gas at Cahors (France); Onia-Gegi process.** *Het Gas* 72, 209-15 (1952).—*C.A.* 47, 6116*h*.

The process was a cycle of blow and run through a catalyst bed downward. During the blow the bed was heated with oil-combustion gases and excess air to 730°C top temp. and 830°C bottom temp. During the run, steam and an oil spray were introduced above the bed to give final temps. of 520° and 770°C, resp., taking 5 min. with 8.5 liters of oil per. min. The Ni in the catalyst oxidized during the blow, giving a high CO_2 content during the first 1/2 min. of run; this gas was wasted.

11395. Dole, Malcolm; Rudd, DeForest P.; Muchow, Gordon R., and Comte, Charles. **Isotopic composition of oxygen in the catalytic decomposition of hydrogen peroxide.** *J. Chem. Phys.* 20, 961-8(1952).—*C.A.* 47, 2025*c*.

The isotopic compn. of O_2 liberated in the catalytic decompn. of H_2O_2, in which MnO_2, Fe_2O_3, colloidal Au, metallic Pt, and sol. catalase were used as catalysts, was measured. A few rate expts. were also detd., and the kinetics studied from the standpoint of isotope sepn. as a function of fraction of H_2O_2 decompd. None of the liberated O_2 came from the substrate H_2O or from the $KMnO_4$ when H_2O_2 was oxidized.

11396. Druz, V. A. and Sokol'skiĭ, D. V. **Potentiometric study of hydrogenation reactions. Effect of additives on the activity of nickel skeleton catalysts.** *Zhur. Fiz. Khim.* 26, 484-91(1952).—*C.A.* 47, 5779*b*.

The rate of hydrogenation of dimethylethynylcarbinol, maleic acid, and Na fumarate was measured on Ni skeleton catalyst contg. increasing amts. of additives: these were Pd, Pt, and benzylmercaptan. At the same time, the equil. e.m.f. of the catalyst relative to the 0.1 *N* calomel electrode was measured. The latter data gave a measure of the strength of H_2 chemisorption. The addn. of Pt to Ni increased considerably the energy of H_2 chemisorption and decreased markedly the catalytic activity.

11397. Duffy, B. J. Jr. and Hart, H. M. **Metal poisoning of fluid cracking catalyst.** *Chem. Eng. Progress* 48, 344-8(1952).—*C.A.* 46, 8838*a*.

The detn. of optimum operation for each feed required only an economic balance between catalyst costs to maintain a low C factor and the yield penalty that was incurred if the C factor rose. An evaluation of the relative economics in sending the 3 different feeds to the catalytic cracking unit was possible by a comparison of the optimum points of operation for each.

11398. Erivanskaya, L. A. and Kagan, M. Ya. **Kinetics of dehydrogenation of methyl-cyclohexane on a chromia-alumina catalyst.** *Zhur. Fiz. Khim.* 26, 1159-63(1952).—*C.A.* 47, 957*d*.

The catalyst was: Cr_2O_3 13, K_2O 2, Al_2O_3 85%. Dehydrogenation of methylcyclohexane was studied at 383°C (contact time τ between 3.7 and 43.6 sec), 397°C ($4 < \tau < 51.8$), 411°C ($15.1 < \tau < 38$), and 436°C ($10 < \tau < 24.3$). The rate const. k was calcd. on the assumption that the rate was inversely proportional to the concn. of H_2 in the gas phase. The apparent energy of activation was 33,500 cal/mole. Expts. were made with H_2-methylcyclohexane mixts., and good rate consts. were obtained.

11399. Fal'kovskiĭ, V. B. **Change in degree of conversion and temperature along the length of a catalytic bed.** *Zhur. Fiz. Khim.* 26, 942-8(1952)—*C.A.* 47, 5776*c*.

Approx. equations were derived for the variation of degree of conversion α and of temp. T along the length l of a catalytic bed of section σ to which n_1 moles of reactant were fed per unit time. This was done for exothermic or endothermic reactions in 3 different cases: adiabatic regime, const. wall temp. T_w and variable T_w, and for zero-order as well as 1st-order reactions. In the adiabatic case: $T = T_0 + (n_1 q/Gc_p)\alpha$ (2), where T_0 was the initial temp. of the gas, q the heat of reaction, G the mass velocity, c_p the heat capacity.

11400. Farbar, Leonard. **Metering of powdered solids in gas-solids mixtures.** *Ind. Eng. Chem.* 44, 2947-55(1952).—*C.A.* 47, 3049*b*.

At fixed gas rates (0.0077 to 0.0152 lb/sec) and vol. (ambient pressure and temp.), solids (Al-Si catalysts) flow rates were measured by converging nozzles. Standard nozzles could be used.

11401. Fleureau, Bernard and Sancelme, André. **Catalytic decomposition of carbon monoxide on iron reduced electrolytically at low temperature.** *Compt. rend.* 235, 801-3(1952).—*C.A.* 47, 2077*f*.

The progress of the reaction $2CO \rightarrow CO_2 + C$ was followed in a circulating system by measuring pressure drop with time at a const. rate of heating. CO_2 was absorbed in KOH. Electrolytic Fe was an excellent catalyst below about 600°C.

11402. Fowle, M. J.; Bent, R. D.; Milner, B. E., and Masologites, G. P. **In reforming it's the catalyst that counts.** *Oil Gas J.* 51, No. 3, 181, 183-5(1952).—*C.A.* 46, 7749*f*.

The Atlantic catalytic reforming process, a continuous, normally nonregenerative process utilizing multiple fixed-bed reactors, was described. The catalyst used was selective and maximized dehydrogenation of naphthenes and isomerization of paraffins and naphthenes while controlling the undesirable cracking reactions. S was a temporary catalyst poison at concns. of 0.1% or higher.

11403. Freĭdlin, L. Kh. and Levit, A. M. **Kinetics of the dehydration of alcohols in the presence of trisubstituted calcium phosphate.** *Izvest. Akad. Nauk S.S.S.R., Otdel Khim. Nauk* 1952, 163-71.—*C.A.* 46, 5409*c*.

Expts. with a feed rate of 0.16 ml/min., on 20 ml (9 g) $Ca_3(PO_4)_2$, were described with EtOH, PrOH, *sec*-PrOH, BuOH, and *iso*-BuOH. The activity of the catalyst remained undiminished for hrs with EtOH. On the same catalyst, the rate of dehydration of Et_2O proved to be twice as slow as that of EtOH, at the same mol. feed rate. On silica gel, dehydration of EtOH was slower and less selective than on $Ca_3(PO_4)_2$. The life of the silica gel catalyst was shorter; 5 hrs heating at 800°C lowered its activity by a factor of 4.

11404. Freĭdlin, L. Kh. and Rudneva, K. G. **Promotion of dehydrogenated skeleton nickel**

Doklady Akad. Nauk S.S.S.R. 83, 105-8(1952).—*C.A.* 46, 8489*h*.

The Ni catalyst, prepd. by 2 hrs-leaching of a 50-50% Ni-Al alloy at 100°C, was dehydrogenated by 1-hr treatment with a 2% soln. of benzoquinone at 60°C under N_2 and then again satd. with H_2. At 60°C, the dehydrogenated catalyst was able to take up an amt. of H_2 up to about 45% of the amt. present in the original catalyst prior to its dehydrogenation. At 90°C, the amt. of H_2 taken up remained about the same, only the time necessary for it was shorter. The rehydrogenated catalyst reduced benzoquinone; consequently, the H_2 taken up was active.

11405. FUKUSHIMA, SHOUZOW; HORIBE, YOSHIO, AND TITANI, TOSHIZO. **A study of the mechanism of the catalytic action of manganese dioxide on the decomposition of potassium chlorate by use of heavy oxygen as an isotopic tracer.** *Bull. Chem. Soc. Japan* 25, 245-8(1952)(in English).—*C.A.* 47, 5781*i*.

$KClO_3$ labeled with heavy O was decompd. by heating in the presence of ordinary MnO_2, using a variety of conditions. The evolved O_2 was converted into H_2O with tank H_2 and Cu catalyst. At the same time a part of the heavy $KClO_3$ was noncatalytically decompd. by heating at 650°C, and evolved O_2 was similarly converted into H_2O. H_2O was also prepd. by reducing a part of the MnO_2 with the same H_2. At the catalytic decompn. of $KClO_3$ in the presence of MnO_2, an unstable compd. was formed between $KClO_3$ and MnO_2, and O_2 was liberated by the decompn. of this intermediate compd.

11406. GRANT, G. A.; KATZ, MORRIS, AND RIBERDY, R. **Oxidation of carbon monoxide by solid silver permanganate reagents. III. Effect of method of preparation on activity.** *Can. J. Technol.* 29, 511-19(1952).—*C.A.* 46, 7937*f*.

The reactivity of reagents prepd. from $AgMnO_4$ and ZnO varied greatly. The best way to ppt. the $AgMnO_4$ on powd. ZnO carrier, was described.

11407. GRIFFITH, ROLAND H. **Catalytic oxidation of organic sulfur compounds in coal gas.** *Ind. Eng. Chem.* 44, 1011-14(1952).—*C.A.* 46, 9284*h*.

A Ni subsulfide catalyst was used in the range 220°-370°C. A plant treating 1,500,000 ft^3 per day, which had been in operation for 14 years was described. It was operated by automatic air addn. controlled from a magnetic O_2 analyzer. Thiophene was not decompd., but other S compds. were reduced to about 2 grains per 100 ft^3.

11408. HALL, C. C.; GALL, D., AND SMITH, S. L. **A comparison of the fixed-bed, liquid-phase ("slurry") and fluidized-bed techniques in the Fischer-Tropsch synthesis.** *J. Inst. Petroleum* 38, 845-76(1952).—*C.A.* 47, 846*g*.

Synthesis expts. were made with fused and sintered Fe catalysts in lab.-scale, fixed-bed, liquid-phase (slurry), and fluidized-bed reactors. By allowing for the increase in activity which accompanied reduction in particle size of fused and sintered Fe catalysts, the reaction rate in a fixed bed was the same as or somewhat greater than that in a fluidized bed, but in a slurry system the rate was appreciably less. With a particular catalyst and reaction temp., carbon formation was controlled by the partial pressure of H_2. The rate of the synthesis reaction was a linear function of operating pressure (300-675 p.s.i.) in all 3 processes.

11409. HAMILTON, W. W.; EASTWOOD, S. C.; POTAS, E. A., AND SCHRAISHUHN, E. A. **Catalytic cracking in Airlift Thermofor catalytic cracking (TCC) units.** *Petroleum Engr.* 24, No. 9, C-5-16(1952).—*C.A.* 46, 11658*g*.

The Airlift Thermofor catalytic cracking unit had many improvements over the bucket-elevator unit. The com. units operated with low catalyst attrition rates and were exceeding design conditions with respect to both yields and carbon-burning capacity.

11410. HANCOCK, C. KINNEY. **Raney nickel-catalyzed hydrogenation of commercial aldol.** *Ind. Eng. Chem.* 44, 1003-6(1952).

Commercial aldol appeared to be largely the condensation product between aldol and acetaldehyde. Under optimum hydrogenation conditions, the aldol yielded about 70% butylene glycol, alcohol being the main by-product. At higher temps., increased dehydration of aldol preceded hydrogenation and led to an increase in yield of BuOH. Raney nickel could be re-used if it was protected properly.

11411. HANSFORD, R. C.; WALDO, P. G.; DRAKE, L. C., AND HONIG, R. E. **Hydrogen exchange between deuterium oxide and hydrocarbons on silica-alumina catalyst.** *Ind. Eng. Chem.* 44, 1108-13(1952).—*C.A.* 46, 9292*g*.

The hydrocarbons investigated were benzene, cyclohexane, methylcyclohexane, neopentane, isobutane, butane, 2-butene, heptane, and isobutylene. The silica-alumina catalyst was hydrated with D_2O, 0.25% by wt, and then brought into contact with the hydrocarbon. Following the reaction period (1 hr) at the desired temp., a sample was removed and analyzed by a mass spectrometer. For a given rate of conversion, satd. hydrocarbons contg. only primary or both primary and secondary H required the highest temp. for exchange, and olefins required the lowest temp. for exchange. Olefins were found to accelerate the reaction rate.

11412. HEIN, L. B. **Synthesis of ammonia at 350 atmospheres.** *Chem. Eng. Progress* 48, 412-18 (1952).—*C.A.* 46, 9809*i*.

Synthesis catalyst, materials of construction, energy requirements, and synthesis converters were reviewed.

11413. HOARE, D. E. AND WALSH, A. D. **The inhibiting effect of lead tetraethyl. II. The effect of lead monoxide on the slow oxidation of methane.** *Proc. Roy. Soc.* (London) 215A, 454-66(1952).—*C.A.* 47, 4716*i*.

Expts. described the slow oxidation of CH_4 in PbO-coated vessels. The PbO coating caused: (1) comparatively little effect on the induction period to the onset of a marked rate of pressure rise, but a very marked diminution of the max. rate of pressure rise; (2) near 500°C, a rise in over-all activation energy from about 25 to about 58 kcal/mole; (3) a small increase in the dependence of the max. rate of pressure rise on the total initial pressure. H and O atoms and OH radicals did not play an important role in the secondary, HCHO-oxidation, chains.

11414. HOLM, V. C. F. AND BLUE, R. W. **Hydrogen-deuterium exchange activity of catalysts.** *Ind. Eng. Chem.* 44, 107-13(1952).—*C. A.* 46, 3381*c*.

Six catalysts, TiO_2, ZrO_2, CeO_2, TiO_2, Al_2O_3, and ZnO, were prepd. (except ZnO) by pptn. of the hydrous oxide from solns. of the nitrates. ZnO was pptd. from the oxalate. Seven Fe catalysts were prepd. by fusion of Armco wire and burning in a stream of O_2 and adding KNO_3 or K_2CO_3; or carbonyl Fe powder was intimately mixed with K_2CO_3, heated at 150-200°C with an oxy-gas flame, cooled, crushed, and screened for size. B.E.T. surface areas were detd. Twelve com. catalysts were also used. H_2 and D_2 was passed over the catalyst at a const. rate of atm. pressure and reaction temp. from —78° to 300°C. The catalysts were pretreated with H_2. Rate consts. were calcd. on the assumption that the exchange reaction was 1st order; 1st-order rate consts. could be used safely for comparison of the several catalysts. Activities for H_2-D_2 exchange were of the same order as for the hydrogenation of C_2H_4, and C_4H_{10} dehydrogenation.

11415. HUGHES, E. C.; STINE, H. M.; STRECKER, H. A.; EASTWOOD, S. C.; GUTZEIT, C. L.; STOVER, W. A., AND WANTUCK, S. J. **Cogelled chromia-alumina catalyst for naphtha reforming. Evaluation of hydrocarbon types and naphthas.** *Ind. Eng. Chem.* 44, 572-5(1952).—*C. A.* 46, 4777*d*.

The yield-octane relationship of naphthas correlated well with $K = (T_B/S)^{1/3}$ where T_B = molal av. b.p., °R and S = sp. gr. at 60°F. Reforming thermally cracked stocks and the production of benzene, toluene, and aviation blending stock were also feasible. From 86 to 97% of the S in the feed stock was removed, mostly as H_2S.

11416. ISHIWARA, TORAJIRO; NIWA, KICHIZO, AND KOIZUMI, KOICHI. **The utilization of pyrrhotite principally composed of iron and sulfur. II. Making of sulfuric acid from the roasting gases of pyrrhotite.** *Science Repts., Research Insts., Tohoku Univ. Japan, Ser.* A. 277-80 (1952).—*C. A.* 47, 2441*i*.

Pyrrhotite (28 to 32 mesh) was roasted in a rotary furnace at 700°C and H_2SO_4 was made from the roasting gases by the contact process with a V catalyst at approx. 440°C.

11417. IZGARYSHEV, N. A. AND ARYAMOVA, I. I. **Influence of the nature of the cathode and of catalysts on the electrolytic reduction of acetone.** *Doklady Akad. Nauk S.S.S.R.* 84, 313-15(1952).—*C. A.* 46, 9453*a*.

The products of the reduction of Me_2CO were pinacone, iso-PrOH, and C_3H_8. On Cu coated with Pb as cathode, best yields were obtained with a c.d. of 1 amp./dm^2. The reduction came to a stop as soon as the Pb coating of the cathode was consumed, but set in again when the cathode was coated anew. With Ni^{++} ions in the soln., no reduction products were obtained (only H_2 evolution).

11418. JACOBS, WILLIAM O. **First "packaged" Thermofor Catalytic Cracking unit now on stream.** *Oil and Gas J.* 50, No. 37, 92-4 (1952).—*C. A.* 46, 3740*i*.

Design and operating details were given for the Artesia, New Mexico, refinery of the New Mexico Asphalt and Refining Co.

11419. KASTENS, M. L.; HIRST, L. L., AND DRESSLER, R. G. **An American Fischer-Tropsch plant.** *Ind. Eng. Chem.* 44, 450-66(1952).—*C. A.* 46, 5292*a*.

Liquid fuels were produced by the Fischer-Tropsch process with a jiggling-catalyst bed which was similar to the fluid-catalyst system found in petroleum cracking. Purified synthesis gas was converted to hydrocarbons, oxygenated org. compds., CO_2, and H_2O at 450-525°F with a reduced Fe catalyst at 300-350 p.s.i.

11420. KATZ, MORRIS; RIBERDY, R., AND GRANT, G.A. **The oxidation of carbon monoxide by solid silver permanganate reagents. V. Determination of low concentration of carbon monoxide by use of thermistors in a thermal cell.** *Can. J. Technol.* 30, 303-10(1952).—*C. A.* 47, 3183*a*.

Physiologically significant concns. of CO in air may be detd. by measuring the temp. within a thermal cell with a thermistor as the air was passed through a Ag-$KMnO_4$-ZnO reagent. A pair of balanced thermistors, one in the active section and the other in inactive pumice, were made part of a Wheatstone bridge circuit.

11421. KAZANSKIĬ, B. A. AND GRUSHKO, I. E. **Catalytic hydrogenation of some trisubstituted ethylenes in the presence of nickel.** *Doklady Akad. Nauk S.S.S.R.* 87, 767-70(1952).—*C. A.* 47, 3098*a*.

On Pt black in alc. soln., the most rapidly hydrogenated deriv. of the type R'R''C:CR'''H was Et_2C = CHMe, followed by derivs. with 1, 2, and 3 phenyl groups. On Pd, the rate of hydrogenation of Et_2C = CHMe was about the same as on Pt. Hydrogenation of 4-nonane was slowed down considerably by addn. of C_6H_6; substituted aromatic compds., such as iso-BuPh, had an even stronger inhibiting action. The skeleton Ni catalyst showed a behavior similar to that of Pd.

11422. KHOMUTOV, N. E. **Electrochemical oxidation of aniline in the presence of catalysts.** *Zhur. Obshcheĭ Khim.* (J. Gen. Chem.) 22, 563-6(1952).—*C. A.* 46, 7908*h*.

$PhNH_2$ soln. in 1.5 *M* H_2SO_4 was electrolytically oxidized with either a Pt wire gauze anode or a perforated Pb anode (Pb cathode plate). The process was carried out in the presence of compds. of Mn, Cr, V, or Ce. The polarization curves in all cases had 2 portions. In the region of about 0.9-1.8 v. the curve became almost flat, then rose rapidly again as formation of O_2 began simultaneously with oxidation of $PhNH_2$, and a dark oxidation product appeared in the anode space.

11423. KIPERMAN, S. L. AND GRANOVSKAYA, V. SH. **Change of the order of reaction of the synthesis of ammonia. II. Kinetics of the reaction on an iron catalyst at a distance from equilibrium.** *Zhur. Fiz. Khim.* 26, 1615-18 (1952).—*C. A.* 47, 6749*a*.

A mixt., H_2:N_2 = 3:1 was passed at 1 atm. on an Fe catalyst at 475°C, at space velocities V = 90,500-13,550 liter/liter catalyst/hr. NH_3 yields were 0.047-0.110 vol. %, i.e. relative yields (in fractions of the equil. amt. of NH_3) 0.288-0.669. The catalyst, made by deposition on silica gel of an amt. of Fe sufficient to form a monolayer, was no more active than Fe catalysts with a surface area 1/50 to 1/100 the size of the gel. The Fe was not spread out over the surface in a monolayer, but formed discrete cryst. aggregates.

11424. KOBOZEV, N. I.; EVDOKIMOV, V. B.; ZUBOVICH, I. A., AND MAL'TSEV, A. N. **Magnetochemistry of active centers. I. Magnetic and catalytic properties of dilute layers.** *Zhur. Fiz. Khim.* 26, 1349-73(1952).—*C.A.* 47, 5745*a*.

The susceptibility, χ_a, per 1 g of adsorbed substance was detd. With $CoCl_2.6H_2O$ adsorbed on silica gel, χ_a was practically equal to the susceptibility of the pure salt. The increase of χ_a with the diln. was particularly marked with $Ni(NO_3)_2.6H_2O$ on carbon. Adsorbed Fe in dil. adsorbed layers behaved in qual. and quant. analogy with Pt. Paramagnetism of dil. adsorbed layers were found not only with paramagnetic and ferromagnetic salts and metals, but also with the normally diamagnetic Ag, only the isolated atom of which was paramagnetic. The sp catalytic activity of Pt on silica or Al_2O_3 gels in hydrogenation of ethylenic compds., was greatest as the surface coverage → 0.

11425. KONISHI, OSAMU. **Design of a catalytic reactor.** *Chem. Eng. Japan* 16, 335-7(1952).—*C.A.* 46, 10698*e*.

The method was illustrated by SO_2 oxidation reactor with V_2O_5 catalyst.

11426. KOTELKOV, N. Z. **Space velocity in heterogeneous catalysis.** *Zhur. Priklad. Khim.* 25, 168-73(1952).—*C.A.* 47, 4716*c*.

Dehydration of iso-PrOH in a flow system, at 250°, 300°, 350°, and 400°C on a clay catalyst taken in equal amts. by vol. but of different grain size showed the yield to be proportional to the surface area of the catalyst and not to its vol. The same surface area of catalyst was obtained on a carrier with 1/8 the amt. necessary to give the same surface area without carrier. Further expts. were done on flow dehydrogenation of iso-PrOH and of cyclohexane, at 300, 350, and 400°C, on Pt deposited on 2 different Ni-Cr wire spirals, of equal vol. and equal mass of the Pt, but with surface areas differing by a factor of 0.6; the yields obtained were found to stand in the ratio of the surface areas.

11427. KUCZYNSKI, WIENCZYSTAW AND HOFFMANN, PRZEMYSTAW. **The catalytic activity of a special type of aluminum gel.** *Roczniki Chem.* 26, 98-105(1952)(English summary).—*C.A.* 46, 10820*d*.

Kinetic measurements of catalytic dehydration of EtOH were made with 3 types of active hydrates of Al_2O_3 (contg. 1.23% SO_4^{--} at pH 7.0, 18.36% SO_4^{--} at pH 5.5, and 4.66% SO_4^{--} at pH 6.5). The studies were made at 330°C and at 380°C, the velocity of instillation equalling 0.00685 *M*/min.

11428. KUMMER, J. T. AND EMMETT, P. H. **Hydrogen-exchange reactions over iron synthetic ammonia catalysts at -195°C.** *J. Phys. Chem.* 56, 258-61(1952).—*C.A.* 46, 8488*i*.

Ortho-para exchange occurred rapidly on doubly-promoted catalyst at -195°C, but was very strongly poisoned by the presence of H_2 chemisorbed at or above 100°C. The H_2-D_2 exchange was very slow at -195°C. Singly-promoted Fe catalysts rapidly catalyze the H_2-D_2 exchange at -195°C as well as the ortho-para H_2 conversion. Furthermore, the latter reaction was not poisoned by H_2 put on the catalyst at 100°C. The existence of a 3rd type of activated adsorption of H_2 on a singly-promoted catalyst was suggested by the high velocity for the H_2-D_2 exchange and by the appearance of the low-temp. adsorption isotherms and the adsorption isobar.

11429. LIHL, F.; WAGNER, H., AND ZEMSCH, P. **Catalytic properties of nickel and cobalt powders for hydrogenation as a function of conditions of preparation.** *Z. Elektrochem.* 56, 612-19(1952).—*C.A.* 47, 2584*b*.

The hydrogenation of benzene was studied in a flow system, at const. flow rate (140°C), and mixt. compn. (C_6H_6:H_2 = 1:5.8) over a series of Ni and Co powders prepd. in different conditions from a variety of reagents. Several runs were made with each catalyst. A single run included preliminary reduction at 140°C during 10 min. followed by reaction during 10 min. The product was analyzed for C_6H_{12}.

11430. LIHL, F.; WAGNER, H., AND ZEMSCH, P. **Catalytic properties of alloy powders in the systems cobalt-nickel and cobalt-iron.** *Z. Elektrochem.* 56, 619-24(1952).—*C.A.* 47, 2584*c*.

Powders of Co-Ni and Co-Fe alloys were prepd. from formate mixed crystals. The phases were detd. by x-ray analysis and the catalytic activity for benzene hydrogenation was measured. With Co-Ni alloys, the activity fell approx. linearly from the value for pure Co to that for Ni. In the Co-Fe system, small addns. of Fe to Co reduced the activity very strongly in the ϵ-phase region. With further addn. of Fe (about 4%) the activity increased, then dropped again.

11431. LIHL, F. AND ZEMSCH, P. **Effect of reduction temperature of nickel and cobalt compounds on the catalytic properties of the metallic catalysts.** *Z. Elektrochem.* 56, 979-85(1952).—*C.A.* 47, 5779*d*.

Ni catalysts were prepd. by reduction in H_2 at 250°-350°C. Co catalysts were prepd. by reduction in H_2 at 250°-700°C of $Co(HCOO)_2$. Each was tested for its activity in the hydrogenation of C_6H_6 to cyclohexane at 130-140°C. The yield in 10 min. was taken as a measure of catalytic activity. The initial activity of Ni catalysts depended on the compd. reduced (NiO and $Ni(HCOO)_2$ being highest) and was higher at lower reduction temps. and increased with grinding. The activity of the Co catalysts was independent of reduction temp. up to 500°C and increased rapidly with time to a const. value giving 96-97% yields.

11432. LIHL, F. AND ZEMSCH, P. **Catalytic properties of nickel and cobalt prepared from amalgams by distillation of the mercury or de-**

composition in air. *Z. Elektrochem.* 56, 985-7(1952).—*C.A.* 47, 5779*h*.

Amalgams of the highest concn. obtainable, 6.88% Ni and 12% Co, were used. The Ni-Hg was heated in inert or reducing atm. to distil off Hg, finally for 2 hrs at 320°C in H_2. The finely powd. Ni obtained was completely inactive for the hydrogenation of C_6H_6 to cyclohexane. The Co-Hg was allowed to decomp. spontaneously in air for 8-12 hrs. The finely powd. Co was the most active catalyst tested so far, giving 98-99% yields, independently to the duration of the expt. The Co-Hg could also be treated to distil off the Hg, a coarse granular product being left; this gave 90% yields at first, but these continually decreased with the duration of the expt.

11433. LIVSHITS, V. D. AND SIDOROV, I. P. **Kinetics of ammonia synthesis in isothermal conditions.** *Zhur. Fiz. Khim.* 26, 538-41(1952). —*C.A.* 47, 398*g*.

Kinetics of NH_3 synthesis at 500°C from pure stoichiometric N_2-H_2 mixts. was studied in an app. that insured strictly isothermal conditions. The rate const. calcd. from these data fell with increasing pressure. If departure from ideal gas behavior was taken into account, the following values ($\times 10^{-4}$) for the rate const. were obtained: 6.60, 7.08, 6.97, 6.93, 6.45, 5.50 at 10, 100, 200, 300, 400, 500 atm., resp.

11434. MAFFEZZONI, UMBERTO. **The manufacture of hydrocyanic acid from methane, ammonia, and air.** *Chimica e industria* (Milan) 34, 460-5 (1952).—*C.A.* 47, 2440*g*.

Many different catalyst were effective for the reaction $CH_4 + NH_3 = HCN + 3\ H_2$: Pt, Rh, Ir, Ru, Os, Au, Al_2O_3, ThO_2, TiO_2, and SiO_2. Pt was preferred, either pure or alloyed with Rh or Ir, supported on porous porcelain, pumice, Al_2O_3, etc. Service of more than 2000 hrs could be obtained without appreciable lowering of yields. A pilot plant producing 100 kg of 100% HCN per day was operated and the detailed conditions were given.

11435. MARGOLIS, L. YA. AND TODES, O. M. **Catalytic oxidation of ethylene on magnesium chromite.** *Izvest. Akad. Nauk S.S.S.R., Otdel, Khim. Nauk* 1952, 52-63.—*C.A.* 46, 5413*e*.

The oxidation was studied in a static system (0.1-2 mm Hg) on a spinel $MgCr_2O_4$ with excess MgO and a surface area of 70 m^2/g. The oxidation was complete, to CO_2 and H_2O. In a stoichiometric $C_2H_4 + O_2$ mixt., under an initial pressure of 0.17-0.18 mm Hg, at 275°C, the rate of the reaction fell off with its progress. The surface contaminated by adsorption of C_2H_4 was regenerated by O_2 (99 mm Hg) and the original activity restored. Addn. of 1, 2, or 3% Na silicate to the catalyst changed the rates, but not the kinetic law. Different SiO_2 contents in the catalysts altered the part of adsorption in the oxidation.

11436. MARSH, J. D. F.; NEWLING, W. B. S., AND RICH, J. **The catalytic hydrolysis of hydrogen cyanide to ammonia.** *J. Appl. Chem.* (London) 2, 681-4(1952).—*C.A.* 47, 6747*i*.

HCN was removed from H_2S concentrates by catalytic hydrolysis. Of the oxides of Al, Ce, Th, Ti, Zr, Mo, V, Mn, Co, Fe, and Ni studied as catalysts, alumina was the most suitable. Compared with N_2, neither H_2S nor CO had any significant effect on the rate of reaction. The reaction was not retarded by the products NH_3 or CO, and the rate was nearly independent of the H_2O concn. if present in excess. The apparent activation energy of the zero-order reaction was 20 kcal/mole.

11437. MASTAGLI, PIERRE; FLOC'H, ANGÈLE, AND DURR, GEORGES. **Action of anion exchangers on the condensation of furfural with aldehydes or with acetone.** *Compt. rend.* 235, 1402-3 (1952).—*C.A.* 47, 3610*g*.

Use of anion-exchange resins instead of KOH or NaOH in aldol-type condensations resulted in selective action. While linear products were formed as a side reaction in the NaOH-catalyzed condensation of aldehydes with furfural, α-furfurylidenealdehydes of higher purity were formed selectively and in better yields in the presence of Amberlite IRA-400.

11438. MAURER, JOHN F. **The effect of pressure on the dehydration of 1-butanol over an alumina-silica catalyst.** *Univ. Microfilm* (Ann Arbor, Mich.), *Pub.* No. 3532, 62 pp. (microfilm $1.00, paper enlargements $6.20); *Dissertation Abstracts* (formerly *Microfilm Abstracts*) 12, 168(1952).—*C.A.* 46, 7415*f*.

11439. MAURER, JOHN F. AND SLIEPCEVICH, C. M. **The effect of pressure on the catalytic dehydration of 1-butanol.** *Chem. Eng. Progress Symposium Ser.* 48, No. 4, *Reaction Kinetics and Transfer Processes*, 31-7(1952)—*C.A.* 47, 2026*d*.

The effect of pressure was detd. on the initial rate of dehydration of 1-butanol over an Al_2O_3-SiO_2 catalyst at 750°F and at pressures up to 7500 p.s.i.g. The initial rate of dehydration increased with pressure up to about 2500 p.s.i.g., which corresponded to a fugacity of 1-butanol of 85 atm., and thereafter decreased.

11440. MAXTED, E. B. AND BALL, G. T. **Reversibility of the adsorption of catalyst poisons. I. The revival of poisoned catalysts by simple washing.** *J. Chem. Soc.* 1952, 4284-8.—*C.A.* 47, 2909*g*.

The catalyst poisons (thiophene, $(CH_3)_2S$, Hg^{2+}, and Zn^{2+}) were removed from Pt catalyst by washing with AcOH. One washing restored the catalyst to its original activity in hydrogenation of cyclohexene, except in the case of Hg^{2+}, where 3 washings were required. Raney Ni catalyst, poisoned with thiophene or Cd^{2+} towards the hydrogenation of crotonic acid, were washed free of poison by 2 or 3 washings with water satd. with H_2. Ni was more difficult to wash free of poisons than Pt.

11441. MCCABE, CHARLES L. AND HALSEY, G.D. JR. **The hydrogenation of ethylene over copper. I. Reproducing the activity of the catalyst.** *J. Am. Chem. Soc.* 74, 2732-4(1952).—*C.A.* 46, 9397*a*.

H_2 chemisorbed near 120°C had a marked effect on the activity of a reduced Cu catalyst. Once this H_2 was adsorbed, activity was maintained by treating the catalyst with H_2 at 0°C. Three methods of placing varying amts. of chemisorbed H_2 on the surface were used, and the activity of the catalyst was reported as a function of the parameter governing the amt. of chemisorbed H_2.

11442. McKinley, Clyde. **Nickel catalysts in acetylene and carbon monoxide chemistry.** *Ind. Eng. Chem.* 44, 995-9(1952).—*C.A.* 46, 9747*h*.

In certain salts, such as $Ni(CN)_2$, Ni served uniquely in the polymerization of C_2H_2 to form cyclooctatetraene. Other Ni catalysts will effect the combination of 3 C_2H_2 mols. to form a C_6H_6 or substituted C_6H_6 structure. Examples mentioned were the formation of trimethylol- and hexamethylol-benzene, C_6H_6, and styrene. Ni served, not uniquely, but as do other strong hydrogenation catalysts, in the reduction of double and triple bonds. Bivalent Ni salts catalyzed the reaction of C_2H_2 and also of olefins with CO and various reactive H-compds.

11443. Miesserov, K.G. **Acidity of aluminosilicates and its relation with catalytic activity.** *Doklady Akad. Nauk S.S.S.R.* 87, 627-30(1952).—*C.A.* 47, 3675*b*.

The acidity of a synthetic aluminosilicate was varied by incorporation of known amts. of Na^+ ions through treatment with solns. of NaCl or AcONa. The catalytic activity of the various samples was detd. by the iodine no. and the paraffin content of the product disproportionation of cyclohexene. The catalytic activity fell linearly with increasing amt. of Na^+ ions absorbed by the catalyst. Pure Al_2O_3 had no exchangeable or hydrolytic acidity, and no catalytic activity. Pure SiO_2 had only a very slight exchangeable acidity, but SiO_2 activated with Al_2O_3 had a catalytic activity of 44.7%, with an exchangeable acidity of 9.6, and a hydrolytic acidity of 33.6.

11444. Mooi, John and Selwood, P.W. **Catalytic activity of supported manganese oxides for the hydrogen peroxide decomposition.** *J. Am. Chem. Soc.* 74, 1750-4(1952).—*C.A.* 46, 6916*c*.

The catalytic decompn. of H_2O_2 in dil. water soln. on various supported Mn oxides was studied. The activity of these catalysts as a function of the concn. of Mn on the support showed an increase with decreasing Mn concn., followed by a sudden decrease for very low Mn concns. The effects of oxidation state, pH, support phase modification, and temp. were studied also.

11445. Mooi, John and Selwood, P.W. **Structure and catalytic activity of supported manganese, copper, and iron oxides.** *J. Am. Chem. Soc.* 74, 2461-4(1952).—*C.A.* 46, 8489*b*.

The catalytic oxidation of CO by air over supported oxides of Mn, Fe, and Cu was studied. The sp activity increased with decreasing concn. of the supported oxide, except for samples of low concn., on which the activity decreased.

11446. Nenniger, Emile Jr. **Fluidone catalytic cracking process of petroleum oils.** *Chemistry & Industry* 1952, 320-8.—*C.A.* 46, 7750*e*.

Excess kerosine, light Diesel fuels, and heavy and visbreaker gas oils were brought into contact with a fine (40 μ) powder catalyst (87% silica and 13% alumina) at 1070 to 1100°F at the base of a reactor. The vaporized hydrocarbons and catalyst passed up the reactor at approx. 925°F and 9.2 p.s.i. The spent catalyst was drawn off near the bottom of the reactor and passed through a steam stripper which drove the entrained hydrocarbons back to the reactor.

11447. Niwa, Makoto and Yamaguchi, Mitsuo. **Sintering of catalysts. II. Relations between sintering and catalytic action of copper catalysts.** *J. Chem. Soc. Japan,* Pure Chem. Sect. 73, 162-4 (1952).—*C.A.* 46, 10488*b*.

Dehydration of EtOH in vapor phase at 200°C was studied by the catalyst reduced at 100°-150°C by H_2 and sintered at 225°C. Catalytic activity after sintering of the catalyst contg. 0.08% Ni was greater than pure Cu. Though $NaNO_3$ prevented sintering, the activity of the catalyst contg. it was poor. The activity of the catalyst pptd. by NaOH was greater than that by $(NH_4)_2CO_3$.

11448. Oborin, V.I. **Mechanisms of catalytic cracking of hydrocarbons.** *Zhur. Fiz. Khim.* 26, 461-8(1952).—*C.A.* 47, 957*g*.

Cracking activity of a $MgO\text{-}SiO_2$ catalyst did not depend uniquely on its acidity. The following activities: 0.214, 0.501, 0.581, 0.856, 1.050, 0.738 correspond to the resp. acidities (mg equiv./g): 1.250, 1.460, 1.396, 1.396, 1.330, 1.330. The mechanism of cracking was discussed on the basis of American and especially Soviet data.

11449. Ohta, Nobuto. **Catalytic hydrolysis of chlorobenzene to phenol in the vapor phase. II. Relationship between the method of preparing the silica gel-cupric chloride catalyst and the catalytic activity. III. Effects of temperature, space velocity, and chlorobenzene-water ratio, and the use of ammonia water in place of plain water.** *Repts. Govt. Chem. Ind. Research Inst., Tokyo* 46, 327-32; 333-9(1952).—*C.A.* 47, 2129*f*.

Silica gel, when molded with 2% $CuCl_2$, became a very active catalyst for the hydrolysis. With the molded catalyst (silica gel 80, acid clay 20, and 2% $CuCl_2$) PhCl dild. with 3 times its vol. of H_2O was hydrolyzed to PhOH most at 450-600°C and a space velocity (cc./hr) 0.064-0.51. Addn. of NH_4OH prolonged the life of the catalyst, but near 500°C, at a low space velocity, the PhOH yield was higher with a higher partial pres. of NH_3, the effect being the reverse at a high space velocity.

11450. Ohta, Nobuto. **Catalytic hydrolysis of chlorobenzene to phenol in the vapor phase. V. Life and regeneration of silica-cupric chloride catalyst.** *Repts. Govt. Chem. Ind. Research Inst. Tokyo* 47, 55-62 (1952).—*C.A.* 47, 3100*i*.

The catalytic activity of silica gel contg. 2-3% $CuCl_2$ used continuously at 525°C in the conversion of $PhCl\text{-}H_2O$ to PhOH and aerated every 10-20 hrs (to burn out carbon deposited) decreased rapidly in the initial 20-40 hrs to a low level. This remained unchanged for the next 100-250 hrs, when the residual $CuCl_2$ was down to about 0.5% (yield of PhOH 95-100 with the conversion rate

15% or below; 80-90 with the rate 20% or above; dropped for a while immediately after the regenerative aeration). Since the silica gel was extremely thermostable, the loss of the activity seemed solely due to the vaporization of $CuCl_2$.

11451. ÔKI, KÔSUKE. **Action of d-electrons of transition metals in catalysis.** *Kagaku* (Science) 22, 42-3(1952).—*C.A.* 46, 2408*i*.
Reactions for org. synthesis were classified by the no. of d-electrons of transition metals acting as catalysts in the reactions: (1) oxidation-reduction occurred when an electron was taken away from, or added to, a hole in d-orbitals in which there were 9 electrons when the atom was in an active state, (2) if d-orbitals could not be filled by electrons, the metal atom assumed an active state by forming a complex with a reactant, and (3) the reactant underwent the oxidation-reduction by its triplet state of π-electrons.

11452. PACK, F.C.; PLANCK, R.W., AND DOLLEAR, F.G. **Determination of the total unsaturation of tung oil by catalytic hydrogenation.** *J. Am. Oil Chemists' Soc.* 29, 227-8(1952).—*C.A.* 46, 7788*e*.
The weighed sample and Pt catalyst were suspended in HOAc during hydrogenation. Data on pure compds., some fatty acids, and many tung-oil samples were recorded.

11453. PANCHENKOV, G.M. AND KUZNETSOVA, E.P. **Kinetics of the catalytic cracking of gas oil.** *Doklady Akad. Nauk S.S.S.R.* 87, 65-8(1952).—*C.A.* 47, 4065*i*.
The amts. of gas, gasoline coke, and unreacted oil were detd. in flow runs with a paraffin gas oil at different feed rates on 2 aluminosilicate aerogel catalysts: Al_2O_3 5, SiO_2 95%, at 450°, 475°, and 490°C and Al_2O_3 30, SiO_2 70%, at 400°, 450°, and 490°C.

11454. PANCHENKOV, G.M. AND TRET'YAKOVA, V.S. **Catalytic cracking as a consecutive chemical reaction.** *Doklady Akad. Nauk S.S.S.R.* 87, 237-40(1952).—*C.A.* 47, 6640*g*.
The cracking of a gas oil A to gas (A_1), gasoline (A_3), and "coke" was assumed to proceed by steps, $A \rightarrow n_iA_i + n_2A_2 + n_3A_3 \rightarrow n_1A_1 + n_5A_2$, each step being a 1st-order reaction. In the case when all products, except the "coke", were adsorbed weakly, and the coke adsorbed strongly, solution of the differential rate equation was obtained. The conclusions were verified with data on cracking Al_2O_3 30-SiO_2 70%.

11455. PARRAVANO, G. **Ferroelectric transitions and heterogeneous catalysis.** *J. Chem. Phys.* 20, 342-3 (1952).—*C.A.* 46, 8944*h*.
The rate of oxidation of CO was detd. as a function of temp. on the surface of $NaNbO_3$, $KNbO_3$, and $LaFeO_3$. For $NaNbO_3$ the oxidation rate first decreased and then increased above the normal rate as the temp. was raised; for the other 2 compds. the increase preceded the decrease. Increase in the rate of heating of $KNbO_3$ shifted the anomaly to higher temps.

11456. PAUL, RAYMOND; BUISSON, PAUL, AND JOSEPH, NICOLE. **Catalytic activity of nickel borides.** *Ind. Eng. Chem.* 44, 1006-10 (1952).—*C.A.* 46, 9960*e*.
By reaction of $NaBH_4$ or KBH_4 with various Ni salts under various conditions of temp., pH, and solvents, voluminous black ppts. were produced which contained one atom of B to two atoms of Ni. Their catalytic activity was studied in comparison with that of Raney Ni in the hydrogenation of safrole, furfural, and benzonitrile. When prepd. from $(AcO)_2Ni$ or $NiCl_2$, these catalysts had an activity equal to or slightly inferior to that of Raney Ni. Their resistance to fatigue appeared particularly high.

11457. PAYNE, J.W.; EVANS, L.P.; BERGSTROM, E.V., AND BOWLES, V.O. **Thermofor catalytic reforming —an answer to demand for higher octane numbers.** *Oil Gas J.* 51, No. 28, 357, 360-2, 364-5, 367-8 (1952).—*C.A.* 47, 1369*h*.
The thermofor catalytic reforming process selectively reformed petroleum naphthas by using a synthetic chromia-alumina gel catalyst. Optimum pressures ranged between 100 and 200 p.s.i. As the gas-recycle ratio increased, the quantity of coke produced decreased and gasoline yield increased slightly, while H-content of the recycle gas remained fairly const. Reactor temps. ranged from 950° to 1000°F. Catalyst-to-naphtha ratio could be varied over a wide range with no marked effect on product yields and quality.

11458. PETERS, KURT AND KAPPELMACHER, ELISABETH. **Conversion of hydrocarbons to carbon monoxide-hydrogen mixtures.** *Brennstoff-Chem.* 33, 296-307 (1952).—*C.A.* 47, 290*h*.
Ni catalysts were prepd. and the reactions studied on a lab. scale with good agreement between theoretical and exptl. results. Catalytic splitting of CH_4 was more rapid with air or O_2 than with CO_2 and steam. Soot formation was reduced by lowering the partial pressure of the hydrocarbons by adding an excess of steam, diln. with inert gases, etc., or by the use of a catalyst of higher activity and selectivity.

11459. PLATE, A.F. AND TARASOVA, G.A. **Mechanism of contact reactions of hydrocarbons on a vanadium catalyst. VII. Comparative behaviors of binary mixtures of heptane, heptene, and toluene.** *Zhur. Obshcheĭ Khim.* 22, 765-71 (1952). —*C.A.* 47, 3096*h*.
C_7H_{16} + C_7H_{14} mixts. of different compns. (0, 5, 10, 50, 75, 90, and 100 mole % C_7H_{14}) were passed over the catalyst (V oxide on Al_2O_3, reduced in H_2) at a space velocity of 0.5 liter/liter catalyst X hr, at 480°C. The toluene content of the catalyzate increased linearly with the C_7H_{14} content of the reacting mixt. The amt. of newly produced toluene was proportional to the amt. of C_7H_{16} in the mixt., i.e., the yield of toluene with respect to C_7H_{16} was const. In a mixt. C_7H_{16} + C_7H_{14} each hydrocarbon was aromatized proportionally to its concn., but in mixts. with toluene the degree of aromatization of C_7H_{16} increased, but that of C_7H_{14} decreased with its concn.

11460. PURSLEY, JOHN A. **An investigation of the reaction between carbon monoxide and hydrogen on a nickel catalyst at pressures above one atmosphere.** *Univ. Microfilms* (Ann Arbor, Mich.), *Pub.* No. 3793, 154 pp. (microfilm $1.93, paper enlargements $15.40); *Dissertation Abstracts* 12, 463-4(1952).—*C.A.* 47, 1917*g*.

11461. PURSLEY, JOHN A.; WHITE, ROBERT R., AND SLIEPCEVICH, CEDOMIR. **The rate of formation of methane from carbon monoxide and hydrogen with a nickel catalyst at elevated pressures.** *Chem. Eng. Progress Symposium Ser.*, 48, No. 4, *Reaction Kinetics and Transfer Processes*, 51-8(1952). —*C.A.* 47, 1917*i*.

The effect of the partial pressures of the reactants on the initial rate of reaction $CO + 3H_2 \rightarrow CH_4 + H_2O$ was studied on a specific Ni catalyst at elevated pressures. The reactor was a 2-ft by 3/4-in. mild-steel pipe with a jacket contg. pressurized boiling fluids for temp. control. This was operated as a differential reaction system, and the initial reaction rates were derived from data obtained at low conversions over a range of temps., pressures, and gas concns.

11462. RADANČEVIĆ, M. **Synthesis-gas production by partial oxidation of methane.** *Nafta* (Yugoslavia) 3, No. 12, 5-11(1952).—*C.A.* 46, 11636*e*.

Catalysts were prepd. by impregnating silica gel of 2-mm size with $Ni(NO_3)_2.6H_2O$ solns., drying several hrs, calcining 1 hr at 500°C in an air stream, and reducing in pure H_2 30 min. at 500°C. Catalytic conversions were carried out in an elec.-tube reactor contg. 25.4-9.4 ml catalyst. The optimum amt. of Ni on the carrier was 3.2%, a further increase of Ni on the carrier giving no better yields of synthesis gas.

11463. RAPOPORT, I.B. AND LEVKOVICH, M.M. **Mechanism of the synthesis of hydrocarbons from carbon monoxide and hydrogen on iron catalysts.** *Doklady Akad. Nauk S.S.S.R.* 84, 725-7 (1952).—*C.A.* 46, 9828*a*.

$CO:H_2$ mixts. (1:1, 1:4, and 1:7) on a Fe-Cu catalyst were studied at 225°C, in a flow system. With the H_2 spent on hydrogenation of alkenes to alkanes subtracted, the ratios of $CO:H_2$ entering the reaction were, resp., 1:0.5, 1:0.8, 1:1. The Fe-Cu catalyst was intimately mixed with finely ground Ca_2C as adsorbent of H_2O. With fresh Ca_2C, CO_2 was entirely absent in the outgoing gas and the contraction was max. CO_2 was formed only as a result of the conversion reaction $H_2O + CO \rightarrow CO_2 + H_2$.

11464. REITLINGER, O. **Increasing the efficiency of catalysts for gas reactions.** *Chem. Ing.-Tech.* 24, 1-2(1952).—*C.A.* 46, 3681*c*.

The catalysts were prepd. by the deposition of powdered active catalytic materials on catalyst carrier by means of hydrated bonds. The prepn. of an Fe_2O_3 catalyst was described in detail.

11465. RIESZ, C.H.; DIRKSEN, H.A., AND PLETICKA, W.J. **Improvement of catalysts and catalyst supports.** *Petroleum Engr.* 24, No. 13, C17-20 (1952).—*C.A.* 47, 5096*b*.

Catalytic cracking initially developed for peak-load gas production has become an important base-load gas-production operation in the catalytic conversion of natural gas. A lab. and pilot-plant study of supports for Ni cracking catalysts revealed periclase (fused MgO) to be particularly effective; certain alumina prepns. and selected refractory compns. were also useful.

11466. ROHRER, C.S.; CHRISTENA, R.C., AND BROWN, O.W. **The catalytic activity of some reduced vanadate salts.** *J. Phys. Chem.* 56, 662-4(1952). —*C.A.* 46, 8945*f*.

The optimum operating conditions for the catalysts, Cu, $Ni_3(VO_4)_2$, $Cu_3(VO_4)_2$, $Pb_3(VO_4)_2$, and V_2O_5 were investigated for the reduction of nitronaphthalene to 1-naphthylamine. Ten g of each catalyst in turn was evenly distributed in a 10-in. bed in the cold furnace and then reduced with 14.5 liters H_2 per hr. Of the catalysts studied, Cu gave the highest yields of the amine. Reduced $Ni_3(VO_4)_2$ was too active for reduction to the amine, but gave appreciable amts. of the overreduction product, naphthalene.

11467. ROHRER, C.S.; KING, P.F., AND BROWN, O.W. **The catalytic activity of the reduced vanadates of nickel, copper, and lead.** *Proc. Indiana Acad. Sci.* 61, 135-9 (1952).—*C.A.* 47, 3096*d*.

The vapor-phase reduction of org. nitro compds. to their resp. amines with H_2 was studied. The catalysts were prepd. by the reduction of 15 g of each salt supported on enough asbestos fiber to give a 12-in. catalyst bed. Ni vanadate was reduced at 300°C for 1 hr, Cu vanadate at 340°C for 2 hrs and 4 min., and Pb vanadate at 360°C, 3 hrs and 15 min. The optimum conditions for the reduced catalysts were temps. from 325 to 385°C, H_2 flowing at a rate of 408% of theory, and $PhNO_2$ flowing at a rate of 5-9 g/hr, giving a yield of 100% $PbNH_2$.

11468. ROOLEY, J.; ROHRER, C.S., AND BROWN, O.W. **The catalytic activity of reduced nickel molybdate and reduced nickel chromate.** *J. Phys. Chem.* 56, 1082-4(1952).—*C.A.* 47, 4715*d*.

Reduced $NiMoO_4$ was an excellent catalyst for the vapor-phase reduction of $1\text{-}C_3H_7NO_2$ at 145°C at a feed rate of 10 ml/hr; yields were obtained of $C_3H_7NH_2$ as high as 94.8%. Reduced $NiCrO_4$ as catalyst gave yields of 70.6% $C_3H_7NH_2$. The activity of the latter catalyst was very sensitive to time and temp. of reduction in H_2. The reduced catalyst consisted partially of metallic Ni with the Mo or Cr present in some partially reduced state.

11469. RUBINSHTEIN, A. M.; KULIKOV, S.G., AND PRIBYTKOVA, N.A. **Deformation of the crystal lattice and the dehydrogenating properties of chromic oxide.** *Doklady Akad. Nauk S.S.S.R.* 85, 121-4(1952).—*C.A.* 46, 9399*b*.

The activity *A* of 11 catalysts was detd. with EtOH at 400° and 430°C, and was expressed in ml $H_2 + C_2H_4$ evolved per ml EtOH; the selectivity *S* was defined by $H_2/(H_2 + C_2H_4)$. There was no relation between *A* and the surface area. The main factor affecting the catalytic activity was the deformation of the lattice; greatest catalytic activity was with the least lattice compression.

11470. RUBINSHTEIN, A.M. AND PRIBYTKOVA, N.A. **Dehydrogenation on copper-chromia catalysts.** *Doklady Akad. Nauk S.S.S.R.* 85, 353-5 (1952).—*C.A.* 46, 9962*e*.

Known amts. of Cu were introduced by impregnating $Cr(OH)_3$ with a $Cu(NO_3)_2$ soln. and thermal decompn. to Cr_2O_3 and CuO. Catalysts prepd. by simultaneous pptn. of $Cr(OH)_3$ and $Cu(OH)_2$ gave results very close to those obtained with the impregnated catalysts. The increased activity with EtOH could be due to partial or total reduction of the CuO to Cu metal which was a more energetic dehydrogenation catalyst than Cr_2O_3.

11471. Saletan, David I. **Synthetic cation-exchange resin as an acid catalyst in continuous liquid-phase esterification.** *Univ. Microfilms* (Ann Arbor, Mich.), *Pub.* No. 3549, 134 pp. (microfilm $1.68, paper enlargements $13.40); *Dissertation Abstracts* (formerly *Microfilm Abstracts*) 12, 275-6(1952).—*C.A.* 46, 8944*c*.

11472. Salsas-Serra, Francisco. **The catalytic oxidation of sulfur dioxide. A study of the catalyst chamber.** *Chimie & industrie* 68, 695-9 (1952).—*C.A.* 47, 5776*f*.

Values of k_1 and k_2 in the integral of the expression $dx/dt = k_1(a - x)^2(b - x) - k_2x^2$ for the 3rd-order reaction $2\ SO_2 + O_2 \rightleftharpoons 2SO_3$, with a Pt catalyst were detd. in the range 420° — 620°C. At 535°C $k_1 \times 10^3$ was max. at 265°, falling to 95 at 620°C; $k_2 \times 10^3$ rose sharply from 0 at 450° to 98 at 610°C. The area under any isotherm between limits x_1 and x_2, detd. by graphic integration, was a function of the min. time required or of the min. amt. of catalyst needed.

11473. Sancelme, André. **The cathodic reduction in aqueous phase of solid insoluble inorganic compounds.** *J. chim. phys.* 49, No. 7-8, C117-22 (1952).—*C.A.* 47, 979*h*.

The yield was determined by comparison of the vol. of H_2 collected with that collected in a water coulometer. CuO in dil. H_2SO_4 was easily reduced, the yield decreasing with c.d. and increasing with H_2SO_4 concn. Under some conditions, Cu_2O was formed. PbO and PbO_2 were reduced in 100% yield in acid or basic media, regardless of temp., concn., or c.d. Ag_2O was completely reduced in dil. NaOH, as was $PbCl_2$ and AgCl in dil. HCl. The reduction of ZnO and Fe_2O_3 in dil. NaOH was incomplete. $PbSO_4$ was not reduced in dil. H_2SO_4, but was reduced in dil. HCl or NaOH, owing to the intermediate formation of $PbCl_2$ and PbO.

11474. Sato, Toshio. **Zinc-chromium oxide catalyst, especially its structural and activity changes with the chromium content.** *Repts. Govt. Chem. Ind. Research Inst., Tokyo* 46, 433-44(1952).—*C.A.* 47, 2909*e*.

The ZnO-Cr_2O_3(1:1 mol.) catalyst from baking $ZnCrO_3.NH_4OH$ pptd. from aq. $Zn(NO_3)_2$-H_2CrO_4 with NH_4OH (1:1:3 mols.) increased in activity, surface area, and porosity with higher Cr contents (max. activity at about 40% Cr). The catalyst pptd. from aq. $Zn(NO_3)_2$-$Cr(NO_3)_3$(1:2) atoms with NH_4OH and baked 10 hrs at-400°C was crystd. microscopically into a spinel structure. It was more active than ZnO or Cr_2O_3.

11475. Sauer, R.W. and Krieger, K.A. **Catalytic surfaces and the hydrolysis of diethyl carbonate.** *J. Am. Chem. Soc.* 74, 3116-20(1952).—*C.A.* 46, 10816*b*.

The heterogeneous catalysis of the hydrolysis of $(EtO)_2CO$ was studied as a method for the characterization of solid surfaces. With the unsupported catalysts, BeO, ZnO, PbO, and NiO, and catalysts NaCl, NaI, KCl, $CdSO_4$, PbO, and CdO, supported on carbon the reaction was substantially zero order with respect to H_2O vapor and was unaffected by changes in the partial pressures of EtOH and CO_2. Evidence of poisoning was found for NiO, CdO, and PbO catalysts. With Cr_2O_3 catalyst the reaction was nearly 1st-order with respect to water.

11476. Schultze, Gg. R. and Theile, H. **Oxidation of ethylene in the gas phase over silver catalysts.** *Erdöl u. Kohle* 5, 552-60 (1952).—*C.A.* 47, 291*a*.

Ethylene was oxidized to ethylene oxide and to H_2O and CO_2. Results indicated that the surface temp. of the catalyst was the detg. factor and not the temp. of the gas stream. The use of N_2O as source of O was inconclusive. The second attempt consisted of passing first O_2, then N_2, followed by N_2 and C_2H_4, and finally again by N_2. Results indicated that C_2H_4 did not react preferentially with adsorbed at. O but with another form of O.

11477. Selwood, P.W. and Lyon, Lorraine. **Supported oxides of manganese: influence of support modification.** *J. Am. Chem. Soc.* 74, 1051-3 (1952).—*C.A.* 46, 5944*d*.

The susceptibility-isotherm method was extended to a series of modified alumina supports; the supported oxides were those of Mn. The support-phase modification had a negligible effect on the oxidation state or dispersion of the supported Mn when the specific surface area was maintained large and no appreciable amts. of alkali were present. The presence of alkali in the support caused a large change in the susceptibility isotherm, reflecting substantial changes in oxidation state and degree of dispersion of the Mn.

11478. Shekhobalova, V.I.; Krylova, I.V., and Kobozev, N.I. **Active centers and mechanism of oxidation of sulfur dioxide.** *Zhur. Fiz. Khim.* 26, 703-18 (1952).—*C.A.* 47, 5233*c*.

The rates of catalytic oxidation of SO_2 on supported Pt and Pd catalysts were detd. in a flow system between 300° and 450°C. Supports were silica gel and 2 samples of alumina gel. In all cases, the active ensemble contained only one metallic atom. The following one-Pt-atom mechanism was given:

$$Pt + O_2 \rightarrow PtO_2 \xrightarrow{SO_2} PtO + SO_3;\ PtO + SO_2 \rightarrow Pt + SO_3.$$

11479. Shuĭkin, N.I. and Levitskiĭ, II. **Preparation of styrene by catalytic dehydrogenation of ethylcyclohexane fraction of Maikop gasoline.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* 1952, 498-504.—*C.A.* 46, 11656*b*.

Passage over Pt-carbon at 300°C and space velocity 0.3 gave a catalyzate with 47% aromatic compds. Azeotropic distn. with MeOH and washing of the fractions with H_2O gave purely aromatic ethylbenzene-xylene concentrate. This fraction was dehydrogenated over V-alumina catalyst best at 600°C, yielding a catalyzate with 22-3% styrene. The catalyzate from the Pt-carbon dehydrogenation at 300°C contained only 11-14% styrene.

11480. Shultz, J.F.; Seligman, B.; Shaw, L., and Anderson, R.B. **Fischer-Tropsch synthesis. Effect of nitriding on three types of iron**

catalysts. *Ind. Eng. Chem.* 44, 397-401(1952).—*C.A.* 46, 5291*f*.

The activities of a fused Fe catalyst at 100 p.s.i. contg. MgO, K_2O, SiO_2, and Cr_2O_3 as promoters, and another contg. Al_2O_3 and K_2O as promoters, were increased by a factor of more than 2 by converting the α-Fe to an ϵ-nitride. For the pptd. catalyst, the product distribution varied extensively with the initial pretreatment of the catalyst. The sample inducted with a H_2-CO mixt. yielded a high mol. wt product; the reduced sample yielded a lower mol. wt product. The nitrided catalysts yielded a mol. wt of still lower av. value than either the reduced sample or the one that had been inducted with a H_2-CO mixt.

11481. Širola, Josip and Plavšić, Nikola. **Catalytic properties of some domestic clays. Optimum conditions of acid activation.** *Nafta* (Yugoslavia) 4, 95-102(1952).—*C.A.* 47, 6126*g*.

Chem. analyses, base-exchange capacities, and x-ray diffraction patterns of clay samples of seven localities in Yugoslavia were given. Optimum conditions of acid activation of the montmorillonite clays were detd. Samples were activated by hot H_2SO_4 and the catalytic cracking activity was tested by cracking gas oil in a lab. cracking equipment.

11482. Sokol'skiĭ, D.V. **Active carriers in hydrogenation.** *Zhur. Obshcheĭ Khim.* 22, 1934-41 (1952).—*C.A.* 47, 3097*e*.

Hydrogenation of dimethylethynylcarbinol with H_2 was effected in soln. in 25 ml 96% alc. With Pt (0.001-0.002 g) on $BaSO_4$ (0.2 g) as catalyst, at 25° and 40°C, the rate of absorption of H_2 remained approx. const. until about 70-75% of the theoretical amt. was absorbed, and then rose sharply. The const.-rate portion corresponded to hydrogenation of the triple bond, and the sharp rise of the rate to complete exhaustion of triple bonds. With a Pd on $BaSO_4$ catalyst, the triple bond was hydrogenated more rapidly than the double bond. Os (20%) on $BaSO_4$, and Ru (20%) on $BaSO_4$ catalysts proved to be completely inactive for the hydrogenation, but they became active when promoted by Pt or Pd.

11483. Sokol'skiĭ, D.V.; Buvalkina, L.A., and Bukhman, A. **Kinetics of hydrogenation of cinnamic acid.** *Zhur. Obshcheĭ Khim.* (J. Gen. Chem.) 22, 558-63 (1952).—*C.A.* 46, 7415*g*.

Hydrogenation of cinnamic acid, over the catalyst prepd. from 50-50 alloy of Ni and Al (by alk. treatment) in 96% EtOH, was studied. The rate of agitation (rocking of the vessel) had no effect on the reaction rate. The 1st order rate was proportional to the amt. of catalyst used.

11484. Sokol'skiĭ, D.V. and Druz, V.A. **Potentiometric investigation of liquid-phase hydrogenation reactions on a skeletal nickel catalyst.** *Zhur. Fiz. Khim.* 26, 364-70 (1952).—*C.A.* 47, 4715*f*.

In the hydrogenation of $Me_2C(OH)C:CH$(0.344 g) in a 0.1 *N* aq. soln. of NaOH (80 ml), on a catalyst (prepd. by leaching 2 g of a Ni 50-Al 50% alloy with 20% alkali for 2 hrs) at 24°C, the rate of absorption of H_2 was const. (about 20 ml/min.) over the stage of the hydrogenation of the triple bond. The potential change of the catalyst, 120 mv., also remained const. A considerable amt. of H_2 remained on the surface during the reaction, despite the adsorptive competition of the unsatd. org. compd., and of desorption as a result of the hydrogenation. Hydrogenation on the same catalysts of Na maleate (0.725 g) and of Na fumarate (0.725 g) in 0.1 *N* NaOH proceeded at a const. rate, i.e. was zero-order over the course of the reaction, and the potential over that range remained approx. const.

11485. Sokol'skiĭ, D.V. and Popov, O.S. **Catalytic hydrogenation under constant pressure.** *Doklady Akad. Nauk S.S.S.R.* 83, 873-5(1952).—*C.A.* 46, 8490*c*.

The rate of hydrogenation of methylethylethynylcarbinol (0.5 ml) on a skeleton Ni catalyst (0.33) in an aq. 0.1 *N* NaOH soln. was investigated at 0°, 20°, 40°, and 50°C, under 2.0, 2.5, and 3.0 atm., at const. rate of agitation (500 oscillations/min.), Up to removal of 3/4 of the total H_2, the reaction was of the zeroth order, the rate of absorption of H_2 remaining independent of the total amt. of H_2 absorbed. At any temp., the e.m.f. (relative to the normal calomel electrode) was 0-20 mv. lower than the reversible H_2-potential and remained const. in the course of the hydrogenation, the change of pressure notwithstanding.

11486. Sourirajan, S. and Bhattacharyya, S.K. **Synthesis of acetic acid from methanol and carbon monoxide in the vapor phase in presence of cobalt catalysts at high pressures.** *J. Sci. Ind. Research* (India) 11B, 263(1952).—*C.A.* 47, 5093*g*.

Co iodide (84%) on silica gel was the most active catalyst tested for vapor-phase operation, but gave a lower yield of AcOH and a higher yield of gaseous decompn. products than a similar Ni iodide catalyst under the same conditions. The % conversion of MeOH was increased with increasing diln. to a max. value after which there was no effect. The temp. range was 150-250°C; pressure range, 80-400 atm.

11487. Stolyarov, E.A. and Todes, O.M. **Kinetics of hydrogenation of styrene and determination of adsorption from solutions.** *Zhur. Fiz. Khim.* 26, 80-7 (1952).—*C.A.* 47, 390*f*.

The rate of hydrogenation of the ethylenic double bond of styrene in soln. at 20°C was studied on a variety of catalysts: Pt black (B.E.T. surface 34.4 m^2/g), Pt black (63.4 m^2/g), Ni prepd. by decompn. of Ni formate in N_2 at 270°C (86 m^2/g; completely poisoned by air); Raney Ni (32.4 m^2/g). In all cases, the order was zero with respect to styrene concn. In the kinetic range, the rate was proportional to H_2 pressure. The quantity of styrene adsorbed on the catalyst from AcOH or benzene solns. was detd. by measuring the vol. of H_2 required to hydrogenate styrene preadsorbed on the catalyst.

11488. Swabb, L.E. Jr. and Hoelscher, H.E. **Kinetics of the catalytic vapor-phase addition of hydrogen chloride to propylene.** *Chem. Eng. Progress* 48, 564-9(1952).—*C.A.* 47, 393*h*.

A kinetic study was made of the vapor-phase addn. of HCl to propylene with Al_2O_3 as a catalyst; iso-PrCl was the only product formed at 80°C or less when this catalyst was used. The catalyst activity decreased with time. The reaction was not controlled by either the adsorption of HCl or the adsorption of propylene. The reaction was controlled by the desorption of iso-PrCl or by the surface reaction.

11489. Thompson, H.L.; Guillaumeron, Pierre, and Updegraff, Norman C. **Ammonia synthesis at 1000 atmospheres. The present-day Claude process.** *Chem. Eng. Progress* 48, 468-76(1952).—*C.A.* 46, 10558^{e}.

Certain aspects of the Claude system were compared with those of the 300-atm. NH_3-synthesis processes. The Claude process comprised final purification of synthesis gas by catalytic conversion of CO to methane (methanation) and conversion of the H_2 and N_2 to NH_3 in a circulatory synthesis system usually contg. 2 synthesis converters in series, with the necessary cooling, condensing, and sepg. equipment for NH_3 recovery, and a gas-circulating compressor.

11490. Thompson, Sydney O.; Turkevich, John, and Irsa, A.P. **Study of the Fischer-Tropsch reaction using deuterium gas.** *J. Phys. Chem.* 56, 243-50(1952).—*C.A.* 46, 7415^{b}.

The app. consisted of a gas-mixing chamber, a reactor contg. the cobalt-thoria-magnesia-kieselguhr catalyst, a series of cold traps at temps. down to the liquid-air b.p. and a circulating system for recycling including a pump and before and after ballast tanks. The reaction temps. were 192° and 227°C. The main product was CD_4 (90%) and 4-6% C_2, 4-6% C_3, and 0.3-0.5% C_4. The C_2 and C_3 fractions contained 20-30% unsatd. compds.

11491, Timofeeva, E.A.; Shuikin, N.I., and Kleimenova, V.M. **Desulfurizing action of Troshkov kaolin.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* 1952, 489-94.—*C.A.* 46, 11647^{g}.

The S content was dropped at 400°C to 0.031%. Artificial mixts. of purified gasoline with PrSH, diisoamyl sulfide, thiophene, and thiophane gave similar results. The catalyst (clay without acid pretreatment) was regenerated by air-blowing at 500°C for 3.3 hrs. After regeneration the desulfurizing action was greatly improved. The removal of thiophene or thiophane to the level of 0.03-0.04% usually required recycling over the catalyst.

11492. Tramm, Heinrich. **Technology of carbon monoxide hydrogenation.** *Brennstoff-Chem.* 33, 21-30 (1952).—*C.A.* 46, 3731^{b}.

The improvement was due to the modern high-capacity Fe catalyst as compared with the older Co catalyst. For max. gas utilization (96-97% conversion with low CH_4 formation) multiple-step conversion was required. The gas for synthesis purposes should have a low CO_2 and H_2O content, but N_2 was not as objectionable. CO_2 was chemisorbed on the catalyst, but N_2 was only physically adsorbed, and was readily displaced.

11493. Uchida, Hiroshi; Kurita, Minoru, and Ogawa, Kiyoshi. **Catalyst for the water-gas shift conversion. I. Macrostructure and catalytic activity of ferric oxides.** *Repts. Govt. Chem. Ind. Research Inst. Tokyo* 46, 403-15 (1952).—*C.A.* 47, 2955^{e}.

By passing CO-H_2O (mole ratio 3) at 300-500°C with 10 liters/hr flow over the catalyst, the Fe_2O_3 was reduced to more active Fe_3O_4. The activity increased with the expanding apparent vol./g, enlarging micropores and diminishing surface area. The Fe_3O_4 thus reduced from the ordinary or α-Fe_2O_3 was less active than Fe_3O_4 reduced from γ-Fe_2O_3 obtained by oxidizing the 1st Fe_3O_4 in a current of air at 500°C.

11494. Uchida, Hiroshi; Kurita, Minoru, and Ogawa, Kiyoshi. **Catalyst for the water-gas shift conversion. II. Changes of the catalytic activity and macrostructure by the addition of chromium trioxide and potassium bichromate.** *Repts. Govt. Chem. Ind. Research Inst. Tokyo* 47, 83-94 (1952).—*C.A.* 47, 2955^{f}.

The activity of the Fe_2O_3 catalyst increased with the increasing addn. of CrO_3 (pptd. as Cr_2O_3 on the microcryst. surface from various CrO_3 concns.). With similar addn. of $K_2Cr_2O_7$ the activity increased first and decreased later, while the macrostructure changed less. The decrease seemed due to the Cr_2O_3 covering up the surface on which it was easily transported by the diffusible K, and also adsorbing CO_2 formed.

11495. Ueno, Keihei and Yamaguchi, Yasuto. **The Catalytic action of synthetic ion exchangers. I. Aldol condensation catalyzed by anion exchangers.** *J. Chem. Soc. Japan,* Ind. Chem. Sect. 55, 234-5 (1952).—*C.A.* 47, 10767^{b}.

Strongly basic anion exchangers showed catalytic action in aldol condensation. The catalytic ability, as detd. by the yield of aldol, was in the order, cyanide > hydroxyl >> chloride. Acetate had no activity.

11496. Wagner, C.D.; Wilson, J.N.; Otvos, J.W., and Stevenson, D.P. **Hydrogen redistribution during olefin hydrogenation.** *J. Chem. Phys.* 20, 338-9, 1331 (1952).—*C.A.* 47, 2680^{f}.

Migrations of H atoms took place among hydrocarbon residues adsorbed on a Ni catalyst. The product of a reaction between an olefin and D contained several deuteriated paraffin species with more than 2 D atoms/mol; this occurred even under conditions such that no exchange took place between H and olefin or H and paraffin.

11497. Weber, George. **Greater heat recovery from catalytic flue gas.** *Oil Gas J.* 51, No. 23, 346-7, 349(1952).—*C.A.* 47, 852^{e}.

The flue gas (775°F) was led over the catalyst, a film of Pt alloy deposited on a bundle of porcelain rods, past heat-exchange tubes filled with molten salt and thence to a gas turbine. The process was tested on a Houdry catalytic cracking unit. Results indicated that a single such reactor receiving 20,000 ft^3 of flue gas per min. at 40 p.s.i., contg. 2% CO, produced 7.5 million B.t.u. per hr.

11498. Wideqvist, Sigvard. **Use of ion exchangers for the determination of the velocity of the alkali-catalyzed hydrolysis of amides.** *Arkiv Kemi* 4, 429-32 (1952)(in English).—*C.A.* 47, 1477^{b}.

Solns. of mixts. of the amide, NaOH, and their reaction products (NH_3 and the Na salt) were allowed to flow through an exchanger contg. Amberlite IR-120. The cations were exchanged for H ions. The acid liberated from the Na salt was titrated.

11499. Zaĭdenman, I.A. and Khomyakov, K.G. **The initial stages of the interaction of carbon monoxide and hydrogen with a cobalt catalyst at the temperature of gasoline synthesis.** *Doklady Akad. Nauk S.S.S.R.* 84, 705-7 (1952).—*C.A.* 46, 9398*c*.

The interaction between $1CO{:}2H_2$ mixt. and a catalyst $Co{:}ThO_2{:}Mg = 100{:}18{:}2$ (by wt) on a carrier, was studied by the kinetic- calorimetric method at 178-186°C. Interaction of CO with the freshly prepd. catalyst was accompanied by evolution of about 92 kcal/mole gas consumed. This effect was reproduced time and again after the catalyst had been regenerated by reduction with H_2. Interaction between the $1CO{:}2H_2$ mixt. and the Co catalyst in a flow system was accompanied by the evolution of 13.6 ± 0.3 kcal/mole gas consumed. Interaction between the pptd. and reduced Co catalyst and a $1CO{:}2H_2$ mixt. at 180°C began with reactions involving both gaseous reactants, and not only CO as with the Ni skeleton catalyst.

11500. Albareda Herrera, Jose M^{A}.; Aleixandre Ferrandis, Vicente, and Fernandez, Teofilo **Effect of the mineralogical composition of clays and the exchange cations on the catalytic oxidation of ethanol in the vapor phase. I.** *Anales edafol. y fisiol. vegetal* (Madrid) 12, 89-140(1953).—*C.A.* 47, 6748*e*.

The transformation of the alc. to the aldehyde was noticeably affected by temp. With bentonite the max. yield was reached at 375°C, whereas the yield in the case of kaolin increased up to 400°C. Below 375°C, no difference existed between the yields of aldehyde with the different clays.

11501. Argo, W.B. and Smith, J.M. **Activity of solid catalysts.** *Ind. Eng. Chem.* 45, 298-302 (1953).—*C.A.* 47, 4180*e*.

Exptl. rate data were given for two Pt catalysts in the oxidation of SO_2. Rates of the reaction, r_1 and r_0 for two sizes of catalysts, were correlated by the equation, $r_1 = r_0F_{10}(a_1\ a_0)$, where activity factor F was independent of temp., compn., and gas velocity.

11502. Atwood, Kenton and Arnold, M.R. **Activity of an iron oxide-chromium oxide water-gas shift catalyst.** *Ind. Eng. Chem.* 45, 424-6 (1953).—*C.A.* 47, 4523*a*.

No effective promoters for the Fe_2O_3-Cr_2O_3 water-gas shift catalyst were found among 33 elements considered. B and P reduced catalyst activity to a considerable extent. Because of these small effects, the method of prepn. was considered more important than minor changes in compn.

11503. Cain, D.G.; Weitkamp, A.W., and Bowman, Norman J. **Products of the hydrogenation of carbon monoxide over an iron catalyst. Oil-soluble oxygenated compounds.** *Ind. Eng. Chem.* 45, 359-62(1953).—*C.A.* 47, 4589*g*.

Oxygenated compds. in the oil stream produced by hydrogenation of CO over an Fe catalyst were higher homologs of those in the water stream. The main components were acids, alcs., and carbonyl compds. of the aliphatic series. At a given C no., the ratio of the molar quantities of each of the main components to the total molar quantity of oxygenated compds. and hydrocarbons was approx. const.

11504. Ciapetta, F.G. **Isomerization of saturated hydrocarbons: cycloalkanes.** *Ind. Eng. Chem.* 45, 159-62(1953).—*C.A.* 47, 4068*a*.

Isomerization of methylcyclopentane, cyclohexane, methylcyclohexane, and ethylcyclohexane over a Ni-SiO_2-Al_2O_3 catalyst showed that cycloalkanes contg. a quaternary C atom were the normal products. At higher temps. dehydrogenation to aromatics took place.

11505. Ciapetta, F.G. **Isomerization of saturated hydrocarbons: nature of the catalyst and mechanism of the reaction.** *Ind. Eng. Chem.* 45, 162-5(1953).—*C.A.* 47, 4067*i*.

The Ni-SiO_2-Al_2O_3 catalyst used for isomerization of satd. hydrocarbons was poisoned by alkali metals. The more rapid isomerization of 1-pentene and 1-hexene compared to *n*-pentane and *n*-hexane indicated that the rate-controlling step was the dissocn. of a C—H bond at the dehydrogenation active surfaces of the catalyst to form an alkene or potential alkene.

11506. Ciapetta, F.G. and Hunter, J.B. **Isomerization of saturated hydrocarbons in presence of hydrogenation-cracking catalysts. Normal hexane..** *Ind. Eng. Chem.* 45, 147-55(1953).—*C.A.* 47, 4067*f*.

With 4-6% of Ni deposited on a SiO_2-Al_2O_3 cracking catalyst, the reduced catalyst in the presence of H_2 selectively isomerized hexane to isohexanes. The activity of the catalyst resulted from compd. formation between Ni and hydrous Al silicate. H_2 was necessary for the reaction, but its function appeared to be to keep the catalyst surface free from hydrocarbon residues. Co and Pt catalysts also showed high isomerization selectivity, while Fe and Cu were poor. Mo oxide and W oxide deposited on SiO_2-Al_2O_3 also had high isomerization ability.

11507. Ciapetta, F.G. and Hunter, J.B. **Isomerization of saturated hydrocarbons: normal pentane, isohexanes, heptanes, and octanes.** *Ind. Eng. Chem.* 45, 155-9(1953).—*C.A.* 47, 4067*g*.

The isomerization of pentane, 2-methylpentane, 2,3- and 2,2-dimethylbutanes, heptane, 2,3- and 2,4-dimethylpentanes, 2,3,3,-trimethylbutane, octane, and 2,2,4-trimethylpentane over a Ni-SiO_2-Al_2O_3 catalyst showed the catalyst to be quite active and highly selective for the isomerization of all except 2,2,4-trimethylpentane.

11508. Clark, Alfred; Matuszak, M.P.; Carter, N.C., and Cromeans, J.S. **Isomerization of pentane—in presence of molybdena-alumina catalysts at low hydrogen-hydrocarbon ratios.** *Ind. Eng. Chem.* 45, 803-6(1953).—*C.A.* 47, 6127*a*.

The isomerization of pentane to isopentane in bench-scale hydroforming type equipment with molybdena-alumina catalysts gave ultimate yields of isopentane of 80-95% and yields per pass of 40-55%. Ratios from 0.3 to 0.8 gave efficient isomerization and minimized by-product formation. The adsorbed H functioned as part of the catalyst.

11509. Cohn, Ernst N. and Hofer, L.J.E. **Some thermal reactions of the higher iron carbides.** *J. Chem. Phys.* 21, 354-9(1953).—*C.A.* 47, 4234*f*.
Hägg carbide was approx. $Fe_{2.4}C$. The synthesis of cementite from metallic Fe and higher Fe carbide proceeded via Hägg carbide and only above about 320°C. Above that temp. decompn. of Hägg carbide into cementite and free carbon was sufficiently rapid to prevent completion of the synthesis. The deposition of carbon on Fe catalysts during the Fischer-Tropsch synthesis was not caused by thermal reactions of Fe carbides, unless hexagonal carbide should contain more carbon than Hägg carbide.

11510. Evering, B.L.; D'Ouville, E.L.; Lien, A.P., and Waugh, R.C. **Isomerization of pentanes and hexanes. Nature and control of side reactions.** *Ind. Eng. Chem.* 45, 582-9(1953).—*C.A.* 47, 5671*d*.
The inhibiting effect of H_2, aromatic hydrocarbons, naphthenes, and isobutane and their effect on catalyst life in disproportionation and cracking of pentanes and hexanes was studied. Hexanes need H_2 for successful isomerization. Olefins nullified the effect of inhibitors and accelerated the disproportionation and cracking reactions.

11511. Eyring, Henry and Wallenstein, Merrill. **Kinetic treatment of saturation and condensation statistics.** *Proc. Natl. Acad. Sci. U.S.* 39, 138-45 (1953).—*C.A.* 47, 7297*e*.
The final equation contained two sp. rate consts., the nos. of free and adsorbed atoms, mols., or other particles, the no. of available adsorption sites, the probability that a site will become satd., and the no. of particles required to sat. a site. The results were used to derive Bose-Einstein, Fermi-Dirac, and classical statistics, the Langmuir adsorption isotherm and multilayer condensation, the Richardson equation for the current leaving a metal surface, and satn. phenomena in homogeneous systems of enzymes.

11512. Grummitt, Oliver and Marsh, Dean. **Alternative methods for dehydrating castor oil.** *J. Am. Oil Chemists' Soc.* 30, 21-5(1953).—*C.A.* 47, 2506*e*, 5133*d*.
Dehydration of castor oil with oil-maleic anhydride adducts seemed advantageous over the conventional catalyst method because products of the former could be combined in a usual step for making paint or varnish products. Dehydration of the castor oil acids with Al_2O_3 catalyst showed 60% conjugation of the diene acids. Acidic ion-exchange resins had some catalytic effect, but the oil so made was inferior in color and film properties.

11513. Heinemann, Heinz; Mills, G.A.; Hattman, J.B., and Kirsch, F.W. **Houdriforming reactions: studies with pure hydrocarbons.** *Ind. Eng. Chem.* 45, 130-4(1953).—*C.A.* 47, 4067*a*.
Cyclohexane and methylcyclohexane were dehydrogenated to benzene and toluene in equil. yields at 800-950°F at 300 or 600 p.s.i. and a liquid space velocity of only 3 vols./vol./hr. Methylcyclopentane was dehydroisomerized to benzene in increasing yields with decreasing space rate and increasing contact time since thermal equil. favored methylcyclopentane. The isomerization of heptane to isoparaffins was favored by increasing temp. until hydrocracking predominated. If benzene was present, hydrocracking was inhibited and yields of isomers increased.

11514. Heinemann, Heinz; Shalit, Harold, and Briggs, W.S. **Houdriforming reactions studies with sulfur compounds.** *Ind. Eng. Chem.* 45, 800-2 (1953).—*C.A.* 47, 5671*e*.
S compds., such as those occurring in petroleum naphthas, were passed over the catalysts in the reforming range and the extents to which dehydrogenation and isomerization reactions occurred were observed. Complete conversion of S compds. occurred even though its dehydrogenation and isomerization functions were severely deactivated. Sulfides and mercaptans were found to be especially detrimental. Catalysts which had been employed for 2000 hrs in the Houdriforming of a low S naphtha suffered some deactivation during 4 hrs exposure to 0.5% S, but recovered when the S was removed from the feed.

11515. Johnson, Paul H. and Stark, Christopher P. **Testing powdered cracking catalysts.** *Ind. Eng. Chem.* 45, 849-55(1953).—*C.A.* 47, 5670*h*.
The confined fluidized bed as the lab. test method was described: a critically designed tapered reactor; a catalyst contg. particles 12% finer than 20 μ (new montmorillonite clay); and a min. vapor velocity of 55 cm per sec. Standard reference catalysts were used as a basis for comparison with test catalysts, and activity and selectivity were reported in terms of activity index and C and H factors.

11516. Langenbeck, Wolfgang and Giller, Arnold. **Mixed formate catalysts.** *Z. anorg. u. allgem. chem.* 272, 64-8(1953).—*C.A.* 47, 6069*h*.
Reduction of the mixed crystals of Ni-Mg formate by H_2 at 280°-350°C gave catalysts as good as Raney nickel for the hydrogenation of cyclohexene.

11517. Lihl, F. and Zemsch, P. **The catalytic activity of nickel and cobalt powders as a function of the hydrogenation temperature.** *Z. Elektrochem.* 57, 58-69 (1953).—*C.A.* 47, 6748*g*.
C_6H_6 to C_6H_{12} was hydrogenated over Ni or Co catalysts. The initial reaction was zero order, but later showed dependence on C_6H_6 and H_2. The highest temp. at which side reactions did not interfere was 160°C. The consts. of the Arrhenius equation were detd. for Ni catalysts prepd. from $Ni(HCOO)_2$, NiO, and $Ni(OH)_2$ for the initial reaction. With Co catalysts, prepd. from $Co(HCOO)_2$ and $Co(COO)_2$, the Arrhenius consts. for the initial reaction could not be detd. The difference between Ni and Co catalysts was ascribed to the fact that the former were one-phase, the latter 2-phase.

11518. Mills, G.A.; Heinemann, Heinz; Milliken, T.H., and Oblad, A.G. **Houdriforming reactions-catalytic mechanism.** *Ind. Eng. Chem.* 45, 134-7 (1953).—*C.A.* 47, 4067*d*.
The reactions of cyclohexane, cyclohexene, methylcyclopentane, and methylcyclopentene over an isomerization catalyst, a dehydrogenation catalyst, and a dual-function Houdriforming catalyst were studied at 950°F, 300 p.s.i., a liquid hourly space velocity of 3 vol. per vol. per hr, and a H to hydrocarbon mole ratio of 4 to 1. Cyclohexane was not changed by an isomerization catalyst, but

gave equil. yields of aromatics with the other two catalysts.

11519. PARRAVANO, G. **Catalytic oxidation of carbon monoxide on nickel oxide. I. Pure nickel oxide. II. Nickel oxide containing foreign ions.** *J. Am. Chem. Soc.* 75, 1448-51, 1452-4 (1953).—*C.A.* 47, 10979*b*.

The reaction between CO and O_2 was investigated on Ni oxide catalysts at various partial pressures of CO and O_2 up to 222°C. After an initial stage characterized by high rates and rapidly diminishing activity, the catalyst showed a min. const. value of activity. The activation energy was not affected in the range 100°-180°C by addn. of foreign ions to Ni oxide lattice.

11520. PODGURSKI, H.H. AND EMMETT, P.H. **The adsorption of hydrogen and carbon monoxide on iron surfaces.** *J. Phys. Chem.* 57, 159-64 (1953). —*C.A.* 47, 7303*i*.

The adsorption was evaluated from 10^{-2} to 700 mm between -195° and 200°C. For singly promoted Fe catalysts (2 to 10% Al_2O_3), the rapid adsorption of H_2 at -195°C was equiv. to adsorption as atoms on about 2/3 of the "free Fe surface." Type-B activated adsorption of H_2 on promoted Fe catalysts at and above 100°C was very pressure-sensitive, and, at a pressure of 10^{-2} mm, apparently became very small relative to type-A adsorption (chemisorbed at -78°C). The chemisorption of CO at -195° or -78°C covered only about 10% of the surface of very pure Fe wire or Fe powder from Fe carbonyl.

11521. RIENÄCKER, GÜNTHER AND BREMER, HEINRICH **Catalytic properties of copper and silver powders as affected by thermal pretreatment.** *Z. anorg. u. allgem. Chem.* 272, 126-46(1953).—*C.A.* 47, 5778*f*.

The decompn. of HCOOH vapor to H_2 + CO_2 by Cu or Ag was zero order at 140°-160°C. The activities of powders of these metals at 140°C varied with the temp. of pretreatment (150° up to 1050°C).

11522. SÁNCHEZ DELGADO, RAMÓN. **Nickel and copper catalysts in the hydrogenation of glycerides and fatty acids. I. Preparation, activity, and half life of catalysts made exclusively from one or both of these metals.** *Rev. cienc. apl.* (Madrid) 7, 39-50 (1953).—*C.A.* 47, 6577*h*.

Ni catalysts used for comparison were of German make prepd. by reduction of the formate. The influence of time and temp. of the reducing operation on final activity (measured by detg. residual I_2 nos. of the oil) were studied, also the ratios of Ni and Cu employed. The best effects were obtained with Ni:Cu ratios of approx. one, reduced from carbonates heated to a max. temp. of 180°C at the rate of 18°/min. Temp. and concn. of solns. from which the carbonates were pptd. had little effect on activity.

11523. SCHLEICHER, MARTIN E. **"Cat" catches fume for McDougall-Butler.** *Paint, Oil & Chem. Rev.* 116, No. 6, 13-14, 50, 52(1953).—*C.A.* 47, 5134*g*.

Fumes were heated to 500°F by a preheater and passed through a catalyst grid coated with Pt-type metals. Complete oxidation occurred and the heated products were conducted to the exhaust through the outer duct of the manifold, giving up heat to prevent condensation of vapors from the kettle. Catalyst life was estd. at 5000-15,000 hrs before regeneration.

11524. SHERWOOD, PETER W. **Autofining: a new solution of an old problem.** *Erdöl u. Kohle* 6, 73-4 (1953).—*C.A.* 47, 5671*c*.

In the desulfurization process developed jointly by the Anglo-Iranian Oil Co. and the Union Oil Co. S was hydrogenated over Co-Mo catalysts.

11525. SHUĬKIN, N.I.; MINACHEV, KH. M., AND FEOFANOVA, L.M. **Hydrogenating and dehydrogenating activity of nickel catalysts on different carriers.** *Izvest. Akad. Nauk S.S.S.R., Otdel, Khim. Nauk* 1953, 96-9.—*C.A.* 47, 6234*c*.

All catalysts were made by reduction of the Ni in a H_2 stream at 350-60°C. Catalytic activities were expressed by the degree of conversion, at 160-70°C on 50 ml catalyst, in the dehydrogenation of cyclohexane at the space velocity of 0.3 liter/liter catalyst/hr, and in the hydrogenation of C_6H_6 at the space velocity of 0.06. Ni on Cr_2O_3 or MgO had a lower activity, and Ni on Fe_2O_3 was unsuitable for dehydrogenation of cyclohexane.

11526. STEITZ, ALFRED JR. AND BARNES, DAVID K. **Products of the hydrogenation of carbon monoxide over an iron catalyst. Water-soluble oxygenated compounds.** *Ind. Eng. Chem.* 45, 353-8 (1953). —*C.A.* 47, 4589*f*.

Seven acids and 32 nonacid chem. compds. were identified in the water stream produced by hydrogenation of CO over an Fe catalyst. These compds. were principally straight-chain alcs., acids, aldehydes, and Ketones. Esters, cyclic ketones, and branched-chain alcs., aldehydes, and acids were present in minor proportions.

11527. STERLIGOV, O.D.; GOMIKBERG, M.G.; RUBINSHTEIN, A.M., AND KAZANSKIĬ, B.A. **Effect of pressing on the activity and structure of alumina-molybdena catalysts.** *Izvest Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* 1953, 28-36.—*C.A.* 47, 5781*e*.

The catalyst, Al_2O_3 80 + MoO_3 20 wt %, was reduced in a stream of H_2 3 hrs at 350°C and 2 hrs at 500°C, then powd. and pressed under 2000-20,000 atm. The catalytic activities were detd. in 4-hr flow expts. of dehydrogenation of C_7H_{16} and of cyclohexane, with 6 ml of catalyst, preliminarily stabilized by 2 hrs activation in H_2 at 500°C, 2 hrs dehydrogenation of C_7H_{16} at 489-91°C, followed by 30 min. regeneration with N_2 and 1 hr with air at 500°C, and repeated 1-2-hr reductions with H_2 at 500°C.

11528. TODES, O.M. AND ANDRIANOVA, T.I. **Oxidation of ethylene and of ethylene oxide on different catalysts.** *Doklady Akad. Nauk S.S.S.R.* 88, 515-18 (1953).—*C.A.* 47, 5782*c*.

On MgO-Cr_2O_3 (on asbestos), C_2H_4 was oxidized to CO_2 and H_2O, with only traces of aldehyde. Kinetic curves in flow expts. with different contact times, at 287°, 300°, and 350°C, with a mixt. of 2.6% C_2H_4 with air showed rates of consumption of C_2H_4 and of production of CO_2 decreasing with the progress of the reaction. Analogous results were found with C_2H_4 and with ethylene oxide on CuO-Cr_2O_3 on asbestos. The fact that ethylene oxide appeared in the oxidation of C_2H_4 on Ag, but did not on MgO-Cr_2O_3, was due simply to the more rapid oxidation of ethylene oxide, as compared with the velocity of oxidation of C_2H_4, on the MgO-Cr_2O_3 catalyst.

11529. TOPCHIEV, A.V.; ANDREEV, L.N., AND KRENTSEL, B.A. **Chlorination of normal butane in the presence of catalysts.** *Doklady Akad. Nauk S.S.S.R.* **88**, 285-7 (1953).—*C.A.* 47, 4716*f*.

A mixt. $C_4H_{10}:Cl_2 = 4.5:1$ (by vol.) was passed at a space velocity of ~ 300 over Al_2O_3 treated with N_2 2 hrs at 400°C and satd. with Cl_2 at 200°C. The product was 50% C_4H_9Cl and 50% $C_4H_8Cl_2$. On silica gel (treated with boiling concd. HNO_3, washed, and dried at 110°C) the product compn. the same as on Al_2O_3. Stainless steel (18-8) in the form of a spiral was a very active catalyst. An iron ore showed similar catalytic action, giving 100% utilization of Cl_2 even at room temp. The Fe catalysts underwent no corrosion in the process.

11530. TURNBULL, DAVID. **Theory of catalysis of nucleation by surface patches.** *Acta Met.* **1**, No. 1, 8-14(1953).—*C.A.* 47, 3674*i*.

A plausible distribution of units for crystal nucleation with respect to size, and a unit size of the order of the crit. size for growth of a nucleus into a supercooled liquid were assumed. The multiplicity in crystal nucleation frequency sometimes observed for the isothermal solidification of small droplets was accounted for with the use of no more than 2 fundamental frequencies.

11531. TYUTYUNNIKOV, B.N. AND FRAĬER, B. **Simplified method of characterization of catalyst activity.** *Masloboĭno Zhirovaya Prom.* **18**, No. 3, 10-11 (1953).—*C.A.* 47, 7241*f*.

The app. consisted of 2 gas burets, fixed vertically on a stand, and 2 equilibrating vessels that were vertically movable. The stationary vessels were connected with a 3-way stopcock and used to measure the H_2 consumed in hydrogenation of a test sample. Another method made use of a test-tube contg. the fat sample, the catalyst being initially contained in a side-arm of the test tube.

11532. WEITKAMP, A.W. AND FRYE, C.G. **Products of the hydrogenation of carbon monoxide over an iron catalyst. Relation of product composition to reaction mechanism.** *Ind. Eng. Chem.* 45, 363-7 (1953).—*C.A.* 47, 4589*i*.

The hydrocarbon synthesis process consisted of many competing and concurrent reactions. The chem. steps in the formation of primary product mols. were initiation, chain extension, and termination. The initiator of chain growth may be an adsorbed radical, possibly formed by hydrogenation of surface carbide. The adsorbed radical was enlarged by repeated addn. and hydrogenation of adsorbed CO mols. The termination reaction produced mainly alcs. or aldehydes and olefins. Competition between growth and termination was responsible for the exponential decrease in yields of successive C-no. fractions.

11533. WEITKAMP, A.W.; SEELIG, HERMAN S.; BOWMAN, NORMAN J., AND CADY, WILLIAM E. **Products of the hydrogenation of carbon monoxide over an iron catalyst. Aliphatic and alicyclic hydrocarbons.** *Ind. Eng. Chem.* 45, 343-9(1953). —*C.A.* 47, 4589*b*.

The hydrogenation of CO over an Fe catalyst formed hydrocarbons and oxygenated compds. of a broad mol. wt range. The hydrocarbons were analyzed by distn., chromatography, spectrometric methods, and other means. Relations among the structures and distributions of the open-chain and ring compds. reflected the mechanism of formation. Significant deviations from thermodynamic equil. indicated that competing reaction rates controlled product compn.

Chapter VI. GENERAL INFORMATION ON ADSORBENTS AND SPECIAL METHODS OF INVESTIGATION

VI-1. Reviews, Histories, and General Discussions

11534. Taylor, Hugh S. **Catalysis and catalytic agents in chemical processes.** *J. Frank Inst.* 194, 1-27 (1922).

11535. Dubosc, André. **Adsorption, absorption and diffusion of gases in contact with raw and vulcanized rubber and balloon fabrics.** *Caoutchouc & gutta-percha* 20, 12009-10 (1923).—*C.A.* 18, 1066.

11536. Armstrong, E.F. and Hilditch, T.P. **Catalysis at solid surfaces.** *Chemistry & Industry* 44, 701(1925).—*C.A.* 19, 3055.

The status of knowledge of catalysis at solid surfaces, with special reference to hydrogenation and dehydrogenation at the surface of metallic catalysts, was given.

11537. Daynes, H.A. **The permeability of rubber and methods of testing it.** *Trans. Inst. Rubber Industry* 3, 428-53 (1928).—*C.A.* 22, 3802.

The influence of various factors on permeation, diffusion and the time to reach equil., was discussed including the nature of the gas, the pressure, the thickness, the temp., the state of vulcanization, and the presence of compounding ingredients.

11538. Franklenburger, Walter. **Recent investigations in the field of heterogeneous catalysis.** *Z. angew. Chem.* 41, 523-31, 561-7 (1928).—*C.A.* 22, 4038.

11539. Sauter, Erwin Richard. **Review of colloid techniques. VI. Catalysis and adsorption.** *Kolloid-Z.* 46, 148-155(1928); 49, 450-8(1929).

The review covered homogeneous and heterogeneous catalysis, adsorption of gases and chemisorption and catalytic activity.

11540. Willstatter, R. **Our knowledge of catalysis.** *Z. Ver. deut. Ing.* 72, 901-5 (1928).—*C.A.* 22, 4332.

The history of catalysis was briefly discussed. Examples were the NH_3 synthesis, acid and basic catalysis in org. reactions, the use of mixed catalysts in the methanol and hydrocarbon synthesis, and enzymes in biological processes.

11541. Astrom, A. **Adsorption of aerosols.** *Svensk Kem. Tid.* 41, 190-203 (1929).—*C.A.* 24, 1780.

The literature on particle size of smokes and fogs and their adsorption by cotton and woolen filters was reviewed.

11542. Fritzman, E. **Palladium hydride and its catalytic properties.** *Zhur. Prikladnoi Khim.* 3, 455-500(1930).—*C.A.* 24, 5209.

The subject was reviewed in detail.

11543. Gehring, A. **Adsorption by soil and base exchange to fertility.** *Handbuch der Bodenlehre* 8, 183-317(1931).

The historical background of exchange and adsorption was reviewed. Sections were devoted to adsorption complexes and the kinetics and equil. involved.

11544. Wiegner, Georg. **Ion exchange and structure.** *Trans. 3rd. Intern. Congr. Soil Sci. Oxford,* 3, 5-28 (1935).—*C.A.* 32, 5550^8.

Theories and laws of ionic exchange were reviewed, with the conclusion that the configuration of the micelle was more important than the chem. compn. in respect to exchange properties.

11545. Schenck, Rudolph. **Is the contact question an equilibrium problem?** *Angew. Chem.* 49, 649-53(1936).—*C.A.* 30, 7986^5.

The science of catalysts involved to a large extent the application of heterogeneous equilibria and was closely related to the phys. and chem. aspects of alloy chemistry.

11546. Sihvonen, V. **The reaction mechanism in carbon oxidation.** *Svensk Kem. Tids.* 48, 185-202(1936).—*C.A.* 30, 7790^8.

11547. Adkins, Homer. **Hydrogenation: role of the catalyst.** *Ind. Eng. Chem.* 32, 1189-92 (1940).—*C.A.* 34, 7551^2.

A review, with several specific examples, was presented.

11548. Ipatieff, Vladimir N. **Mixed catalysts.** *Natl. Petroleum News* 32, No. 32, R-280-2; *Refiner Natural Gasoline Mfr.* 19, 250-5; *Science* 91, 605-8(1940).—*C.A.* 34, 6512^6.

Work on promoted Cu hydrogenation catalysts was reviewed which supported the interpretation of catalysis in terms of chem. reaction.

11549. Kostir, Josef. **Chromatographic adsorption methods and their application to analytical and preparative chemistry.** *Casopis Ceskoslov Lekarnictva* 20, 227-35, 246-57 (1940).—*C.A.* 38, 1701^4.

11550. Neurath, F. **Bleaching earth-natural and activated.** *Chem. Age* (London) 43 (1121) 287-88 (1940).

Fuller's earth for bleaching oils, fats, and waxes was discovered in England and dominated all markets until about 1800 when bleaching earths of equivalent qualities were found in the United States. In 1907 the Pfirsching Mineral Works placed an activated Bavarian earth on the market under the trade name Frankonit. Shortly afterward, the Moosburg Clay Works introduced another activated Bavarian earth under the name of Tonsil.

11551. Paul, R. **Raney nickel.** *Bull. soc. chim.* 7, 296-346 (1940).—*C.A.* 36, 4294^{8}.
The method of prepn. and catalytic activity of Ni prepd. by the Raney method was reviewed.

11552. Portillo, R. **Adsorption indicators in volumetric analysis.** *Anales real acad. farm.* (Madrid) 1, 22-39 (1940).—*C.A.* 37, 4321^{3}.
The theoretical principles involved in the titrations in the presence of adsorption indicators, based on the work of Fajans, Kolthoff and others were reviewed.

11553. Samesima, Z. and Sano, I. **Sorption of gases by promoted catalyst.** *J. Chem. Soc. Japan* 61, 799-802 (1940).—*C.A.* 34, 7711^{6}.

11554. Bertrand, Andre. **A technical review of the industrial recovery of vapors by adsorbent solids and in particular active carbon.** *Chemistry & Industry* 1941, 171-5.—*C.A.* 35, 3734^{1}.

11555. Fast, J.D. **Diffusion of gases through metals.** *Chem. Weekblad* 38, 2-8, 19-23 (1941). —*C.A.* 36, 5399^{3}.

11556. Fuchs, Hugo. **The development of the German "Ersatz" for carbon black.** *India Rubber World* 105, 147-9 (1941).—*C.A.* 37, 5223^{1}.
The history and development of the manuf. of carbon black in Germany and Czechoslovakia since 1922 were traced.

11557. Harkins, William D. **A general thermodynamic theory of the spreading of liquids to form duplex films and of liquids or solids to form multilayers.** *J. Chem. Phys.* 9, 552-68 (1941).—*C.A.* 35, 6172^{5}.
A comprehensive thermodynamic theory was developed for the spreading of any liquid or solid over the surface of any liquid.

11558. Krischer, Otto. **Theoretical principles of dehydrating hygroscopic substances.** *Vorratspflege u. Lebensmittelforsch.* 4, 117-25 (1941); *Chem. Zentr.* 1941, II, 3005.—*C.A.* 38, 4490^{9}.
The various means of binding water in hygroscopic substances such as absorption, adsorption and capillary condensation were explained. The laws governing the movement of capillary water and vapor diffusion were given.

11559. Lindsay, F.K. **Ion exchangers.** *Trans. Am. Inst. Chem. Engrs.* 37, 547-57 (1941).—*C.A.* 35, 7600^{5}.

11560. Matagrin, Am. **Colloidal clays and the decolorization of printed papers.** *Rev. chim. ind.* (Paris) 50, 22-46(1941); *Chem. Zentr.* 1942, II, 1867.—*C.A.* 38, 2204^{8}.
A historical review was given of the de-inking of paper, dealing with phys. and chem. methods used. Substances used in the decolorization of paper were kaolin, Fuller's earth, natural bentonites and activated clays.

11561. Myers, F.J. **Synthetic-resin exchangers and their application.** *Proc. Ann. Water Conf., Eng. Soc. Western Penna.* 2, 133-43(1941).—*C.A.* 38, 6425^{1}.

11562. Schröer, E. and Schumacher, H.J. **Observations upon catalysis.** *Naturwissenschaften* 29, 411-16(1941).—*C.A.* 38, 1941^{2}.
The original conception of catalysis according to Berzelius was contrasted with the kinetic concept of Ostwald. An unequivocal definition, which would be generally acceptable, has not yet been devised.

11563. Trapeznikov, A.A. **Methods of measurement of surface viscosity. Viscosity of unimolecular and adsorption layers in solutions.** *Akad. Nauk. S.S.S.R., Otdel. Tekh. Nauk, Inst. Mashinóvedeniya, Sóveshchanie Vyazkosti Zhidkosteĭ i Kolloid Rastvoróv* (Conf. on Viscosity of Liquids and Colloidal Solns.) 1, 67-86, 87-115 (1941).—*C.A.* 41, 1518e.
Methods, theories, and results were critically reviewed.

11564. Waeser, B. **Materials resistant to hydrochloric acid.** *Chem.-Ztg.* 65, 253-5 (1941).—*C.A.* 37, 479^{8}.
The resistance of metals, carbons, ceramic ware, quartz, rubber, synthetic resins, and wood to the action of dry and moist HCl, and aqueous HCl of various strengths was discussed.

11565. Walton, Harold Frederic. **Ion exchange between solids and solutions.** *J. Franklin Inst.* 232, 305-37(1941).—*C.A.* 36, 19^{1}.

11566. Aten, A.H.W. Jr. **Gas adsorption.** *Chem. Weekblad* 39, 562-3(1942); *Chem. Zentr.* 1943, I, 376.—*C.A.* 38, 2867^{7}.
Sorption on solids was reviewed.

11567. Charlot, G. **Adsorption reagents and indicators.** *Ann. chim. anal.* 24, 198-200(1942).—*C.A.* 38, 2897^{9}.

11568. Devaux, Pierre. **The unimolecular layers and the investigations of Prof. Henri Devaux.** *Peintures, pigments, vernis* 17, 726-32, 769-72 (1942).—*C.A.* 40, 6316^{9}.

11569. Herrmann, Fr. E. **Bauxite and other aluminum ores (one hundred years of bauxite).** *Wehrtechn. Monatsh.* 46, 40-2 (1942).—*C.A.* 37, 3529^{6}.

11570. Hofmann, Ulrich. **Recent developments in the chemistry of clay.** *Die Chemie* 55, 283-9 (1942).—*C.A.* 37, 4991^{3}; 38, 2290^{9}.
The kaolinite group, micaceous clays, the montmorillonite group, Mg silicate gels of two-dimensional orientation, electron-microscope examns. on clays, the inner-cryst. swelling of montmorillonite, and suspension vols. of bentonites were reviewed.

11571. Martí, Fernando Burriel. **Adsorption indicators in volumetric analysis by precipitation.** *Afinidad* 19, 389-96(1942); 20, 49-59 (1943).—*C.A.* 39, 1817^{1}.

11572. Menafra, Maria Mercedes R.R. de. **Theory of adsorption indicators.** *Anales asoc. quim. farm. Uruguay* 45, 28-35 (1942); *Ph* 1942, No. 3, 21-5.—*C.A.* 37, 1667^{6}.

11573. MYERS, ROBERT J. **Synthetic-resin ion exchanges.** *Advances in Colloid Sci.* 1, 317-51 (1942).—*C.A.* 36, 3414^{3}.

11574. OLLILA, OLLI. **Activated carbon.** *Suomen Kemistilehti* 15A, 81-6(1942).—*C.A.* 40, 4498^{5}.

11575. STOURDZE, YVONNE F. **Decolorizing earths and their activation.** *Rév. brasil. quim.* (Sao Paulo) 14, 109-16 (1942).—*C.A.* 37, 733^{9}.

11576. SULLIVAN, R.R. AND HERTEL, K.L. **The permeability method for determining specific surface of fibers and powders.** *Advances in Colloid Sci.* 1, 37-80 (1942).—*C.A.* 36, 3414^{2}.

11577. TAKEI, FUMIO AND KAWAMURA, SHIN'ICHIRO. **Properties of colloidal clay, bentonite.** *J. Agr. Chem. Soc. Japan* 18A, 113-22(1942).—*C.A.* 44, 9650*h*.

11578. WISLICENUS, H. **Alumina "wool" and its use as adsorbent for adsorbimetry and chromatoscopy.** *Kolloid-Z.* 100, 66-82 (1942).—*C.A.* 37, 4950^{3}.

The prepn., structure and physicochem. properties of this material and analytical technique for its use were described.

11579. ABBOTT, HAROLD E. **Catalysis and the chemical industry.** *Field & Lab.* 11, 1-9 (1943).—*C.A.* 38, 179^{7}.

Recent applications of catalysis were discussed.

11580. ANDERSON, J.S. **The imperfect crystal.** *J. Proc. Roy. Soc. N.S. Wales* 76, 345-58 (1943).—*C.A.* 38, 904^{3}.

A lecture on lattice defects in heteropolar binary compds., involving lattice disorder only and those giving rise to nonstoichiometric crystals was reported.

11581. BACCAREDDA, MARIO. **The phenomena of poisoning in heterogeneous catalysis.** *Chimica e industria* (Milan) 25, 103-13 (1943).—*C.A.* 43, 6498*b*.

11582. BANGHAM, D.H. **Physical chemistry of coal and carbonaceous materials.** *Ann. Reports Progress of Chem.* 40, 29-43 (1943).

The detn. of surface area by the B.E.T. method, heats of wetting detns., and the Harkins and Jura method were critically reviewed.

11583. BORESKOV, G.K. AND SLIN'KO, M.G. **The basis for calculation of catalyst apparatus for reversible exothermic processes.** *J. Applied Chem.* (U.S.S.R.) 16, No. 9/10 377-96(1943)(English summary).—*C.A.* 38, 6135^{6}.

For calcn. of optimum temp. it was sufficient to know the apparent activation energy of the forward reaction. Graphical and analytical methods of detn. of optimum temp. were presented.

11584. BRICHER, LOUIS J. **Wetting and spreading. Laboratory experiment.** *J. Chem. Education* 20, 428-30(1943).—*C.A.* 37, 6517^{6}.

Surface tension of solns. contg. varying mol. ratios of NaOH and lauric acid were detd. and also the interfacial tensions of each of these solns. against a drop of paraffin oil.

11585. CARRINGTON, J.H. **Carbon black and synthetic rubbers.** *Rubber Age* (London) 24, 104, 107 (1943).—*C.A.* 37, 6493^{2}.

11586. COPLEY, G.N. **Adsorption in chemical analysis.** *Ind. Chemist* 19, 142-8, 169 (1943).—*C.A.* 37, 3005^{9}.

11587. CRANE, E.J. **Nomenclature, spelling and pronunciation committee (adsorbate and adsorption complex).** *Chem. Eng. News* 21, 673 (1943).—*C.A.* 37, 3645^{3}.

The A.C.S. Nomenclature, Spelling and Pronunciation Committee definitions were offered for "adsorbate" and "adsorption complex."

11588. DAVIDSON, R.C.; EWING, F.J., AND SHUTE, R.S. **Catalysts of the activated montmorillonite type.** *Natl. Petroleum News* 35, No. 27, R 318-21 (1943).—*C.A.* 37, 5227^{8}.

Natural catalysts and their application to petroleum cracking were discussed. The theories of catalytic mechanisms as applied to activity were reviewed, as well as possible applications in heterogeneous catalysis.

11589. D'OR, L. **Catalysis.** *Rev. universelle mines* 19, 109-11 (1943).—*C.A.* 38, 5718^{9}.

The joint action of active adsorption (in contrast to the van der Waals adsorption) and heterogeneous catalysis of chem. reactions was reviewed. The bromination of ethylene in glass vessels with pure and coated inner surface, resp. was discussed.

11590. DÖRING, R. **Hysteresis.** *Forschung Gebiete Ingenieurw.* 14B, No. 6, 148-58(1943).—*C.A.* 40, 1378^{4}.

Mech., thermal (allotropy), and phys.-chem. (water absorption by coal and cement, swelling of gels, and sol-gel transformations) hysteresis were discussed.

11591. GROSSE, ARISTID V. **Concept of catalytic chemistry.** *Ind. Eng. Chem.* 35, 762-7 (1943).—*C.A.* 37, 4294^{4}.

11592. GUEDRAS, MARCEL. **The colloidal clays-bentonites.** *Rev. ind. minérale* 23, 241-54(1943).—*C.A.* 44, 5767*i*.

11593. HARKINS, WILLIAM D. **Intermolecular forces and two-dimensional systems.** *Pub. Am. Assoc. Advancement Sci.* No. 21, 40-87(1943).—*C.A.* 38, 3888^{7}.

A review of Harkins' work in the field of surface chemistry.

11594. HOPU, ALEXANDRINA. **Adsorption phenomena.** *Rev. Stiintifica "V. Adamachi"* 29, 194-6 (1943).—*C.A.* 38, 4175^{3}.

11595. HOUGEN, O.A. AND WATSON, K.M. **Solid catalysts and reaction rates - general principles.** *Ind. Eng. Chem.* 35, 529-41 (1943).—*C.A.* 37, 4294^{5}.

The effect of solid catalysts on the reaction rates of liquid-or gas-phase chem. reactions was discussed. Equations were derived for the effects of adsorption, catalyst activity, particle size, porosity, flow conditions, poisons and diluents as well as pressure, temp. and concn.

11596. KAINER, FRANZ. **Recent processes for the preparation of surface-active contact catalysts and carriers.** *Kolloid-Z.* 102, 106-12, 210-16, 315-20 (1943).—*C.A.* 38, 839^8.
A review of patents was presented.

11597. KAINER, FRANZ. **Preparation and use of technical adsorbents.** *Kolloid-Z.* 103, 84-8, 252-5; 104, 129-36 (1943).—*C.A.* 38, 1612^9.
A review of patents was presented.

11598. KOLTHOFF, I.M. **Aging of crystalline precipitates.** *Suomen Kemistilehti* 16A, 89-96 (1943) (in English).—*C.A.* 40, 4582^8.

11599. MYERS, F.J. **Ion-exchange resins-new tools for the process industries.** *Ind. Eng. Chem.* 35, 858-63 (1943).—*C.A.* 37, 5514^5.

11600. NUTTING, P.G. **Adsorbent clays, their distribution, properties, productions and use.** *U.S. Geol. Survey, Bull,* 928-C, 127-221(1943).—*C.A.* 38, 1329^5.
The adsorbent clays had a SiO_2-Al_2O_3 ratio of 1:2 to 1:8, but the chem. compn. had no apparent relation to activity or activatability. Base-exchange properties were pronounced. Activatable bentonites attained max. bleaching efficiency on removal of about half their bases on leaching in strong acid. Time of storage affected the bleaching efficiency of some clays. Water was assocd. with adsorbent clays in at least 4 different ways.

11601. RAO, K.S. **Investigations on the phenomenon of hysteresis in sorption.** *J. Mysore Univ.*, Sect. B, 4, 1-15 (1943)(Contrib. 8 in Chem.).—*C.A.* 37, 5298^9.

11602. RUBINSHSTEIN, A.M. **The uses of palladium and platinum as catalysts.** *Ann. secteur platine, Inst. chim. gen.* (U.S.S.R.) No. 19, 61-102 (1943).—*C.A.* 38, 1941^9.

11603. SANTOS, MARIA SERPA DOS. **Chromatographic analysis.** *Notícias farm.* (Portugal) 10, 242-61 (1943-4).—*C.A.* 39, 236^7.

11604. TISELIUS, ARNE. **Studies on adsorption analysis. I.** *Kolloid-Z,* 105, 101-9(1943).—*C.A.* 38, 2895^6.
A summarization of previous work was given together with some improvements in the technique.

11605. TISELIUS, ARNE. **Displacement development in adsorption analysis.** *Arkiv. Kemi, Mineral. Geol.* 16A, No. 18, 11 pp. (1943) (in English). —*C.A.* 38, 2895^7.

11606. TRUSTY, A.W. **Catalysts have important role in war industry.** *World Petroleum, Thirteenth Ann. Refinery Issue* 1943, 74-5, 78.—*C.A.* 38, 179^7.

11607. WIELAND, THEODOR. **Recent methods in preparative organic chemistry. II. Chromatographic methods for the separation of amino acids.** *Die Chemie* 56, 213-15 (1943).—*C.A.* 38, 334^9.
A procedure was outlined for the analysis of the products of hydrolysis of proteins.

11608. ZDICHYNEC, TOMÁŠ. **The evaluation of catalysts.** *Chem. Listy* 37, 257-8(1943).—*C.A.* 44, 5497*i*.
The following terms were defined and correlated: Selectivity (yield), effectiveness (conversion), efficiency (capacity), resistance (duration), and cost of a catalyst.

11609. ACKERMANN, ARTHUR. **Fields of application of adsorbents in industry.** *Chimie & industrie* 52, 44-51(1944).—*C.A.* 40, 2595^4.
An address was given enumerating the different classes of adsorbents, the chief methods of production, and industrial uses in gaseous mediums and in liquid mediums.

11610. BALLESTEROS, RAFAEL BLASCO AND MARTÍNEZ, MANUEL CABANZÓN. **Active carbon and its importance in industry.** *Ion* 4, 234-41(1944).—*C.A.* 38, 4778^3.

11611. BALLESTEROS, RAFAEL BLASCO AND MARTÍNEZ, MANUEL CABAZÓN. **The processes of adsorption in active carbons.** *Ion* 4, 526-30(1944).—*C.A.* 39, 2021^3.
A review was presented showing the great irregularity in the behavior of various activated carbons depending both on the prepn. of the carbons and the character of the material decolorized or adsorbed.

11612. BRDIČKA, RUDOLF. **Polarographic evaluation of adsorption.** *Chem. Listy* 38, 252-9(1944).—*C.A.* 44, 5676*d*.

11613. CLARKE, BEVERLY L. **Some applications of selective adsorption and differential diffusion in chemical analysis.** *Colloid Chem.* 5, 457-71 (1944).—*C.A.* 38, 2862^9.
A discussion was presented of adsorption and diffusion, capillary effects, chromatographic analysis (theory, technique, adsorbents, solvents, eluants), electrophoresis and the moving boundary method.

11614. FARMER, F.R. **Dryers—heat and mechanical.** *Manufg. Chemist* 15, 7-11(1944).—*C.A.* 39, 4535^3.
A brief review was given of available drying methods and app. for (a) liquids, (b) pastes, filter-press cakes, etc., and (c) crystals and powders, and the relative merits of steam, gas, electricity, direct firing, and hot flue gas were discussed.

11615. FRANCE, WESLEY G. **Adsorption and crystal habit modification.** *Colloid Chem.* 5, 443-57 (1944).—*C.A.* 38, 2862^9.
Results of late expts. were given with consideration of mol. structure effects based on modern concepts.

11616. GALLIE, JOHN F. **Carbon black.** *Petroleum Refiner* 23, 93-104(1944).—*C.A.* 38, 2809^4.
The manuf., properties, and uses of carbon black were discussed.

11617. GIL QUINZÁ, P. SALVADOR. **Chromatographic adsorption and its use in chemistry.** *Afinidad* 21, 289-301 (1944).—*C.A.* 41, 4021*d*.
The history, theory, and practical applications of selective chromatographic adsorption in org. and inorg. chemistry were discussed.

11618. HARKINS, WILLIAM D. **The surfaces of solids and liquids and the films that form upon them.** *Colloid Chem.*, 5, 12-102(1944).—*C.A.* 38, 2861^3.

11619. Harwood, J. and Davies, W. Cule. **Activated alumina. Its properties and industrial applications.** *Chem. Age* (London) 50, 223-8(1944).—*C.A.* 38, 2457^{4}.

11620. King, H.L. Jr.; Laughlin, C.D., and Gwyn, H.M. Jr. **Bauxite as an adsorbent, catalyst and catalyst carrier.** *Oil Gas J.* 42, No. 49, 236, 239, 241, 244, No. 50, 71-74 (1944).—*C.A.* 38, 4416^{7}.
The prepn. and use of bauxite were discussed for decolorization, carrier for isomerization catalyst as well as catalyst uses for desulfurization, cracking and reforming.

11621. Mathieu, Marcel. **Structure of catalytically active solid phases.** *Mém. services chim. état (Paris)* 31, 316-20(1944).—*C.A.* 40, 5986^{1}.
Catalysts forming a definite compd., surface catalysts, and catalysts in 3 dimensions were reviewed.

11622. Rienäcker, Günther. **Heterogeneous catalysis and atomic structure.** *Die Chemie* 57, 84-90 (1944).—*C.A.* 40, 4593^{5}.

11623. Thau, A. **The removal of sulfur from industrial gases.** *Oel u. Kohle* 40, 208-20 (1944).—*C.A.* 38, 6428^{6}.

11624. Travers, A. **"Physical" adsorption and chemical adsorption.** *Chimie & industrie* 52, 35-43 (1944).—*C.A.* 40, 2371^{4}.
Phys. adsorption brought into action orienting forces due to permanent or induced dipoles. Chem. adsorption corresponded to binding forces of the covalence type, and consequently involved much greater energies.

11625. Wiegand, W.B. **Recent developments in colloidal carbons.** *Can. Chem. Process Inds.* 28, 151-62(1944).—*C.A.* 38, 2797^{2}.

11626. Zimens, K.E. **Porous materials—characterization, preparation, and properties.** *Trans. Chalmers Univ. Technol., Gothenburg, Sweden* No. 40, 5-178(1944).—*C.A.* 40, 2372^{9}.
The measurement of pore volumes, surface areas, diffusion through capillaries, and the relation to catalytic activity were reviewed.

11627. Adam, N.K. **Surface chemistry.** *Nature* 156, 284 (1945).
Recent progress in the U.S.S.R. was reviewed. Included were promoting effect of small amts. of adsorbed metals on gases (S.Z.Roginsky), and the effect of adsorbed films on hardness (P.A. Rehbinder).

11628. Aleixandre, V. **The preparation and uses of kieselguhr.** *Ion* 5, 445-50, 466; 526-31 (1945).—*C.A.* 39, 5418^{8}; 40, 1638^{6}.

11629. Beeck, Otto. **Catalysis—a challenge to the physicist.** *Rev. Modern Phys.* 17, 61-71 (1945).—*C.A.* 40, 4593^{2}.

11630. Bishop, John A. **Chromatographic adsorption in undergraduate qualitative analysis.** *J. Chem. Education* 22, 524-5(1945).—*C.A.* 40, 509^{6}.

11631. Cohan, Leonard H. **Carbon black in war and peace. A review of recent developments in the carbon black industry.** *Chem. Eng. News* 23, 2078-85, 2145(1945).—*C.A.* 40, 697^{1}.

11632. Hamoir, G. **The use of inorganic precipitates in aqueous chromatography.** *Bull. soc. roy. sci. Liège* 14, 451-9(1945).—*C.A.* 42, 6603*d*.

11633. Harkins, William D. **Surfaces of solids in science and industry.** *Science* 102, 263-8, 292-5 (1945).—*C.A.* 39, 5139^{7}.
The topics included surface energy, the area of a finely divided solid, the area occupied by mols., the surfaces of liquids, polar and nonpolar solids and mol. attraction, the distance to which the attractive energy of a solid extends into a liquid or a film, and phases and phase changes in adsorbed films on solids.

11634. Harvey, Edmund N., Jr. **Survey of sorption chemistry.** *Interchem. Rev.* 4, 95-110(1945).—*C.A.* 40, 3322^{5}.

11635. Hauser, Ernst A. **Colloid chemistry of clays.** *Chem. Rev.* 37, 287-321(1945).—*C.A.* 40, 787^{2}.

11636. Howat, D.D. **Clays.** *Mine & Quarry Eng.* 10, 55-61(1945).—*C.A.* 39, 2183^{2}.
Investigations discussed were with emphasis on clay lattice structure, ion-exchange reactions, base-exchange capacity, water of osmotic imbibition, nature and properties of naturally occurring clay, and factors in deflocculation.

11637. Ljunggren, G. **Some phenomena of adsorption and catalysis with porous materials.** *Finska Kemistsamfundets Medd.* 54, No. 1/2, 12-26 (1945).—*C.A.* 41, 3684*f*.
Cu-Mn impregnated charcoal appeared promising for protection against HCN, converting it in moist air into NH_3 and CO_2. Carene from pine turpentine was dehydrogenated with Ni to cymene, which could then be split to toluene and propylene by an Al_2O_3.SiO_2 catalyst.

11638. Lott, F.S. **Carbon black. Current and postwar outlook.** *Chem. Eng. News* 23, 1338(1945).—*C.A.* 40, 2343^{3}.

11639. Maxwell, Donald H. **Historic filter plant adapted for softening equipment.** *Water Works Eng.* 98, 1024-27, 1070, 1072, 1074, 1076 (1945)
Steps taken to adapt the existing plant to the water softening process were outlined.

11640. Ribeiro, Guimarães Luiz. **Chromatographic adsorption and its importance in organic chemistry.** *Rev. Quím. ind.* (Rio de Janeiro) 14, No. 160, 18-20(298-300) (1945).—*C.A.* 40, 1375^{9}.

11641. Rideal, E.K. **Reactions in monolayers.** *J. Chem. Soc.* 1945, 423-8.—*C.A.* 39, 4539^{8}.

11642. Storch, H.H. **Catalysis in synthetic liquid-fuel processes.** *Ind. Eng. Chem.* 37, 340-51 (1945).—*C.A.* 39, 2189^{9}.
Data were reviewed relating to the kinetics of (1) the Fischer-Tropsch synthesis; (2) the hydrogenolysis of coal and coal tar; (3) the hydrogenation and cracking of gas oil from petroleum or middle oils from process (2).

11643. TAYLOR, HUGH S. **Applications of isotopes in catalytic reactions at surfaces.** *Frontiers in Chemistry* 3, 43-61 (1945).—*C.A.* 39, 4281^3.

11644. WEST, JAMES R. **Some industrial aspects of adsorption.** *J. Chem. Education* 22, 398-401 (1945).—*C.A.* 39, 4703^9.

11645. BERSIN, THEODOR. **The significance of exchange adsorption for biochemical processes.** *Naturwissenschaften* 33, 108-11(1946).—*C.A.* 41, 7425*f*.
Ion-exchange reactions were reviewed.

11646. BRANDENBERGER, E. **The constitution of amorphous solids.** *Schweiz, Arch. angew. Wiss. Tech.* 12, 338-58(1946)-*Schweiz. Verband Materialprufung Tech.*, Ber. No. 41, 9-31(1946).—*C.A.* 41, 4020*b*.
The detailed review included: (1) nature and structure, (2) constitution in the light of general stereo-chemistry, (3) cryst. compds. and their constitution, (4) survey of reaction mechanisms of cryst. compds., and (5) constitution and properties of amorphous solids.

11647. CADMAN, W.H. **Colloidal carbon.** *J. Roy. Soc. Arts* 94, 646-63; *Petroleum Times* 50, 898-9, 927(1946).—*C.A.* 41, 638*c*.
The manuf. and uses of carbon black were reviewed.

11648. CANNAN, R. KEITH. **Amino acid analysis of proteins. Chromatographic and ion-exchange methods of amino acid analysis.** *Ann. N.Y. Acad. Sci.* 47, 135-59 (1946).—*C.A.* 40, 7257^1.

11649. CORREIA, ALICE. **Adsorption indicators.** *Rev. soc. brasil quim.* 15, 103-50(1946).—*C.A.* 41, 6834*h*.

11650. DROGIN, ISAAC. **Ten years of progress in the carbon-black industry.** *Rev. gén. caoutchouc* 23, 34-7, 47-52 (1946).—*C.A.* 40, 6788^7.

11651. EMMETT, PAUL H. **Catalysis and its industrial applications.** *Colloid Chem.* 6, 214-42; *Record Chem. Progress* 7, 41-9(1946).—*C.A.* 40 2377^8, 6325^8.
The concept of contact catalysis, mechanism, promotor action, catalyst poisons, and selection of catalysts were discussed. In studying catalyst mechanisms use is made of the ortho-para hydrogen conversion and of isotopes, mol. beams, metal films, the electron microscope, and surface-area measurements.

11652. EVANS, U.R. **Recent work on corrosion and oxidation.** *J. Chem. Soc.* 1946, 207-14.—*C.A.* 40, 4016^7.

11653. FRARY, FRANCIS C. **Adventures with alumina.** *Chemistry & Industry* 1946, 14-16; *Ind. Eng. Chem.* 38, 129-31 (1946).—*C.A.* 40, 1364^2.

11654. HARKINS, WILLIAM D. **The surface of solids and liquids and the films that form on them. II. Solids and adsorption at the surface of solids or liquids.** *Colloid Chemistry* 6, 1-76 (1946).—*C.A.* 40, 2371^7.
A résumé of fifteen years work: classes of solids, effect of subphase on metallic films; calcn. and detn. of surface energy values; adsorption at interfaces in solid, liquid, and gaseous systems, water/oil; Gibbs equation applied to solid surfaces; exptl. procedures; areas of solids from adsorption isotherm.

11655. HARWOOD, J.H. **Recent developements in the technology of activated alumina. II.** *Ind. Chemist* 22, 721-5 (1946).—*C.A.* 41, 1399*e*.

11656. HELBIG, W.A. **Adsorption from solution by activated carbon.** *Colloid Chem.* 6, 814-39(1946).—*C.A.* 40, 2039^4.

11657. JHA, SHACHEENATHA AND DUBE, G.P. **The variation of the accommodation coefficient as an indicator of the adsorption of gases by the solid surfaces.** *Bull. Patna Sci. Coll. Phil. Soc.* No. 16, 83-91 (1946).—*C.A.* 40, 5316^5.

11658. LAHUERTA CASAUS, PASCUAL. **The Fischer-Tropsch synthesis-a bibliographic study.** *Combustibles* (Zaragoza) 6, 62-75, 120-34 (1946).—*C.A.* 42, 6510*f*.

11659. LONG, ROBERT H. **An apparatus for demonstrating adsorption by charcoal.** *School Sci. and Math.* 46, 423-4(1946).—*C.A.* 40, 6899^7.

11660. MARTINEZ, MANUEL CABANZÓN. **Evaluation of active carbons.** *Ion* 6, 476-9 (1946).—*C.A.* 41, 2558*f*.

11661. McCULLOCH, LEON. **Demonstration of combustion by catalysis.** *J. Chem. Education* 23, 524 (1946).—*C.A.* 41, 904*e*.
A piece of thick Cu wire, preheated to redness, was hung from the top of an open beaker so that its lower end was just above the surface of a layer of acetone about 2 cm deep. At contact with the vapor, the oxidized surface of the Cu was reduced, and catalyzed combustion began.

11662. MINTON, A.S. **Catalysis and its relation to fire extinction.** *Quart. Inst. Fire Engrs.* 6, 67-73 (1946).—*C.A.* 41, 1841*d*.
The combination of many inflammable vapors, including CO with O_2 was promoted by the addn. of small amts. of water. Traces of N_2O materially assisted in the spontaneous ignition of all inflammable air mixts.

11663. MOOIJ, H.H. **Physical-technical aspects of the development of heterogeneous catalytic processes.** *Chem. Weekblad* 42, 28-34(1946).—*C.A.* 40, 3334^9.

11664. MYERS, FREDERICK J. **Ion-exchange resins.** *Colloid Chem.* 6, 1107-12(1946).—*C.A.* 40, 2352^1.
Theory and use of resinous exchangers, application to water conditioning, sugar refining, etc., were reviewed.

11665. POWERS, T.C. **The physical properties of hardened portland cement paste. I. A review of methods that have been used for studying the physical properties of hardened portland cement paste.** *J. Am. Concrete Inst.* 18, 101-32 (1946).—*C.A.* 40, 7551^5.

11666. ROBINSON, F.A. **General principles of chromatographic analysis.** *Analyst* 71, 251-5 (1946).—*C.A.* 40, 4971^9.

11667. SAMUELSON, OLOF. **Organic ion exchange and its use in analytical chemistry.** *Tek. Tid.* 76, 561-71(1946).—*C.A.* 40, 5657^9.

11668. SELWOOD, P.W. **Magnetism and catalysis.** *Chem. Rev.* 38, 41-82(1946).—*C.A.* 40, 2723^9.

11669. SYNGE, R.L.M. **Partition chromatography.** *Analyst* 71, 256-8(1946).—*C.A.* 40, 4971^9.

11670. TAYLOR, HUGH S. **Contact catalysis between two world wars.** *Am. Scientist* 34, 553-72 (1946). —*C.A.* 41, 644*b*.

11671. THIELE, E.W. **Material or heat transfer between a granular solid and flowing fluid. Present status of the theory.** *Ind. Eng. Chem.* 38, 646-50 (1946).—*C.A.* 40, 4284^7.

A review of the work so far reported on the computation of the transfer of material (or heat) when a fluid (liquid or gas) was passed through a bed of granular solid, as in the decolorization of liquids, the recovery of volatile solvents, etc.

11672. VAHRMAN, M. **Chromatographic adsorption analysis.** *Bull. Brit. Coal Utilisation Research Assoc.* 10, 305-14 (1946).—*C.A.* 41, 1524*h*.

Advances in technique, application to coal chemistry, and the theory of chromatography were reviewed.

11673. WARTH, A.H. **Purifying water by ion exchange.** *The Crown* 36, No. 1, 13(1946).—*C.A.* 41, 2512*f*.

The ion-exchange process and the use of Amberlites in water purification were described.

11674. AKAMATSU, HIDEO. **Amorphous carbon.** *Kagaku-no-Ryoiki* 1, 7-13(1947).—*C.A.* 44, 9842*i*.

11675. ATEN, W.H.W. JR. AND HEYN, F.A. **Use of isotopes as tracers.** *Philips Tech. Rev.* 8, 296-303 (1947).—*C.A.* 41, 4703*a*.

Examples were given illustrating the use of isotopes as tracers; P in steel; Hg in Hg poisoning; soly. of Pb. in Sn; activation of metal surfaces.

11676. AUSTERWEIL, G.V. **Some aspects of ionic exchange and its applications.** *Proc. Intern. Congr. Pure and Applied Chem.* (London) 11, 323(1947)(in English).—*C.A.* 44, 7466*i*.

11677. BOGNÁR, REZSÖ. **Role of catalysis in organic chemistry.** *Magyar Kém. Lapja* 2, 181-8, 201-6, 225-30 (1947).—*C.A.* 41, 7214*a*.

11678. BOGOYAVLENSKY, B.A. **The eightieth anniversary of a pioneer in catalysis. Vladimir N. Ipatieff.** *Chimie & industrie* 58, 600-2(1947).—*C.A.* 42, 2145*i*.

11679. BRAUNBEK, WERNER, **Diffusion in solid substances.** *Naturforsch. u. Med.* 1939-1946, 8, Pt. 1, 221-8(1947); *Chem. Zentr.* (Russian Zone Ed.) 1948, II, 1268.—*C.A.* 45, 7402*g*.

A comprehensive review was presented.

11680. BROCKMANN, HANS. **New findings in the field of chromatographic adsorption.** *Angew. Chem.* A59, 199-206 (1947).—*C.A.* 42, 4019*i*.

The adsorption process, variations in the adsorption medium, adsorbents with different adsorption activities, the "eluotrope" series of solvents, constitution and adsorption, chromatographic sepn. of colorless substances, and the distribution chromatogram were reviewed.

11681. CASSIDY, HAROLD G. **Chromatography, a method of separating mixtures of substances.** *Science Counselor* 10, 107-9, 136 (1947).—*C.A.* 42, 3236*i*.

Adsorption, demonstration expts., and principles of the chromatographic methods were discussed.

11682. CORSON, B.B. **Industrial catalysis.** *J. Chem. Ed.* 24, 99-103, 150-5 (1947).—*C.A.* 41, 3888*d*..

11683. DAUBY, R. **Chromatography.** *Ind. Chim. belge* 12, 155-60 (1947).—*C.A.* 43, 1625*a*.

11684. FILLINGER, HARRIETT H. **Chromatographic adsorption in qualitative analysis.** *J. Chem. Education* 24, 444-5 (1947).—*C.A.* 41, 6833*g*.

11685. GAY, R. **Contribution to the study of periodic precipitation.** *Bull. soc. franc. mineral.* 70, 251-87 (1947).—*C.A.* 42, 8588*b*.

New experiments in support of Ostwald's explanation were given.

11686. GEE, GEOFFREY. **Some thermodynamic properties of high polymers and their molecular interpretation.** *Quart. Revs.* (London) 1, 265-98 (1947).—*C.A.* 42, 2491*i*.

The review covered polymer crystn., second-order transitions, rubberlike elasticity, stretch polymer crystn., absorption of gases and vapors, soly. in liquids, and swelling in liquids.

11687. GRAHAME, DAVID C. **The electrical double layer and the theory of electrocapillarity.** *Chem. Revs.* 41, 441-501 (1947).—*C.A.* 42, 1105*a*.

11688. KERMACK, W.O. **Partition chromatography.** *J. Incorp. Brewers' Guild* 33, 81-4(1947).—*C.A.* 42, 7600*a*.

The silica-gel column, filter-paper chromatography, two-dimensional partition chromatography, and some applications of partition chromatography were reviewed.

11689. LANTZ, ROBERT. **The mechanism of dyeing.** *Teintex* 12, 189 (1947).—*C.A.* 41, 6051*d*.

The chemical and adsorption theories of the mechanism of dyeing were reviewed.

11690. LEWANDOWSKI, ANZELM. **Chemical properties and classification of natural ferric hydroxides.** *Arch. mineral. soc. sci. Varsovie* 17, 179-90 (in Eng. 190) (1947).—*C.A.* 43, 1291*c*.

The hydrous Fe oxides were classified on the basis of their reactions with Ag salts to form ferrites, and by their catalytic effect on the oxidation of org. matter by H_2O_2.

11691. LOWRY, H.H. AND ROSE, H.J. **Some observations on German coal research and developments.** *U.S. Bur. Mines Inform. Circ. No.* 7422, 27 pp. (1947).

11692. RAETHER, HEINZ. **The structure of thin films.** *Naturforsch. u. Med. Deutschland* 1939-1946 8, No. 1, 102-8(1947).—*C.A.* 44, 8722*f*.

Both amorphous and cryst. films were reviewed.

11693. Ray, Arthur B. **Unit-operation review. Adsorption.** *Ind. Eng. Chem.* 39, 12-13, 32-5 (1947).—*C.A.* 41, 1135*b*.

11694. Riley, H.L. **Amorphous carbon and graphite.** *Quart. Revs.* (London) 1, No. 1, 59-72 (1947).—*C.A.* 42, 805*d*.

11695. Robinson, F.A. **Recent developments in chromatography.** *Pharm. J.* 158, 46-8(1947).—*C.A.* 41, 2626*a*.

Adsorbents, solvents, partition chromatography, analyses of antibiotics, and sepn. processes were reviewed.

11696. Robinson, F.A. **Recent developments in chromatography.** *Chemist Druggist* 147, 121-4 (1947).—*C.A.* 41, 3677*e*.

11697. Sanchez Marco, Godofredo. **Spontaneous oxidation of coal.** *Combustibles* 7, 124-32, 163-70(1947).—*C.A.* 42, 7043*f*.

11698. Schay, Géze. **Catalysis. III. Adsorption in catalysis. IV. Heterogeneous catalysis.** *Magyar Kem. Lapja* 2, 139-41, 154-7, 167-72(1947). —*C.A.* 41, 7214*e*.

11699. Strong, Frederick C. **Trends in quantitative analysis.** *Anal. Chem.* 19, 968-71 (1947).—*C.A.* 42, 835*i*.

11700. Ternisien, Jean. **Oxidation catalysis and the effect of the condition of the catalyzing surface.** *Chimie & industrie* 58, 234-7(1947).—*C.A.* 42, 442*c*.

The review included: nature of oxidation catalysis, catalytic properties of metals that favored the combustion reaction of a gas, causes of the deterioration of catalysts, theory of the catalysis of combustible gases, and electron-microscope examn. of the surface of metal catalysts.

11701. Tiselius, Arne. **Adsorption analysis of amino acid mixtures.** *Advances in Protein Chemistry* 3, 67-93 (1947).—*C.A.* 41, 4178*g*.

11702. Titov, E.M. **Chromatographic adsorption analysis under increased pressure.** *Zavodskaya Lab.* 13, 1359-64 (1947).—*C.A.* 43, 8790*f*.

The advantages of operation under moderate pressure (up to 450 cm Hg above atm.) were stressed as used by Tsvet in his pioneer work.

11703. Van Horn, H.T. **Base exchange and its application in ceramics.** *Ceram. Age* 50, 330-2(1947). —*C.A.* 42, 8432*h*.

11704. Zerban, F.W. **The color problem in sucrose manufacture.** *Sugar Research Foundation* (N.Y.) *Technol. Rept. Ser. No.* 2, 31 pp. (1947).—*C.A.* 41, 7143*f*.

A review of the literature on (1) the nature of caramel substances, melanoidins, and polyphenol Fe compds. occurring in sucrose products, (2) their role in the color changes during operations, (3) their detrimental effect on the marketability of the products, (4) methods for minimizing color increase and for the removal of coloring matters.

11705. Zettlemoyer, A.C. **Adsorption as a research tool.** *Trans. N.Y. Acad. Sci.* 10, 56-8(1947).—*C.A.* 42, 2155*f*.

11706. Akeroyd, E.I.; Kressman, T.R.E., and Cooper, A.T. **Ion exchange in research and industry. I. Removal of ions from solutions.** *Mfg. Chemist* 19, 344-50, 394-8(1948).—*C.A.* 43, 331*f*, 1881*c*.

11707. Beebe, Ralph A. **Dr. Stephen Brunauer's contributions in the field of adsorption.** *J. Wash. Acad. Sci.* 38, 117-22 (1948).—*C.A.* 42, 4019*g*.

11708. Beeck, Otto. **Surface catalysis.** *Revs. Modern Phys.* 20, 127-30(1948).—*C.A.* 42, 4435*b*.

The effect of traces of H_2O and H_2S in lowering the decompn. temp. of hydrocarbons was discussed. Mol. ray expts. indicated the decompn. of CH_4 into CH_3 and H and ethane into CH_3 radicals. The adsorption step was the crucial step in surface catalysis and the reaction of ethylene and H_2 was an example.

11709. Bernaerts, M.J. **Recent progress in chromatographic analysis.** *Mededel. Vlaam. Chem. Ver.* 10, 215-23(1948).—*C.A.* 43, 3307*g*.

11710. Blanc, Georges. **Gases in copper alloys.** *Fonderie* 1948, 1163-71; *Chem. Zentr.* (Russian Zone Ed.) 1949, I, 1412.—*C.A.* 46, 7974*b*.

The soly. of individual gases and of several gases simultaneously present were discussed, also the reactions between metal and molding sand, and the influence of the dissolved gases on the casting.

11711. Brooks, J.D. **The catalytic oxidation of coal and petroleum products with air.** *Bull. Brit. Coal Utilisation Research Assoc.* 12, 393-400(1948).—*C.A.* 43, 5133*e*.

Catalysts, oxidation of aliphatic and aromatic hydrocarbons, and industrial oxidation products were reviewed.

11712. Consden, R. **Partition chromatography on paper, its scope and application.** *Nature* 162, 359-61(1948).—*C.A.* 42, 8571*a*.

11713. Csuros, Zoltán. **New principles in catalysis. Selectivity.** *Magyar Kém. Lapja* 3, 29-37(1948).—*C.A.* 43, 8832*a*.

Selective hydrogenation of cinnamic aldehyde with colloidal Pd as catalyst and of BzH and *o*-, *p*-, and *m*-hydroxybenzaldehyde in the presence of Pd catalyst pptd. on animal charcoal was reviewed.

11714. Davies, C.W. **Ion-exchange resins.** *Chemistry & Industry* 1948, 51-4.—*C.A.* 42, 3107*d*.

11715. Descamps, M. **Chromatographic analysis.** *Bull. assoc. anciens étude brass.* 44, 125-44, 171-90 (1948).—*C.A.* 44, 2325*f*.

11716. Dickel, G. **Adsorption and desorption.** *FIAT Rév. German Sci., 1939-1946, Phys. Chem.* 1948, 199-204.—*C.A.* 43, 1623*d*.

11717. Endell, K. and Hofmann, U. **The adhesion of inorganic binders and the plasticity and thixotropy of clay.** *Angew Chem.* A60, 237-42 (1948).—*C.A.* 43, 828*h*.

11718. Erbring, H. **Colloid chemistry.** *FIAT Rev. German Sci. 1939-1946, Phys. Chem.* 1948, 113-50. —*C.A.* 43, 1625*b*.

11719. Freund, Mihály. **Application of liquid catalysts in the industry of mineral oils.** *Magyar Tech.* 3, No. 8, 70-3 (1948).—*C.A.* 43, 8122*i*.

11720. Fricke, R. **What are active solid substances and what is the significance for science and technology?** *Festskr J. Arvid Hedvall* 1948, 189-202.—*C.A.* 42, 5737*b*.
The reason for the activity of a solid substance was reviewed: (1) existence in the amorphous state; (2) derangement of the lattice, such as alterations in the lattice distances, straining of the crystals, etc. (3) existence as an unstable allotrope; and (4) occurrence of a very large surface area.

11721. Fricke, R. **Active states and reaction properties in solids.** *Iva* 19, 192-8(1948).—*C.A.* 43, 5250*g*.
Ideal crystal structures with regard to the classical theory and real crystal structures were discussed with regard to solid body reactions. The active states were characterized by large surface development and lattice disorder.

11722. Fuks, N.A. **Distributive chromatography and its application to analytical chemistry.** *Uspekhi Khim.* 17, 45-54(1948).—*C.A.* 42, 4863*h*.
Typical examples of the use of chromatography in the analysis of complex compds.were given.

11723. Gapon, E.N. and Gapon, T.B. **Chromatographic analysis of ions.** *Uspekhi Khim.* 17, 452-67 (1948).—*C.A.* 43, 7859*e*.

11724. Gapon, T.B. and Gapon, E.N. **Chromatographic analysis of ions. I. Chromatographic exchange adsorption of ions.** *Zhur. Anal. Khim.* 3, 203-12 (1948).—*C.A.* 43, 8971*f*.

11725. Godel, A. **Fluidization used in making activated carbon.** *Chem. Eng.* 55, No. 7, 110-11 (1948).—*C.A.* 42, 6964*a*.

11726. Guitton, L. **Passivation of nonoxidizing steels and adsorption phenomena.** *Metaux & Corrosion* 23, 29-33 (1948).—*C.A.* 43, 1699*c*.
The mechanism of pure passivation, effect of heat on the surface, adsorption, and structure of oxide film were reviewed.

11727. Hais, I.M. **Paper chromatography.** *Chem. Listy* 42, 125-37(1948).—*C.A.* 44, 9210*h*.

11728. Inoue, Katsuya. **Colloid chemistry of clay.** *Kagaku no Ryôiki* (J. Japan Chem.) 2, 308-12(1948).—*C.A.* 45, 4526*e*.

11729. Jungers, J.C. **The present situation in heterogeneous catalysis.** *Soc. roy. belge ing. et ind., Ser. B., Mem.* 6, 14-25 (1948).
In heterogeneous catalysis, 5 steps were apparent: appearance of the catalyst at the surface, adsorption of the catalyst on the surface, transformation of the adsorbed substances, desorption, elimination of the products formed.

11730. Keenan, A.G. **Relation between the Brunauer-Emmett-Teller and Langmuir multilayer adsorption equations.** *J. Chem. Education* 25, 666-7(1948).—*C.A.* 43, 2485*a*.

11731. Konstantinova-Shlezinger, M.A. and Gorbacheva, N.A. **Theory of chromatographic analysis.** *Zhur. Anal. Khim.* 3, 213-19 (1948).—*C.A.* 43, 8945*h*.

11732. Kreshkov, A.P. **New silicate products, based on silicoörganic compounds.** *Doklady Akad. Nauk S.S.S.R.* 59, 723-6(1948).—*C.A.* 46, 3681*d*.
General reaction schemes were given for partial hydrolysis of esters of orthosilicic acid and condensation of the products, and for Grignard-like reactions of silicon aryl and alkyl halides. The similarity of silicones to silicates and SiO_2 glass was discussed.

11733. Kunin, Robert. **Unit operations. Ion exchange.** *Ind. Eng. Chem.* 40, 41-45 (1948).—*C.A.* 42, 1088*e*.

11734. Levin, V.I. **Statistical theories of active surfaces.** *Uspekhi Khim.* 17, 174-203(1948).—*C.A.* 42, 5298*b*.
Theories of heterogeneous surfaces, adsorption equil., kinetics of adsorption, kinetics of heterogeneous catalysis, and interaction of adsorbed particles were reviewed.

11735. MacEwan, D.M.C. **Adsorption by montmorillonite, and its relation to surface adsorption.** *Nature* 162, 935-6 (1948).—*C.A.* 43, 7774*c*.

11736. Moore, Stanford and Stein, William H. **Partition chromatography of amino acids on starch.** *Ann. N.Y. Acad. Sci.* 49, 265-78 (1948).—*C.A.* 42, 5488*e*.
Starch acted both as an adsorbent and a liquid support.

11737. Mukaibo, Takashi. **Graphitization of amorphous carbon.** *Kagaku no Ryoiki* (J. Japan Chem.) 2, 301-7(1948).—*C.A.* 45, 4912*a*.

11738. Nowak, Lucjan. **Catalysis in polymerization processes.** *Przemysl Chem.* 27, 578-86 (1948).—*C.A.* 43, 8199*c*.
The mechanism of catalysis and the various types of catalysts and inhibitors used in the manuf. of plastics were reviewed.

11739. Palacios, J. **Adsorption as an origin of electromotive force.** *Scientia* 83, 123-6(1948).—*C.A.* 42, 8680*e*.
When a carbon electrode was placed in a soln. of $ZnSO_4$ a difference in potential was produced by adsorption of Zn^{++}.

11740. Peck, Robert L. **Chromatography in the streptomycin problem.** *Ann. N.Y. Acad. Sci.* 49, 235-48 (1948).—*C.A.* 42, 5619*c*.

11741. Rabek, Tadeusz. **Ion exchangers.** *Przemysł Chem.* 27, 678-87 (1948).—*C.A.* 43, 7757*c*.
The theory of ion exchange was reviewed and the general characteristics and applications of inorg. and org. cation and anion exchangers were described.

11742. Tiselius, Arne. **Electrophoresis and adsorption analysis as aids in investigations of large-molecular-weight substances and their breakdown products.** *Prix Nobel* 1948, 102-21; *Naturwissenschaften* 37, 25-33 (1950).—*C.A.* 44, 5678*f*.

11743. Treszczanowicz, E. **The physical approach to contact catalysis.** *Research* 1, 304-10(1948).—*C.A.* 42, 4434*i*.

11744. Velasco, Fernando. **Methods of analysis by adsorption - chromatography.** *Ion* 8, 591-600 (1948).—*C.A.* 43, 1679*c*.

11745. Williams, A.E. **Fuller's earth. Some notes on its mining, preparation, and properties.** *Mining J.* (London) 230, 238-42(1948).—*C.A.* 42, 5623*g*.

11746. Williams, Trevor I. **Recent advances in chromatographic sorption analysis.** *Research* 1, 400-6(1948).—*C.A.* 42, 5792*c*.

11747. Williams, Trevor I. **Chromatography: recent developments and future possibilities.** *Anal. Chim. Acta* 2, 635-48 (1948) (in English). —*C.A.* 43, 7775*b*.

Partition chromatography, inorg. chromatography, and the theory of chromatography were discussed.

11748. Williamson, W.O. **The clay/water relation.** *Research* (London) 1, 363-8 (1948).—*C.A.* 42, 4829*a*.

11749. Winters, James C. **Ion exchange develops as a unit process.** *Chem. Inds.* 62, 754-8(1948).

11750. Zechmeister, L. **History, scope, and methods of chromatography.** *Ann. N.Y. Acad. Sci.* 49, 145-60(1948).—*C.A.* 42, 5371*d*.

11751. Ackermann, A. **Absorbent earth industry.** *Chimie & industrie* 61, 29-37(1949).—*C.A.* 43, 7159*g*.

11752. Appell, F. **Chromatography in the examination of tanning principles.** *Rev. tech. ind. cuir* 41, 1-6(1949).—*C.A.* 46, 9333*b*.

11753. Arthur, J.R. **Recent investigation on the combustion and gasification of beds of solid fuels.** *Bull. Brit. Coal Utilisation Research Assoc.* 13, 297-304(1949).—*C.A.* 44, 5563*c*.

The 1944-48 period was reviewed.

11754. Barrer, R.M. **Molecular-sieve action of solids.** *Quart. Revs.* 3, 293-320(1949).—*C.A.* 44, 4306*b*.

Molecular-sieve action of porous sorbents and permeable crystals on gases, of metallic, vitreous, and org. membranes on gases, and of various materials on ions in soln. were discussed.

11755. Barrer, R.M. **Separations with zeolitic materials.** *Disc. Faraday Soc.* 1949, No. 7, 135-41.—*C.A.* 45, 18*h*.

Most natural cryst. zeolites fell into 3 classes of mol. sieve sorbent, each capable of sepg. mixts. by selective occlusion if there are sufficient differences in shape and dimensions between the mols. in the mixt. The mols. removed by occlusion must always be comparatively small. A diversity of modified mol.-sieve sorbents could be produced by cation exchange and by burning out interstital NH_4^+.

11756. Blankenship, Forrest and Donaldson, Paul. **Improved demonstration experiment on gas adsorption.** *J. Chem. Education* 26, 105-6 (1949). —*C.A.* 43, 3686*d*.

Me_3BO_3 was adsorbed and then eluted.

11757. Boelhouwer, C. **Catalysis and the surface structure of metals.** *Chem. Weekblad* 45, 590-6 (1949).—*C.A.* 44, 25*i*.

11758. Bognár, Rezso. **Valency in modern chemistry. VII. Valency, adsorption, chemisorption.** *Magyar Kém. Lapja* 4, 6-14(1949); *Magyar Tech.* 4, No. 1, 51-8(1949).—*C.A.* 45, 924*g*.

11759. Boutaric, A. **Adsorption phenomena.** *Scientia* (Italy) 84, 159-65 (1949) (in French). —*C.A.* 44, 402*a*.

The various types of adsorption were discussed.

11760. Braidy, H. **Characteristics and uses of porous materials. III.** *Industrie chimique* 36, 69-74(1949).—*C.A.* 46, 9377*b*.

Surface phenomena, mol. orientation and adsorption, heterogeneous catalysis, electrolysis, and other elec. phenomena were discussed.

11761. Brusset, H. **Graphite formation.** *Bull. Soc. chim.* 1949, D49-52.—*C.A.* 43, 4546*i*.

The mechanism of the change of amorphous carbon to graphite was reviewed.

11762. Campbell, Neil. **Adsorption chromatography.** *Pharm. J.* 162, 197-9(1949).—*C.A.* 43, 5255*d*.

11763. Cano Marotta, C.R. **The Fajans procedure: use of adsorption indicators.** *Ph (Montevideo)* 1949, No. 3, 25-35.—*C.A.* 44, 9858*c*.

11764. Cavallini, Doriano; Frontali, Nora, and Toschi, Giovanni. **Partition chromatography on filter paper.** *Ricerca sci.* 19, 208-19(1949).—*C.A.* 45, 4169*e*.

App. and technique, detn. of amino acids, keto acids, sugars, pyrimidines, and purines were reviewed.

11765. Coussens, R. **Adsorption analysis.** *Mededel. Vlaam. Chem. Ver.* 11, 125-48, 163-71 (1949).—*C.A.* 44, 2403*d*; 47, 5839*g*.

Description and use of a no. of adsorbents for analytical work were reviewed.

11766. Dubinin, M.M. **Advances in adsorption studies.** *Vestnik Akad. Nauk S.S.S.R.* 19, No. 3, 19-36 (1949).—*C.A.* 43, 7774*a*.

11767. Eley, D.D. **Mechanisms of hydrogen catalysis.** *Quart. Revs.* (London) 3, 209-25(1949).—*C.A.* 44, 26*f*.

A review with 74 references.

11768. Eucken, A. **Contact catalysis.** *Naturwissenschaften* 36, 48-53, 74-81 (1949).—*C.A.* 44, 3777*d*.

General principles, dehydration and dehydrogenation of alcs. on metal oxides, hydrogenation of unsatd. hydrocarbons on metals were reviewed.

11769. Fleisher, Harry. **Ion exchangers-their naval application.** *J. Am. Soc. Naval Engrs.* 61, 845-63 (1949).—*C.A.* 44, 878*f*.

11770. Fricke, Robert. **Active states (and catalytic activity) of solid surfaces.** *Z. Elektrochem.* 53, 264-8 (1949).—*C.A.* 44, 2353*i*.

11771. Fricke, Robert; Huttig, Gustav F.; Grubitsch, Heribert; Kohlschütter, Hans W.; Beischer, Dietrich; Tiede, Erich, and Remy, HEINRICH. **Active states and reactions in the solid state.** *FIAT Rev. German Sci. 1939-1946, Inorg. Chem., Pt. VI,* 1949, 1-221.—*C.A.* 45, 1411*d*.

11772. FRUMKIN, A.N. **Adsorption and oxidative processes.** *Uspekhi Khim.* 18, 9-21 (1949).—*C.A.* 43, 7774*b*.

11773. FUTTERKNECHT, ANDRÉ. **Bibliographic study of ion exchange and its applications.** *Ind. Chim.* 36, 219-21(1949).—*C.A.* 44, 4748*i*.

11774. GALECKI, A. **Physical chemistry of catalysts.** *Przemyst Chem.* 5(28), 564-6(1949).—*C.A.* 45, 10022*i*.
The mechanisms of catalysts were reviewed.

11775. GLEMSER. **Active solid materials.** *Eisen- u. Metall-Verarb.* 1, 50-1, 78-9(1949).—*C.A.* 46, 10487*i*.
The structure, properties, and uses of activated carbon, activated Fe$_2$O$_3$, Al$_2$O$_3$, Cu, Ca, ZnO, and a ZnO-Cr$_2$O$_3$ catalyst were discussed.

11776. GOGGI, G. **Selective adsorption of gases by activated charcoal. Theoretical principles.** *Riv. combustibili* 3, 157-69 (1949).—*C.A.* 43, 8789*d*.
The use of activated charcoal for the sepn. of ethylene from higher olefins in cracking gas, the hypersorption for the sepn. of light gases, and adsorption and capillary condensation in porous media were reviewed.

11777. GORDON, A.H. **Partition chromatography on paper with special reference to quantitative separations.** *Discussions Faraday Soc.* 1949, No. 7, 128-34.—*C.A.* 44, 9856*a*.
Recent improvements in the method of partition chromatography on paper were reviewed.

11778. GRUNER, ERHARD. **Results of the colloid-chemical investigation of bentonite in the foreign literature from 1940-1947.** *Kolloid-Z.* 114, 49-54 (1949).—*C.A.* 44, 1304*a*.

11779. GUGGENHEIM, E.A. **Surface thermodynamics—progress since Willard Gibbs.** *Research* (London), Suppl., *Surface Chemistry* 1949, 11-13 (in English), 13-15 (in French).—*C.A.* 43, 8789*c*.
Modern developments in the thermodynamics, both classical and statistical, of interfaces were reviewed.

11780. HAIS, I.M. AND RABEK, V. **Paper chromatography.** *Chem. Listy* 43, 80-94(1949).—*C.A.* 44, 9210*h*.

11781. HARRIS, B.L. **Chemical engineering unit operations review. Adsorption.** *Ind. Eng. Chem.* 41, 15-19 (1949).—*C.A.* 43, 1227*g*.

11782. HEDVALL, J. ARVID. **The development and application of the reaction theory of the solid state.** *Z. anorg. Chem.* 258, 180-7(1949).—*C.A.* 44, 25*i*.
The important developments in the present state of knowledge of reactions in the solid state were discussed.

11783. HEINEMANN, FELIX. **The Fischer-Tropsch hydrocarbon synthesis. Its first development.** *Petroleum Refiner* 28, No. 1, 126-7(1949).—*C.A.* 43, 3167*c*.

11784. HILFIGER, J.P. **Ion exchangers.** *Chimie & industrie* 61, 559-63; 62, 29-34 (1949).—*C.A.* 43, 8577*i*.

11785. HONDA, MASATAKE. **Ion-exchange resins and inorganic chemistry.** *Kagaku no Ryoiki, Extra Ed. No.* 1, 19-66 (May 1949) *No.* 2, (July 1949).—*C.A.* 44, 6753*g*.

11786. HONDA, MASATAKE. **Ion-exchange resins in analytical chemistry. I. Exchange capacity of cation exchangers.** *J. Chem. Soc. Japan,* Pure Chem. Sect., 70, 52-5(1949).—*C.A.* 45, 4169*g*.

11787. IL'IN, B.V. **The nature of van der Waals' forces on the interphase of various phases.** *Izvest. Sektora Fiz.-Khim. Anal., Inst. Obshcheĭ i Neorg. Khim., Akad. Nauk S.S.S.R.* 17, 15-32(1949).—*C.A.* 45, 2760*f*.

11788. JACOBS, PH. **Fractional chromatography.** *Pharm. Weekblad* 84, 717-25, 734-9 (1949).—*C.A.* 44, 2325*g*.

11789. JONES, TUDOR S.G. **The application of chromatography to amino acids and peptides.** *Disc. Faraday Soc. No.* 7, 285-96 (1949).—*C.A.* 44, 7921*f*.
An account was given of the application of the chromatographic methods, adsorption, ion exchange, and partition chromatography in its various forms to amino acids and peptides. Paper chromatography and newer applications were discussed in greater detail.

11790. KISELEV, A.V. **Basic structural types of adsorbents and their effect on adsorptive properties.** *Zhur. Fiz. Khim.* 23, 452-68 (1949).—*C.A.* 43, 6033*i*.
Typical kinds of rigid adsorbents were: nonporous, coarsely porous and uniform, finely porous and uniform, and mixed. Adsorption isotherms and adsorption hysteresis of these types were discussed.

11791. KRAUSE, A. **Chemistry of catalysts.** *Przemysl Chem.* 5(28), 267-72(1949).—*C.A.* 45, 10022*h*.
The chemistry of catalysts was reviewed in the light of current theories, and the mechanisms of a no. of typical reactions were discussed in detail.

11792. KUNIN, ROBERT. **First annual review of analytical chemistry. Ion exchange.** *Anal. Chem.* 21, 87-96 (1949).

11793. LUNDBERG, LISE. **Ion exchange and its application.** *Dansk Tids. Farm.* 23, 227-44, 265-89 (1949).—*C.A.* 44, 380*h*.

11794. MCLAUGHLIN, R.R. AND AZIZ, D. **A lecture experiment to demonstrate the adsorption of gases by solids.** *J. Chem. Education* 26, 325-6 (1949).—*C.A.* 43, 8232*i*.
The adsorption of ether by silica gel was made visible by the use of a column of Hg to measure pressure.

11795. MITTELMAN, NAUM. **Adsorption and partition chromatography.** *Chemia* (Buenos Aires) 15, 73-92 (1949).—*C.A.* 44, 2820*i*.

11796. Nebel. **Basic concepts and their interaction in crystallization processes in sugar solutions in sugar refining.** *Zucker* 2, 200-4 (1949).—*C.A.* 44, 2267^{d}.

11797. Pallai, Iván and Kormendy, Károly. **Distribution paper chromatography.** *Magyar Kém. Lapja* 4, 398-403(1949).—*C.A.* 45, 971^{c}.
Its use in qual. and quant. analysis of org. compds. was reviewed.

11798. Pearce, J.G. **Development stages in the study of the graphite structure.** *Giesserei* 1, 17-21(1949).—*C.A.* 44, 4744^{i}.

11799. Reis, Thomas. **The investigation of catalysts.** *Magyar Kém. Lapja* 4, 445-54 (1949).—*C.A.* 44, 1627^{c}.
Methods available for the testing of catalysts generally used for industrial purposes were reviewed.

11800. Rideal, Eric K. **Solvation of colloids.** *Science Progress* 37, 193-201 (1949).—*C.A.* 43, 6490^{g}.

11801. Roudier, A. **Chromatographic analysis.** *Chim. anal.* 31, 220-5, 247-52, 277-82 (1949).—*C.A.* 44, 475^{c}, 2883^{e}.
The procedure was explained, suitable app. shown, and the advantages of the methods, especially for biol. chemists, outlined.

11802. Sanghavi, M.K.D. and Shah, S.M. **Catalytic vapor-phase dehydrocyclization of toluene to anthracene.** *Trans. Indian Inst. Chem. Engrs.* 3, 67-78(1949-50).—*C.A.* 46, 10820^{b}.
The reactions resulting in the formation of C_6H_6, $C_{10}H_8$, CH_4, C_2H_6, C, and H_2 were all serious thermodynamic competitors of the anthracene formation reactions. The choice of the reaction path could not be affected by a shift of temp. but only by a proper choice of catalyst.

11803. Sarry, Brigitte; Rienäcker, Günther and Fricke, Robert. **Chemical constitution and catalysis.** *FIAT Rev. German Sci. 1939-1946, Inorg. Chem.*, Pt. VI, 1949, 223-53.—*C.A.* 45, 1413^{g}.

11804. Schwab, Georg-Maria. **Alloy-catalysts for dehydrogenation.** *Z. Elektrochem.* 53, 274-8 (1949).—*C.A.* 44, 2144^{h}.

11805. Senyavin, M.M. **Chromatographic adsorption analysis.** *Uspekhi Khim.* 18, 183-205 (1949).—*C.A.* 43, 7859^{d}.

11806. Srikantan, B.S. **Physical structure of metals in relation to their catalytic behavior. I. Langmuir surfaces.** *J. Indian Chem. Soc.* 26, 561-4(1949).—*C.A.* 44, 7636^{h}.
Metals with face-centered cubic lattice structure and high vibrational energy at their m.p. were good catalysts.

11807. Strain, Harold H. **First annual review of analytical chemistry. Chromatographic separations.** *Anal. Chem.* 21, 75-81(1949).—*C.A.* 43, 2113^{g}.

11808. Tolley, G. **Paper partition chromatography.** *Mfg. Chemist* 20, 215-18(1949).—*C.A.* 43, 6489^{h}.

11809. Tompkins, Edward R. **Laboratory applications of ion-exchange techniques.** *J. Chem. Education* 26, 32-8, 92-100 (1949).—*C.A.* 43, 3264^{e}.
The properties and uses of ion-exchange resins in analytical sepns. were reviewed.

11810. Waksmundzki, Andrzej. **Chromatographic adsorption.** *Wiadomosci Chem.* 3, 169-83(1949).—*C.A.* 45, 9334^{h}.

11811. Warabioka, Kotaro. **Filter-paper chromatography.** *Yakugaku* (Science of Drugs) 3, 115-29 (1949).—*C.A.* 46, 7460^{g}.

11812. Weil, Herbert. **Industrial chromatography. I. Column chromatography and radial chromatography.** *Can. Chem. Process Inds.* 33, 956-9 (1949).—*C.A.* 44, 1357^{g}.
New developments in radial and column chromatography were noted. A new mech. isolation equipment and a new separator in radial chromatography were discussed. Fractions could be isolated by elution or by sectioning the adsorbent bed.

11813. Weil, Herbert. **Industrial chromatography II. Industrial chromatography of the rare earths.** *Can. Chem. Process Inds.* 33, 1036-42 (1949).—*C.A.* 44, 1357^{h}.
The evolution of chromatographic technique from analytical methods to unit operation in industry was traced.

11814. Winkler, G.F. **Clays and their properties - interpretation.** *Research* (London) 2, 175-83 (1949).—*C.A.* 43, 5559^{g}.

11815. Yoneda, Yukio. **Oxygen-anode reaction.** *J. Electrochem. Soc. Japan* 17, 247-51 (1949).—*C.A.* 44, 5230^{i}.
The methods of measurement of O_2 overvoltage and the effects of electrodes, temp., and electrolytes on the overvoltage were discussed.

11816. Antipina, T.V. and Frost, A.V. **Kinetics of catalytic reactions on a uniform surface.** *Uspekhi Khim.* 19, 342-60 (1950).—*C.A.* 45, 4123^{e}.

11817. Bénard, J. **The role of diffusion in surface oxidation of metals.** *Métaux & corrosion* 25, 241-7(1950).—*C.A.* 45, 9439^{i}.

11818. Block, Richard J. and Sober, Herbert A. **Paper chromatography of amino acids.** *Colloid Chem.* 7, 181-200 (1950).—*C.A.* 44, 10019^{d}.

11819. Bonch-Bruevich, V.L. **Quantum theories of adsorption.** *Uspekhi Fiz. Nauk* 40, 369-405 (1950).—*C.A.* 47, 1999^{a}.

11820. Boulanger, Paul and Biserte, Gérard. **Partition chromatography.** *Exposés anuels biochim. méd.* 11, 53-121(1950).—*C.A.* 46, 6897^{f}.
Theory and applications to specific sepns. were reviewed.

11821. Bratzler, K. **Connection between depolarizability and catalytic activity of activated carbons. Mechanism of the carbon-oxygen electrode.** *Z. Elektrochem.* 54, 81-8 (1950).—*C.A.* 44, 8214^{b}.

11822. Brooks, Benjamin T. **Catalysis and carbonium ions in petroleum formation.** *Science* 111, 648-50(1950).—*C.A.* 44, 10623*f*.
Natural petroleum was formed through a carbonium-ion mechanism at relatively low temps., catalyzed by clays and other acid silicate minerals in adjoining strata.

11823. Burstall, F.H. and Kember, N.F. **Inorganic chromatography.** *Ind. Chemist.* 26, 400-4(1950).—*C.A.* 46, 7927*b*.
Sepn. of inorg. compds. by use of paper strips or columns of cellulose pulp and org. solvents as eluents was described.

11824. Cassidy, Harold G. **The nature of separation processes.** *J. Chem. Education* 27, 241-4 (1950).—*C.A.* 44, 8705*f*.

11825. Castka, Joseph F. and Crane, Joseph. **Classroom demonstrations of ion-exchange resins.** *J. Chem. Education* 27, 673 (1950).—*C.A.* 45, 7833*d*.
Amberlite resins were used to demonstrate cation and anion removal and demineralization of H_2O.

11826. Clegg, Doris L. **Second annual review of analytical chemistry; fundamental analysis. Paper chromatography.** *Anal. Chem.* 22, 48-59, 742 (1950).—*C.A.* 44, 1843*d*, 6759*i*.

11827. Cremer, E. **Fundamental laws of adsorption historical survey.** *Z. physik. Chem.* 196, 196-204 (1950).—*C.A.* 45, 8845*i*.

11828. Davies, C.W. **Ion-exchange resins in chromatography.** *Research* 3, 447-52(1950).—*C.A.* 45, 60*c*.

11829. Deuel, H. and Hostettler, F. **History of ion exchange.** *Experientia* 6, 445-56(1950)(in English).—*C.A.* 45, 2272*f*.
A historical development of the field of ion exchange, 1850-1949 was presented.

11830. Feigl, F. **Chemistry of specific, selective, and sensitive reactions.** *Research* (London) 3, 550-7(1950).—*C.A.* 45, 3749*i*.
Reactions leading to metallo-org. compds., catalytic reactions, fluorescence effects, capillary analysis and chromatography, masking and demasking of effects by the control of exptl. variables, and topochem. reactions were reviewed.

11831. Fink, Colin G. **Theory of the electrodeposition of metals from aqueous solutions.** *Science* 112, 12(1950).—*C.A.* 44, 7678*b*.
The reactions actually taking place at the surface of the cathode were discussed. The importance of H in its varying forms was stressed.

11832. Fuks, N.A. **Advances and practical achievements in the field of aerosols.** *Uspekhi Khim.* 19, 175-201(1950).—*C.A.* 45, 4113*e*.

11833. Gilliland, E.R. **Techniques of contacting fluids and solids.** *Can. Chem. Process Inds.* 34, 632-9(1950).—*C.A.* 44, 9194*e*.
The techniques of fixed, moving, and fluidized beds in industrial operations were discussed. Applications of the fluidized powder system were to the hydrocarbon synthesis process based on the Fischer-Tropsch method and possible applications included gasification of coal and distn. of shale oil.

11834. Hagenmuller, P. **Heterogeneous catalysis.** *Bull. soc. chim. France* 1950, D123-30.—*C.A.* 45, 6029*d*.
The history and definition of heterogeneous catalysis, the role of adsorption and chemisorption, thermodynamic conditions, the theory of active centers, the action of promoters and poisons, the effect of porosity, and the correlation with magnetism were reviewed.

11835. Harris, B.L. **Chemical engineering unit operations review. Adsorption.** *Ind. Eng. Chem.* 42, 20-4 (1950).—*C.A.* 44, 1289*i*.

11836. Haul, R. **Molecular physical model considerations of wetting.** *Z. Elektrochem.* 54, 152-9(1950).—*C.A.* 44, 7120*d*.

11837. Hauser, Ernst A. **Organophilic clays.** *Colloid Chem.* 7, 431-41(1950).—*C.A.* 44, 10214*h*.
The development of organophilic clays by base-exchange reactions or by esterification was discussed.

11838. Heinrich, Kurt. **New developments in ion exchange.** *Vom Wasser* 18, 360-79(1950-51).—*C.A.* 46, 7252*c*.
New resins, techniques, and theory of industrial ion exchange were discussed, especially as to economy of operation, efficient exchange, and the useful life of the resins.

11839. Hesse, Gerhard. **Chromatographic analysis in its present form.** *Chem.-Ztg.* 74, 634-6, 647-9(1950).—*C.A.* 45, 418*f*.

11840. Hoge, G.F. Hornday and Walls, C.O. Jr. **Measurement and control problems in typical fixed-bed catalytic processes.** *Instruments* 23, 132-5, 174, 176, 178(1950).—*C.A.* 44, 5085*e*.
A description was given of a Houdry fixed-bed catalytic cracking plant.

11841. Keĭer, N.P. **Use of tagged atoms in the study of phenomena of adsorption and catalysis.** *Uspekhi Khim.* 19, 59-87(1950).—*C.A.* 45, 4123*e*.

11842. Khitrin, L.N. and Tsukhanova, O.A. **Combustion of carbon.** *Uspekhi Fiz. Nauk* 41, 311-30(1950).—*C.A.* 45, 6022*c*.

11843. Kunin, Robert. **Second annual review of analytical chemistry; fundamental analysis. Ion Exchange.** *Anal. Chem.* 22, 64-5(1950).—*C.A.* 44, 1843*e*.

11844. Lesser, Milton A. **Ion-exchange resins.** *Drug & Cosmetic Ind.* 67, 770-2, 854-7, 860-2 (1950).—*C.A.* 45, 4377*f*.

11845. Lindner, Roland. **Radiometric adsorption analysis.** *Z. Elektrochem.* 54, 421-3(1950).—*C.A.* 45, 4996*i*.
The sepn. of radio-active isotopes by adsorption on Al_2O_3 in Germany and on resins in the U.S. was reviewed.

11846. Loosjes, R. **Measurement of pH in suspensions.** *Chem. Weekblad* 46, 902-6(1950).—*C.A.* 45, 4116*a*.

11847. MacEwan, Douglas M.C. **Solvation of clay minerals in relation to crystal structure: Interlamellar adsorption by clay minerals.** *Trans. Intern. Congr. Soil Sci. 4th Congr., Amsterdam 1950,* I, 107-8; IV, 57.—*C.A.* 46, 1198*g*.

11848. Mantell, J.C. **Moisture control with solid adsorbents.** *Chem. Products* 13, 271-3 (1950).—*C.A.* 45, 9199*b*.

11849. Mathieu, Marcel. **Structure and texture of catalytically active metallic phases.** *J. chim. phys.* 47, 223-8(1950).—*C.A.* 44, 7636*h*.

11850. Miwa, Mitsuo; Mamiya, Shôichi; Igarashi, Tatsuo, and Ouchi, Yoshio. **Structure of amorphous carbon.** *Science* (Japan) 20, 129-30 (1950).—*C.A.* 45, 9980*f*.

11851. Mulcahy, M.F.R. **The kinetics of decomposition of gases at metal surfaces.** *Trans. Australian Inst. Metals* 3, 67-70(1950); *Australasian Engr.* Dec. 7, 1950, 53-6.—*C.A.* 46, 8480*i*.

The theory of metal-gas surface reactions, the results of published expts. on the rate of deposition of carbon from CH_4 and of N_2 from NH_3 were reviewed.

11852. Muto, Toshio. **Paper partition chromatography. Its method and application. I.** *Nogaku* 4, 373-80(1950).—*C.A.* 45, 2287*a*.

11853. Nys, J. **Organic chromatography.** *Mededel. Vlaam. Chem. Ver.* 12, 109-19(1950).—*C.A.* 44, 10447*d*.

Adsorbents, methods and applications, and an outline of the effect of structure on adsorbability were reviewed.

11854. Otosai, Kiyoteru. **Paper chromatography of alkali salts.** *J. Japan. Chem.* 4, 411-19 (1950).—*C.A.* 44, 9295*i*.

11855. Palasi, Vicente Villar. **Analytical possibilities of filter paper chromatography.** *Anales real. acad. farm.* 16, 227-46 (1950).—*C.A.* 45, 2361*f*.

The general and quant. technique, along with various applications in physiology, medicine, biochemistry, etc., were reviewed.

11856. Patton, A.R. **Student experiments with paper chromatography.** *J. Chem. Education* 27, 574(1950).—*C.A.* 45, 1839*g*.

Hydrolysis products of sucrose, raffinose, and rutin were identified, and the presence of various types of plant pigment in spinach and carrots and of aureomycin and streptomycin in the proper animal protein factor supplements was shown.

11857. Pedinelli, Mario and Bovelacci, Franco. **Ion exchange and ion exchangers.** *Chimica e industria* (Milan) 32, 271-6, 341-5(1950).—*C.A.* 45, 9994*b*.

11858. Pepper, K.W. **Ion-exchange resins.** *School Sci. Rev.* 31, 164-75(1950).—*C.A.* 44, 10393*f*.

Constitution of resins, the equilibria and kinetics of ion-exchange processes, and their applications were discussed.

11859. Pizarro, Agustín Vioque. **Filter paper chromatography applied to inorganic analysis.** *Inform. quím. anal.* (Madrid) 4, 127-39(1950).—*C.A.* 45, 2814*c*.

11860. Rabó, Gyula. **Aromatization of the distillates of mineral oils.** *Magyar Kém. Lapja* 5, 8-12(1950).—*C.A.* 45, 1329*i*.

Various industrial methods were discussed, including suitability and effect of catalysts.

11861. Rachinskiĭ, V.V. **Paper chromatography.** *Uspekhi Khim.* 19, 445-65(1950).—*C.A.* 45, 4113*c*.

11862. Rienäcker, G. **Problems and findings in the field of catalysts and mixed catalysts.** *Chem. Tech.* 2, 1-7(1950).—*C.A.* 44, 5497*i*.

11863. Ruess, Gerardo L. **Microcrystalline carbon.** *Ciencia e invest.* 6, 257-67(1950).—*C.A.* 44, 9762*g*.

Graphite and several com. carbon blacks, including cryst. structure and size, chem. properties and adsorption, type of aggregation, and uses were discussed.

11864. Ryabchikov, D.I. and Terent'eva, E.A. **Ionites [ion-exchange resins] and their uses.** *Uspekhi Khim.* 19, 220-51(1950).—*C.A.* 45, 3683*i*.

11865. Safina, Giuseppe. **Chromatography and applications.** *Ann. facoltà sci. agrar. univ. Palermo* 1, 289-305(1950).—*C.A.* 46, 1841*d*.

11866. Schubert, Jack. **Analytical applications of ion-exchange separations.** *Anal. Chem.* 22, 1359-68(1950).—*C.A.* 45, 1458*i*.

Fundamental principles, removal of interfering substances, sepn. of cations from anions, purification of inorg. and biol. compds., detn. of trace impurities, complex ion stabilities, and evaluation of mol. structure were reviewed.

11867. Shishakov, N.A. **Electronography as a method for the physical chemistry of surface films.** *Zhur. Fiz. Khim.* 24, 1026-9(1950).—*C.A.* 45, 1405*e*.

11868. Silverman, Leslie. **Filtration through porous materials.** *Am. Ind. Hyg. Assoc. Quart.* 11, 11-20 (1950); *Heating and Ventilating* 47, No. 7, 68-74 (1950).—*C.A.* 45, 2270*c*, 2721*b*.

Types of filters applicable to the cleaning of air and gases released from industrial processes were reviewed.

11869. Sittig, Marshall. **Catalytic cracking. II.** *Petroleum Refiner* 29, No. 8, 99-104 (1950).—*C.A.* 45, 338*h*.

The Thermofor catalytic cracking process was considered, including a discussion of the process, control problems, catalyst development, transfer and regeneration, and recent development such as the Houdriflow process.

11870. Sollner, Karl. **Recent advances in the electrochemistry of membranes of high ionic selectivity.** *J. Electrochem. Soc.* 97, 139-51C (1950).—*C.A.* 44, 7678*c*.

11871. Steiner, H. **Some notes on oxide catalysts for dehydrogenation.** *Discussions Faraday Soc.* 1950, No. 8, 264-70.—*C.A.* 45, 9989*h*.

The active centers catalyzing the three steps which form the reaction sequence, viz., dehydrogenation, cyclization, and isomerization, were largely identical.

11872. STRAIN, HAROLD H. **Second annual review of analytical chemistry; fundamental analysis. Chromatography.** *Anal. Chem.* 22, 41-8 (1950).—*C.A.* 44, 1843*d*.

11873. SZYBALSKI, W. **Determination of amino acids by filter-paper chromatography.** *Przemysl Chem.* 6(29), 32-7 (1950).—*C.A.* 45, 10141*b*.

The principles underlying partition chromatography and its use in the detn. of amino acids were described.

11874. TACHIBANA, TARÔ. **Particles and surfaces. A lecture on colloid science.** *Nôgaku* (Sci. of Agr.) 4, 32-6, 150-4, 210-14, 276-9, 395-400 (1950).—*C.A.* 45, 2285*d*.

11875. TAYLOR, H.D. **Radioactive isotopes in chemical and industrial research.** *Bull. Brit. Coal Utilisation Research Assoc.* 14, 293-303 (1950).—*C.A.* 45, 3251*g*.

The principles, methods, and techniques with applications to chem. analysis, soly., vapor pressure, adsorption, surface area, diffusion, reaction kinetics, and industry were reviewed.

11876. TAYLOR, HUGH S. **The role of adsorption in colloid science.** *Frontiers in Chem.* 8, *Frontiers in Colloid Chem.* 1-28(1950).—*C.A.* 44, 5676*b*.

11877. TEREM, HALDUN NÜZHET. **Reactions in the solid state.** *Kimya ve Sanayi* 5, 22-31(1950).—*C.A.* 45, 1411*d*.

11878. TOMPKINS, EDWARD R. **Ion-exchange separations.** *Anal. Chem.* 22, 1352-9(1950).—*C.A.* 45, 912*d*.

Properties and uses of com. ion exchangers were discussed. Some current lab. procedures for equil. expts. and for column sepns. were described.

11879. UEMURA, TAKU AND SHIBATA, MURAJI. **Inorganic paper chromatography.** *J. Japan. Chem.* 4, 406-11 (1950).—*C.A.* 44, 9295*i*.

11880. VALENTIN, H. **New fields of application of chromatographic adsorption analysis in pharmacy.** *Suddeut. Apoth. Ztg.* 90, 500-3(1950).—*C.A.* 44, 9116*i*.

11881. WEIL, HERBERT. **Application of partition chromatography in industry.** *Chimie & industrie* 64, 432-8(1950).—*C.A.* 45, 913*a*.

11882. WEISS, D.E. **A novel method of using ion-exchange resins.** *Nature* 166, 66(1950).—*C.A.* 44, 9770*h*.

A chromatographic method was described for using ion-exchange resins under conditions that allow only one of two possible adsorption mechanisms (electrostatic and van der Waals forces). Both adsorption mechanisms were demonstrated.

11883. WESLY, W. **The use of synthetic resin ion-exchange systems.** *Melliand Textilber.* 31, 62-5, 127-30(1950).—*C.A.* 47, 4523*a*.

The properties, uses, and methods of operation of ion-exchange filters, known in Germany by Wofatit, were described.

11884. WEYL, W.A. **Role of ionic deformation in surface chemistry.** *Trans. N.Y. Acad. Sci.* 12, 245-56(1950).—*C.A.* 44, 9774*c*.

The polarizing effect of the asymmetric field was expected to alter the electron d. distribution of the ions so that the chem. behavior of the ions had directional properties. The rules were applied to the explanation of heterogeneous catalysis and other surface phenomena.

11885. WIELAND, TH. **The separation of amino acids through paper chromatography.** *Z. Electrochem.* 54, 412-13(1950).—*C.A.* 45, 10141*b*.

11886. AMERO, R.C. **Fuller's earth, a general review.** *Trans. Am. Inst. Mining Met. Engrs., Tech. Pub.* No. 3024-H *Mining Eng.* 3, 441-6(1951). —*C.A.* 45, 6354*e*.

11887. ANON. **Research on the use of solid fuels.** *Coke and Gas* 13, 215-23(1951).—*C.A.* 46, 2775*h*.

A review of research in progress on fuel utilization at the British Coal Utilisation Research Station at Leatherhead was presented.

11888. ARNOLD, WILLIAM P. JR. **Medical uses of ion-exchange resins.** *New Engl. J. Med.* 245, 331-6(1951).—*C.A.* 46, 688*e*.

11889. BARTOS, L.H. **Control tests for the gel-forming properties of bentonites.** *Ceram. Age* 57, No. 5, 20-2(1951).—*C.A.* 45, 7760*d*.

11890. BASIŃSKI, ANTONI. **The characteristics and importance of ion-exchange resins.** *Wiadomości Chem.* 5, 133-52(1951).—*C.A.* 45, 9994*e*.

11891. BERG, CLYDE. **Hypersorption design. Modern advancements.** *Chem. Eng. Progress* 47, 585-91(1951).—*C.A.* 46, 296*e*.

Design factors and new applications were reviewed.

11892. BERKOWITZ, N. **The colloidal structure of coal.** *Brennstoff-Chem.* 32, 225-32(1951).—*C.A.* 45, 10542*a*.

It was possible, by briquetting under carefully controlled conditions, to impart the colloidal structure characteristic of natural coking coals to relatively soft lignites.

11893. BOULANGER, PAUL; BISERTE, GÉRARD, AND SCRIBAN, RENÉ. **Paper chromatography of amino acids as applied to plant chemistry and food chemistry.** *Ann. nutrition et aliment.* 5, 149-71 (1951).—*C.A.* 45 9423*b*.

11894. BÜCHI, J. **Ion exchanger in pharmacy and medicine.** *Arzneimittel-Forsch.* 1, 247-57(1951). —*C.A.* 46, 1715*a*.

Special uses in pharmacy and medicine were the deionization of water, and the prepn., purification, and analysis of alkaloids, of amino acids from protein hydrolyzates, of vitamins B_1 and B_2, and of antibiotics and various other pharmaceutical-chemical substances.

11895. Catoggio, José, A. **Chromatographic analysis.** *Anales direc. nacl. quím.* (Buenos Aires) 4, 98-123(1951).—*C.A.* 47, 2625*g*.

11896. Cramer, Fr. **Paper chromatography.** *Angew. Chem.* 63, 449-50(1951); *Monograph* No. 64, 81 pp.—*C.A.* 46, 804*d*.

Comprehensive directions were presented for paper chromatographic methods. The specific treatment covered sepn. of individual groups of substances such as the amino acids, sugars, purines, etc.

11897. d'Ans, Jean and Blasius, E. **Chromatography of electrolytes. II.** *Naturwissenschaften* 38, 236 (1951).—*C.A.* 46, 2242*b*.

Work with Dowex 2 as anion-exchange resin and Dowex 50 and Permutit RS as cation exchangers was reviewed in the analysis and synthesis of various complex inorg. salts such as Co-NH_3 complexes and Cr-aquo compds.

11898. Davis, Lannes E. **Cation-exchange equilibria.** *J. Am. Chem. Soc.* 73, 5006(1951).—*C.A.* 46, 8460*i*.

11899. Deibner, Léonce. **History of chromatography.** *Chim. anal.* 33, 135(1951).—*C.A.* 45, 5485*c*.

11900. Dickel, G. and Titzmann, K. **Ion exchangers as laboratory aids.** *Angew. Chem.* 63, 450-7 (1951).—*C.A.* 46, 804*c*.

Types of exchange compds., the laws of ion exchange, sepns. with ion exchangers, use of exchangers in chem. analysis and for preparative and general chem. purposes were reviewed.

11901. Dryden, I.G.C. **The physical structure and chemical nature of glance coals.** *Brennstoff-Chem.* 32, 321-4(1951).—*C.A.* 46, 1227*a*.

11902. Egloff, G. **Catalysis in petroleum refining.** *Riv. combustibili* 5, 269-95(1951).—*C.A.* 46, 1237*b*.

11903. Elving, Philip J. **Role of heterogeneous equilibria in analytical chemistry.** *Anal. Chem.* 23, 1202-9(1951).—*C.A.* 46, 847*e*.

11904. Farradane, J. **History of chromatography.** *Nature* 167, 120(1951).—*C.A.* 45, 4113*d*.

The real start of chromatographic analysis was credited to Goppelsroeder.

11905. Fuhrmeister, Charles Jr. **Improving filtration and filtration rates. Chemical and mechanical preparation of filter feed slurries.** *Chem. Eng. Progress* 47, 550-4(1951).—*C.A.* 46, 295*a*.

11906. Garner, W.E. **Catalysis and solid reactions.** *Chemistry & Industry* 1951, 1010-15.—*C.A.* 46, 1855*f*.

11907. Gilchrist, J.D. and Taylor, J. **Marco-pore size analysis of metallurgical coke.** *J. Inst. Fuel* 24, 207-11(1951).—*C.A.* 45, 9835*h*.

11908. Glueckauf, E. **The nature of ion exchangers.** *Endeavour* 10, 40-5(1951).—*C.A.* 46, 318*h*.

Cation and anion exchangers and the phys. chemistry of distribution equilibria were reviewed. A schematic representation was given of cross-linked sulfonated styrene exchangers involving styrene and divinylbenzene.

11909. Govindarajan, V.S. **Chromatography in the analysis of fatty oils and fatty acids.** *Proc. Symposium Indian Oils Fats Natl. Chem. Lab. India Poona* 1951, 242-7.—*C.A.* 47, 4631*e*.

11910. Grubitsch, H. **Surface films on metals.** *Finska Kemistsamfundets Medd.* 60, No. 1, 4-19 (1951).—*C.A.* 46, 7486*f*.

11911. Haensel, Vladimir. **Catalytic cracking of pure hydrocarbons.** *Advances in Catalysis* 2, 171-97(1951).—*C.A.* 45, 8337*a*.

11912. Harris, B.L. **Chemical engineering unit operations. Adsorption.** *Ind. Eng. Chem.* 43, 46-55 (1951).—*C.A.* 45, 1825*e*.

11913. Heide, R. von der. **Filtration with the aid of kieselguhr.** *Chem.-Ztg.* 75, 516-19, 539-41(1951).—*C.A.* 46, 1817*i*.

11914. Hellmann, Heinrich. **Paper chromatographic analysis.** *Z. ges. inn. Med.* 6, 577-89(1951).—*C.A.* 46, 11011*h*.

An app. employing a glass cylinder with a desiccator cover was described and recommended for either one or two-dimensional, ascending or descending paper chromatography.

11915. Hoog, H. **Catalysts. Choosing a catalyst. Catalyst manufacture. Recent applications.** *Chem. Eng.* 58, No. 12, 157-68(1951).—*C.A.* 46, 3183*a*.

A comprehensive review of selection, manuf., and industrial applications for catalysts.

11916. Hoog, H. and Verschoor, H. **The importance of catalysis in industry.** *Chem. Weekblad* 47, 479-87(1951).—*C.A.* 46, 1668*c*.

A review dealing with H_2SO_4, NH_3, MeOH, EtOH, phthalic anhydride, acetone, aviation gasoline, and synthetic rubber was presented.

11917. Hoy, H.R. and Whittingham, G. **Fundamental work on the combustion of small coal particles.** *Bull. Brit. Coal Utilisation Research Assoc.* 15, 69-78(1951).—*C.A.* 46, 1734*c*.

11918. Jasmund, K. **The silicate clay minerals.** *Monograph. "Angew. Chem." u. "Chem.-Ing. Tech."* No. 60, 7-142(1951).—*C.A.* 45, 6130*e*.

The properties, structure, and behavior of clay minerals were described and discussed.

11919. Jiménez de Abeledo, María E. **The study of clays.** *Ciencia e invest.* (Buenos Aires) 7, 487-99(1951).—*C.A.* 46, 1396*a*.

11920. Jones, W. Idris. **Recent developments in the thermal treatment of coal.** *J. Inst. Fuel* 24, 69-75(1951).—*C.A.* 45, 4426*e*.

The phys. and chem. changes occurring during coal heating and various products were discussed, including coke, carbon, coal plastics and briquets.

11921. Kipling, J.J. **Adsorption of nonelectrolytes from solution.** *Quart. Revs.* (London) 5, 60-74(1951).—*C.A.* 46, 2372*h*.

11922. Kirkpatrick, William J. **Nickel sulfide catalysts.** *Advances in Catalysis* 2, 329-39 (1951).—*C.A.* 45, 8337*a*.

11923. Kölbel, Herbert; Ackermann, Paul; Ruschenburg, Ernst; Langheim, Robert, and Engelhardt, Friedrich. **The Fischer-Tropsch synthesis with iron catalysts. I.** *Chem. Ing.-Tech.* 23, 153-7(1951).—*C.A.* 45, 6365*d*.

The subjects discussed were: improvement of catalyst surface, compn. of catalysts after use, Fe carbides, the reaction mechanism, catalyst compn. and promoters, and prepn. of precipitated catalysts.

11924. Lang, Walter. **Analysis of plant preparations by means of paper chromatography.** *Deut. Apoth.-Ztg.* 91, 125-9(1951).—*C.A.* 45, 10488*f*.

11925. Lee, Donald E. **Bentonite and bleaching clay in Japan.** *Gen. Headquarters Supreme Commander Allied Powers, Nat. Resources Sect., Rept.* No. 139, 28 pp.(1951).—*C.A.* 45, 3772*i*.

11926. Martin, S.L. **Catalysis.** *Intern. Chem. Eng. & Process Inds.* 32, 119-23(1951).—*C.A.* 46, 4338*a*.

The polymerization process, modern views on acids and bases, the Brönsted-Loury theory, the Lewis theory, and low-temp. catalytic polymerizations were reviewed.

11927. Maxted, E.B. **The poisoning of metallic catalysts.** *Advances in Catalysis* 2, 129-78 (1951).—*C.A.* 45, 8337*a*.

11928. McLaren, A.D. and Rowen, John W. **Sorption of water vapor by proteins and polymers: a review.** *J. Polymer Sci.* 7, 289-324(1951).—*C.A.* 45, 9992*g*.

11929. Miller, Shelby A. **Recent advances in filtration theory.** *Chem. Eng. Progress* 47, 497-501(1951).—*C.A.* 46, 294*f*.

11930. Möhler, Klement. **Chromatographic analysis on filter paper. A comprehensive review.** *Z. Lebensm.-Untersuch. u.-Forsch*, 92, 338-42 (1951).—*C.A.* 45, 6528*c*.

11931. Moralli, G. **Ion exchangers and their uses.** *J. recherches centre natl. recherche sci., Labs. Bellevue (Paris)* 1951, 332-6.—*C.A.* 46, 5*c*.

11932. Moring-Claesson, Ingrid. **Chromatography.** *Tek. Tid.* 81, 253-60(1951).—*C.A.* 45, 5559*c*.

11933. Muus, L.T. **The water sorption of textiles.** *Tids. Textiltek.* 9, 29-33(1951).—*C.A.* 45, 5932*h*.

The relation between the relative humidity of the atm. in textile mills and the moisture absorbed by the textiles, the sorption isotherms, electrostatic charge, and thermostatic effect of wool, cotton, and nylon were reviewed.

11934. Nachod, F.C. **Chromatography.** *Drug Standards* 19, 173-82(1951).—*C.A.* 46, 1330*e*.

11935. Oblad, A.G.; Milliken, T.H. Jr., and Mills, G.A. **Chemical chracteristics and structure of cracking catalysts.** *Advances in Catalysis* 2, 199-247(1951).—*C.A.* 45, 8337*a*.

11936. Ohlweiler, Otto Alcides. **Ion exchanges in analytic chemistry.** *Rev. brasil. quim.* (São Paulo) 31, 125-7(1951).—*C.A.* 45, 6525*h*.

11937. Oosterhoff, L.J. **Fundamentals of the theory of heterogeneous catalysis.** *Chem. Weekblad* 47, 406-15(1951).—*C.A.* 46, 1339*a*.

The theory of the activated complex was reviewed. If adsorption occurred directly in the activated state, adsorption of unactivated reactants was equiv. to a poisoning.

11938. Pacault, A. **Magnetic method of structural investigation of catalysts.** *Research* (London) 4, 548-55(1951).—*C.A.* 46, 2893*a*.

Examples were given of the application of the magnetic method to the detn. of the state of oxidation of a cation on a support and to studies of the state of dispersion of a catalyst on a support.

11939. Patton, A.R. **Quantitative paper chromatography for students.** *J. Chem. Education* 28, 629(1951).—*C.A.* 46, 1312*e*.

11940. Peterson, Sigfred. **Student experiments on ion exchange.** *J. Chem. Education* 28, 22-3 (1951).—*C.A.* 45, 4523*h*.

Water softening, recovery of La from dil. soln., and sepn. of Cu and Cd were covered.

11941. Pollard, F.H. and McOmie, J.F.W. **Analysis of inorganic compounds by paper chromatography.** *Endeavour* 10, 213-21(1951).—*C.A.* 46, 374*b*.

Historical survey of paper chromatography techniques developed for cations was presented.

11942. Primo Yúfera, Eduardo. **Ion-exchange resins. I. Theory and methods.** *Rev. cienc. aplicada* (Madrid) 5, 216-34(1951).—*C.A.* 46, 662*c*.

11943. Ransford, J.E. **Demonstration of ozone from bottle oxygen.** *J. Chem. Education* 28, 477(1951).—*C.A.* 46, 1317*c*.

Ozone was prepd. by passing O_2 through a U-tube packed with coarse steel wool, toward which an induction coil was being discharged.

11944. Reitema, K. **Survey of theories of filtration.** *Ingenieur* 63, CH, 1-7(1951).—*C.A.* 45, 4970*e*.

General laws could not be given since cake formation always took place.

11945. Rideal, E.K. **Concepts in catalysis. The contributions of Paul Sabatier and of Max Bodenstein.** *J. Chem. Soc.* 1951, 1640-7.—*C.A.* 45, 7833*e*.

11946, Rijnders, G.W.A. **Heterogeneous acid-base catalysis.** *Chem. Weekblad* 47, 621-8, 641-50 (1951).—*C.A.* 46, 2384*c*.

11947. Roudier, A. **Application of paper partition chromatography to qualitative and quantitative sugar analysis.** *Bull. assoc. tech. ind. papatiere* 5, 56-61(1951).—*C.A.* 45, 6119*d*.

11948. Rushton, J. Henry. **Catalytic oxidation of acetylene in air for oxygen manufacture.** *Advances in Catalysis* 2, 107-28(1951).—*C.A.* 45, 8337*a*.

11949. SAMUELSON, OLOF. **Investigations of complex salt solutions with the use of ion exchangers.** *Svensk Kem. Tid.* 63, 183-93 (1951) (in English).—*C.A.* 46, 848a.

11950. SAUNDERS, L. **Surface and colloid chemistry.** *J. Pharm. Pharmacol.* 3, 865-82(1951).—*C.A.* 46, 2372a.

11951. SCHEICHL, LUDWIG. **Chromatography- a recent method for the separation of complicated mixtures of substances.** *Seifen-Ole-Fette-Wachse* 77, 109-11, 135-7, 157-8(1951).—*C.A.* 45, 6456g.
Adsorption and partition chromatography were reviewed.

11952. SCHON, JÁNOS. **The chemistry of ion-exchange resins.** *Magyar Kem. Lapja* 6, 51-8(1951).—*C.A.* 45, 8677e.

11953. SCHUIT, G.C.A. **Theories of the catalytic activity of metals.** *Chem. Weekblad* 47, 569-78, 585-92, 601-7(1951).—*C.A.* 46, 2384d.

11954. SCHULER, ROBERT H.; BOYD, ALFRED C. JR., AND KAY, DANIEL J. **Experiments with ion exchange resins.** *J. Chem. Educ.* 28, 192-194(1951).
The separation of Cu^{++} from Ag^{+} by means of ion exchange was suggested as an experiment suitable for advanced undergraduate work.

11955. SELWOOD, PIERCE W. **Magnetism and the structure of catalytically active solids.** *Advances in Catalysis* 2, 27-106(1951).—*C.A.* 45, 8337a.

11956. SHOTT, JOHN III AND HEINE, HAROLD W. **A chromatographic separation of some dyes.** *J. Chem. Education* 28, 39-40(1951).—*C.A.* 45, 4457a.
The sepn. of fluorescein-methylene blue, methyl orange-methylene blue, and methyl orange-Victoria Blue B mixts. were covered.

11957. SILVERMAN, LESLIE. **Performance of industrial aerosol filters.** *Chem. Eng. Progress* 47, 462-8(1951).—*C.A.* 45, 9309b.

11958. SMITH, TORE H. **Chromatographic methods and their use in cellulose chemistry.** *Norsk Skogind.* 5, 141-8(1951).—*C.A.* 45, 10573i.
The principles and techniques of chromatography particularly as applied to sugars and sugar derivs. were reviewed.

11959. SPAUSTA, FRANZ. **Magnesium silicates or hydrosilicates.** *Radex Rundschau* 1951, 87-101.—*C.A.* 45, 10113e.
Mg silicates and hydrosilicates, including their formation and properties, synthetic production, hydrothermal synthesis, and transformations were reviewed.

11960. STORCH, H.H. **Process in petroleum technology. Liquid fuels from coal and oil shale.** *Advances Chem. Ser. No.* 5, 138-50(1951).—*C.A.* 45, 10558f.
The basic chem. and engineering problems involved in coal gasification, coal hydrogenation, hydrogenation of CO, retorting of oil shale, and refining of shale oil were presented.

11961. STRAIN, HAROLD H. **Chromatographic systems.** *Anal. Chem.* 23, 25-38(1951).—*C.A.* 45, 1897g.

11962. TOPP, N.E. **Ion-exchange resins.** *Science Progress* 39, 640-57 (1951).—*C.A.* 45, 10436d.
Kinetics of the exchange reactions, distribution of ions between soln. and ion-exchanger, theories of the process, deionization by such resins, and ion-exchange sepn. techniques were reviewed.

11963. TRAPNELL, B.M.W. **Balandin's contribution to heterogeneous catalysis.** *Advances in Catalysis* 2, 1-25(1951).—*C.A.* 45, 8337a.

11964. TRAWINSKI, H. **Hydrodynamics of fluidized particle beds.** *Chem.-Ing.-Tech.* 23, 416-19 (1951).—*C.A.* 46, 5c.

11965. VEGA, J. ALEMÁN. **Mechanism of catalytic oxidation.** *Rev. cienc. aplicada* (Madrid) 5, 408-18(1951).—*C.A.* 46, 3839e.

11966. WAESER, V. **Filtration of liquids.** *Kolloid-Z.* 121, 165-8(1951).—*C.A.* 45, 4970e.

11967. WEIDENHAGEN, R. **Paper chromatography of sugars.** *Zucker* 4, 275-80(1951).—*C.A.* 45, 8789h.

11968. WEIL, HERBERT. **Continuous and discontinuous ion exchange.** *Chimica e industria* (Milan) 33, 287-94 (1951).—*C.A.* 46, 6866i.
Principles, methods, and equipment were reviewed.

11969. WEST, PHILIP W. **Microchemical applications of catalytic and induced reactions.** *Anal. Chem.* 23, 176-80(1951).—*C.A.* 45, 3751f.
The status of catalytic and induced reactions in quant. and qual. micro-work, especially in spot tests were reviewed.

11970. WEYL, W.A. **A new approach to surface chemistry and to heterogeneous catalysts.** *Penna. State Coll. Mineral Inds. Expt. Sta. Bull.* No. 57, 118 pp. (1951).—*C.A.* 46, 330f.

11971. WHEELER, AHLBORN. **Reaction rates and selectivity in catalyst pores.** *Advances in Catalysis* 2, 250-327(1951).—*C.A.* 45, 8337a.

11972. WICKE, E. **Heat transfer and reactions in fluidized particle beds.** *Chem.-Ing.-Tech.* 23, 405-8(1951).—*C.A.* 46, 6b.

11973. WICKE, E. **Mass and heat transfer in gas-solid system.** *Chimia* (Switz.) 5, 173-81(1951) (in German).—*C.A.* 46, 3333d.
Heat transfer in empty tubes, packed tubes and pebble heaters was discussed generally.

11974. YANOVSKIĬ, M.I. **Chromatographic method of determination of adsorption isotherms, isobars, and isosteres.** *J. Appl. Chem. U.S.S.R.* 24, 745-50(1951)(Engl. translation).—*C.A.* 47, 2568f.

11975. ANDERSON, J. WILLIAM. **Engineering for ion exchange. II.** *Chemistry in Can.* 4, No. 10, 41-4(1952).—*C.A.* 47, 921b.

11976. ANDERSON, ROBERT B.; FELDMAN, JULIAN, AND STORCH, HENRY H. **Synthesis of alcohols by hydrogenation of carbon monoxide.** *Ind. Eng. Chem.* 44, 2418-24(1952).—*C.A.* 47, 291e.
Processes for the hydrogenation of CO to alcs. (Fischer-Tropsch synthesis) were divided into

groups: (1) catalysts difficultly reducible oxides, including the MeOH synthesis, the higher-alc. synthesis, and the iso synthesis, (2) variations of the Fischer-Tropsch synthesis over Fe catalysts.

11977. ANDO, TOSHIO AND ISHII, SHINICHI. **Identifications of halogens in organic compounds by means of paper chromatography.** *Bull. Chem. Soc. Japan* 25, 106-9(1952)(in English).—*C.A.* 47, 1538*c*.

11978. ANON. **Adsorption. Introduction.** *Chem. Eng.* 59, No.10, 149(1952).—*C.A.* 47, 7*a*.

11979. BARDENHEUER, P. **Gases in metals.** *Metall* 6, 351-6(1952).—*C.A.* 46, 8919*g*.
The absorption and behavior of gases in metals were discussed.

11980. BAUER, LEOPOLD. **Separation of carotenoids and chlorophylls by paper chromatography.** *Naturwissenschaften* 39, 88(1952).—*C.A.* 47, 446*e*.
The sepn. obtained with different solvents was illustrated for one- and for two-dimensional chromatography of leaf exts.

11981. BENDER, MAX. **The use of light scattering for determining particle size and molecular weight and shape.** *J. Chem. Education* 29, 15-23 (1952).—*C.A.* 46, 1825*b*.

11982. BEYER, ERNST. **Chromatographic procedures.** *Arch. Pharm.* 285, 129-50(1952).—*C.A.* 46, 10531*f*.

11983. BLOOIS, F.I. VAN. **Chromatography.** *Rubber* 8, 75-6(1952).—*C.A.* 47, 4641*b*.
The technique was used in the rubber lab. for identifying accelerators, softeners, and antioxidants.

11984. BOLDINGH, J. **Various forms of chromatography and some of their technical aspects. I. II.** *Chem. Weekblad* 48, 1-11 17-22(1952).—*C.A.* 46, 9462*a*.

11985. BÖSWART, J. AND JINDRA, A. **Paper chromatography.** *Československ farm.* 1, 667-81(1952).—*C.A.* 47, 5071*a*.
Methods and uses were reviewed.

11986. BRACE, A.W. **Gas removal from molten aluminum alloys.** *Foundry Trade J.* 93, 3-11 (1952).—*C.A.* 46, 8594*c*.
An investigation of the use of Cl_2 and volatile chlorides to eliminate gases was reported.

11987. BRAENDLE, H.A. **A midcentury review of rubber carbons.** *Rubber India* 4, 15-27; *Rubber Age* (N.Y.) 70, 609-16(1952).—*C.A.* 46, 5351*f*, 11750*e*.
The importance of specific surface area, pH, and structure, the part played by the electron microscope, anomalies (roughness, unsatn., and gel), and new types of carbon black, were reviewed.

11988. BRITTON, J. BOYD AND SMITH, W.R. **Carbon black, black but useful.** *Kautschuk Anwendungen* 2, 122-4(1952).—*C.A.* 47, 1914*f*.

11989. BROOKS, J.D. **Fractionation of coal extracts by partition chromatography.** *Research* (London) 5, 93-4(1952).—*C.A.* 46, 7731*e*.
An ethylenediamine soln. of a low-rank coal was fractionated by using paper partition chromatography.

11990. BROWN, C.O. AND WAINWRIGHT, R.B. **Cat cracker catalysts. How they work best.** *Chem. Eng.* 59, No. 11, 148-9, 362-4, 366-8, 370-2 (1952).—*C.A.* 47, 1920*e*.
In fluid catalytic cracking units, best results were attained if the catalyst contained the optimum mixt. of particle sizes and if the operation of the units was smoothly controlled.

11991. BROWNING, FRANK M. **Vapor-phase processes serve industry well.** *Chem. Eng.* 59, No. 10, 158-61(1952).—*C.A.* 47, 7*a*.

11992. BUSCHE, ROBERT M.; BATCHELDER, HOWARD R., AND ARMSTRONG, WILLIAM P. **A selected bibliography of coal gasification.** *U. S. Bur. Mines, Rept. Invest.* No. 4926, 28 pp.(1952).—*C.A.* 47, 1356*c*.
The subjects were: thermodynamics of gasification, reaction kinetics, math, analysis of gasification, reaction of O_2 with carbon, reaction of O_2 with CO, reaction of O_2 with H_2, reaction of carbon with steam, reaction of carbon with CO_2, water-gas shift reaction, reactivity, heat-transfer considerations, gasifier design and operation, and particle size, dynamics, and compn.

11993. CREMER, E. **Study of surface structure by means of adsorption and catalysis.** *Z. Elektrochem.* 56, 439-46(1952).—*C.A.* 47, 392*h*.

11994. CROWELL, ALBERT D. **The adsorption of gases on metal filaments, films, and single crystals.** *Am. J. Phys.* 20, 89-98(1952).—*C.A.* 47, 20*i*.
The concepts involved in the study of adsorption of gases on solids, especially on uniform surfaces, were reviewed.

11995. DEDONDER, R. **Sugars and related compounds.** *Bull. soc. chim. France* 1952, 874-83.—*C.A.* 47, 1958*c*.
Paper chromatographic techniques for sugars, alcs., and phosphoric acid esters derived from them, and heterosides were reviewed.

11996. DESIKACHAR, N.; RAO, T.V. SUBBA; VENUGOPAL, T., AND NAMBIAR, P.S.R. **Utilization of wastes in the refining, bleaching, and hydrogenation of vegetable oils.** *Indian Soap J.* 17, 289-93(1952).—*C.A.* 47, 3009*e*.

11997. DEVEY, JAMES D. **Paper chromatography in the food industry.** *Food Manuf.* 27, 416-17 (1952).—*C.A.* 47, 1866*a*.

11998. DEVIENNE, MARCEL. **Condensation and adsorption of molecules on a surface in rarefied atmosphere.** *Mem. sci. phys.* No. 53, 1-86(1952).—*C.A.* 47, 2010*h*.
The review included binding and reflection of mols. on a surface, vaporization of mols. or atoms constituting a thin film on a surface, theories of condensation, adsorption, and vaporization of mols., and field of forces in the vicinity of a surface.

11999. DRAKE, BIRGER. **Partition chromatography.** *Svensk Kem. Tidskr.* 64, 335-40 (1952).—*C.A.* 47, 4145*h*.

The work in the field of partition chromatography by the Nobel prize winners Archer J. P. Martin and Richard L. M. Synge was described.

12000. DUBININ, M.M. **Adsorption of gases and vapors and the structure of adsorbents.** *Uspekhi Khim.* 21, 513-33(1952).—*C.A.* 47, 2012*h*.

12001. DUBININ, M.M. **Porous structure of adsorbents.** *Compt. rend. réunion ann. avec comm. thermodynam., Union intern. phys.* (Paris) 1952, Changements de phases 437-41—*C.A.* 47, 6734*h*.

12002. ENGEL, CHR. **Reaction chromatography.** *Chem. Weekblad* 48, 766-7(1952).—*C.A.* 47, 1460*c*.
Chem. reactions occurring in chromatography that may be used with advantage to perform sepns. were surveyed.

12003. FISCHER, J. AND BECHTEL, H. **Methods for determining oxygen in metals.** *Z. Erzbergbau u. Metallhüttenw.* 5, 14-19(1952).—*C.A.* 46, 3902*e*.
The detn. of O_2 in Cu, Pb, Al and Zn was reviewed.

12004. FUCHS, WALTER. **Chemistry of coals.** *Industrie chim. Belge* 17, 944-8(1952).—*C.A.* 47, 2956*f*.
Microörganisms of variable reducing power were responsible for increased carbonization of carbonaceous deposits.

12005. GRASSMANN, W. AND DEFFNER, G. **Chromatography.** *Chem.-Ztg.* 76, 623-6(1952).—*C.A.* 47, 4689*a*.
Columnar chromatography was especially suitable for the sepn. of large quantities to be analyzed.

12006. GROSSE, ARISTID V. **Catalytic chemistry of hydrocarbons.** *Record Chem. Progress* 13, 55-64 (1952).—*C.A.* 46, 10593*g*.

12007. GUIBOT, A. **The problem of "combined" water in biological colloids.** *Inds. agr. et aliment.* (Paris) 69, 7-13(1952).—*C.A.* 47, 2570*b*.

12008. HAIS, I.M. **Paper chromatography of radioactive substances.** *Českoslov. farm.* 1, 681-704(1952).—*C.A.* 47, 4781*f*.

12009. HALSEY, GEORGE D. JR. **The role of surface heterogeneity in adsorption.** *Advances in Catalysis* 4, 259-69 (1952).—*C.A.* 46, 7749*d*.

12010. HARRIS, B.L. **Chemical engineering unit operations. Adsorption.** *Ind. Eng. Chem.* 44, 30-8 (1952).—*C.A.* 46, 1822*a*.

12011. HAUSER, ERNST, A. AND JORDAN, J.W. **"Organophilic" clays.** *Silicates ind.* 17, 9-10 (1952).—*C.A.* 46, 3722*b*.

12012. HEERTJES, P.M. **Technical filtration.** *Chem. Weekblad* 48, 573-8(1952).—*C.A.* 47, 6190*c*.
The effects of filtercake compaction and grain configuration required addnl. research.

12013. HELBIG, WALTER A. **Liquid-phase processes are important.** *Chem. Eng.* 59, No. 10, 153-7 (1952).—*C.A.* 47, 7*a*.

12014. HILL, TERRELL L. **Theory of physical adsorption.** *Advances in Catalysis* 4, 211-58 (1952).—*C.A.* 46, 7749*d*.

12015. HOFMANN, U. **New knowledge in the field of thixotropy, especially clay gels.** *Kolloid-Z.* 125, 86-99(1952).—*C.A.* 46, 5936*e*.

12016. HONDA, MASATAKE. **Ion-exchange resins.** *Kagaku* (Science) 22, 285-94(1952).—*C.A.* 46, 10777*g*.

12017. JAQUES, T.A.J. **Vacuum coating by sputtering and thermal evaporation methods.** *Ministry of Supply, Harwell, Berks. (Engl.) At. Energy Research Estab., Unclassified* C/R 861, 22-6 (1952).—*C.A.* 46, 11079*d*.

12018. JONES, W. IDRIS. **Recent researches on and developments in the carbonization of coal.** *Gas World* 135, No. 3520, Coking Sect., 15-18 (1952).—*C.A.* 46, 3236*c*.

12019. KAINER, FRANZ. **Alumina gel-metal oxide contact catalysts.** *Kolloid-Z.* 128, 37-43(1952).—*C.A.* 46, 9962*i*.
Patents were reviewed.

12020. KIRCHHOF, F. **Technical carbon black and its use in the rubber industry. IV.** *Gummi u. Asbest* 5, 435-9(1952).—*C.A.* 47, 1914*f*.

12021. KOLTHOFF, I.M. **Aging of crystalline precipitates.** *Analyst* 77, 1000-11(1952).—*C.A.* 47, 2014*e*.

12022. KRESSMAN, T.R.E. **The practical possibilities of ion exchange. I. The separation of ions. II. Ion exchangers in chemical analysis. III. Ion exchange in the organic biochemical, and medical fields. IV. New processes and materials.** *Mfg. Chemist* 23, 93-5, 98, 149-51, 160, 194-7, 241-3(1952).—*C.A.* 46, 8903*e*.

12023. LAPIDUS, LEON. **Theory and practice are converging.** *Chem. Eng.* 59, No. 10, 164-6(1952).—*C.A.* 47, 7*a*.

12024. LEDERER, EDGAR. **Theoretical and practical aspects of paper chromatography.** *Bull. soc. chim. France* 1952, 815-21—*C.A.* 47, 1460*d*.
The limitations, technique, and mechanism of paper chromatography, factors affecting R_F values, and some applications of the method. were reviewed.

12025. LÓPEZ PECIÑA, DARIÓ. **The combustion of carbon in cement kilns.** *Cemento-Hormigón* (Barcelona) 20, 266-72, 300-8, 330-6, 363-9 (1952).—*C.A.* 47, 4057*d*.
The thermochemistry and stoichiometry of carbon combustion were reviewed in detail.

12026. MACEK, K. **Adsorption chromatography and its use in pharmacy.** *Českoslov. farm.* 1, 657-66 (1952).—*C.A.* 47, 5071*f*.

12027. MANTELL, C.L. **Bigger role lies ahead.** *Chem. Eng.* 59, No. 10, 166-8(1952).—*C.A.* 47, 7*a*.

12028. MARINI-BETTÓLO, G.B. **The methods and new developments of chromatography.** *Chimica e industria* (Milan) 34, 269-81(1952).—*C.A.* 46, 11011*e*.

Examples were given of the use in medicine, in the analysis of explosives and biol. secretions, and in toxicological and inorg. analyses.

12029. Martinez Cordon, Jose Luis. **Chromatography and its applications to fuels.** *Combustibles* (Zaragoza) 12, 243-58, 333-51(1952).—*C.A.* 47, 6113*c*.

12030. Mathey, M.P. **The importance of pH control in the dyeing of wool.** *Tinctoria* 49, 21-3, 57-9(1952).—*C.A.* 46, 5847*g*.

12031. Merims, Robert. **Fixed-bed design more empirical than moving bed.** *Chem. Eng.* 59, No. 10, 161-3(1952).—*C.A.* 47, 7*a*.

12032. Moore, S. and Stein, W.H. **Chromatography.** *Ann. Rev. Biochem.* 21, 521-46(1952).—*C.A.* 46, 10039*e*.
The innovations in principles and practice of partition, paper, and column chromatography for the past 2 years were reviewed.

12033. Partridge, M.W. **Applications of chromatography in pharmacy.** *J. Pharm. and Pharmacol.* 4, 217-30(1952).—*C.A.* 46, 7283*i*.

12034. Patel, S.M. **Principles and application of chromatography.** *Indian J. Pharm.* 14, 27-34 (1952).—*C.A.* 46, 8564*h*.

12035. Pepper, K.W. **Ion-exchange resins.** *Plastics Inst.* (London), *Trans.* 20, No. 41, 68-84 (1952).—*C.A.* 47, 796*h*.
Applications for recovery of metals, removal of Fe from H_3PO_4 pickle solns., the prepn. of silicic acid solns., and medical applications were discussed.

12036. Plavšić, N. and Zamberlin, I. **Synthetic silica-alumina cracking catalysts.** *Nafta* (Yugoslavia) 3, 274-81(1952).—*C.A.* 47, 6127*a*.

12037. Preston, J.M. **Removal of water from textiles.** *Bull. inst. textile France* No.30, 467-75(1952).—*C.A.* 47, 2494*f*.
The ways in which H_2O was mechanically held by fabrics, as contrasted to that chemically bound were reviewed.

12038. Prettre, Marcel. **Silica and alumina gels.** *Bull. assoc. franc techniciens pétrole* No. 91, 23-41(1952).—*C.A.* 47, 5581*b*.

12039. Quastel, J.H. **Synthetic soil conditioners and soil structure.** *Science Progress* 40, 385-402(1952).—*C.A.* 46, 8792*i*.
The effect was reviewed of polyuronides, polysaccharides, cellulose esters, and synthetic soil conditioners upon soil aggregation and aeration.

12040. Ries, Herman E., Jr. **Structure and sintering properties of cracking catalysts and related materials.** *Advances in Catalysis* 4, 87-149 (1952).—*C.A.* 46, 7749*d*.

12041. Roberts, Thomas H.; Willeford, B.R. Jr., and Alberty, Robert A. **An ion-exchange experiment for physical chemistry.** *J. Chem. Education* 29, 545-8(1952).—*C.A.* 47, 2553*d*.
Ni and Co ions were adsorbed in an ion-exchange column filled with Dowex 50 W resin. These ions were eluted at a rate of 5 ml/cm^2/min. with a 5% citric acid soln. adjusted to a pH of 3.24 with NH_4OH.

12042. Sadek, Hussein. **Adsorption on nonuniform surfaces.** *Euclides* (Madrid) 12, 133-40(1952). —*C.A.* 46, 9930*f*.

12043. Schaeffler, A.L.; Campbell, H.C., and Thielsch, H. **Hydrogen in mild-steel weld metal.** *Welding J.* (N.Y.) 31, 283-309 (1952). —*C.A.* 46, 7493*c*.

12044. Schulman, J.H. and Smith, T.D. **Selective flotation of metals and minerals.** *Kolloid.-Z.* 126, 20-35(1952).—*C.A.* 46, 7827*c*.

12045. Sherwood, Peter W. **Hydroforming with fluid-bed catalysts.** *Erdöl u. Kohle* 5, 295-6 (1952).—*C.A.* 46, 7749*h*.
Industrial application of the hydroforming process was reviewed.

12046. Sherwood, Peter W. **The aging of cracking catalysts.** *Erdöl u. Kohle* 5, 488-9(1952).—*C.A.* 47, 298*i*.

12047. Smith, James Boyd. **A lecture demonstration of ion exchange.** *J. Chem. Education* 29, 292-4 (1952).—*C.A.* 46, 7381*a*.

12048. Srinivasan, M. and Subramanian, N. **Chromatography and food analysis.** *Bull. Central Food Technol. Research Inst. Mysore* 2, 44-7, 75-9(1952).—*C.A.* 47, 7125*d*.

12049. Stokes, C.A. and Friedenstein, Hanna. **Physical and chemical properties of commercial charcoals in relation to industrial use.** *Northeastern Wood Utilization Council Bull.* No. 37, 7-19(1952).—*C.A.* 46, 4200*c*.
Charcoal was seldom made to exact specifications. However, its characteristics included low ash, 1.5-3.5%; low-S compds., 0.02-0.03%; and low d. The chief industrial use for charcoal was in the production of CS_2.

12050. Surak, John G. and Schlueter, Donald P. **Introductory experiments in inorganic paper chromatography.** *J. Chem. Education* 29, 144-5 (1952).—*C.A.* 46, 8564*i*.
A drop of soln., placed on a strip of filter paper 35 × 1.5 cm and allowed to dry, was developed with a soln. contg. H_2O 15, acetoacetic ester 10, and *n-* or *tert-*BuOH 75% (contg. enough HOAc to give pH 3.5-4.0) in a corked 300-mm test tube. After 20 hrs the paper was dried and the cations identified by spraying with KI or $K_2Cr_2O_7$ (for Group I cations) or by exposure to H_2S (for Group II or IIa ions).

12051. Tompkins, Edward R. **Application of ion exchange to analytical chemistry.** *Analyst* 77, 970-82(1952).—*C.A.* 47, 1529*d*.

12052. Treybal, Robert E. **Techniques are ideal for difficult separations.** *Chem. Eng.* 59, No. 10, 150-2(1952).—*C.A.* 47, 7*a*.

12053. Trumbore, Conrad N. and Rogers, Horace E. **Experiments in paper partition chromatography.** *J. Chem. Educ.* 29, 404-5(1952).—*C.A.* 47, 3652*g*.

Chromatographic sepns. of the group I cations were studied as a function of pH and compn. of the BuOH-glacial AcOH solvent.

12054. ULLRICH, W. **Ion exchangers and their application.** *Österr. Apoth.-Ztg.* 6, 77-8(1952).—*C.A.* 46, 3330*g*.

12055. VEERSCHOOR, H. **Some chemical engineering problems concerned with catalytic processes in the liquid-fuel industry.** *Chem. Eng. Sci.* 1, 216-19(1952).—*C.A.* 47, 1915*i*.

Chem. engineering problems involved in the design of catalytic processes (various methods for carrying out catalytic reactions, fixed bed, trickle, slurry, moving bed, and fluidized bed were reviewed.

12056. VLIES, G.S. VAN DER. **The development and applications of technical ion exchangers.** *Chem. Weekblad* 48, 350-5(1952).—*C.A.* 46, 7680*g*.

12057. VOITURET, KARL. **Ion exchangers and their applications in technology.** *Seifen-Öle-Fette-Wachse* 78, 67-70, 91-3, 146(1952).—*C.A.* 47, 6069*g*.

12058. VOŠAHLÍK, B.; KOŠTÍŘ, J.V., AND JINDRA, A. **Paper chromatography in pharmaceutical analysis.** *Československ. farm.* 1, 204-6(1952).—*C.A.* 46, 10533*i*.

12059. WEIL, HERBERT. **Fifty years of petroleum chromatography. II. Technological era.** *Petroleum Processing* 7, 973-6(1952).—*C.A.* 46, 10593*f*.

12060. WILLIAMS, A.F. **Application of chromatography to the paper industry.** *Proc. Tech. Sect., Brit. Paper and Board Makers' Assoc.* 33, 85-101 (1952).—*C.A.* 46, 8369*e*.

The use of paper and columns of cellulose for the sepn. of metal ions was reviewed.

12061. YASUMURA, JIRO. **Raney nickel catalyst.** *Kagaku no Ryoiki* (J. Japan Chem.) 6, 733-40 (1952).—*C.A.* 47, 6234*a*.

12062. YLSTRA, J. **Principles of chromatography.** *Chem. Weekblad* 48, 793-8, 813-20(1952).—*C.A.* 47, 1529*d*.

12063. ZIMMERMANN, G. **New methods for paper chromatography.** *Chem. Tech.* 4, 149-52 (1952).—*C.A.* 46, 9010*i*.

12064. ALLISON, C.L.; READ, DAVIS; HOGE, A.W.; SHAMBAUGH, J.P.; FISCHBECK, A.D.; ZIMA, A.G.; PENISTEN, J.R.; CARLTON, RICHARD, AND MORRISON, MELVIN. **Catalyst poisons—and what to do about them.** *Petroleum Refiner* 32, No. 2, 125-7(1953). —*C.A.* 47, 5670*g*.

A panel discussion of poisoning of cracking catalysts was presented.

12065. EGLOFF, GUSTAV. **Catalysis in the refining of petroleum.** *Bull. assoc. franc. techniciens petrole* No. 97, 31-55(1953).—*C.A.* 47, 5671*a*.

12066. ERNE, KURT. **Developments in the field of paper chromatography.** *Farm. Revy* 52, 35-9, 53-64(1953).—*C.A.* 47, 4240*d*.

12067. GENIE, GUY. **Introduction to chromatography.** *Sucr. belge* 72, 221-30(1953).—*C.A.* 47, 4239*h*.

12068. GRIESSBACH, R. **Development and study of ion exchange adsorbents.** *Z. Elektrochem.* 57, 147-162(1953).

The general properties of exchangers as well as recent applications were reviewed. Numerous photomicrographs are included in the paper.

12069. HARRIS, B.L. **Chemical engineering unit operations. Adsorption.** *Ind. Eng. Chem.* 45, 24-31(1953).—*C.A.* 47, 1985*b*.

12070. JENNEN, J.J. **Hydrogen bridges and chromatographic separability.** *Mededel. Vlaam. Chem. Ver.* 15, 29-60 (1953).—*C.A.* 47, 6735*g*.

12071. JUHOLA, A.J. **Physical chemistry of hydrocarbons. Separation and purification of hydrocarbons by selective adsorption.** *Phys. Chemistry of Hydrocarbons* 2, 319-89 (1953).—*C.A.* 47, 6125*f*.

12072. KRESSMAN, T.R.E. **Ion-exchange resins: what they are and how they work.** *Chem. Products* 16, 3-7(1953).—*C.A.* 47, 5581*a*.

12073. PEPPER, K. AND REICHENBERG, R. **The influence of the degree of cross linking on certain fundamental properties of cation exchange resins of the sulfonated cross linked polystyrene type.** *Z. Elektrochem.* 57, 183-188 (1953).

Theories of ion exchange employed to justify the variation of resin volume and degree of hydration with change in cross-linkage were reviewed.

12074. RUSSELL, ALLEN S. **Alumina properties.** *Aluminum Co. of America, Research Labs., Tech. Paper* No. 10, 35 pp. (1953).—*C.A.* 47, 4562*h*.

12075. THOMPSON, JOSEPH; MCGARVEY, FRANCIS X.; WANTZ, JOHN F.; ALLING, S.F.; GILWOOD, M.E., AND BABB, DAVID R. **Mixed-bed ion exchange. A symposium covering theory, design of production units, and production results. II. Production results.** *Chem. Eng. Prog.* 49, 341-8, 437-42 (1953).—*C.A.* 47, 8929*e*, 9673*i*.

Theory, chem. basis, phys. considerations, design of production units, operation, construction materials, operational factors, and construction influences were discussed.

12076. WEIL, HERBERT. **Industrial petroleum chromatography. III. The work of the U.S. National Bureau of Standards.** *Petroleum* (London) 16, 40-3, 54(1953).—*C.A.* 47, 5101*h*.

The work done in conjunction with the American Petroleum Inst. Project No. 6 on the chromatographic sepn. of hydrocarbons was reviewed.

12077. WEIL, HERBERT. **Chromatographic techniques for petroleum.** *Can. Chem. Processing* 37, No. 3, 92-4(1953).—*C.A.* 47, 6125*a*.

12078. WEIL, HERBERT. **Color chromatography.** *Farbe u. Lack* 59, 128-37(1953).—*C.A.* 47, 6302*b*.

12079. WEIL, HERBERT AND WILLIAMS, T.I. **Problems of chromatographic technology.** *Research* (London) 6, 16-20(1953).—*C.A.* 47, 3080*i*.

12080. Willard, J.E. **Applications of radiotracers to the study of surfaces.** *J. Phys. Chem.* 57, 129-34(1953).—*C.A.* 47, 6736*c*.

This review of recent radiotracer studies of reactions of surfaces included the following examples: (1) reactions of glass with aq. solns., (2) reactions of glass with Br_2 vapor, (3) detn. of striking coeffs., (4) surface reactions with low-vapor-pressure compds., (5) adsorption at soln.-air interfaces, (6) depth of surface penetration by adsorbed layer, (7) mechanism of Fischer-Tropsch synthesis, (8) surface exchange reactions of Al halides.

VI-2. Chemical Composition, Sampling

12081. Annetts, May and Newman, Lorne. **Spectroscopic estimation of adsorbed ions.** *J. Phys. Chem.* 40, 187-93(1936).—*C.A.* 30, 3297⁷.

The adsorptions of various ions on a Au and a Cu sol were detd. by spectroscopic methods. When Au sols stabilized by NaOH were pptd. by $AlCl_3$, at least 90% of the Al ions were adsorbed by the Au and at least 98% of the Na ions remained in the supernatant liquid. When Cu sols, positively charged, were pptd. by the min. necessary quantity of $MgCrO_4$, at least 90% of the CrO_4 ions were adsorbed by the Cu and at least 95% of the Mg ions remained in the supernatant liquid.

12082. Schütze, Max. **New method for the direct determination of oxygen in organic substances.** *Z. anal. Chem.* 118, 245-58(1939).—*C.A.* 34, 2286².

The method consisted in decompg. the substance and leading the "cracked" products over charcoal which was heated to 1000°C in a stream of pure N_2. Then, at room temp., the CO was oxidized with I_2O_5 and the CO_2 collected in an absorption tube contg. P_2O_5, pumice, and soda-asbestos.

12083. Aĭzenshtadt, E.I. **Microdetermination of carbon and hydrogen in an apparatus with ground stopcocks.** *Zavodskaya Lab.* 9, 360 (1940); *Khim. Referat. Zhur.* 1940, No. 9, 58. —*C.A.* 37, 554³.

The side arms of the absorption tubes were equipped with stopcocks and connected with each other by means of glass tubing with stopcocks at both ends. This construction prevented the lubricant from reaching the absorption tubes.

12084. Koshurnikov, M.N. **The physical characteristics of the principal substances composing clays.** *Ogneupory* 1940, No. 7, 320-4; *Khim. Referat. Zhur.* 4, No. 4, 38 (1941).—*C.A.* 37, 4991⁷.

Montmorillonite was dehydrated in 2 phases. The liberation of approx. 75% of the water content, which was of the adsorbed or zeolitic character, occurred in the 1st phase on heating to 300°C. The 2nd phase, occurring on heating to 450-600°C, liberated 5-7% of water, which was not taken up after the liberation of the zeolitic water. Heating to above 800°C resulted in the decompn. of the mineral into mullite and sillimanite.

12085. Neĭland, K.K. **The application of the carbometer for the determination of carbon in steel.** *Zavodskaya Lab.* 9, 1139-44 (1940); *Khim. Referat. Zhur.* 4, No. 4, 85 (1941).—*C.A.* 37, 4934⁸.

The app. was suitable for the analysis of open-hearth steels contg. C 0.35-1.50%. The samples were taken, and the test made in 2 min. for the tempered and 3 min. for the untempered samples. The accuracy of the detns. was equal to that of rapid chem. analysis.

12086. Caillere, Simonne. **An adsorbing clay from the rhyolitic cinerite of Bourboule (Puy-de-Dome).** *Compt. rend.* 213, 489-91(1941). —*C.A.* 37, 3371³.

The compn. of the cinerite was SiO_2 63.53, Al_2O_3 14.81, Fe_2O_3 4.46, FeO 0.03, CaO 1.10, MgO 0.51, K_2O 4.57, Na_2O 1.04, H_2O^- 2.93, H_2O^+ 6.54 and sum 99.52%. After standing a month in storage in contact with air, the compn. becomes SiO_2 14.72, Al_2O_3 4.20, Fe_2O_3 6.19, MgO 0.32, H_2O^- 72.02, H_2O^+ 2.55, and sum 100.00%.

12087. Dobine, Mathieu. **Purification of blood charcoal; method of determination of the HCl contained in the carbon.** *Compt. rend.* 212, 790-3(1941).—*C.A.* 39, 602⁷.

The best method for the purification of the charcoal was to treat first with HCl, then with with soda in the cold and then wash with water. HCl was detd. by igniting the charcoal in a stream of dry CO_2-free air and absorption of the HCl in $AgNO_3$ or alkali. The HCl content reached a min. during the washing process, then increased.

12088. Polanco, Luis Pombo. **The electrical apparatus "Trub-Tauber" for the determination of carbon dioxide and of combined carbon monoxide and hydrogen in combustion gases.** *Cemento* (Barcelona) 9, 231-6 (1941).—*C.A.* 37, 3640⁴.

The app. and explanation of the method was described for the detn. of CO + H_2 by the heat generated due to combustion and the detn. of CO_2 by the thermal cond. compared to air.

12089. Siegfried, H. **Wood charcoal analyses.** *Schweiz, Brau. Rundschau* 52, 67-8 (1941); *Chem. Zentr.* 1942, I, 829.—*C.A.* 37, 2913⁷.

Twenty-four samples of wood charcoal were analyzed for moisture, ash, and pure carbon. A relationship between pure carbon content and heating value was detd.

12090. Grangaud, Rene. **Microdetermination of volatile substances by diffusion. A new apparatus and its application to determination of carbonates, especially those in bone.** *Compt. rend. soc. biol.* 136, 529-31 (1942).—*C.A.* 37, 4027².

By means of a special dropping funnel, acid was added to the sample in a container suspended in the upper part of a stoppered Erlenmeyer flask. The evolved CO_2 diffused into 0.05 *N* $Ba(OH)_2$ placed in the bottom of the flask; 5-6 hrs were allowed for complete absorption.

12091. KLEMENT, R.; HÜTER, F., AND KÖHRER, K. **Do carbonate apatites form in aqueous systems?** *Z. Elektrochem.* 48, 334-6(1942).—*C.A.* 37, 5669^9.

Prepns. of Ca phosphate pptd. in the presence of carbonate were interpreted as being mixts. of hydroxyapatite and $CaCO_3$.

12092. PEYRONEL, GIORGIO. **Vanadates of zirconium. II. The existence and structure of the pyrovanadate, ZrV_2O_7.** *Gazz. chim. ital.* 72, 83-9 (1942).—*C.A.* 37, 573^4.

When NH_4VO_3 and $ZrO(NO_3)_2$ react in the presence of H_2O_2, the only products were adsorption compounds of HVO_3 on $3ZrO_2.2V_2O_5.9H_2O$. After heating at 260-70°C, these adsorption products gave x-ray patterns identical with that of ZrV_2O_7. Between 670° and 760°C, ZrV_2O_7 decomposed into ZrO_2 and $Zr(VO_3)_4$. In the presence of H_2O_2, Ti vanadate and Sn vanadate formed adsorption compounds with HVO_3.

12093. PIRLOT, FRÉDÉRIC J. **Primary sampling of granular materials and mineral pulps.** *Rev. universelle mines* 18, 401-11(1942).—*C.A.* 38, 2238^8.

The principal factors affecting sampling, theories, app. and methods were discussed.

12094. ZEIDLER, G. AND BRISKE, H. **The detection of lampblack in the presence of aniline black in black paints.** *Farben-Ztg.* 47, 189-90 (1942).—*C.A.* 41, 295*h*.

A procedure was outlined whereby aniline black in the presence of lampblack could be detected and removed. According to this procedure, aniline black, but not lampblack was destroyed by HNO_3 and transformed to a brown oxidation product.

12095. FENTON, G.W. **Development in the method for the rapid determination of carbon and hydrogen in coal.** *J. Soc. Chem. Ind.* 62, 160-3 (1943).—*C.A.* 38, 631^5.

The combustion-tube method was modified so that by using 250-300 ml of O_2 per min., combustion was completed in about 10 min., although the furnace was operated at the usual temp. of 800°C. $Mg(ClO_4)_2$ and soda-asbestos were used in the absorption train.

12096. HOFMANN, ULRICH. **The formula of graphitic acid.** *Kolloid-Z.* 104, 112-14(1943).—*C.A.* 38, 4494^8.

The formula $C_6(OH)_3$ proposed by Thiele did not hold for all prepns. of graphitic acid. Well-washed and dried prepns. showed a lowered H-content.

12097. KAUTSKY, H. **Permutoids.** *Kolloid-Z.* 102, 1-14(1943).—*C.A.* 37, 5895^2.

Permutoid structures were illustrated with siloxenes. The siloxene ring was a chromophore and groups such as OH or NH_2 acted as auxochromes. The silicones had numerous active centers, which gave individual chem. reactions; this accounted for catalytic activity.

12098. PROKOF'EV, V.K. **Electrodes from wood charcoal for qualitative and quantitative spectrochemical analysis.** *Doklady Akad. Nauk S.S.S.R.* 38, 232-4; *Compt. rend acad. sci. U.R.S.S.* 38, 206-8(1943).—*C.A.* 37, 6554^9.

Electrodes having suitable elec. cond. and d. were obtained by heating cylindrical wood sticks (length 100-150 mm, diam. 15 mm) for 2 hrs to 800°C in an electrically heated tube. Operation at lower temps. produced charcoal of insufficient elec. cond. Linden and birch yielded the most dense and suitable electrodes.

12099. SANDERA, K. **Orientation analyses of activated charcoal.** *Listy Cukrovar* 61, 85-6(1943). —*C.A.* 42, 2889*g*.

Detailed analyses were given for moisture, sol. salts, wt per liter, active reaction, decolorizing capacity, and resistance to flow.

12100. SIEGEL, O. **The sorption complex of agricultural soils of Africa.** *Bodenkunde u. Pflanzenernahr.* 29, 100-7(1943); *Chem. Zentr.* 1943, *I*, 2719.—*C.A.* 38, 6450^3.

Soil samples from Dutch Southwest, Dutch East and Portuguese East Africa were examd. for total C, C stable in acetyl bromide, N, N-C ratio and humic acid. To characterize the org. materials, the total sorption capacity was detd. as well as that of the minerals.

12101. VANDONI, R. **Gas analysis. II. Direct determination of hydrogen in a hydrogen-methane mixture by passage over platinized asbestos heated to 300°-400°C.** *Mém. services chim. état* (Paris) 30, 272-4(1943).—*C.A.* 40, 7078^3.

The catalytic effect of platinized asbestos was insufficient in itself to effect the combustion of the H_2 alone without touching the CH_4 in a H_2-CH_4 mixt. A slightly higher quantity of O_2 was used than that corresponding theoretically to the H_2. The reaction began at about 320°C, and the mixt. progressively heated so as to reach the max. temp. of 400°C only after about 1-1/2 hrs. The O_2 acted selectively on the H_2 with none going to the CH_4.

12102. WETTERHOLM, ALLAN. **The determination of the degree of carbonization of charcoal.** *Svensk. Kem. Tid.* 55, 80-98(1943).—*C.A.* 38, 5384^3.

The ratio of volatile matter of wood-volatile matter of charcoal to the volatile matter of wood was used as the degree of carbonization; a value of 100 was assumed for a charcoal prepd. at 1000°C. The analytical detn. was made with 1 g each of charcoal and original wood in a Pt crucible which was heated in a quartz crucible filled with charcoal.

12103. ARDENNE, MANFRED VON AND BERNHARD, FRITZ. **Nuclear physical method for determining small amounts of carbon in iron.** *Z. Physik* 122, 740-8 (1944).—*C.A.* 42, 2866*a*.

The sample to be analyzed was bombarded by a beam of 1-m.e.v. protons or deuterons; these convert C atoms to radioactive $_7N^{13}$, whose measured activity was a function of the C content of the sample. The limit of detectibility was about 0.05%.

12104. Dutton, Herbert J. **Adsorption analysis of colorless compounds: method and application to the resolution of stearic and oleic acids.** *J. Phys. Chem.* 48, 179-86(1944).—*C.A.* 38, 5127^{1}.
A modification of a highly sensitive differential refractometer was described by means of which measurements of changes of *n* could be continuously made upon the percolate from adsorption columns during continuous flow.

12105. Gurry, R.W. and Trigg, Hastings. **Determination of carbon in low-carbon steel. Precision and accuracy of the low-pressure combustion method.** *Ind. Eng. Chem., Anal. Ed.* 16, 248-50 (1944).—*C.A.* 38, 2584^{6}.
Results obtained were accurate to within 0.0007% C, which corresponded to about 1/3 the error of the standard combustion method.

12106. Murray, William M. Jr. and Ashley, S.E.Q. **Determination of carbon by the low-pressure combustion method.** *Ind. Eng. Chem., Anal. Ed.* 16, 242-8(1944).—*C.A.* 38, 2584^{5}.
Over 5000 detns. were made with samples consisting chiefly of Fe and Si. Experiences resulted in modifications which increased the speed but maintained the accuracy. Thus, 3 different labs. reported values for a standard sample ranging from 0.0108 to 0.116% C. The results were obtained by measuring the vol. of purified CO_2 formed.

12107. Murray, William M. Jr. and Niedrach, Leonard W. **Determination of carbon. Simplification of the low-pressure combustion apparatus.** *Ind. Eng. Chem., Anal. Ed.* 16, 634-6(1944).—*C.A.* 39, 38^{5}.
The procedure was modified so that 10-15 samples could be handled, with 2 measuring systems, by 1 operator in an 8-hr day. The compn. of the blank gases was studied and found to be mostly H_2O that escaped condensation in the dry-ice trap.

12108. Pierron, Paul. **The precipitation of barium sulfate in the presence of phosphoric ions.** *Bull. soc. chim.* 11, 323-7(1944).—*C.A.* 40, 2081^{8}.
$BaSO_4$ pptd. in the presence of H_3PO_4 contained complexes which were not present in the original soln. and which could not therefore be held by adsorption. If excess $BaCl_2$ was used for pptn., complexes of the type $-Ba-SO_4-Ba-SO_4-Ba-PO_4$: Ba were formed; if less $BaCl_2$ was used, the complexes were $-SO_4-Ba-SO_4-Ba-PO_4H_2$. These complexes hydrolyzed after long boiling, but hydrolysis was never complete.

12109. Sengoku, Tadashi; Imanishi, Yoshiichi; Ikisu, Taro, and Nishizawa, Shingo. **Studies of carbon blacks. I. Properties of various types of carbon black.** *J. Soc. Rubber Ind. Japan.* 17, 39-47(1944).—*C.A.* 44, 9718*f*.
Analyses and vulcanization tests were made of various types of carbon black, and the blacks compared with respect to their effects.

12110. Shishido, Keiichi and Onishi, Akira. **A semi-microanalysis apparatus for carbon and hydrogen.** *J. Soc. Chem. Ind. Japan* 47, 899(1944). —*C.A.* 42, 6170*b*.
A simple combustion app. capable of detg. H and C to within 0.3% in a 20 mg sample was described. The combustion tube was electrically heated.

12111. Wagman, Donald D. and Rossini, Frederick D. **Macroanalysis of carbon and hydrogen by combustion.** *J. Research Natl. Bur. Standards* 32, 95-100(1944).—*C.A.* 38, 3167^{5}.
A combustion app. for accurate macroanalysis of C and H in hydrocarbons, or in compds. contg. C, H and O, was described. Its precision and accuracy were detd. on 5 expts. on highly purified C_6H_5COOH.

12112. Bray, Roger H. and Kurtz, L.T. **Determination of total, organic and available forms of P in soils.** *Soil Sci.* 59, 39-45 (1945).—*C.A.* 39, 1951^{8}.

12113. Clark, Ralph O. and Stillson, Gordon H. **Microdetermination of carbon and hydrogen.** *Ind. Eng. Chem., Anal. Ed.* 17, 520-2(1945).—*C.A.* 39, 4562^{6}.
The results of experience and of comparative expts. were summarized.

12114. Cline, Marlin G. **Methods of collecting and preparing soil samples.** *Soil Sci.* 59, 3-5 (1945).—*C.A.* 39, 1951^{6}.

12115. Cotton, J.B. **Determination of carbon in ferrous materials.** *Analyst* 70, 466-8(1945).—*C.A.* 40, 1420^{5}.
The combustion of carbon in a stream of O_2 and absorption of the resulting CO_2 in a $Ba(OH)_2$ + NaOH soln. and titration of the excess alkali with standard mineral acid in the presence of phenolphthalein was described. The CO_2 was absorbed in an evacuated bottle; at the other end, O_2 was bubbled through Hg. The stream was kept const. during the combustion so that little supervision was necessary. Results obtained with irons and steel were excellent.

12116. Feigl, Fritz. **Spot-reaction experiments. X. Topochemical reactions.** *J. Chem. Education* 22, 342-7(1945).—*C.A.* 39, 4539^{7}.
The following spot-reactions were described: topochem. detection of the volatilization of Hg at room temp.; charring of carbohydrates by adsorbed aq. HCl; topochem. effect with amorphous Si; topochem. reactions on surface of metallic Ag and Cu; a topochem. reaction of magnesite that depends on its free surface; a temp.-dependent topochem. effect with calcite; topochem. detection of Zn in ZnO; and nuclear effects in the reduction of Ag salts.

12117. Gates, A.O. **Moisture determination in solid materials.** *Chem. & Met. Eng.* 52, No. 12, 119-120(1945).—*C.A.* 40, 1755^{2}.
Moisture in a nonporous solid was detd. by measuring the sp. vol. by displacement of water before and after drying.

12118. Holmes, R.S. **Determination of total copper, zinc, cobalt and lead in soils and soil solutions.** *Soil Sci.* 59, 77-84(1945).—*C.A.* 39, 1952^{3}.

12119. Lacourt, A. and Crets, Liliane. **Microdetermination of carbon and of hydrogen.** *Bull. soc. chim. Belg.* 54, 96-100(1945).—*C.A.* 40, 6020^1.

It was not feasible to base a microchem. detn. of C and H in an org. compd. by causing the H_2O formed to react with an acid chloride whereby HCl was liberated.

12120. Langer, Alois. **Closed absorption tube for microdetermination of carbon and hydrogen.** *Ind. Eng. Chem., Anal. Ed.* 17, 266 (1945).—*C.A.* 39, 2233^5.

A new type of absorption tube for microdetn. of C and H was designed.

12121. MacIntire, W.H. **Soil content of fluorine and its determination.** *Soil Sci.* 59, 105-9 (1945).—*C.A.* 39, 1952^8.

12122. Magistad, O.C.; Reitemeier, R.F., and Wilcox, L.V. **Determination of soluble salts in soils.** *Soil Sci.* 59, 65-75 (1945).—*C.A.* 39, 1952^2.

12123. Peech, Michael. **Determination of exchangeable cations and exchange capacity of soils—rapid micro-methods utilizing centrifuge and spectrophotometer.** *Soil Sci.* 59, 25-38 (1945).—*C.A.* 39, 1951^7.

12124. Prince, Arthur L. **Determination of total nitrogen, ammonia nitrates and nitrites in soils.** *Soil Sci.* 59, 47-52 (1945).—*C.A.* 39, 1951^9.

12125. Reed, J. Fielding and Cummings, R.W. **Soil reaction—glass-electrode and colorimetric methods for determining pH values of soils.** *Soil Sci.* 59, 97-104 (1945).—*C.A.* 39, 1952^7.

12126. Robinson, W.O. **The fusion analysis of soils. Determination of Si, Ti, Al, Fe, Mn, Ca, Mg, K, Na and S. Determination of V and Mo in soils. Determination of total Se and As in soils.** *Soil Sci.* 59, 7-11, 91-2, 93-5 (1945).—*C.A.* 39, 1951^6, 1952^6.

12127. Schollenberger, C.J. **Determination of soil organic matter. Determination of carbonates in soil.** *Soil Sci.* 59, 59, 53-6, 57-63, (1945).—*C.A.* 39, 1952^1.

12128. Schollenberger, C.J. and Simon, R.H. **Determination of exchange capacity and exchangeable bases in soil—the ammonium acetate method.** *Soil Sci.* 59, 13-24 (1945).—*C.A.* 39, 1951^7.

12129. Steyermark, Al. **Microdetermination of carbon and hydrogen. A modern industrial setup.** *Ind. Eng. Chem., Anal. Ed.* 17, 523-6(1945).—*C.A.* 39, 4562^6.

The general layout of the microchem. lab. of Hoffmann-LaRoche, Inc., with special attention to the balance room, was described.

12130. Truog, Emil. **Determination of total and available boron in soils.** *Soil Sci.* 59, 85-90 (1945).—*C.A.* 39, 1952^5.

12131. Étienne, André and Mileur, Roger. **Semimicrodetermination of carbon and hydrogen in organic compounds containing nitrogen without the use of lead dioxide.** *Ann. chim. anal.* 28, 215-18 (1946).—*C.A.* 41, 925*g*.

Excellent results for C and slightly high values for H were obtained by burning the sample at 650°-700°C in O_2 with the combustion tube contg. considerable Ag wool and Ni wool, made of very fine wire. The exit gases were passed through a weighed tube contg. Anhydrone, to absorb H_2O, then through H_2SO_4 to absorb N oxides and finally through a weighed ascarite tube to absorb CO_2.

12132. Field, Edmund and Oldach, C.S. **Determination of hydrogen sulfide in gases.** *Ind. Eng. Chem., Anal. Ed.* 18, 665-7 (1946).—*C.A.* 41, 54*a*.

In a gas which contains no O_2, but which may contain H_2, N_2, CO, CH_4, C_2H_4 and as much as 2% CO_2, as little as 7 γ of H_2S could be detected and detd. within 10%. The H_2S was absorbed in 6% NaOH soln. and black Bi_2S_3 was formed by adding a reagent prepd. from 42.8 g $Bi(NO_3)_3$ in 3 liters of AcOH and dild. with 15 liters of water, or yellow CdS was formed by adding a soln. prepd. from 44 g of $UO_2(NO_3)_2.6H_2O$ + 31.4 g $Cd(OAc)_2.2H_2O$ + 20 liters of water + 4 liter of AcOH. The Bi reagent was the more sensitive.

12133. Field, Edmund and Oldach, C.S. **Conversion of organic sulfur to hydrogen sulfide for analysis.** *Ind. Eng. Chem. Anal. Ed.* 18, 668-9 (1946).—*C.A.* 41, 54*f*.

Gas contg. S present in C compds. together with excess H_2 was passed over 6 ml of 14-20-mesh Al_2O_3 (desulfurized Alorco Grade A or gel prepd. from $Al(NO_3)_3$ soln. and NH_4OH) in quartz tubes of 10-mm inside diam. or in a Vycor tube. When the Al_2O_3 was at 900°C, all COS, CS_2, CH_3SH, C_4H_4S, CH_3CNS, and SO_2 were completely changed to H_2S which was absorbed by a suitable scrubbing agent, such as NaOH soln. The presence of aq. vapor was helpful but not necessary.

12134. Gand, E. **Rapid determination of carbonates by measurement of the volume of gas evolved on treatment with acid.** *Bull. soc. chim.* 1946, 683-5.—*C.A.* 41, 2658*h*.

When a carbonate was treated with excess HCl in a simple app., the vol. of CO_2 over dil. HCl was always a little low. It was convenient, to det. the vol. of gas evolved (about 100 ml) by treatment of a known wt of marble with 6 *N* HCl and then carry out a test under the same conditions with a sample of wt sufficient to furnish about the same vol of CO_2.

12135. Grace, R.J. and Gauger, A.W. **Study of Millin technique for determination of carbon and hydrogen in coal.** *Ind. Eng. Chem., Anal. Ed.* 18, 563-5 (1946).—*C.A.* 40, 6236^8.

Excellent results were obtained with samples of coal and with other org. materials. The Nesbitt ascarite tubes, which had 4 times the capacity of the Fisher type, were recommended.

12136. Hale, Cecil H. **Rapid analysis of Fischer synthesis catalyst.** *Petroleum Refiner* 25, No. 6, 265-8 (1946).—*C.A.* 43, 60*a*.

Rapid methods for the detn. of Co and Th in Fischer catalysts were described. Co was detd. by titrating with ferricyanide to a "dead stop" end point. Th was pptd. as the iodate and detd. volumetrically.

12137. KENNEY, EDWARD F. **Raw sugar—sampling, mixing and testing.** *Ind. Eng. Chem., Anal. Ed.* 18, 684-8 (1946).—*C.A.* 41, 301*g*.

The U.S. Customs 1943 modifications reduced the sampling of undamaged bags of raw sugars to one bag in seven. The older hand-mixing method was still permitted, as well as a new box-and-screen method. This latter consisted of a thrice-repeated screening through a 3/8-inch-mesh wire screen, and quartering. The data and statistical analyses upon which these new practices were based were discussed.

12138. KORSHUN, M.O. AND HEL'MAN, N.E. **An apparatus for quantitative organic microanalysis. I.** *Zavodskaya Lab.* 12, 109-14 (1946).—*C.A.* 40, 6894^9.

The sample was burned in a current of O_2 in a tube of transparent quartz or of high-melting glass. The combustion products passed over a Pt catalyst and into absorption tubes through a part of the combustion tube filled with metallic Ag and PbO_2. CO_2 and water formed in the combustion were absorbed and weighed on a microbalance.

12139. KURCHATOV, M.S. **A new method for the determination of the inorganic (ash) sulfur in coal and coke.** *Annuaire univ. Sofia, Faculte phys.-mat.* 43, Livre 2, 229-34(1946-1947)(German Summary).—*C.A.* 44, 306*b*.

Samples of ash (15 g) were placed in a 250 ml Erlenmeyer flask, mixed with 20 ml of 3% H_2O_2, and heated a few min. with a low flame. Concd. HCl (1 ml) was added to the mixt. and heating continued a few min. The mixt. was dild. with 80 ml H_2O and 6 g $(NH_4)_2CO_3$ added. The covered flask was again heated until the $(NH_4)_2CO_3$ was completely decompd. The contents of the flask were dild. with 100 ml boiling H_2O, filtered, and washed. The filtrate which contained $(NH_4)_2SO_4$ was neutralized with HCl, decompd. with 4-5 ml concd. HCl, and pptd. at boiling temp. with 10 ml 10% $BaCl_2$; $BaSO_4$ was obtained as a ppt.

12140. KURCHATOV, M.S. **A rapid method for the determination of inorganic (ash) sulfur in coal and coke.** *Annuaire univ. Sofia, Faculte phys.-mat.* 43, Livre 2, 235-42(1946-1947) (German summary).—*C.A.* 44, 306*e*.

Samples of ash (0.2 to 0.5 g) from coal or coke were mixed with Zn powder (1g) and $HgCl_2$ (1g), and placed in a porcelain crucible. The mixt. was covered with Zn powder, the crucible covered, and heated 20-25 min. over a Bunsen burner. The cooled crucible was placed in a wide-neck flask where the contents of the crucible were decompd. with HCl in a stream of pure CO_2. The H_2S was collected in a mixt. of solns. of $Cd(CH_3CO_2)_2$ and CH_3CO_2H and titrated with I_2.

12141. TUNNICLIFF, D.D.; PETERS, EDWARD D.; LYKKEN, LOUIS, AND TUEMMLER, F.D. **Determination of carbon and hydrogen by combustion. Unitized dual apparatus and improved procedure.** *Ind. Eng. Chem., Anal. Ed.* 18, 710-18 (1946).—*C.A.* 41, 51*e*.

During 5 yrs about 6500 analyses were made with one dual unit. The results, as shown by repeated analyses of pure org. compds., justified weighing to 0.01 mg with the readings adjusted to a vacuum basis and allowance made for vol. changes of ascarite and drierite as a result of absorption of CO_2 and H_2O. Rubber connections were abolished, the rate of gas flow controlled, the heating temp. controlled, and the operating conditions were greatly improved.

12142. BARTON, KAREL AND TAMPA, JAROSLAV. **Determination of different forms of sulfur in solid fuels.** *Paliva a voda* 27, 261-6(1947).—*C.A.* 42, 2741*e*.

Total S was detd.: (a) heat a sample for approx. 1 hr at 750°C in O_2 and absorb the products of combustion in 3% H_2O_2, acidified with HCl, (b) fuse the ash from (a) with Na_2CO_3, leach with water, combine the soln. with that obtained in (a), remove SiO_2 and R_2O_3, and det. S as $BaSO_4$. Methods for sulfate and pyrite S were also given.

12143. CHARRIN, V. **French kieselguhr.** *Rév. matériaux construction trav. publ.* C, 1947, 387-9.—*C.A.* 42, 4723*c*.

The analyses of several minerals were given.

12144. CLARK, RALPH O. AND STILLSON, GORDON H. **Automatic microdetermination of carbon and hydrogen.** *Anal. Chem.* 19, 423-6(1947).—*C.A.* 41, 5053*h*.

A semiautomatic combustion unit was described which, with the exception of a motor-driven vaporization furnace and modified Abrahamczik absorption tubes, did not differ much from the manually operated equipment commonly used for microchem. work.

12145. DUVAL, CLÉMENT. **The thermogravimetry of analytical precipitates I. Generalities.** *Anal. Chim. Acta.* 1, 341-4(1947).—*C.A.* 42, 8696*i*.

The optimum temp. limits were studied for the ignition of about 600 substances encountered most often in gravimetric analysis.

12146. GROSSE, A.V.; KIRSHENBAUM, A.D., AND HINDIN, S.G. **Elementary isotopic analyses: determination of carbon.** *Science* 105, 100-1 (1947).—*C.A.* 41, 2349*d*.

The method for detg. O with the mass spectrograph and heavy O was applied to the detn. of C with heavy carbon.

12147. GUR'YANOVA, E.N. **Determination of moisture by a dielectric method.** *Zavodskaya Lab.* 13, 163-8(1947).—*C.A.* 42, 486*g*.

The moisture content of powders was detd. from the dielec. const. measured in a specially constructed condenser consisting of 2 concentric brass cylinders. The powder must be finely ground and sifted to a definite grain size to insure uniformly close packing which was made reproducible by the use of a known load on a piston attached to the condenser. Variation of 1°C corresponded to a change in the dielec. const. by 0.05-0.07.

12148. HOREISCHY, KURT; DREHER, INGEBORG, AND HOFFMANN-OSTENHOF, OTTO. **Automatic microchemical determination of carbon and hydrogen in organic substances.** *Mikrochemie ver. Mikrochim. Acta* 33, 221-30(1947) (in German).—*C.A.* 42, 1457*h*.

All heating was electrical and the movable burner was activated by means of a synchronized motor. The combustion tube contained a Pt contact, CuO, Ag wool, and PbO_2. The heating of the PbO_2 was controlled by an Fe-H_2 resistance. The absorption tubes contd. $Mg(ClO_4)_2$ and Ascarite.

12149. KHANNA, K.L.; PRASAD, S.N., AND BHATTACHARYA, P.B. **An improved rapid chemical method for the estimation of calcium in calcareous soils.** *Proc. Indian Acad. Sci.* **25A**, 51-4(1947).—*C.A.* **41**, 4263*a*.

The soil (1 g) was stirred in a 100-ml beaker with 20 ml of *N* HCl until effervescence ceased and filtered through paper. Ten drops of the filtrate was transferred to test tubes (4-mm tubing), treated with 1 drop NH_4OH, then with enough (2 to 3 drops) of glacial HOAc to clear and then with 20 drops satd. $Na_2C_2O_4$. After 15 min. the height of the column of pptd. CaC_2O_4 was compared with a graph made by analyzing in the same manner a series of soils whose Ca content was known.

12150. KITAĬGORODSKIĬ, I.I.; SENTYURIN, G.G., AND RISHINA, V.A. **Combination reducing mixtures for sulfate charges.** *Stekol'naya i Keram. Prom.* 4, No. 4, 6-8(1947).—*C.A.* **43**, 9400*e*.

Coke had a greater chem. activity and thermal stability than wood charcoal, electrode carbon, or anthracite in reducing sulfate. Similarly, a 1:1 mixt. of coke and wood charcoal was better than the following: (1) 98% wood charcoal + 2% SiC, (2) 95% wood charcoal + 5% SiC, (3) 90% wood charcoal + 10% SiC, (4) wood charcoal and electrode carbon (2:1 or 1:1), (5) wood charcoal and anthracite (2:1 or 1:1), and wood charcoal and coke (2:1).

12151. LACOURT, A. **Absorbers for carbon and hydrogen microdetermination.** *Metallurgia* **36**, 289-90(1947).—*C.A.* **41**, 7295*d*.

The Friedrich type of absorber for absorption of CO_2 and H_2O in microanalysis was described. Methods of sealing were illustrated by diagram.

12152. MALQUORI, ALBERTO AND SERSALE, RICCARDO. **The montmorillonitic clay of Casalbore (Avelline).** *Ricerca sci.* 17, 247-9(1947).—*C.A.* 45, 7477*f*.

A soapy, yellow alk. clay used in industry showed 13.50-17.52% loss on ignition, 62.45-53.98% SiO_2, 14.91-13.77% Al_2O_3 + TiO_2, 1.87-2.64% Fe_2O_3, 2.19-8.12% CuO, 1.22-1.48% MgO, 2.55-2.09% Na_2O, 0.77-0.60% K_2O, 8.60-8.32% loss at 110°C, 0.13-5.98% CO_2, pH 8.81-9.24

12153. MARTIN, R.M. **Supplementary determinations necessary in the ultimate analyses of solid fuels.** *Chaleur et end.* **28**, 167-73(1947).—*C.A.* **41**, 7073*e*.

Detns. must be made of C as carbonate, H_2O, free and combined S and possibly also N. Carbonate was detd. by treating 0.1 to 0.2 g of the coal sample with 50% H_2SO_4; H_2S was absorbed by a mixt. made from 200 g $K_2Cr_2O_7$ with 50 ml H_2O and 100 ml concd. H_2SO_4; and H_2O by pumice soaked in concd. H_2SO_4; and the CO_2 in soda lime. Combined H_2O was detd. from the difference between total H_2O and free H_2O. Total H_2O was detd. by passing pure xylene vapor or N_2 over a sample (25 to 100 g) of the coal, heated gradually to 800°C, the water being condensed out and detd. volumetrically. Free H_2O was detd by the usual method of heating in xylene and detg. the vol. of H_2O distd. over.

12154. NESBITT, CHARLES E. AND HENDERSON, JAMES. **Determination of carbon in low-carbon steel. A low-pressure gasometric method.** *Anal. Chem.* **19**, 401-4(1947).—*C.A.* **41**, 4736*h*.

The analysis of steels contg. less than 0.1% C was detd. within an hr accurate to within 0.0003% C in a 2-g sample. The sample was burned at 1140-1450°C in a stream of purified O_2. S was removed with activated MnO_2 and the CO_2 absorbed in 4 ml of 20% NaOH. The absorbent contg. Na_2CO_3 was treated with a little H_2SO_4 and the resulting CO_2 measured under reduced pressure.

12155. RAY, F.E. AND POTAS, A.E. **Simplified method for determination of carbonaceous deposits on cracking catalysts.** *Oil Gas J.* 46, No. 28, 255-8(1947).—*C.A.* 42, 1726*d*.

The app. consisted of an electrically heated furnace, combustion tubes, and a gas-collecting system. A sample of approx. 20 g was used. The C- content of the sample being analyzed was calcd. from vol. of gas collected (CO_2 content), and the wt of sample charged to the combustion tube. A deviation of ± 3% of the total C present was reported with up to 7% by wt on the catalyst.

12156. TITOVA, A.N. **The nature of synthetic aluminosilicate catalysts and the mechanism of contact catalytic reactions in the presence of such catalysts.** *J. Gen. Chem.* (U.S.S.R.) 17, 673-80 (1947).—*C.A.* 42, 729*d*.

Catalysts were made by mixing hydrosols of H_2SiO_3 and of $Al(OH)_3$, coagulation in an alk. medium and drying at different velocities. With a "standard" aluminosilicate catalyst, chem. analysis showed almost identical contents of SiO_2 80-85, and Al_2O_3 11-12 in all 4 catalysts; SiO_2/Al_2O_3 ≈7:1; metals (Na, Fe, Ca, and Mg) were present only in insignificant amts. Spectrographic analysis showed absence of As, Be, Pt, Au, Th, Sc, Ag, Zn, Cd, Co, Mo, Ta, Cb, Bi, Te, P, Sb, In, Ga, K, Li, Ba, W, Ge, V, and Sr; presence of Ti up to 0.05% in three catalysts; and Zr 0.05 in the "standard" catalyst.

12157. CHERNIKHOV, YU. A AND MAKAROVA, R.F. **Rapid determination of sulfide sulfur.** *Zdvodskaya Lab.* 14, 649-53(1948).—*C.A.* 43, 969*f*.

The sample was heated in a combustion tube in a current of air, keeping the temp. at 800°-820°C to avoid decompn. of carbonates. The SO_2 was absorbed in 25 ml of 1% H_2O_2 which had been neutralized to methyl red with 0.1 *N* NaOH. The H_2SO_4 formed was titrated.

12158. COLSON, A.F. **Rapid microanalytical determination of carbon and hydrogen in organic compounds.** *Analyst* 73, 541-7(1948).—*C.A.* 43, 969*a*.

Excellent results were reported on 5-mg samples burned in an "unpacked", helical combustion tube of silica or glass (heated to 800° or 750°C, resp.) through which a stream of O_2 passed at the rate of 40 ml per min. Halogen and S were retained, if present, on granular Ag heated to 600°C and oxides of N were removed by passage of the products of combustion through PbO_2 at 180°C. The detn. of C and H required only 30-40 min.

12159. Deitz, Victor R.; Higginson, Helen R., and Parker, Cola. **Determination of sulfur in bone char.** *J. Research Natl. Bur. Std.* 40, 263-74 (1948).—*C.A.* 42, 5698*b*.

Soln. of the total S in bone char was obtained by 3 methods: (1) after oxidation with HNO_3 and $HClO_4$, (2) after air oxidation in an intimate mixt. with Na_2CO_3 and MgO, (3) after oxidation with HNO_3 in a modified Carius tube. The ppt. of $BaSO_4$ was found to be contaminated with Ca and phosphate from the bone char. $BaSO_4$ was completely sol. in hot 70% $HClO_4$; this makes possible a purification by repptn. The distribution of the total S between the carboneous residue and the filtrate was detd after digestion in 3 mixts.: HNO_3 and HCl, $KClO_3$ and HCl, and HCl, alone. The S contained in the gases evolved with HCl was greater in most samples than that detd. as sulfide S.

12160. Furter, M.F. and Steyermark, Al. **Pressure regulator for use in microdetermination of carbon and hydrogen.** *Anal. Chem.* 20, 257-8 (1948).—*C.A.* 42, 4001*h*.

A glass pressure regulator to contain 5% NaOH soln. for the C and H microdetn. was described.

12161. Goulden, Frank. **Semimicrodetermination of carbon and hydrogen by the Sucharda and Bobranski method using a macrobalance.** *Analyst* 73, 320-1(1948).—*C.A.* 42, 6702*b*.

The time required was shortened by increasing the CuO content of the combustion tube and increasing the flow rate of O_2.

12162. Irimescu, Ion and Popescu, Barbu. **Simplified micro-method for determining carbon and hydrogen in organic compounds.** *Z. anal. Chem.* 128, 185-93(1948).—*C.A.* 42, 5801*h*.

For retention of N compds., highly active silica gel powder impregnated with a soln. of diphenylamine in H_2SO_4 was used. The combustion tube contd. a 120 mm layer of CuO, PbO, and kieselguhr. The results of 14 tests with various compds. showed sataisfactory agreement with the theory.

12163. Korshun, M.O. and Sheveleva, N.S. **Rapid simultaneous micro-determination of carbon, hydrogen, halogens, or sulfur in organic compounds.** *Doklady Akad. Nauk S.S.S.R.* 60, 63-5 (1948).—*C.A.* 42, 6270*d*.

The sample was burned in an empty tube with O_2 flowing at 35-50 ml/min. The exit gas was passed through a tube which contained a roll of thin Ag ribbon which retains halogens and S. The usual H_2O-CO_2 absorption train followed this tube. When the Ag-filled tube was at 450°C, complete retention of Cl, Br, and I occurred, while S was retained at 750°C. C. detns. were usually within 0.3%; H detns. within 0.1-0.2%.

12164. Lányi, B. and Kafka, L. **Determination of silver in active carbon.** *Müegyetemi Közlemények* 1948, 173-6 (in English).—*C.A.* 43, 6539*c*.

Moisten the sample (100g) with 100 ml of 5% $KMnO_4$ soln. and heat on a sand bath for at least 6 hrs. Repeat this treatment 3 times or until the $KMnO_4$ shows no sign of being reduced. Dry at 200°C and heat in an elec. furnace for at least 4 hrs. Cool, spray with 100 ml of water, and add 150 ml of 12 *N* H_2SO_4. Heat till dense fumes are evolved. Cool, add water and SO_2 soln. until all MnO_4- or MnO_2 is reduced; use a little H_2O_2 if necessary. After evapg., dil. to about 250 ml, filter if necessary, and titrate the Ag^+ by the Volhard method.

12165. Lindenbaum, Arthur; Schubert, Jack, and Armstrong, W.D. **Rapid wet-combustion method for carbon-determination with particular reference to isotopic carbon.** *Anal. Chem.* 20, 1120-1 (1948).—*C.A.* 43, 1285*f*.

Heat the sample together with about 0.3 g of KIO_3 at 160°C with a mixt. of Cr_2O_3, H_3PO_4, and fuming H_2SO_4 in an evacuated app. arranged so that the resulting CO_2 can be absorbed in a freshly filtered, satd. $Ba(OH)_2$ soln. After removing the $BaC^{14}O_3$ ppt. with the aid of the centrifuge and drying with acetone and Et_2O, the ppt. can be weighed and its radioactivity detd.

12166. Marling, John B. **Spectrographic determination of sodium in a silica-alumina catalyst.** *Anal. Chem.* 20, 299-300(1948).—*C.A.* 42, 4867*g*.

A rapid method for the spectrographic detn. of Na involved the use of Cu counterelectrodes as a standard to furnish reference lines. The material to be analyzed was placed in the crater of a graphite electrode and volatilized in an a.-c arc. This procedure was repeated 3 or 4 times, and the results averaged.

12167. Pieters, H.A.J. **Notes on analytical procedures I. Determination of carbon dioxide.** *Anal. Chim. Acta* 2, 263-9(1948).—*C.A.* 42, 8710*f*.

The CO_2 liberated by H_2SO_4 was absorbed in $Ba(OH)_2$, the excess of which was titrated with 0.1 *N* HCl, with cresolphthalein as indicator. The absorption and titration were performed in a special vessel in which the liquid was agitated by CO_2-free air.

12168. Rickson, J.B. **Semimicro combustion method for the determination or organic carbon.** *Analyst* 73, 268-74(1948).—*C.A.* 42, 6481*g*.

In detg. org. carbon in soils, a modification of the Ter Meulen combustion procedure was described in which a new type of vessel was used for adsorbing the CO_2 in a measured vol. of $Ba(OH)_2$, with subsequent titration of the excess of absorbent.

12169. Willey, R.A. and Caine, J.B. **Develop chemical methods for faster sand analysis.** *Am. Foundryman* 14, No.1 50-6(1948).—*C.A.* 42, 8694*i*.

Short, accurate procedures were given for the detn. of loss on ignition, carbon, Fe_2O_3, CaO, Na_2O, K_2O, SiO_2, Al_2O_3, and MgO in foundry sand. Proper care in sampling was stressed.

12170. Aranda, Vicente Gomez and Miranda, Maria Luisa Gonzalez. **Analytical methods in the chemistry of coal. Determination of moisture.** *Combustibles* (Zaragoza) 9, 99-114 (1949).—*C.A.* 44, 6099*d*.

The various methods of moisture detn. in coal were reviewed, including drying at 105°C, drying in vacuum over a desiccant, drying in a current of inert gas followed by recovery of H_2O by $CaCl_2$

and weighing, gasometric methods using MeMgI, CaC_2, etc., cryohydric method of Dolch, dielec. methods, and distn. with an immiscible solvent.

12171. BAUMINGER, B.B. AND POULTON, F.C.J. **Combustion method for the estimation of carbon black in compounded rubber.** *Analyst* 74, 351-60 (1949).—*C.A.* 43, 9515*h*.

Ext. the weighed sample with Me_2CO and, should hard asphalt be present, also with $CHCl_3$. Then weigh a sample of about 0.1 g into a SiO_2 combustion boat, introduce N_2 at the rate of 500 ml per min. and slowly raise the temp. to 600°C, with preheating of the gas to 500°C. Finally cool in N_2. The residue consists of carbon black + mineral matter. Transfer the boat and its contents to another tube for combustion in O_2 and absorption of the CO_2 formed in a weighed ascarite tube. Data were obtained with tests on 11 samples of rubber and rubber substitutes and on 16 different kinds of carbon black.

12172. BURR, ALEX C.; OPPELT, WALTER H., AND KAMPS, TED W. JR. **The rate of drying of lignite in hot oil at 315°F.** *Proc. N. Dakota Acad. Sci.* 2, 32-6(1949).—*C.A.* 43, 4831*b*.

Lignite (1, 2 and 4 in. in diam.) was dried by immersion in motor oil, SAE 20, at 310-20°F. The final moisture content of the dried lignite depended upon time and was a function of the diam. of the sphere.

12173. EDGCOMBE, L.J.; CROSSLEY, H.E.; MACDOUGALL, D., AND PARKER, A. **Improved methods for the quantitative analysis of coal ash and coke ash.** *Dept. Sci. Ind. Research* (Brit.) *Fuel Research Survey Paper* No. 50, 40 pp. (1949).—*C.A.* 44, 4226*i*.

The prepn. of the ash avoided thin layers of coal or coke. The procedure for dissolving the ash allowed soln. of all constituents. A simplified and shorter method for sepg. silica and detn. of Ba were given. Fe and Ti were detd. without previous sepn. by titrating first with $HgNO_3$ to obtain Fe, then reducing with Zn amalgram to obtain Ti. Pt from contamination by lab. app. was removed, then Mg, Mn, P, S, and alkalies were analyzed.

12174. GEORGIADIS, CONSTANTIN. **Determination of the mineral content of coals.** *Compt. rend. congr. ind. gaz, Lyon* (Assoc. tech. ind. gaz France) 66, 272-7(1949).—*C.A.* 46, 6807*c*.

For the calorimetric process of mineral detn. a new formula, $Q' = (Q \times 100)/(100 - ac)$ was suggested where Q' = heat content as measured in the bomb, Q = true heat content, and c = ash content. The coefficient a, detd. by given exptl methods, ranged between 1.070 and 1.086. The factor ac represented the mineral content of the examd coal.

12175. GUNN, E.L. **Metallic contaminants in fluid cracking catalyst.** *Anal. Chem.* 21, 599-602 (1949).—*C.A.* 43, 8655*i*.

The emmission spectrograph was routinely applied to the analysis of alumina-silica catalysts for traces of Fe, Na, Ca, Ni, Cr, and W. Co, W, and Sr salts were used as internal standards: selected lines of Co for Fe, Ni, V, and Na; W for Cr; and Sr for Ca.

12176. HESSE, GERHARD AND SANTER, O. **pH measurements on adsorbents.** *Angew. Chem.* 61, 24-8 (1949).—*C.A.* 43, 4076*d*.

Exptl. results were presented for the Pt-H_2, glass, quinhydrone, and alloxanthine electrodes as well as indicator dyes. Suspensions of the adsorbent contg. sufficiently high concn. of solids permitted the reproducible detn. of the pH. The Pt-H_2 and glass electrodes gave values in good agreement, but the quinhydrone values showed variations from +0.8 to -0.5 pH units. Indicator dyes gave even larger deviations.

12177. HILL, W.L.; HARDESTY, J.O., AND WHITTAKER, C.W. **The determination of moisture in fertilizers.** *J. Assoc. Offic. Agr. Chemists* 32, 228-41(1949).—*C.A.* 43, 9325*g*.

The methods were: (1) oven drying at 100°C (official); (2) vacuum desiccation at room temp.; and (3) air flow at 60°C. It was recommended that (2) and (3) by made official methods for free water. Several changes in the present A.O.A.C. text on moisture detn. were also recommended.

12178. HIMUS, G.W. AND BASAK, G.C. **Analysis of coals and carbonaceous materials containing high percentages of inherent mineral matter.** *Fuel* 28, No. 3, 57-65 (1949).—*C.A.* 43, 3168*d*.

Coal or oil shale, divided into fractions yielding percentage of ash higher and lower than that of the original material, showed a linear relationship between the percentages of ash and of C, H, N, and S. The compn. of the mineral-free org. matter was detd. by extropolating to zero ash. The ratio of original mineral matter to ash was also calcd. While the agreement with direct analysis was generally good, the generalization failed in some cases (carbonaceous rocks).

12179. IKENBERRY, L.C. AND CANFIELD, J.J. **Rapid method for determining nickel on the surface of enameling iron.** *J. Am. Ceram. Soc.* 32, 308-12(1949).—*C.A.* 43, 9406*i*.

The sample was obtained by dissolving the Ni coating on a small area with dil. HNO_3. The HNO_3 was confined by using a weighted rubber ring and the soln. was withdrawn by suction into a 200 ml Erlenmeyer flask, 30 ml concd. NH_4OH, 10 ml 20% $(NH_4)_2S_2O_8$, and 5 ml of 1% alc. soln. of dimethylglyoxime were added with mixing. The soln. was then dild. with H_2O to 200 ml and after filtn. of the $Fe(OH)_3$, the intensity of the red color was measured photometrically.

12180. KOIDE, TAKEKI; KUBOTA, TAKEO; KOMURO, NOBUYUKI, AND KUROI, TETSUI. **Determination of free carbon in vulcanized rubber by nitric acid methods.** *J. Soc. Rubber Ind. Japan* 22, 272-5 (1949).—*C.A.* 46, 1792*f*.

The analytical value of the HNO_3 method, which used 1.05 as correction factor was affected by the kind of carbon used. The Louth method, in which heat-treatment of carbon was applied before ignition, gave fairly accurate results without using a correction factor, but some variation occurred, according to the kind of carbon used. When vulcanized rubber contg. carbon was decompd. by HNO_3, carbon was oxidized and its wt increase varied with the kind of carbon, which was also true for the blank test of carbon blacks alone.

12181. LaForce, J.R.; Ketchum, D.F., and Ballard, A.E. **Microdetermination of total carbon in carbonates, cyanides, and alkali, or alkaline earth organic salts and mixtures.** *Anal. Chem.* 21, 879(1949).—*C.A.* 43, 8306*h*.

Weigh 5 to 20 mg sample into a Pt microcombustion boat and cover with about 60 mg of powd. $NaHSO_4$. The combustion was carried out in a Hallett app. with a pyrolysis furnace at 725-75°C; water was absorbed in a Drierite tube and the liberated CO_2 in Ascarite.

12182. Lescher, Vera L. **Determination of carbon and hydrogen by combustion.** *Anal. Chem.* 21, 1246-9(1949).—*C.A.* 44, 3403*i*.

Solids were burned in a compartmented boat of special design. The combustion tube filling (in the direction of gas flow) was Cu gauze, quartz chips, platinized asbestos, CuO wire, $PbCrO_4$ on CuO, glass wool; the absorption train was essentially conventional. Six to 8 detns. were made per day.

12183. Majumdar, K.K. **A new method for the analysis of adulterated graphite.** *J. Sci. & Ind. Research* (India) 8B,168-9(1949).—*C.A.* 44, 5266*e*.

Carbonaceous adulterants of natural graphite, such as charcoal, coke, and coal, were detd. by burning off the adulterants. The dried sample (1g) was weighted into a porcelain crucible and heated over an open flame at about 700°C. The temp. of the contents was slowly raised until the adulterant particles glowed. The temp. was maintained as low as possible and the contents stirred constantly. Complete combustion of the adulterants took 5-20 min. When glowing ceased, the temp. was slowly raised to ensure complete combustion and the end-point judged by the difference in color of the red-hot graphite. Loss in wt represented volatile matter and adulterants.

12184. Poncins, Pierre de. **The chemistry of macromolecules. Its application to the study of the chemical composition of coals, cokes, and rosins.** *Compt. rend. congr. ind. gaz. Lyon* (Assoc. tech. ind. gaz France) 66, 590-6 (1949).—*C.A.* 46, 6806*i*.

During coking of coal, 3 stages were observed: (1) The degradation of the macromols. into viscous liquid and into gaseous mols., which reached a max. between 400° and 600°C and gave coke its characteristic cavernous structure. (2) The thermal hardening of the coke to semicoke at 700°-750°C brought about by the addn. of linear macromols. to the planes of C atoms in polymerization reactions, particularly the combination of H and OH end groups to eliminate H_2O. (3) The production of metallic coke by heating to 900°-1000°C which transformed the amorphous carbon into graphite.

12185. Sanchez, Felipe González. **Sampling of solid fuels and preparation for analysis. I.** *Combustibles* (Zaragoza) 9, 16-3, 64-76 (1949). —*C.A.* 44, 6099*c*.

The standard methods of various countries were reviewed, with a view toward developing one for Spain.

12186. Schmitkons, George E. **Determination of carbon on cracking catalyst by the Leco method.** *Proc. Am. Petroleum Inst. III.* 29M, 25-38(1949). —*C.A.* 44, 4662*f*.

Carbon on the catalyst was burned with O_2 in a combustion furnace. Ceramic chips impregnated with CuO, prepd. by decompn. of $Cu(NO_3)_2$, used to convert CO to CO_2 in the combustion tube. The combustion gases were collected alternately in 2-water-jacketed burets, one with 1000-ml capacity and a 5% stem and the other with 500-ml capacity and a 1% stem, while the CO_2 was being absorbed from the previous sample in a pipet packed with steel wool and filled with caustic soln. A rapidly burning sample may be run in about 10 min.

12187. Shell, Haskiel R. **Chemical analysis of clay.** *U.S. Bur. Mines, Rept. Invest. No.*4420, 36 pp. (1949).—*C.A.* 43, 8628*e*.

Methods were given for moisture, ignition-loss, SiO_2, Al_2O_3, Fe_2O_3, TiO_2, P_2O_5, CaO, MgO, Na_2O, K_2O, total C, carbonate C, total S, sol. salts, and sol. sulfate. Tests showed that 1100°C was the min. temp. for const. ignition loss results within 1 hr. In detg. SiO_2, 2 dehydrations were necessary, the 1st with HCl and the 2nd with $HClO_4$ were chosen.

12188. Snyder, Robert E. and Clark, Ralph O. **Determination of free and combined iron in cracking catalysts.** *Proc. Am. Petroleum Inst. III.* 29M, 104-8(1949).—*C.A.* 44, 4662*i*.

The sensitive colorimetric reaction between o-phenanthroline and Fe^{++} was used. For total Fe, the catalyst was digested with hot HCl or fused with $KHSO_4$; for free Fe, it was treated with neutral $CuSO_4$ soln. and the excess Cu removed by displacement with pure Al. $NH_2OH.HCl$ was added, the pH of the soln. adjusted with an acetate buffer, and the colored complex developed.

12189. Tanner, Louis and Deming, W. Edwards. **The sampling of bulk materials.** *Proc. Am. Soc. Testing Materials* 49, 1181-6, discussion 1187-8 (1949).—*C.A.* 44, 9194*d*.

12190. Vesserberg, V.E. and Zhabrova, G.M. **Catalytic combustion column for gas analysis.** *Zavodskaya Lab.* 15, 1256 (1949).—*C.A.* 44, 1287*f*.

An app. suitable for gas analysis in the field utilized a combustion tube, filled with suitable catalyst, wrapped with Pt or Pd asbestos, heated preliminarily by ignition of some alc. poured on it, then inserted into a can contg. some MeOH. The continued combustion of MeOH vapor on the catalyst maintained 280-300°C within the combustion tube, which could be raised to 400°C by forcing air from bellows into the combustion chamber.

12191. Willits, C.O. and Ogg, C.L. **Report on standardization of microchemical methods. Carbon, hydrogen, and nitrogen.** *J. Assoc. Offic. Agr. Chemists* 32, 561-86 (1949).—*C.A.* 43, 8962*f*.

A comprehensive collaborative study of the methods was made. The semimicro procedure for C gave significantly better results than the micro procedure, provided variables other than sample size were disregarded. The data indicated that the A.O.A.C. micro-Kjeldahl method was unsatisfactory for many compds. with ring N.

12192. Allen, H.R. **Report on sampling fertilizers.** *J. Assoc. Offic. Agr. Chemists* 33, 229-34(1950).—*C.A.* 44, 8580*i*.

Results of a preliminary study were presented on reducing the inspection sample to the desired size and of prepn. of sample for analysis.

12193. Barber, E. Gordon. **The determination of moisture in coal.** *J. Inst. Fuel* 23, 296-6 (1950).—*C.A.* 45, 329*g*.

Accurate sampling of wet products was made more difficult by the uneven distribution of moisture in the batch or consignment. Duplicate sampling was desirable and the use of sub-samples and control charts was a necessary adjunct to a proper appraisal of the moisture content.

12194. Bogdanchenko, A.G. **Determination of elementary and carbonate carbon in blast-furnace dust.** *Zavodskaya Lab.* 16, 97-8(1950).—*C.A.* 44, 6764*i*.

The total C was detd. by combustion and the carbonate C by CO_2 evolution in the app. previously used for carbide detns.

12195. Burr, Alex. C. and Magnusson, Adelynn. **Sulfur in North Dakota lignite.** *Proc. North Dakota Acad. Sci.* 4, 49-51(1950).—*C.A.* 45, 3144*d*.

The data were based upon the analyses of 1017 samples. Org. S, sulfate, S, and pyritic S were found to be the principal forms in which S occurred.

12196. Coulson, J.M. and Maitra, N.K. **The mixing of solid particles.** *Ind. Chemist* 26, 55-60 (1950).—*C.A.* 44, 6202*i*.

The equation $ln\ (100/X) = kt$, where X = percentage unmixed, t = time and k a const. of proportionality, represented the mixing process for a binary solid-solid system in a simple drum mixer.

12197. Deinum, H.W. and Schouten, A. **The direct semimicro determination of oxygen in organic substances.** *Anal. Chim. Acta* 4, 286-99(1950). —*C.A.* 44, 10591*b*.

The procedure involved pyrolysis at 1050°-1100°C in a stream of O_2-free N_2, and conversion of all the O into CO by passing over carbon at the same temp.; the CO was oxidized to CO_2 by HgO, then absorbed in $Ba(OH)_2$ soln. and detd. titrimetrically. About 4 mg of oxygen was detd. with a max. error of 0.1 mg, and a mean error of 0.05 mg.

12198. Fedoseev, P.N. and Pavlenko, M.M. **Determination of carbon and hydrogen in the presence of catalysts. I.** *Zhur. Anal. Khim.* 5 296-9(1950).—*C.A.* 44, 10590*a*.

The substance to be analyzed was flamelessly surface-burned in a stream of air or O_2 passed at a rate of 100-300 ml/min. Cr_2O_3, tabletted and broken into pieces 1.5-2 mm, was used as surface combustion catalyst. The combustion carried out in high-melting glass, quartz, or porcelain tubes of 10-20 mm diam. and 350-760 mm long. Samples of 0.1-0.06 g were analyzed with sufficient accuracy.

12199. Harris, Charles C.; Smith, Donald M., and Mitchell, John Jr. **Direct determination of oxygen in compounds containing carbon, hydrogen, and oxygen. A physical-chemical technique.** *Anal. Chem.* 22, 1297-1304(1950).—*C.A.* 45, 979*c*.

The sample was decompd. in a stream of He and the pyrolysis products circulated in a closed system over carbon at 1100-50°C until all the O was converted to CO. During the circulation, practically all the H_2 was removed selectively by diffusion through a heated Pd tube. The compn. of the resulting He-CO mixt. was detd. with a thermal cond. bridge with a sensitivity of 0.20% CO per mv.

12200. Hüttig, G.F. **Catalytic activity and composition of oxide systems.** *Discussions Faraday Soc.* **1950, No. 8,** 215-22.—*C.A.* 45, 9988*e*.

Intermediate states in the transformation from an oxide mixt. to a chem. compound were important in the theory of catalysts. The transformation did not proceed discontinuously but went through individual characteristic states by the diffusion of the mobile component, i.e. the oxide of lower m.p. over the surface of the less mobile component. Later the mobile component became strongly bound and localized.

12201. Ipatieff, Vladimir N. and Pines, Herman. **Composition of W-6 Raney nickel catalyst.** *J. Am. Chem. Soc.* 72, 5320-1(1950).—*C.A.* 45, 2298*a*.

Raney nickel contained about 77% Ni, 21% Al_2O_3, 1.4% Al, and $NaAlO_2$ rather than Al and Ni. Treatment with HNO_3 proved Al_2O_3 was present. The high activity of the catalyst may be, in part, caused by the presence of Al_2O_3.

12202. Kipling, J.J. **Retention of sulfur by cokes and activated charcoals.** *Fuel* **29,** No. 3, 62-3(1950).—*C.A.* 44, 3699*a*.

The S content of a coal, of the coke made from it by carbonization to 700°C, and of a series of charcoals prepd. by steam-activation of the coke at 890°C, were detd. About 1/3 of the total S originally present in the coal escaped with the volatile matter on carbonization; all of the remainder was removed progressively by steam-activation of the coke. The coke and charcoals contg. Cu(2.5%) retained more of the original S as CuS.

12203. Kirsten, W. **Micro- and semimicrodetermination of carbon and hydrogen.** *Mikrochemie ver. Mikrochim. Acta* 35, 217-35(1950).—*C.A.* 44, 7712*i*.

Experiences in detg. C and H by different methods and an improved procedure and app. were described. Samples of 2-5 mg gave results within 0.1% of the truth for H and within 0.3% for C.

12204. Lowry, H.H. **Carbonaceous products from coal.** *Chemistry & Industry* **1950,** 619-25.—*C.A.* 45, 7335*e*.

Data obtained in the survey of coals carbonized by the U.S. Bur. of Mines were used to show quant. relationships between chem. and phys. properties of the cokes produced and the max. temp. to which the samples were heated. The properties of the cokes thus evaluated were the contents of volatile matter, O, N, and S, resp.; the C/H, and C/H, N, O + S ratios; the "true" and apparent sp. grs.; the 1.5-in. shatter index; and the size distribution.

12205. Lucas, Jacques and Millot, Georges. **The quartz content and behavior when heated of**

some refractory clays. *Géol. appliquée et prospection minière* 3, 63-88(1950).—*C.A.* 46, 6801*g*.
Chem. analyses, detns. of free SiO_2, expansion, loss of wt on heating, and x-ray detns. were made on kaolinitic clays.

12206. Miles, S.R. and Quackenbush, F.W. **Precision of samples and analyses of fertilizers and feeds.** *J. Assoc. Offic. Agr. Chemists* 33, 424-48 (1950).—*C.A.* 44, 8581*a*.
An investigation was conducted to det. how many bags of feed or fertilizer should be sampled to obtain a reliable sample. It was found that a sufficiently precise sample of a lot was usually obtained by taking full-length diagonal cores from a max. of 20 bags, regardless of the number of bags in the lot.

12207. Mott, R.A. **The rapid determination of the forms of sulfur in coal.** *Fuel* 29, No. 3, 53-61(1950).—*C.A.* 44, 3696*f*.
Org. S was obtained by the difference between the total S and the sum of sulfate and pyritic S. The present standard methods for detg. sulfate and pyritic S in coal required digestion for 40 and 24 hrs, resp., in dil. HCl and dil. HNO_3 at 60°C and at air temp. The proposed methods reduced the time of digestion to 30 min. for each acid, which was boiled.

12208. Mott, R.A. **Sulfur in coking coal.** *Coke and Gas* 12, 369-70(1950).—*C.A.* 45, 2179*f*.
Coal was ground to 72 mesh and extd. by boiling with 16% HCl 30 min., thus removing nonpyritic and sulfate S; another sample was extd. by boiling 30 min. with 2*N* HNO_3, removing pyritic S. Fe was detd. on the HNO_3 ext., then the non-pyritic Fe in the HCl ext. was deducted to calc. pyritic S as FeS_2.

12209. Pichler, Helmut and Merkel, Heinrich. **Chemical and magnetochemical investigations of iron catalysts used in Fischer-Tropsch syntheses. I.** *Brennstoff-Chem.* 31, 1-9 (1950); *U.S. Bur. Mines, Tech. Paper* **718**, 16-45 (1949).—*C.A.* 44, 3696*g*.
The compn. of Fe catalysts used in medium-pressure syntheses was studied by means of acid decompn. The activity of the catalysts increased with increasing formation of carbide during carburization. In synthesis the large amt. of carbide present after pretreatment decreased during the first days of operation to 0.2-0.4 g of carbidic C/10 g of Fe in an active catalyst; there was a corresponding increase in the O-content to 0.1-0.2 g/10 g of Fe.

12210. Pichler, Helmut and Merkel, Heinrich. **Chemical and magnetochemical investigations of iron catalysts used in Fischer-Tropsch syntheses. II. Magnetochemical investigations.** *Brennstoff-Chem.* 31, 33-42 (1950); *U.S. Bur. Mines, Tech. Paper* **718**, 47-100 (1949).—*C.A.* 44, 4223*h*.
Two Fe carbides, both having the formula Fe_2C, appeared in various stages in the prepn. and use of Fe catalysts for hydrocarbon synthesis. The more stable form had a Curie point of 265°C; the less stable a Curie point of 380°C.

12211. Pozzetto, L. **Rapid determination of the ash content of solid fuels by regulated combustion in oxygen.** *Rev. ind. minérale* 31, 156-61(1950).—*C.A.* 45, 4021*e*.
A sample of 1 g coal was dried in an air current at 100-10°C and burned in O_2 in a muffle at about 825°C. The whole procedure including crushing, drying, incineration, and weighing took only 13 min.

12212. Rodden, C.J. **Carbon, hydrogen, and oxygen.** *Natl. Nuclear Energy Ser.*, Div. VIII, 1, *Anal. Chem. Manhattan Project*, 271-86(1950).—*C.A.* 45, 1911*f*.
H was detd. in graphite and in powd. U by combustion in O_2 and absorption of the water in Anhydrone. To distinguish between H and H_2O, the latter was detd. first by heating in dry N_2. CO_2 was detd. by standard methods. Water in U_3O_8 was obtained by mixing with Na_2CO_3 and heating to 900°C. In UF_4, water was detd. by heating in N_2 and passing the liberated gases over Cu and then CuO; it was also detd. by mixing with Na_2CO_3 and heating to 1000°C in a stream of O_2. Water in UO_2SO_4 was detd. by thermal decompn. and allowing the gases to react with Na which formed H_2 from the H_2SO_4. The Karl Fischer method was successful for detg. H_2O in $UO_2(NO_3)_2$ and in its ethereal soln.

12213. Šimek, Břetislav G.; Helm, Jiří, and Koštál, Jaroslav. **Determination of free sulfur in coke and semicoke.** *Paliva* 30, 23-6(1950).—*C.A.* 44, 5566*i*.
A 10-g sample was extd. with benzene at 78°C or with CCl_4 at 60°C for 24 hrs. H_2S was removed by shaking with $CdCl_2$ or Cd acetate, and free S was pptd. by shaking with Hg. Hg sulfide was dissolved in aqua regia and the resulting H_2SO_4 detd. as the Ba salt. Added S (from 0.1 to 4.8% of the extd. semicoke) could be recovered quantitatively within 0.02%.

12214. Sutcliffe, G.R. **Determination of organic matter by acid ashing.** *J. Textile Inst.* 41, T196-7(1950).—*C.A.* 44, 8824*h*.
When $HClO_4$ oxidations were applied to material incapable of easy oxidation by HNO_3, explosions may occur. There was no danger with materials that were easily oxidized by hot HNO_3.

12215. Thomas, W.C. and Wilkinson, H.C. **Determination of carbon dioxide in coal.** *J. Soc, Chem. Ind.* (London) 69, 306-9 (1950).—*C.A.* 45, 2649*d*.
CO_2 was detd. by adding 10 ml of 5 *N* HCl and measuring the pressure increase in an app. of const. vol. Grinding the coal to 72 Brit. Standard mesh was satisfactory. The short period of heating and strength of acid used did not produce H_2S or release occluded CH_4.

12216. Unterzaucher, Josef. **A new automatic micromethod for the determination of carbon and hydrogen based on the micromethod for determining oxygen.** *Chemie Ing. Tech.* 22, 39-40 (1950).—*C.A.* 44, 3840*e*.
The unknown was oxidized in a stream of air over CuO, the excess O_2 removed from the combustion gas by Cu heated to about 500°C and the H_2O absorbed on anhyd. $BaCl_2$. The CO_2 was converted

to CO over a carbon catalyst heated to 1120°C and the CO made to react with I_2O_5 to form CO_2 and I_2. The I_2 was absorbed in dil. alkali hydroxide and titrated; the absorbed H_2O was then evapd. from the $BaCl_2$ and passed over the carbon catalyst where it was converted to CO, which was detd. as before.

12217. Yebra Montagut, Joaquín de and Rich, José Ma Mensa. **Analysis of mixtures of graphitic and amorphous carbon.** *Afinidad* 27, 488-93 (1950).—*C.A.* 45, 5568*b*.

A finely powd. sample (1.0 g) free from combined water and carbonates, was boiled for 2.5 hrs in a Kjeldahl flask with 30 g concd. H_2SO_4 and 2-3 g of K_2SO_4. The cooled liquid was dild. with water; the solid residue filtered off, washed, dried 2 hrs at 105°C, weighed, and calcined in O_2 until no dark or brilliant particles were seen. The residue was weighed as ash and the graphite calcd. by difference. The method was tested on Ceylon graphite, various coals, and carbon black.

12218. Aleixandre Ferrandis, Vicente and Garcia Verduch, Antonio. **Relations between certain physical, chemical, and technical properties of clays. II. III.** *Anales edafol. y fisiol. vegetal* (Madrid) **10**, 207-46; 327-400 (1951).—*C.A.* 46, 4187*f*.

Chem., mech., and thermal analyses of a no. of Spanish clays were made and the presence of org. and inorg. gels and the surface activity were detd. The base-exchange capacity was affected by fineness, but this was evident only in samples of the same compn. The montmorillonite samples had a capacity to absorb methylene blue of 159.9 mg/g, the illites less than 76, the halloysites less than 68, and the kaolins less than 12. The study of the clays was extended to include plasticity, viscosity, thixotropy, vol. of sedimentation, rate of loss of water through the mass, shrinkage on drying, porosity during drying, shrinkage during firing, and porosity, sintering, and mech. resistance in dried and fired samples.

12219. Ballow, F.H. Jr. **Limestone in the California beet-sugar industry.** *Calif. J. Mines Geol.* 47,9-16(1951).—*C.A.* 45, 4951*h*.

The prepn. and use of limestone in beet-sugar making was described. Desirable phys. and chem. qualities in the stone were: fine-grain size, 95% or more $CaCO_3$, 4% or less $MgCO_3$, and 1% or less SiO_2.

12220. Baron, J. **Determination of water of constitution and of carbon dioxide in ferrous minerals.** *Chim. anal.* 33, 92-4(1951).—*C.A.* 45, 4174*d*.

To det. H_2O by itself, heat the sample to 300°-350°C in a stream of dry air and pass the escaping gases through a mixt. of PbO and PbO_2 before absorbing the H_2O in weighed tubes contg. P_2O_5. The method for detg. CO_2 was similar to that commonly used.

12221. Belcher, R. and Goulden, R. **Microdetermination of carbon and hydrogen in organic compounds containing fluorine.** *Mikrochemie ver. Mikrochim. Acta* 36/37, 679-89(1951).—*C.A.* 45, 5067*f*.

Burn the substance in a silica combustion tube in O_2 at 4 ml/min. Complete the oxidation by passing the product over a Pt contact at 750°C. Ag wool at this temp. removed S and halogens, including the F from any HF formed. Use granular NaF to absorb SiF_4. Det. H_2O and CO_2 as usual by absorption in $Mg(ClO_4)_2$ and Ascarite, resp. Preliminary work with fluorocarbons indicated that these compds. could be analyzed in the same way, if water vapor was introduced.

12222. Bertholf, W.M. **The design of coal-sampling procedures.** *Am. Soc. Testing Materials, Symposium on Bulk Sampling, Spec. Tech. Pub.* No. **114**, 46-57, discussion, 58-65(1951).—*C.A.* 46, 10579*i*.

A min. no. of increments must be taken to obtain a sample of pre-assigned accuracy, regardless of the increment wt. The principal variances included the true variability of the coal from time to time, the random variation in increments, (such as no. of particles, particle wt, and ash content), and variations of reduction and analysis.

12223. Burr, Alex C. and Jaffer, M.M. **Sulfur in North Dakota lignite. III. Humic and resinic sulfur.** *Proc. N. Dakota Acad. Sci.* 5, 11-18 (1951).—*C.A.* 46, 7738*e*.

Total S was detd. by both the Eschka and turbidimeter methods; total inorg. S and sulfate S were detd. directly. Resinic S was detd. indirectly by subtracting from the total S the phenol-insol. fraction. Humic S, pyritic S, and total org. S were detd. by difference.

12224. Bush, Joseph L. **Determination of moisture in pigments with the Karl Fischer reagent.** *Natl. Paint, Varnish and Lacquer Assoc., Sci. Sect. Circ.* No. **748**, 15-22(1951).—*C.A.* 46, 2961*h*.

A sample of pigment suspended in MeOH was titrated with the Karl Fischer reagent. Results on various pigments agreed with oven-drying and toluene-distn. methods. This method could not be used for pigments such as Cu_2O, Cd red, and certain pigments contg. Pb and Zn.

12225. Chamberlain, E.A.C.; Caldwell, J.B., and Waters, P.L. **A variable-ratio sample-divider for granular materials and powders.** *Nature* **167**, 980-1(1951).—*C.A.* 46, 2345*i*.

Granular or powd. material (coal) fell by gravity through a duct and was deflected to alternate outlets by an oscillating chute. The rates of feed and of movement of the chute detd. the size of sample.

12226. Cuneo, R. **Devices and methods for water determination in different substances.** *Bull. école meunerie belge* **13**, 134-43(1951).—*C.A.* 46, 1389*e*.

The recent methods used in different countries were reviewed.

12227. Dalen, E. van. **Rapid determination of dissolved nitrate by catalytic reduction with hydrogen.** *Anal. Chim. Acta* 5, 463-71(1951)(in German).—*C.A.* 46, 7473*d*.

N as nitrate was estd. by reduction to NH_3 in alk. soln. by means of H_2 in the presence of a Ni catalyst. The NH_3 was transported by the H_2 to a receiver in which it was absorbed and titrated simultaneously. PO_4^{3-}, Ca^{2+}, K^+, Cu^{2+}, and Fe^{2+} did not interfere seriously but Cd^{2+} and Pb^{2+} caused low results.

12228. DUNDY, MORRIS AND STEHR, ERVIN. **Determination of oxygen in organic materials by a modified Schütze-Unterzaucher method.** *Anal. Chem.* 23, 1408-13(1951).—*C. A.* 46, 855*e*.

Analyses of hydrocarbon samples indicated O-content as high as 2.5%. This anomaly was caused by liberation of extraneous I_2O_5 through the partial reaction of the oxidant and the H_2 formed by the pyrolysis of the sample. A gravimetric procedure precluded interference due to extraneous I_2. The I_2 was retained in an absorption tube contg. crystals of $Na_2S_2O_3$ and suitable drying agents.

12229. EMERY, E.T.G. **Sampling of small coal.** *Engineering* 172, 452-4(1951).—*C. A.* 46, 2264*c*.

If the sampling was designed to limit the variability of the ash detn. to some predetd. value, other properties of coal, such as volatile-matter content and calorific value, would be obtained with sufficient precision. Since the general level of ash content may vary from place to place in the coal consignment, a sampling procedure for com. application should take this factor into consideration.

12230. GAMBLE, LEON W. **Spectrographic analyses of cracking catalysts. Determination of magnesium and zirconium.** *Anal. Chem.* 23, 1817-20 (1951).—*C. A.* 46, 5826*i*.

Spectrographic methods were applicable to either natural clay, synthetic silica-alumina, or silica-magnesia catalysts, or their mixts. For Mg the catalyst was mixed with CuO and graphite and arced at various intensity levels by means of a step sector; the ratio Mg 2779.8/Cu 2768.9 was used. Standards were prepd. by working pure catalyst into a slurry with known amts. of pure $Mg(NO_3)_2$ soln. and calcining. Cu was a better internal standard than Mo. The analytical range for Mg was 0.2-12% MgO. For Zr a similar technique with Co internal standard, was used.

12231. GANGULY, A.K. **Hydration of exchangeable cations in silicate minerals.** *Soil Sci.* 71, 239-44(1951).—*C. A.* 46, 318*g*.

The moisture content of silicate minerals was affected markedly by the exchangeable cations. The following nos. of mols. were found assocd. with various cations on bentonite: H 1, Na 2.86, K 0.96, Ca 6.6, Ba 2.84; on kaolinite, H 1, Na 2.93, K 1.29, Ca 8.5, Ba 3.54. These values were detd. from losses of wt on ignition.

12232. GLOGOCZOWSKI, JAN JACEK. **Simplified thermal analysis of clays.** *Nafta* (Poland) 7, 262-4(1951).—*C. A.* 46, 4424*d*.

The method was based on heating gradually a steel block having twin cavities filled with clay and with calcined Al_2O_3, resp., and recording at intervals of 2 min. the temps. read on two Hg thermometers inserted with their bulb ends into the samples. The differences in temp. were plotted against the temp. of the Al_2O_3. Irregularities in the resultant curve were indicative of exothermic or endothermic effects (e.g. removal of adsorbed H_2O, crystn. H_2O, changes in structure, etc.).

12233. GOUVERNEUR, P.; SCHREUDERS, M.A., AND DEGENS, P.N. JR. **Direct determination of oxygen in organic compounds. Some sources of error in the Schütze-Unterzaucher carbon reduction method.** *Anal. Chim. Acta* 5, 293-312 (1951)(in English).—*C. A.* 46, 855*d*.

The high blanks and extra corrections normally required were eliminated by changing the volumetric I_2 end point to a volumetric CO_2 one, and by improving the purification of the transport gas.

12234. GUNN, E.L. **Spectrographic determination of metal contaminants in cracking catalyst—characteristics of arc excitation.** *Anal. Chem.* 23, 1354-8(1951).—*C. A.* 46, 1237*i*.

Results indicated that arcing the catalyst sample to depletion did not provide as good precision as that obtained by a somewhat shorter arcing period in analysis. Basic compn. of the catalyst was a factor which significantly influenced the excitation characteristics exhibited by spectra of the contaminant elements.

12235. HALE, CECIL H. AND HALE, MARGIE N. **Carbon on cracking catalyst. Determination by combustion and conductivity.** *Anal. Chem.* 23, 724-6 (1951).—*C. A.* 45, 8750*g*.

An analytical method, based on the decrease in elec. cond. when CO_3^{--} replaced OH^-, was devised. For best detn., the NaOH soln. should have a concn. of 0.04 *M* with a sample size of 0.2-0.3 g of catalyst, so that the depletion of NaOH did not exceed 50%. The burning was followed closely because the measurements could be made in a few sec. The change in cond. was linear with the CO_2 absorbed.

12236. HAMMER, A.S. **Sulfide content of clays and its bearing on calculations for barium treatment.** *Ceram. Age* 57, No. 4, 17-18, 60 (1951).—*C. A.* 45, 7759*i*.

Many clays and shales contained S in the form of insol. sulfides, which exceeded the amt. of sol. sulfates. Sulfide S was usually ignored in the calcns. for the Ba requirement.

12237. HARMON, DUANE D. AND RUSSELL, RAYMOND G. **Impurities in catalyst materials—quantitative spectroscopic analysis with an alternating-current spark.** *Anal. Chem.* 23, 125-8(1951).—*C. A.* 45, 3751*a*.

A spectrographic method for the analysis of an Al silicate matrix catalyst for Fe, Ni, V, and Na with Si as an internal standard was described. Samples of catalyst were ground to 100 mesh before ignition at 500°C for 2 hrs.

12238. HENTOLA, YRJÖ. **The activation of native (Finnish) clays.** *Suomen Kemistilehti* 24A, 18-22 (1951).—*C. A.* 46, 662*d*.

Two deposits of clays suitable after activation as a catalyst for the polymerization of sulfate (kraft) turpentine to lubricating oil were found in Finland. Analysis of the former sample showed SiO_2 48.42-49.82, Al_2O_3 17.44-17.68, Fe_2O_3 13.12-14.24%. The clays were activated with H_2SO_4.

12239. HOLOWCHAK, JOSEPH AND WEAR, G.E.C. **Direct determination of oxygen in organic compounds.** *Anal. Chem.* 23, 1404-7(1951).—*C.A.* 46, 855*b*.

The modified procedure involved oxidation of the CO to CO_2 by means of CuO, collection of the CO_2 in a liquid-N_2 trap, and, after the residual gases were pumped out, detn. of the CO_2 manometrically in a standard vol. H_2 was removed as H_2O and frozen out in a Dry Ice trap.

12240. LIDDELL, F.D.K. **Coal sampling.** *Fuel* 30, 275-83(1951).—*C.A.* 46, 705*g*.

Sampling procedures should give an accurate sample and some measure of the variation in the lot of coal sampled. Duplicate samples should be taken so that the differences between the duplicates can be used to indicate accuracy. Further, the use of sub-samples will give an idea of the variation within a large quantity of coal. The sampling accuracy required will depend on the purpose of the sampling. For much routine work the accuracy of each sample could be much reduced from the present accepted standards; the total wt of coal to be examd. may not be substantially altered and the over-all gain would be considerable.

12241. MARTIN, F. **Rapid microanalysis of sulfuric ashes in organic materials (determination of alkalies).** *Mikrochemie ver. Mikrochim. Acta* 36/37, 660-4(1951).—*C.A.* 45, 5071*c*.

A combustion was conducted in a Pt boat with O_2 contg. a little SO_2. With the aid of the Pt as catalyzer, the S was all converted to SO_3. The alkalies remaining in the boat retained only sufficient SO_3 to form the anhyd. sulfates which were weighed.

12242. MERKEL, H. **Thermomagnetic analysis.** *Chem.-Ing.-Tech.* 23, 570-5(1951).—*C.A.* 46, 3897*c*.

Fundamental principles, construction of magnetic balances, and procedures were discussed. Mixts. of Fe, Fe_2O_3, and Fe_3C, of Cr and Ni in alloys, and examns. of metal-contg. catalysts were analysed.

12243. ORNING, A.A. **Coal-sampling problems.** *Am. Soc. Testing Materials, Symposium on Bulk Sampling, Spec. Tech. Pub.* No. 114, 29-35(1951). —*C.A.* 46, 10579*h*.

The economic sampling of coal required attention to max. piece to sample wt, and applicability to estimates of ash content, methods of mining as related to impurities, methods of handling affecting mixing of varying components. The compositing of alternate increments into 2 gross samples to be reduced and analyzed separately provided one method of routine control of sampling.

12244. OTTING, W. **Experiments for the explanation of the blank values in the microdetermination oxygen.** *Mikrochemie ver. Mikrochim. Acta* 38, 551-3(1951).—*C.A.* 46, 2446*a*.

Traces of Fe in the contact carbon acted as catalyst for the reduction of the quartz tube and thus gave rise to high blank values.

12245. RADMACHER, WALTER AND LANGE, WILFRIED. **The determination of the nitrogen content of solid fuels.** *Glückauf* 87, 739-46(1951).—*C.A.* 46, 2777*g*.

When the N-content of coals was detd. under the same conditions as for cokes, the results were too high, because pyrolytically formed CH_4 contaminated the N_2 and entered the azotometer. This CH_4 could be oxidized completely by a layer of Pt wool 40-50 mm long, heated to about 1000°C and placed directly behind the combustion tube with the sample. Procedures and results of the N detns. in coals, cokes, and org. N compds. (test substances) obtained with this modified Unterzaucher method were given in detailed tabular form.

12246. RODRIGUEZ PIRE, LUCAS. **Proximate analysis, swelling, and agglutination of coals.** *Combustibles* (Zaragoza) 11, 71-82(1951).—*C.A.* 45, 9831*g*.

Methods of sample prepn. and analysis were described. The sample prepn. method and methods for detn. of moisture, ash, volatile matter (British standard), and fixed carbon were taken from the ASTM and its British, German, and French counterparts. An increment in ash content of coal represented a loss in value substantially greater than the carbon it replaced, e.g. in blast furnace operation the ash in the coke was a large contributor to the S and other impurities to be dealt with.

12247. SCHUSTER, FRITZ. **Estimation of mineral constituents in bituminous coal.** *Brennstoff-Chem.* 32, 366-8(1951).—*C.A.* 46, 2264*h*.

12248. STALZER, ROBERT F. AND VOSBURGH, W.C. **Determination of available oxygen and total manganese in manganese oxides.** *Anal. Chem.* 23, 1880(1951).—*C.A.* 46, 2446*b*.

The error was greater with OsO_4 as catalyst than with iodate and was probably caused by atm. oxidation or Mn^{2+} in the presence of pyrophosphate. Good results were obtained by titrating under N_2.

12249. THORN, J.A. AND SHU, PING. **A new apparatus for the rapid determination of carbon by wet combustion.** *Can. J. Chem.* 29, 558-62(1951).—*C.A.* 45, 8938*i*.

A sample contg. 0.3-15 mg of C was analyzed. The sample was mixed with KIO_3 and Van Slyke-Folch combustion reagent (contg. CrO_3, sirupy H_3PO_4 and fuming H_2SO_4) and heated to 210°C in 7 9 min. at a pressure of 20-30 mm Hg. The CO_2 produced was allowed to diffuse through a tube contg. KI and Zn turnings into standard NaOH for another 10 min. after the cessation of heating. The NaOH was stirred magnetically during the absorption. The excess NaOH was titrated with HCl.

12250. UNTERZAUCHER, J. **Elementary determination of oxygen, a method of determining carbon and hydrogen developed from it, and a new procedure for carrying out the Dumas nitrogen determination for compounds difficult to burn.** *Mikrochemie ver. Mikrochim. Acta* 36/37, 706-26(1951). —*C.A.* 45, 5066*i*.

The method consisted in changing the O to CO at 1120°C, and causing the CO to react with I_2O_5 at 118°C, absorbing the liberated I_2 in NaOH soln., oxidizing it to IO_3^-, and titrating iodometrically with $Na_2S_2O_3$ soln. A new procedure for the microdetn. of C and H was given. The sample was burned in air over CuO, the excess O_2 removed by Cu heated to 500 °C, water removed by $BaCl_2$, and the CO_2 reduced to CO which was analyzed as in the detn. of O_2. The Dumas detn. of N in compds. hard to burn completely was discussed.

12251. WAGNER, HERBERT. **Notes on the determination of carbon and hydrogen.** *Mikrochemie ver. Mikrochim. Acta* 36/37, 634-40(1951).—*C.A.* 45, 5067*d*.

A somewhat modified combustion tube was recommended for detg. C and H by combustion and 2 readily exchangeable extension tubes were provided. To obtain good H values, it was recommended to burn samples free from N without any PbO_2 in the combustion tube and to use aged PbO_2 in the extension tube when N was present.

12252. WILLITS, C.O. AND OGG, C.L. **Report on standardization of microchemical methods (carbon, hydrogen, and nitrogen).** *J. Assoc. Offic. Agr. Chemists* 34, 607-20(1951).—*C.A.* 45, 10118*c*.

A statistical analysis of the results obtained showed that they were superior to or as good as those obtained in the previous study in which each analyst used his own method. Another collaborative study indicated that a microkjeldahl method for N employing 1.30 g of K_2SO_4 per 2 ml of H_2SO_4 was superior to one employing 0.85 g.

12253. WNEKOWSKA, LIDIA AND CZUBEK, STANISLAW. **Determination of phosphorus in bituminous coal.** *Prace Glównego Inst. Górnictwa, Komun.* No. 83, 14 pp. (1951)(English summary).—*C.A.* 46, 11628*d*.

Kjeldahl decompn. resulted in detn. of inorganically and organically combined P. Pyro- and meta P compds. were converted into the ortho form. After H_2SO_4 was sepd. by pptn., orthophosphates were detd. as ammonium molybdenum phosphate. This method was found to be up to 98.48% accurate (based on P content), and good reproducibility was obtained.

12254. WURZSCHMITT, BERNHARD. **Simultaneous determination of nitrogen and hydrogen in organic substances.** *Mikrochemie ver. Mikrochim. Acta* 36/37, 614-27(1951).—*C.A.* 45, 5066*g*.

Instead of using PbO_2 in the combustion tube, a small, weighed, drying tube was introduced between the combustion tube and the microazotometer. The N and H were detd. in the same app. and with the same filling of the combustion tube; in the first case CO_2 was used to drive out the combustion products from the tube and in the C detn., moist N_2 was used.

12255. BARTLET, J.C.; COUTU, CLEO; LIST, ETHEL, AND WOOD, MARGARET. **The composition of edible bone meal.** *Can. J. Technol.* 30, 137-42(1952).—*C.A.* 46, 8288*e*.

The compn. of 16 samples of edible bone meal from 3 processors was detd. The av. values obtained were Ca 33.0, P 15.4, total ash 87.9, and moisture 1.46% with only a slight variation between samples. The fluoride content varied between 350 and 770 p.p.m. with an av. of 572 p.p.m. The av. Zn was 129 p.p.m. and with one exception less than 10 p.p.m. Pb was present. Less than 10 p.p.m. of Cu and 1 p.p.m. As was found.

12256. BHATTACHARYA, A.T. AND GUPTA, M.P. **Nitrogen and sulfur of cokes and the possibility of their recovery.** *J. Proc. Inst. Chemists* (India) 24, 105-19(1952).—*C.A.* 47, 4063*g*.

Ordinary and synthetic cokes, prepd. by heating charcoal with different org. substances at 400°-800°C, were investigated with respect to N and S elimination. The synthetic product was invariably the more active of the two, with respect to both adsorption and elimination of N and S.

12257. BRYSON, ALEXANDER AND PICKERING, W.F. **The determination of moisture in coal with the Karl Fischer reagent.** *J. Inst. Fuel* 25, 28-30(1952).—*C.A.* 46, 2265*a*.

Prior to titration, the coal was suspended in MeOH for short periods, and to improve the clarity of the end point, it was found desirable, although not always essential, to extend this period to at least 15 min. The results combined the accuracy of a distn. procedure with the speed, simplicity, and convenience of the oven-drying method.

12258. DUKE, FREDERICK R. **The disproportionation of manganate ion. Manganese dioxide as a heterogeneous catalyst.** *J. Phys. Chem.* 56, 882-4(1952).—*C.A.* 47, 958*d*.

The disproportionation was followed by measuring the absorption of the manganate ion at 600 mμ. The reaction was forced to go to completion by adding tetraphenylarsonium chloride, which removed the $KMnO_4$ as it was formed. The MnO_2 formed acted as a catalyst.

12259. ELPHICK, J.O. AND GERSON, T. **Conductometric determination of sulfur in coal.** *Fuel* 31, 438-44(1952).—*C.A.* 46, 11628*f*.

The calorimeter bomb washings were boiled, neutralized with excess (approx. 0.0025 *N*) NaOH, brought to a boil, filtered while hot, and then after cooling titrated conductometrically against $Ba(OH)_2$ soln. Significant results were obtained when the wt of S detd. was not less than 0.0016 g, with 0.8 g of coal. The results were in good agreement with those obtained by the Eschka method for all coals tested.

12260. EVANS, U.R. AND TOMLINSON, R. **A new method for the transfer of oxide films from heat-tinted iron to glass or plastic.** *J Applied Chem.* (London) 2, 105-9(1952).—*C.A.* 46, 6515*h*.

A heat-tinted Fe or stainless steel specimen was attached to glass by means of petroleum jelly or sealing resin, and the Fe then removed anodically, leaving the film clinging to the transparent support.

12261. GRASSNER, FRIEDRICH. **Determination of traces of sulfur in organic materials.** *Z. anal. Chem.* 135, 186-91(1952).—*C.A.* 46, 6036*e*.

The new procedure consisted in vaporizing the material in a suitable app. through which H_2 slowly flowed, burning the resulting mixt. of gases in O_2 against Pt, absorbing the resulting SO_3, and measuring the turbidity produced with $BaCl_2$.

12262. Guérin, Henri; Bastick, Marthe, and Marcel, Paul. **The direct determination of oxygen in combustible solids.** *Chaleur & ind.* 33, 177-80(1952).—*C.A.* 46, 10580*d*.

Two methods of O analysis in coal were compared with 11 different coals, some high in S. The preferred method involved pyrolysis in N_2 at 1200°C, passage of the gases through wood charcoal at 1200°C to give CO, subsequent oxidation to CO_2 with a Pt catalyst, and finally, gravimetric detn. of CO_2.

12263. Guérin, Henri and Marcel, Paul. **The direct determination of oxygen in coals. II. Method of hydrogenation.** *Bull. soc. chim. France* 1952, 310-11.—*C.A.* 46, 10580*b*.

The method based on the pyrolysis of the sample and the transformation of the oxygenated compds. of H_2O by catalytic hydrogenation was investigated. At 325°C and with a delivery of 2 liter H_2/hr, the conversion of CO and CO_2 to H_2O was quant. A catalyst of reduced Ni with 2% Th proved to be satisfactory for coals poor in S. Oxides of Fe, carbonates, and sulfates interfered in the detn.; silica did not.

12264. Howard, H.C. **Evidence for the cyclic structure of bituminous coals.** *Ind. Eng. Chem.* 44, 1083-8(1952).—*C.A.* 46, 6362*i*.

Consideration of the at. C:H ratios in the coal series, as well as the nature of the products obtained in degradations by mol. distn. up to 525°C, solvent action at 250° to 400°C, hydrogenation at 300° to 400°C, and oxidation at 100° to 270°C led to the conclusion that coal was predominantly cyclic in character.

12265. Jahns, Hans. **Accuracy of sampling coal and ores.** *Glückauf* 88, 289-303(1952).—*C.A.* 46, 6561*d*.

The sample wt should be proportional to the wt of the shipment. In sampling a conveyor belt the timing of the sample must be such that the quality was not influenced by the end of a shift or other extraneous conditions. The wt of the largest particles in the sample should be as small as practical in relation to the wt of the sample, a ratio of 1:3000 being desirable.

12266. Jahns, Hans. **The influence of the largest particles on sample quartering and the residue left in the apparatus on the accuracy of sampling.** *Glückauf* 88, 684-8(1952).—*C.A.* 46, 9461*h*.

A statistical survey was given of the effect of factors such as the ratio of the wt of large particles to the wt of the sample and of the effect of sample prepn. on the accuracy of sampling.

12267. Key, C.W. and Hoggan, G.D. **Spectrographic method for analysis of cracking catalysts.** *Anal. Chem.* 24, 1921-5(1952).—*C.A.* 47, 2638*i*.

Cr, Fe, Ni, Na, and V in silica-alumina cracking catalysts were detd. spectrographically. A high-voltage spark and a rotating-disk electrode contg. Li_2CO_3 as flux and buffer and Co as internal standard were used.

12268. King, J.G. **Standard methods of coal analysis.** *Coke and Gas* 14, 363-7(1952).—*C.A.* 47, 3541*i*.

The standards covered sample analysis, detn. of total moisture, ash and mineral matter, volatile matter and calorific value, C and H, total S, N, O, calcn. of the "ultimate" analysis, P, Cl, and As, forms of S, caking properties of coal, crucible swelling test, Gray-King assay coke type and Arnu test, agglutinating value, reporting of results, and sampling of coal.

12269. McCarthy, Robert and Moore, Carl E. **Determination of free carbon in atmospheric dust.** *Anal. Chem.* 24, 411-12(1952).—*C.A.* 46, 4709*d*.

Treat 0.2-0.8 g of sample with 25 ml of concd. HNO_3 and boil 20 min. Dil. with 125 ml of 6 *N* HNO_3 and let stand over night. Filter through a tared, filtering crucible, dry 2 hrs at 140°C, cool, and weigh. Ignite for 2 hrs at 700°C, cool, and weigh. The loss in wt was due to oxidation to gaseous CO_2. In large cities the carbon content of the dust may reach nearly 50%

12270. Otsubo, Yoshio and Kato, Chuzo. **Hydrothermal synthesis of Japanese acid clay. I. II.** *J. Chem. Soc. Japan,* Pure Chem. Sect. 73, 146-8; 148-50(1952).—*C.A* 46, 10057*f*.

The clay was synthesized from Al_2O_3 gel, silica gel, $Mg(OH)_2$, and water in the steel autoclave at 300°C and under 85 atm. The product was studied by thermal, chem., and x-ray methods and found to consist of montmorillonite 35, beidellite 58, and silica gel 7%. The acidity, color reactions, swelling, and decolorizing abilities of synthesized products were studied.

12271. Pagliassotti, J.P. and Porsche, F.W. **Spectroscopic determination of metals in silica-alumina cracking catalysts.** *Anal. Chem.* 24, 1403-5(1952).—*C.A.* 47, 69*g*.

Ignite the sample to 815°C for 1 hr and then dissolve in acid. Analyze the soln. spectrographically for Fe, V, Ni, Cu, Pb, Ca, and Mg with a pos. rotating electrode by interrupted-arc or spark discharge. Na was detd. by the flame photometer with precision and accuracy both within ±1% of the amt. present.

12272. Schöberl, Heimo. **Determination of the oxygen content of coals.** *Brennstoff-Chem.* 33, 241-4(1952).—*C.A.* 46, 10580*a*.

Best results were obtained by the use of a modified differential method in which the true content of mineral matter was used instead of the ash content, and in which consideration was given to the carbonate C content.

12273. Shugar, D. **Semiquantitative spectrographic analysis of the boron content of graphite and carbon.** *Bull. centre phys. nucleaire, Univ. libre Bruxelles* No. 34, 5 pp. (1952).—*C.A.* 46, 6029*c*.

A powd. sample of graphite or carbon was mixed well with a $Ca(OH)_2$ suspension and evapd. to dryness. It was then fired at 850-900°C for 1.5 hrs. The resulting mixt. was divided into 3 portions, each being packed into a 5-mm deep hole in

Acheson graphite electrodes. Arcing was carried out at 10 amps. for 60 sec. Intensity of the 2497.8 A. line of B was estd. with a 7-step sector. Standards were made up with known quantities of B in the $Ca(OH)_2$ suspension.

12274. Shultz, J.F.; Seligman, B.; Lecky, J., and Anderson, R.B. **Studies of the Fischer-Tropsch synthesis. XII. Composition changes of nitrided iron catalysts during the synthesis.** *J. Am. Chem. Soc.* 74, 637-40(1952).—*C.A.* 46, 5290*h*.

Chem. and x-ray analyses were used to det. changes in the compn. of nitrided Fe catalysts during use in the Fischer-Tropsch synthesis at 7.8 and 21.4 atm. The ϵ-nitrides were converted slowly to ϵ-carbonitrides; the rate of replacement of N by C was somewhat more rapid at 21.4 than at 7.8 atm. At 7.8 atm. pressure, oxidation and deposition of carbon proceeded at a very slow rate, whereas at 21.4 atm. these reactions were considerably more rapid in some catalysts. When used nitrided catalysts were treated with H_2, the N was removed almost completely, but the C content was not changed greatly.

12275. Tendolkar, G.S. and Thakoor, N.R. **Ash from coconut shell.** *J. Sci. Ind. Research* (India) **11B**, 501(1952).—*C.A.* 47, 6122*a*.

The ash content of coconut shell at 550° and 750°C was 0.67 and 0.46% ash, resp., based on the wt of the oven-dried material.

12276. Tendolkar, G.S. and Thakoor, N.R. **Ultimate analyses of coconut shell and shell charcoal.** *J. Sci. Ind. Research* (India) **11B**, 501-2 (1952).—*C.A.* 47, 5664*h*.

Ultimate analyses of the shell and the shell charcoal were carried out and the variation of C, H, and calorific value of charcoal with temp. of carbonization was studied. The coconut shell contained: C 51.58; H 5.83; N 0.145; S 0.055; Cl 0.324; ash 0.49; and O (by difference) 41.576%.

12277. Wildenstein, Raoul. **Alteration of Ascarite.** *Mikrochemie ver. Mikrochim. Acta* 39, 194-5(1952).—*C.A.* 46, 6776*c*.

Examn. showed that considerable free NaOH was present, but the absorption of CO_2 was very slow although regeneration occurred after rapid trituration. Apparently, the sample of Ascarite was covered with a thin film of Na_2CO_3.

12278. Wurzschmidt, B. **Microdetermination of carbon and hydrogen without lead dioxide.** *Mitt. Lebensm. Hyg.* 43, 126-8(1952).—*C.A.* 46, 7937*b*.

The combustion tube was packed with CuO/Ag pumice-Cu-CuO/Ag pumice.

12279. Banerjee, N.G. **Determination of carbon and hydrogen in coal.** *J. Sci. Ind. Research* (India) **12B**, 24-8(1953).—*C.A.* 47, 6633*d*.

The method was used for coal, coke, coal tar, pitch, coal ext., and montan wax, with results that compared favorably with standard methods. The precision for C was 0.10% and for H was 0.03%. Fourteen detns. could be made in 7 hrs.

12280. Belcher, R. **A wet-combustion method for the determination of chlorine in coals.** *Anal. Chim. Acta* 8, 16-21(1953)(in English).—*C.A.* 47, 4579*e*.

Cl was detd. in coals by wet-combustion with H_2SO_4 in the presence of $K_2Cr_2O_7$ and Ag_2SO_4. The liberated Cl was absorbed in H_2O_2 and detd. acidimetrically after treatment with $Hg(OH)CN$.

12281. Fereday, F. and Flint, D. **Use of mineral matter formulas in the classification of coal.** *Fuel* 32, 115-16(1953).—*C.A.* 47, 2956*f*.

For evaluating elementary analyses of coal for the purpose of classification, two formulas for mineral matter were suggested, both derived by statistical methods from a large no. of coal analyses.

12282. Foster, Margaret D. **Geochemical studies of clay minerals. III. The determination of free silica and free alumina in montmorillonites.** *Geochim. et Cosmochim. Acta* 3, 143-54 (1953)(in English).—*C.A.* 47, 6831*b*.

The uncombined SiO_2 or Al_2O_3 was found by the following method: Digest 1 g of sample with 75 ml of 0.5*N* NaOH in a covered Pt crucible for 4 hrs, stirring at intervals of 30 min. After filtration, wash the undissolved material several times with 1% NaOH. Neutralize the filtrate with HCl and add 5 ml in excess. Det. SiO_2 and Al_2O_3 in the usual way. The free SiO_2 or Al_2O_3 was found by detg. the excess of either oxide over that found in the clay.

12283. Frei, Erwin. **Sampling and sample preparation of solid fuels.** *Z. Erzbergbau u. Metallhüttenw.* 6, 56-62(1953).—*C.A.* 47, 5091*i*.

12284. Goodman, John B.; Gomez, Manuel, and Parry, V.F. **Determination of moisture in low-rank coals.** *U.S. Bur. Mines, Rept. Invest. No.* 4969, 20 pp. (1953).—*C.A.* 47, 6632*c*.

Volumetric methods, which gave the most if not all the recoverable H_2O short of that derived from coal decompn., were the most accurate. The problem of air oxidation in the low-rank, high-moisture coals was eliminated by distn. methods. The coal particle was protected at all times by the liquid or vapor phases of the oil or xylene.

12285. Headlee, A.J.W. and Hunter, Richard G. **Elements in coal ash and their industrial significance.** *Ind. Eng. Chem.* 45, 548-51(1953). —*C.A.* 47, 5094*i*.

Analyses of 596 spot samples of coal ash were made for 38 elements. Na, K, Ru, Ca, Mg, Si, Cr, and Mn were present in the coal ash to a lesser extent than their av. presence in the earth's crust. Li, Sr, Ag, As, Bi, B, Ga, Ge, La, Hg, Pb, Sb, Sn, Zn, and Zr had enrichment values (coal ash to earth's crust) between 10 and 185.

12286. Mitsui, Tetsuo. **Organic elementary analysis. V. Removal of nitrogen oxide in the microdetermination of carbon and hydrogen.** *Japan Analyst* 2, 3-5(1953).—*C.A.* 47, 5844*d*.

Instead of using Pregl's PbO_2 for removing NO in detg. C and H in org. compds. contg. N, the use of a satd. soln. of $K_2Cr_2O_7$ in concd. H_2SO_4 was tried. Samples contg. NH_2 groups gave good results, but NO_2 groups gave high H values. A device to prevent the condensation of H_2O on the end of the combustion tube or on the joints of train was described.

12287. TOMLINSON, R.C. AND HALL, DAVID A. **Analytical tolerances and the detection of mistaken results with particular reference to coal analysis.** *Fuel* 32, 77-81(1953).—*C.A.* 47, 2956*g*.

It was usual to fix tolerances to the difference between duplicates, so that if the tolerance was exceeded, further detns. were carried out to detect whether an error had been made. Care must be taken in fixing the tolerances; if they are too close unnecessary extra work will be called for. A method for fixing the tolerances was outlined.

VI-3. Density and Other Physical Properties (Hardness)

12288. KING, A.T. **Specific gravity of wool and its relation to swelling and sorption in water and other liquids.** *J. Textile Inst.* 17, 53-67T (1926).—*C.A.* 20, 1326.

The effect of sorption on the actual detn. of sp. gr., penetration by solvents and oils, influence of salts on swelling and sorption, and density methods of detg. regain and of estg. wool-cotton mixts. were discussed.

12289. MURPHY, E.J. AND WALKER, A.C. **Electrical conduction in textiles.** *J. Phys. Chem.* 32, 1761-86 (1928).—*C.A.* 23, 1273.

The rate of change of resistivity with moisture content was much greater for silk and wool than for cotton, and for a given moisture content the resistivity of silk or wool was greater than that of cotton.

12290. STAMM, ALFRED J. **Electrical conductivity method for determining the moisture content of wood.** *Ind. Eng. Chem., Anal. Ed.* 2, 240-4 (1930).—*C.A.* 24, 4240.

The elec. resistance of wood increased over a millionfold from a 20-35% moisture content (satn. of the fibers) to the oven-dried condition. A linear relationship existed between the logarithm of the sp. elec. resistance and the moisture content.

12291. HEERTJES, P.M. **Density determinations as an aid in examination of fibers.** *Chem. Weekblad* 36, 610-11 (1939).—*C.A.* 34, 4565^{5}.

An examn. of the d. of cotton in He-H_2O mixts. showed that part of the adsorbed H_2O (6.25%) was actually fixed in the cellulose lattice and the remainder (about 20%) was adsorbed on the surface in the usual manner.

12292. BOUTARIC, A. **Investigations of the viscosity of colloidal solutions.** *Rév. gén. sci.* 51, 231-4 (1940-41).—*C.A.* 37, 2978^{7}.

Measurements on hydrous sols of clay, bentonite, humin, gum arabic, As_2S_3, $Fe(OH)_3$ and serum albumin were reported. The effect of electrolytes and acetone were investigated. The viscosity-concn. relation for the disperse phase was interpreted on the basis of Arrhenius' equation: $\ln \eta/\eta_0 = Ac + Bc^2$. ($\eta_0$ was the visocity of the pure solvent; A and B were consts.)

12293. HALLER, K. **Microscopic test of hardness.** *Werkzeugmaschine* 44, 465-70 (1940).—*C.A.* 37, 3640^{8}.

A micro hardness-testing app. was described and its possible uses reported for testing the variation in hardness in an Eloxal coating on Hydronalium as well as for measurements of hardness on a Cr-matrix steel and a high-speed steel.

12294. SCOGNAMIGLIO, CIRO. **Activated carbon.** *Riv. fis. mat. sci. nat.* 14, 385-94(1940).—*C.A.* 37, 515^{3}.

The true d. of a series of commercial activated carbons dried in vacuum at 300°C was detd. by the pycnometric method. Water could not be used for this purpose. The values obtained with toluene were always higher than those obtained with benzene. With benzene, the density was detd. in the same manner for specimens of carbon of the same origin (almond shells but of varying degrees of activation). An increase from 1.08 to 1.92 was found for an increase in the period of activation (with water vapor) from 0 to 45 minutes.

12295. SHAROV, V.S. AND BUTOVSKAYA, V.A. **The production and the properties of calcium clay in the state of primary dispersity.** *Colloid J.* (U.S.S.R.) 6, 587-96 (1940).—*C.A.* 37, 6519^{5}.

The percentage of particles under 0.001 mm of Na clay was the same whether the suspension was prepd. from powd. clay or from a thick dough; that of Ca clay was less if made from powd. clay. Expts. with the Kudin clay indicated that by grinding thick clay dough it was possible to obtain from a soil satd. with bivalent cations a suspension of the same degree of dispersion as from Na soil.

12296. DÉRIBÉRÉ, M. **Effect on reflecting power in the near infrared of liquids absorbed by solids.** *Compt. rend.* 213, 379-80 (1941).—*C.A.* 36, 6857^{3}.

Measurements of percentage of reflection of finely powd. ZnO, kaolin, pptd. silica, sand, Prussian blue, and graphite contg. 0-9% H_2O showed a rapid initial decrease followed by a slow decrease tending to an asymptotic value corresponding with the value for a liquid paste. The influence of the liquid was shown by data for pptd. Al_2O_3 contg. 0-5% of various liquids.

12297. HEERTJES, P.M. **The density and sorptive capacity of some samples of cotton, silk and wool. II. Determinations on silk.** *Rec. trav. chim.* 60, 329-41(1941).—*C.A.* 35, 8303^{2}.

The densities of raw silk, of fibroin obtained by degumming raw silk, and of dyed fibroin were detd. in H_2, He, benzene and air. The amts. of H_2 and of air adsorbed were also measured at various temps. The d. in He was independent of temp. and was the true d. Reproducible detns. of the adsorption of air could not be obtained.

12298. HEERTJES, P.M. **The density and sorptive capacity of some samples of cotton, silk, and wool. III. Determinations on Egyptian cotton.** *Rec. trav. chim.* 60, 689-99(1941).—*C.A.* 37, 1275^{2}.

The density of mercerized cotton, dyed and undyed, in H_2, He, and air as well as the apparent density in air, H_2, water, and benzene were detd. Cotton dyed with substantive dyes was unchanged and the dye was between the micelles. Air and H_2 were adsorbed by cotton. The amount of adsorbed gas was not affected by the dyeing operation.

12299. Higuti, Izuni. **Dielectric properties of a substance in the sorbed state.** *Bull. Inst. Phys. Chem. Research* (Tokyo) (Abstracts (in English) 33-4 (in *Sci. Papers Inst. Phys. Chem. Research* (Tokyo) 38, Nos. 1036-8)) 20, 489-513 (1941).—*C.A.* 37, 3985^1.

The dielec. const. of PrOH sorbed by TiO_2 gel was measured between 70° and -70°C. Values in the adsorbed state and in the state of capillary condensation from -60° to 40°C were calcd. Both were less than those for the bulk liquid, the differences increasing with fall of temp.

12300. Courty, Clément. **Magnetic properties of porous bodies.** *Compt. rend.* 215, 18-20(1942).—*C.A.* 38, 6144^7.

The additivity law applied to "clean" porcelain (i.e. washed in water) and H_2O and to pulverized activated coconut charcoal and H_2O. It did not apply, however, to "dirty" porcelain and H_2O nor to granular charcoal (whether activated or not) and H_2O. The failure of the additivity law in these cases was ascribed to the difficulty with which the H_2O penetrated the pores.

12301. Courty, Clément. **The magnetic properties of the iron included in activated charcoals.** *Compt. rend.* 215, 461-3(1942).—*C.A.* 38, 6144^2.

The coeff. of magnetism of Fe_2O_3 existing in activated charcoal was large, but less than that of the pure compd. It was a function of the particle size, becoming larger as the surface increased due to the larger quantity of air retained on the surface.

12302. Dériberé, M. **Role of pH in the preparation and use of silicic acid sols.** *Chimie & industrie* 47, 538-40(1942).—*C.A.* 37, 4288^6.

Silica gel was transformed into a sol by replacing the water with NH_3 soln., either by purifying the gel and soaking it in 0.5-1% NH_3, or by treating it with NH_3 gas, or by washing the unpurified gel with ammoniacal H_2O. Such a peptized gel heated 24 to 48 hrs was liquified to a sol. The pH of such sols was 8 to 10. However, if the sols were prepd. by pptn. from a soln. of silicate by HCl, followed by dialysis, they were capable of cataphoresis and had neg. charges. Hence, colloidal silica was amphoteric, the isolec. point being at pH = 2.5.

12303. Heertjes, P.M. **The density and sorptive capacity of several samples of cotton, silk and wool. IV. Remarks on the sorption of water by cotton, silk and wool.** *Rec. trav. chim.* 61, 751-62(1942).—*C.A.* 38, 3137^8.

The true vol. of water held by 1 ml of dry fiber was $1 + (q'/100) = d_h\,[(p/s) + (1/d_w) + (1/d_h) - (1/d_b)]$, where q' = vol. increase by water taken up minus the vol. of the non-accessible pores of the fiber as detd. by sorption with benzene, d_h, d_w, d_b = the densities of the fiber in He, water and benzene, s = d. of water and p = g of water adsorbed per g of fiber substance. At first the water mols. entered the outer layers of the fiber. Then the water-intake continued by adsorption on the inner and outer fiber substance without any noticeable change in vol. Finally, the water was taken up by capillary condensation in the pores of the fiber, still without any noticeable change in vol.

12304. Hendricks, Sterling B. **Lattice structure of clay minerals and some properties of clays.** *J. Geol.* 50, 276-90 (1942).—*C.A.* 37, 585^2.

Minerals appearing in clays generally had layer lattice structures formed from (1) uncharged layers with OH ions on both surfaces, (2) OH ions on one surface and O ions on the other, (3) O ions on both surfaces, (4) charged layers with O ions on both surfaces or (5) two types of layers, one with OH ions on both surfaces and the other with O ions on both surfaces. The discussion was limited to class (2) kaolin minerals, serpentines, and cronstedtite; class (3) pyrophyllite and talc; class (4) hydrous micas (illite, bravaisite, pholidolite), glauconite, celadonite, and the montmorillonite-nontronite group of minerals.

12305. Heyes, J. and Lueg, W. **A new method for the characterization of the surface quality of materials.** *Mitt. Kaiser-Wilhelm Inst. Eisenforsch. Dusseldorf* 24, No. 3, 31-9; *Werkstattstech u. Werksleiter* 36, 98-104 (1942).—*C.A.* 37, 4946^7.

Highly polished and very rough surfaces, plane or curved, were tested by detg. the ratio between the light brown thrown into the microscope objective by the surface under bright-field illumination and the same under dark-field illumination. The reciprocal value of this ratio was a measure for the roughness.

12306. Meincke, Hermann. **The determination of maximum hardness with the ball method.** *Z. Metallkunde* 34, 289-91 (1942).—*C.A.* 38, 2298^1.

The use of max. hardness instead of Brinell hardness led to a better evaluation of the metal with respect to compression and tensile-strength data. A modified equation was obtained: $H = P\,[(1.28/d^2) - (0.4/D^2)]$ where H = hardness, P = the load, d the diam. of impression, and D for the diam. of the steel ball.

12307. Hüttig, G.F. and Hennig, W. **Reactions in the solid state. CXXXII. Dilatometric study of fritting in lead powders.** *Z. anorg. allgem. Chem.* 251, 260-9 (1943).—*C.A.* 37, 5633^5.

Finely powdered Pb (99.92%) was compressed in rectangular rods and the linear expansion observed in H_2, A, N_2 and air. The results were compared with those obtained with compact Pb. Up to 100°C reversible expansion occurred; at higher temps. fritting set in, retarded by the absorbed gases which were partly expelled at 225°C. This was noticed in the dilatometric curve by the concealed max.

12308. Milner, G.; Spivey, E., and Cobb, John W. **The solid product of carbonization.** *Proc. Chem. Soc. London* 1943, Part II, 578-89.

True specific gravity of cokes reached approximately 1.4 at 500°C and 1.8 at 800°C, with very slight further change to 1200°C. The absence of progress to 2.25, the specific gravity of graphite, was attributed to gas (which escaped very slowly) between the layers of graphitic crystallites. Oxygen remaining in the substance carbonized was held responsible for the subsequent gasification from 500°C upwards. Increasing the surface of a coke by carbonizing it with admixed inert material increased reactivity but not adsorption.

12309. Moll, W. **The density of cellulose.** *Beih. Z. Ver. deut. Chem. A: Chemie, B: Chem. Tech.* **1943**, No. 47, 105-11—*C.A.* **38**, 6091^6.
Pycnometer and gasometric d. measurements for regenerated cellulose gave a value of 1.52 (earlier values were 1.4-1.6). The use of the suspension method (especially in CCl_4) led to much greater accuracy. The av. value of the usual com. fibers was about 1.520 ("mantle fibers" 1.507, native fibers (cotton) and pulp 1.54). The d. of regenerated cellulose was independent of its degree of polymerization, its concn. in the viscose and its stretching during the spinning.

12310. Morris, Humbert and Selwood, P.W. **Magnetic moments on some catalytically active substances.** *J. Am. Chem. Soc.* 65, 2245-52 (1943).—*C.A.* 38, 294^4.
Magnetic-susceptibility measurements, over a range of temp. and field strength, were made on a series of Ni-activated Cu hydrogenation catalysts, on Ni supported on magnesia, and on a catalyst derived from NH_4 Ni molybdate. Active Cu-Ni catalysts were a continuous series of solid solns. ranging in compn. from about 66 to 92.5% Ni. Pure metallic Ni was not present. Thermal deactivation was accompanied by diffusion of Cu into the Ni-rich alloys. Poisons affected a small but measurable fraction of the Ni atoms.

12311. Rossman, R.P. and Smith, W.R. **Density of carbon black by He displacement.** *Ind. Eng. Chem.* 35, 972-6(1943).—*C.A.* 37, 5896^8.
Liquid pycnometer ds. of com. carbon blacks were found considerably lower than the resp. ds. computed from x-ray diffraction. Ceylon graphite was used to interrelate d. data, structure of the working particle, and reinforcing value as rubber pigment. He ds., were preferable for surface-area detns., and H_2O values were adequate for ink and rubber compounding. For graphite, Carbolac 1, grade 6 rubber black, and Shawinigan acetylene black, resp., the "immediate He d." was found to be 2.26 ± 0.1, 2.10, 1.88 and 1.84: the "final He d." (after pentration of He into the free space within the working particle) 2.26, 2.13, 1.90 and 1.95: and the "H_2O d." 2.26, 1.99, 1.82 and 1.79.

12312. Schumb, Walter C. and Rittner, Edmund S. **A helium densitometer for use with powdered materials.** *J. Am. Chem. Soc.* 65, 1692-5 (1943). —*C.A.* 37, 6497^9.
The densitometer was applicable to fine powders that did not appreciably adsorb He and did not possess appreciable vapor pressures at room temp. The method was accurate to ± 0.1% with samples of about 0.5-ml vol. and a ratio of bulk to true d. of about 0.5.

12313. Hermans, P.H.; Hermans, J.J.; Vermass, D., and Weidinger, A. **Volume relations in the system cellulose-water. (Preliminary communication).** *Rec. trav. chim.* **63**, 44-5(1944)(in English).—*C.A.* **39**, 1584^9.
The d. of cellulose in water, rather than that in other media, must be regarded as the true d. D. was a typically macroscopic concept which must be replaced by considerations involving the packing of spheres when systems of mol. dispersion were discussed.

12314. Illingworth, J.W. **The density of textile fibers. I.** *Textile Recorder* **61**, No. 737, 60-2, 64-5(1944).—*C.A.* **38**, 6102^1.
The d. of a fiber in an inert medium such as benzene was usually very close to the value obtained for the over-all d. Porosity of these fibers was apparently very small and swelling must take place before there was appreciable penetration of the fiber. An anamolous d. figure indicated penetration. The apparent d. at any regain = 100 + $R/[(100/Da)\ (R/Ds)]$, where R = percentage regain, Da = apparent d. of the dry fiber and Ds the d. of the swelling medium. This permitted calcn. of the apparent d. at any regain, knowing the apparent d. of the dry fiber.

12315. Lauer, K. and Westermann, U. **Cellulose fibers. VI. Density determinations of cellulose in different media.** *Kolloid-Z.* **107**, 89-93(1944).—*C.A.* **39**, 183^6.
The d. of cellulose was influenced by the mol. forces between the OH groups and certain groups of the displacement media in which the measurements were made. The influence was small when H_2O was used. The influence was appreciable if the medium was an org. liquid (e.g., higher alcs., $CHCl_3$, acetone, benzene or toluene). The d. values in the org. liquids were all lower than those for H_2O.

12316. Lauer, K. **Cellulose fibers. VII. The physical structure of fibers.** *Kolloid-Z.* **107**, 93-103(1944).—*C.A.* **39**, 183^9.
The dry and wet strength of native cellulose and cellulose hydrate fibers as measured in H_2O and org. liquids were discussed.

12317. Mason, B. **The determination of the density of solids.** *Geol. Fören. Förh.* **66**, No. 1, 27-51 (1944) (in English).—*C.A.* **40**, 6903^3.
The concept of d. and 6 different methods used for its detn. in mineralogical work (volumetric, gas volumenometer, La Chatelier and Bogitch, pycnometric, Archimedes, direct comparison with heavy liquid) were discussed. The possible sources of error in the detn. were considered.

12318. Serrallach Juliá, José and Rotllant de Franch, Mario. **A technical method for the analysis of active carbon.** *Ion* 4, 840-6 (1944). —*C.A.* 39, 2467^5.
Methods for detg. apparent d., heat of wetting, adsorptive capacity and concn. of impurities for active carbon were described.

12319. Smith, W.R and Wilkes, G.B. **Thermal conductivity of carbon blacks.** *Ind. Eng. Chem.* 36, 1111-12(1944).—*C.A.* 39, 602^8.
The thermal cond. of 2 samples of com. carbon black was found to be lower than that of still air, viz. 0.141 and 0.148, resp., apparently independent of apparent d. and ultimate particle size.

12320. WADDAMS, A. LAWRENCE. **Flow of heat through granular materials.** *Chemistry & Industry* 1944, 306-10.—*C.A.* 38, 5438^9.
Theoretical methods were reviewed and considered not yet satisfactory.

12321. WADDAMS, A. LAWRENCE. **The flow of heat through granular material.** *J. Soc. Chem. Ind.* 63, 337-40(1944).—*C.A.* 39, 1091^4.
A simple and reliable method of measurement of the apparent thermal cond. of granular materials was described which involved unsteady heat flow from the surface to the axis of a cylinder of material.

12322. BERKELHAMER, LOUIS H. AND SPEIL, SIDNEY. **Differential thermal analysis. II.** *Mine & Quarry Eng.* 10, 273-9 (1945).—*C.A.* 40, 2378^4.
The hydrothermal and thermal analysis curves of kaolin were given and the effect of rate of temp. rise on the form and position of the peak in the thermal-analysis curve shown. Differential curves of kaolin and quartz mixts., kaolin and bentonite mixts., bauxite flotation products, and distinctive characteristics of montmorillonite, beidellite, allophane, Fuller's earth, and bleaching clay were given.

12323. HEERTJES, P.M. **Volume relations in the system cellulose-water.** *Rec. trav. chim.* 64, 52-3; 53-4(1945)(in English).—*C.A.* 40, 786^1.
The true d. of cellulose was discussed. The closest approximation to the true d. of a porous material was found with He.

12324. KRIEGER, K.A. **Apparatus for measurement of the density of porous solids.** *Ind. Eng. Chem., Anal. Ed.* 17, 532 (1945).—*C.A.* 39, 4271^1.
A method was described for detn. of the d. of a porous solid using He as the displaced fluid.

12325. LECLERC, YVES. **Testing methods for carbon black and lamp black.** *Rev. gén. caoutchouc* 22, 18-19 (1945).—*C.A.* 40, 6788^8.
Procedures were outlined for detg. the true d., apparent d., moisture, volatile matter, ash, acetone ext., fixed carbon, particle size, grit, absorptive capacity, coloring power, covering power, color, pH value, and reenforcing power in rubber.

12326. RIBAUD, GUSTAVE AND BÉGUÉ, JULIETTE. **Temperatures of sublimation of carbon under reduced pressure.** *Compt. rend.* 221, 73-5 (1945).—*C.A.* 40, 1713^5.
A graphite cylinder (20 mm diam. and 50 mm high) was heated in a high-frequency furnace in A at pressures from 3 to 76 cm. The cylinder was heated gradually to about 2000°C. The power was then increased considerably above that necessary for sublimation and the time-temp. curve was plotted. The temp. at which this flattened out was taken as the temp. of sublimation. Also, the temps. of operation for different power inputs were detd. The flattening of the input-temp. curve gave the temp. of sublimation. Between 3 and 76 cm, the temp. (T°K) of vaporization was represented by the equation $T = 3424 + 5.37\ p - 0.0118\ p^2$, where p = pressure.

12327. URAZOVSKIĬ, S.S. **Variation of the specific gravity of precipitates and a new method for its determination.** *Trudy Khar'kov. Khim.-Tekhnol. Inst. im. S. M. Korova* No. 5, 40-3 (1945)(in Russian).—*C.A.* 42, 808*c*.
A known amt. of substance was pptd. with a known amt. of precipitant in a pycnometer which was then filled up to the mark and weighed; the wt G of the ppt., being known from the amts. of the reactants, gave the wt g of the supernatant liquid. Since the vol. V of the pycnometer and the sp. gr. d of the liquid phase were known, the sp. gr. D of the ppt. was found: $D = G/[V - (g/d)]$. Detns. on $BaSO_4$ pptd. from $BaCl_2$ with H_2SO_4 1/2 N, 1/4 N, and 1/8 N, at 19.3°C, gave D = 3.08, 3.37, and 3.97, resp.

12328. WILSON, D.M. **Sieving and bulk-density tests.** *J. Oil Colour Chem. Assoc.* 28, 104-7 (1945).—*C.A.* 39, 4497^9.
Coarse pigment particles retained by a 300-mesh sieve were examd. microscopically to detect possible adulteration. Percentages of coarse residue in typical pigments were given. Bulk densities were easily detd. by settling the pigment in C_6H_6 by a standardized procedure and observing the settled vol. The result was computed by $D = M/V$, where D = bulk d., M g of pigment, and V the vol. of settled bulk in ml.

12329. BANGHAM, D.H., AND FRANKLIN, ROSALIND E. **Thermal expansion of coals and carbonized coals.** *Trans. Faraday Soc.* 42B, 289-94 (1946).—*C.A.* 42, 6512*h*.
The thermal expansion coeff., α, up to 400°C was detd. on 3 coals: (1) a bituminous coal of high O-content; (2) a bituminous coal of high C-content, and (3) anthracite coal. The α for each temp. range was practically independent of the preheat temp. below 300°C. Within each temp. range (about 50°) α, for coals (1) and (2) was independent of: (a) "rank"; (b) whether artifact or monolith; (c) pressure applied during fabrication (of artifacts); and (b) orientation with respect to the bedding plane (of monoliths).

12330. GUEST, R.M.; MCINTOSH, R., AND STUART, A.P. **The pore structure and adsorptive properties of some activated charcoals. II. The apparent density of charcoal in liquid media.** *Can. J. Research* 24B, 124-36 (1946).—*C.A.* 40, 7573^5.
The apparent d. of 8 charcoal samples was detd. in a series of liquids at 25° and 55°C. A correlation between apparent d. of the charcoal and surface tension of the measuring fluid was suggested. An attempt was made to explain this approx. regularity in terms of the surface free-energy change on immersion.

12331. HERMANS, P.H. AND VERMAAS, D. **Density of cellulose fibers. I. Introduction and experiments on the penetration of liquids into dry cellulose.** *J. Polymer Sci.* 1, 149-55(1946).—*C.A.* 40, 5255^2.
Substances like H_2O and glycerol penetrated very slowly into dry cellulose; indifferent org. liquids did not penetrate into dry fibers, even after being heated for 24 hrs at 100°C. On penetration by water vapor, sharp, microscopically visible boundary lines appeared between the wet and the dry portions of the fiber.

12332. HERMANS, P.H.; HERMANS, J.J., AND VERMAAS, D. **Density of cellulose fibers. II. Density and refractivity of model filaments.** *J. Polymer Sci.* 1, 156-61(1946).—*C.A.* 40, 5255⁵.

Densities were detd. (by the flotation method), and *n* (by immersion methods) of the following types of dry model filaments from viscose: (1) common isotropic fibers, (2) similar fibers which had first been subjected to a steam treatment, and (3) highly oriented filaments. Densities were detd. by means of mixts. of CCl_4 and $PhNO_2$. The immersion liquids used in the optical measurements were standardized mixts. of Bu stearate and tritolyl phosphate; contamination with moisture during the measurements was carefully avoided.

12333. HERMANS, P.H.; HERMANS, J.J., AND VERMAAS, D. **Density of cellulose fibers. III. Density and refractivity of natural fibers and rayon.** *J. Polymer Sci.* 1, 162-71(1946).—*C.A.* 40, 5255⁸.

A micromethod was described for d. detns. of artificial cellulose fibers by the floating method in CCl_4 under dry CCl_4 vapor; the method was accurate to within 1 part per thousand. The d. was derived from the temp. at which the samples neither sunk nor floated. The temp. varied, with the kind of fiber, between 45° and 65°C. Refractive power was measured simultaneously. The ds. were given for native ramie, of contracted and reoriented ramie, and of several series of rayon fibers spun with increasing stretch.

12334. LYSAGHT, VINCENT E. **The Knoop indenter as applied to testing nonmetallic materials ranging from plastics to diamonds.** *ASTM Bull.* No. 138, 39-44(1946).—*C.A.* 40, 2699⁶.

Hardness data were reported on diamond (Knoop no. 5500-6950), other stones, such as sapphire (Knoop no. 1837), on dentine and enamel, on plastics, such as cellulose acetate (Knoop no. 18.1), cellulose acetobutyrate, and polystyrene (Knoop no. 16.7), and on various glasses (Knoop nos. 373 to 546).

12335. MAGGS, F.A.P. **Adsorption-swelling of several carbonaceous solids.** *Trans. Faraday Soc.* 42B, 284-8(1946).—*C.A.* 42, 6200*a*.

Adsorption-swelling relations in MeOH were detd. on charcoal blocks, monoliths of coal, and compressed coal powder artifacts after heating. The swelling-adsorption relations with charcoal were detd. by its obedience to Hooke's law, the dimensional change being proportional to the pressure of the films formed at its inner surfaces. The stress-strain relation for charcoal resulted in a straight-line curve, but that for coal was complex.

12336. MEADE, GEORGE P. **Apparent specific gravity of refined sugar.** *Ind. Eng. Chem.* 38, 904-5 (1946).—*C.A.* 40, 6856⁷.

A simple method was described for wt/ft³ of refined sugars. The app. consisted of a metal funnel 7 in. in diam. and 7 in. on the vertical axis with a slope of 67.5°. A 5/8 in. brass nozzle with a shear gate was attached at the bottom. Sugar was run from the funnel into a 1000-ml tared and calibrated Erlenmeyer flask with a 1-1/4 in. mouth. After the flask was filled, the sugar was poured back into the funnel and the flask refilled and weighed. This gave a reproducible wt. The av. wt of refined sugars by this method was 50 lb/ft³. Large-grain sugars were lighter than small grain, but mixts. of large and small grain gave wts higher than any of the components.

12337. SCHWAB, G.M. **Mechanical strength as electron effect.** *Experientia* 2, 103-4(1946) (in German).—*C.A.* 40, 4010².

The Brinell hardness of Hume-Rothery alloys depended on their electron concn. in the same way as did catalytic activation energy and elec. resistance. A wave-mechanical theory of hardness based on the more or less total completion of the Brillouin zones was proposed.

12338. THIELE, E.W. **Material or heat transfer between a granular solid and flowing fluid. Present status of the theory.** *Ind. Eng. Chem.* 38, 646-50 (1946).—*C.A.* 40, 4284⁷.

The work so far reported on the computation of the transfer of material (or heat) was reviewed when a fluid (liquid or gas) was passed through a bed of granular solid. There was need for better and more exptl. information.

12339. DOBRY, JAROSLAV. **A new apparatus of Czechoslovak construction for measuring hardness.** *Hutnicke Listy* 1, 177-80(1947).—*C.A.* 41, 5075*d*.

A force of up to 30 kg/mm² was applied by means of a spring, and the depth of the impression left in the material by a diamond pyramid was detd. with the attached microscope. The hardness corresponding to each reading was given.

12340. JAGER, F. **The grinding of powders.** *Tech. moderne* 39, 357-9 (1947).—*C.A.* 42, 1767*i*.

The slow application of high pressures to sand or cement in a cylinder further decreased the particle size, and more efficiently than by normal milling methods. Pressing to 9000 kg/cm² produced the max. compressive strength in cement, although higher pressures were necessary for particle-size analysis to show an increase in fineness. Tests with 2.6 kg steel balls falling 1 to 2 m indicated that max. instantaneous av. pressures of 28,000 to 23,000 kg/cm², resp., were reached at the contact against a flat steel plate.

12341. MARIANI, EUGENIO. **The actual density of coke.** *Ann. chim. applicata* 37, 47-50(1947). —*C.A.* 41, 5704*i*.

Coke ground to 60 mesh was not fine enough to give a true d.; it was necessary to grind to 200 mesh.

12342. PENTICE, T.K. AND CLEMES, A. **Crushing and grinding efficiencies. Discussion.** *J. Chem. Met. Mining Soc. S. Africa* 47, 283-5 (1947).—*C.A.* 41, 4971*a*.

Tests were carried out on a milling unit consisting of a 9-ft × 10-ft primary ball mill in closed circuit with a 10-ft × 25-ft rake classifier, followed by two 8-ft × 16-ft secondary pebble mills, each in closed circuit with sep. 16-ft bowl classifiers at the mines of the Venterspost Gold Mining Co., Ltd. The surface areas of the various screen fractions of the samples were calcd. down to -28 mesh by means of the Prentice H_2O and paraffin method. The specific surface of smaller sizes was detd. by the air-permeability method.

12343. Rossi, Corrado. **Granulometric measurements on powders.** *Proc. Intern. Congr. Pure and Applied Chem.* 11, 609-20(1947).—*C.A.* 44, 5183*f*.

The d. of a suspension was detd. with a Westphal balance and plotted vs. time; the av. diam. of the particles could then be calcd. from the initial slope. Values so obtained agreed well with microscope values both for direct products of chem. reaction and for pulverized materials.

12344. Ault, W.B. **A method for the determination of the apparent density of dry powders.** *J. Soc. Chem. Ind.* 67, 313-15(1948).—*C.A.* 43, 3265*a*.

Work was done mainly on pptd. $CaCO_3$ with an apparent d. ranging from 0.100 to 1.310. The app. was: (1) a dropping box built to confine (2) 250-ml graduated cork-stoppered cylinder weighing 240 g, allowing only a vertical movement, (3) a timing device, and (4) a standard 30-mesh sieve. Prep. 40-g sample (w) by rubbing through the 30-mesh sieve and transfer to the cylinder carefully. Place in the dropping box. Record vol. before (V_o) and after (V_d) dropping 50 times at a rate of 1 drop/2 sec. The apparent d., (AD) $= w/V_d$ and V_o indicated the lightness or bulk. The test was accurate to 1 ml on a V_o of 250 ml or to an AD of 0.002.

12345. Franklin, Rosalind E. **A note on the true density, chemical composition, and structure of coals and carbonized coals.** *Fuel* 27, No. 2, 46-9(1948).—*C.A.* 42, 7003*i*.

The true sp. vol. of coals was a linear function of the H-content, and the d. of a hypothetical coal of zero H-content would be considerably lower than that of graphite. This indicated that there was a fundamentally similar structure in a wide range of different coals, and that this was markedly different from that of graphite. The true d. of various carbonized coals was primarily dependent on the max. carbonization temp.

12346. Haayman, P.W. **Use of inorganic, nonmetallic materials in the electrical industry.** *Chem. Weekblad*, 44, 603-8 (1948).—*C.A.* 45, 4151*g*.

Resistors unaffected by temp. were prepd. by heating ceramic tubes, roughened by treating with HF, to 800-900°C in the vapor of a hydrocarbon. A smooth, graphitic layer was gradually built up. Resistors with a very high temp. coeff. were produced by mixing Fe_2O_3, MgO, and Cr_2O_3, and heating the mixt. in N_2 to approx. 1300°C. For resistors in which the resistance value depended on the direction of the current, very pure Si, prepd. by decompg. $SiCl_4$, was mixed with 0.1-0.01% of Al and B.

12347. Hatta, Shiroji and Maeda, Shiro. **Heat transfer in granular beds. I-II.** *Chem. Eng.* (Japan) 12, 56-64(1948).—*C.A.* 45, 5465*e*.

Theoretical equations were derived for axial temp. distribution caused by the heat transfer between the fluid passing through the granular beds and the wall of const. temp., with the assumption that chem. reaction was absent and the only resistances to heat transfer were that in turbulent core and that in the fluid film near the wall.

12348. Reif, Arnold E. **The lump density of coke.** *J. Inst. Fuel* 22, 24-31, 52(1948).—*C.A.* 43, 378*i*.

The experimentally detd. lump density of a porous body varied with the state of the body and with the inherent nature of the method used for its detn. The lump density of a porous body, which had a definite limit of max. pore size, may lie in the range between the density of individual mol. units and the true lump density; with no max. limit of pore size it may lie in the range between the density of individual mol. units and zero density. Coke was best evaluated from a consideration of the shatter test, bulk density, and lump density.

12349. Utescher, K. **Chemistry of Fuller's earth clays.** *Z. Pflanzenernähr. Düngung u. Bodenk.* 42, 228-41 (1948).—*C.A.* 43, 7651*d*.

A clay suitable for the prepn. of Fuller's earth was fine and sandy; 85-92% of the particles were less than 0.01 mm in diam. It was extensively disintegrated but the disintegrated products were still present. In spite of effluorescence it was very rich in exchangeable bases, especially Na. Bentonite-like compds. were responsible for the fine distribution of the clay particles and consequently the great effective adsorptive surface.

12350. Adams, J.T. Jr.; Johnson, J.F., and Piret, Edgar L. **Energy - new surface relationship in the crushing of solids. II. Application of permeability measurements to an investigation of the crushing of halite.** *Chem. Eng. Progress* 45, 655-60 (1949).—*C.A.* 44, 380*f*.

In contrast to the straight line reported previously for brittle materials such as quartz, fluorite, glass, and labradorite, the energy input-new surface relationship for cryst. NaCl had a pronounced curvature over the same range of energy input. X-ray diffraction photographs indicated that plastic deformation occurred under the conditions of crushing used. The efficiency of crushing was confirmed as being extremely low.

12351. Agroskin, A.A.; Mikhaĭlik, A.D.; Pitin, R.N., and Sapronov, V.S. **Bulk weight of some coals of the Donets basin.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* 1949, 532-7.—*C.A.* 45, 6365*f*.

The bulk wt of samples up to 6-mm particle size reached a min. at 7-8% H_2O content. An addn. of 0.05-0.8% of kerosine caused a progressive increase in bulk wt to a max. which in some cases was in excess of 20%. The optimal amt. of kerosine varied with the coal used and with its H_2O content, being about 0.1-0.4%.

12352. Akamatsu, Hideo and Inokuchi, Hiroo. **The electric resistance of various kinds of carbon.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 70, 185-9 (1949).—*C.A.* 45, 4110*b*.

Measurements by the potential-drop method were made on the compressed powd. samples. The relation between resistivity p and pressure p was expressed by $p = (a/p) + b$, for p greater than 30 kg/cm², where a and b were consts. Thus, carbons were classified according to the values of b:

graphite (b = 0.02-0.03 ohm-cm), C_2H_2 black (b = 0.07-0.09), carbon black (b = 0.2-0/8), and charcoal ($b \approx 10^3$).

12353. BEARER, LOUIS C.; FINDLAY, R.A., AND GOINS, R.R. **Development of test methods for heat-exchange pebbles.** *Petroleum Refiner* 28, No.12, 104-8 (1949).—*C.A.* 44, 3729*f*.

Resistance to mech. shock included resistance to abrasion and crushing strength. A choice of suitable pebbles for use as heat carriers could be made based on these data. The particular process in which the pebble was to be used governed the actual selection. Several of the pebbles studied possessed the desired properties to a high degree. The method of making the pebbles was found to be of great importance.

12354. BOEHLER, ROBERT E. AND ASON, THOMAS. **Determining densities and adsorption of gases by solids.** *Anal. Chem.* 21, 1568-70(1949).—*C.A.* 44, 4818*f*.

The vol. of the material was detd. by gas displacement and was based on the equation correlating the amt. of a gas to the time needed to escape through an orifice until a certain pressure-drop was obtained at a const. temp. By comparison of a dense and porous material the addnl. vol. was found. The timing was done automatically by elec. contacts in the Hg manometer. The values obtained were in agreement with liquid displacement detns.

12355. DELASSUS, MARCEL; GEORGIADIS, CONSTANTIN, AND MONTIGNY, P. **The state of carbon in metallurgical coke.** *Compt. rend. congr. ind. gaz, Lyon* (Assoc. tech. ind. gaz France) 66, 597-611 (1949).—*C.A.* 46, 6809*i*.

Dilatometric tests of coal mixts. were not infallible and must often be substantiated by costly and inconvenient large-scale tests in cokeries. The cohesion of a coke could not be related with graphite content. Resistivity and cohesion measurements of coal mixts. pyrogenated in the lab. showed no direct relation between these 2 properties.

12356. DÉRIBÉRÉ, M. **Testing of surface conditions by fluorescence.** *Rév. gén. mécan.* 33, 251-6 (1949).—*C.A.* 43, 7368*a*.

Defects on the surface of materials were made more clearly visible than by other known methods by applying a very thin fluorescent film which fills all cracks, fissures, and irregularities. The material was also applied as a powder on the surface where the condition of the test piece did not permit the other method, as in testing antiques, paintings, etc. The piece is then examd. in filtered ultraviolet light. Fluorescent substances, suitable liquids, and photographic plates were discussed; a yellow fluorescence was best for visual examn.

12357. DOBROCVETOV, E.N. **The specific gravity of solids as a function of some physical constants.** *Bull. soc. chim. Belgrade* 14, 1-11 (1949)(English summary).—*C.A.* 46, 4288*d*.

The sp. gr. of solids depended not only on the mass per unit vol. but also on the vol. occupied by the particles ("own mass vol.," v_k). For elements with coordination nos. 12, 8, 6, and 4, v_k = 0.7405, 0.6802, 0.5236, and 0.34 ml, resp. The sp. gr. of elements and binary compds. was given as a function of the coordination no.: $d = v_k \{(1 \times 10^{24})/(4/3)\pi R^3\}\{[(A + B)/2]/(6.061 \times 10^{23})\}$ (R = interionic or interat. half-distance, A and B = at. wt of 2 adjacent particles: for elements $(A + B)/2$ = at. wt; for binary compds. $(A + B)/2$ = mol. wt).

12358. FRANKLIN, ROSALIND E. **Fine structure of carbonaceous solids by measurements of true and apparent densities. I. Coals.** *Trans. Faraday Soc.* 45, 274-86(1949).—*C.A.* 43, 5653*f*.

True d. was detd. with He and the apparent d. with MeOH, water, *n*-hexane, and benzene liquids. He rapidly and completely filled the pore space of coals ground to pass a 72 B.S. sieve. The pore space was filled by MeOH almost completely in a few hrs. There was a contraction of 2.6×10^{-8} ml for each cm^2 of surface covered by MeOH. Water, *n*-hexane, and benzene filled the pore space of some low-rank coals practically completely; *n*-hexane and benzene penetrated only very slowly into the pore space of some coals.

12359. FRANKLIN, ROSALIND E. **Fine structure of carbonaceous solids by measurements of true and apparent densities. II.** *Trans. Faraday Soc.* 45, 668-82(1949).—*C.A.* 43, 9412*d*.

The d. of 4 coals carbonized from 300° to 1650°C were detd. with He, MeOH, water, and *n*-hexane. CS_2 was also used with one coal and C_6H_6 with another. After heating to 600°C there was a large pore vol. which was accessible to He, but inaccessible to *n*-hexane. As the carbonization temp. was increased above 600°C, this pore vol. increased however, it became less accessible to fluids. MeOH, CS_2, and water were successively excluded; and, after carbonization at 1,000°C, He was excluded from the pores of one coal and penetrated only slowly into the others. The adsorption of He, H_2, CH_4, and O_2 decreased with increasing carbonization temp.

12360. HATTA, SHIROJI AND MAEDA, SHIRO. **Heat transfer in granular beds. III. Factors affecting the turbulent conductivity and the film coefficient.** *Chem. Eng.* 13, 79-84(1949). —*C.A.* 45, 5465*f*.

12361. HUDSON, DOUGLAS R. **Density and packing in an aggregate of mixed spheres.** *J. Applied Phys.* 20, 154-62(1949).—*C.A.* 43, 2842*i*.

In close-packing of spheres, 2 types of interstice were noted, bounded by 6 and by 4 convex spherical surfaces. These were termed "square" and "triangular." They were connected by a continuous labyrinth through which a ball not exceeding a specified radius could be threaded. In both cubic and hexagonal arrangements, their shape and size were identical, but their distribution differed. Radii R for n smaller balls, which could take up patterns with cubic symmetry within each square interstice, were calc. for values of n up to 27 and plotted. When R/r was plotted against the d. increment attributable to this interstitial packing, a set of spires was obtained.

12362. JOHNSON, J.F.; AXELSON, J., AND PIRET, EDGAR L. **Energy-new surface relationship in the crushing of solids. III. Application of gas adsorption measurements to an investigation**

of crushing of quartz. *Chem. Eng. Progress* 45, 708-15(1949).—*C.A.* 44, 879*c*.

The crushing of quartz was studied covering a much wider range of energy input to the material than that previously reported. Screened particles retained in a steel mortar were crushed by impact and also by slow compression. Surface areas of the samples were measured by the gas adsorption and also by the permeability method. Use of the drop-wt method resulted in a definitely curved relation of energy input to new surface, while a practically straight line was obtained by slow compression. Adsorption areas of the crushed samples were shown to bear a const. ratio of about 2.0 to the permeability areas.

12363. KWONG, J.N.S.; ADAMS, J.T. JR.; JOHNSON, J.F., AND PIRET, EDGAR L. **Energy-new surface relationship in crushing. I. Application of permeability methods to an investigation of the crushing of some brittle solids.** *Chem. Eng. Progress* 45, 508-16 (1949).—*C.A.* 43, 8751*f*.

The crushing of quartz, fluorite, glass, labradorite, and a few other solids was studied. Crushing was accomplished by dropping a steel ball on a piston resting on the material in a steel mortar. Surface areas of the samples were measured by the permeability method. The relation of energy to new surface for these materials was shown to be a straight line through the origin over the range studied.

12364. MACKENZIE, J.K. AND SHUTTLEWORTH, R. **A phenomenological theory of sintering.** *Proc. Phys. Soc.* (London) 62B, 833-52 (1949).— *C.A.* 44, 1771*i*.

The rapid increase of d. during the sintering of single substances was studied. The d. of a compact was calcd. as a function of the time for 2 different laws of deformation. The effect of gas in the pores was calcd. in the case of the viscous law. The theory suggested that gas pressures of a few atms. applied to the outside of a compact could appreciably increase the rate of sintering.

12365. SMEKAL, A. **The initiation of reactions between solid phases.** *Powder Met. Bull.* 4, 120-6(1949).—*C.A.* 44, 14*g*.

For contact areas of 10^{-7} cm diam., forces of a few γ produced stresses sufficient for the splitting of chem. valence bonds. Up to diam. of 1 micron, the full strength of the chem. bonding forces may be utilized. Beyond this, the notch effect had to be taken into account. Local reactions were stimulated which were accompanied by the liberation of heat in the order of magnitude of heats of fusion. This could no longer be considered a process involving only solid phases. Such small loads as created by packing may initiate chem. reactions between solids as well as sintering of metals.

12366. ZHAVORONKOV, N.M.; AEROV, M.E., AND UMNIK, N.N. **Hydraulic resistance and packing density of a layer of grains.** *Zhur. Fiz. Khim.* 23, 342-60(1949).—*C.A.* 43, 5645*h*.

Glass tubes (diam. $D = 0.8$-10 cm) were filled with Pb shot (diam. $D' = 0.25$ cm) or steel balls ($D' = 0.32$ or 0.71 cm), and ϕ = (vol. of solid): (vol. of system) was detd. as function of $n = D/D'$. Air was forced upward through these tubes and the pressure gradient Δp detd. If f was the coeff. of friction of an equiv. tube and *Re* its Reynolds no. (between 2 and 800), $f = (36.3/Re) + 0.4$ as long as $n > 3$. Also catalyst tablets gave a similar result.

12367. AUVIL, H. STUART AND GAYLE, JOHN B. **Physical properties of coke: size and its measurement.** *U.S. Bur. Mines, Rept. Invest.* No. 4735, 27 pp.(1950).—*C.A.* 45, 846*i*.

Twelve samples of run-of-oven coke were taken at coke plants in the United States and Canada. Sampling procedure was directed toward obtaining the highest possible degree of uniformity in the gross samples. Under these conditions the standard deviation of the screen analysis test on 500-lb samples was found to range from 1.2% for the 1-in. screen to 4.5% for the 5-in. screen. Statistical procedures were given to check on the adequacy of a testing procedure.

12368. BEVAN, D.J.M. AND ANDERSON, J.S. **Electronic conductivity and surface equilibria of zinc oxide.** *Discussions Faraday Soc.* 1950, No. 8, 238-41, discussion 241-6.—*C.A.* 45, 9989*b*.

The electronic cond. of ZnO at 500°-1000°C, in air, varied widely according to prepn. of the oxide. At low O_2 pressures the cond. was quasi-metallic, and fairly reproducible for samples irrespective of their origin. At pressures greater than 0.01-0.1 mm for any one sample, the cond. varied with O_2 pressure in readily reversible fashion. The bulk-phase cond. of zinc oxide was probably high, but electrons were trapped by chemisorption of O_2 on the surface. The cond. of ferric oxide at 500°-600°C displayed similar features, a pressure-independent conducting state preceding the dissocn. to Fe_3O_4.

12369. BUSLIK, DAVID. **Mixing and sampling with special reference to multi-sized granular material.** *ASTM Bull.* No. 165, 66-73(1950).—*C.A.* 44, 5652*g*.

Equations were developed for the detn. of the min. size of sample that should be taken to obtain results within prescribed sampling error. Derivation was from probability theory in the classical mathematical statistics manner. Results were applicable only to sieve analysis in certain specialized cases. No generally applicable results were obtained. The validity of the results was tested by use of table of random nos.

12370. DE WIT, C.T. AND ARENS, P.L. **Moisture content and density of some clay minerals and some remarks on the hydration pattern of clay.** *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* 2, 59-62; 4, 59(1950).—*C.A.* 46, 4714*b*.

The d. of some clays with varying moisture contents was detd. Relationships between d. and moisture content of montmorillonite and illite samples and the sp. vol. of bound H_2O were calcd. At concns. below 1% the calcd. hydration of the mineral was independent of the concn. The d. of fully hydrated montmorillonite practically did not exceed that of H_2O.

12371. GREEN, I.E. **Measurement of surface roughness. I. II.** *Finish* 7, No. 6, 27-30; No. 7, 22-4(1950).—*C.A.* 44, 7595*a*.

Instruments developed for comparing, measuring, and delineating the surface profiles of metallic materials were described. The stylus type of surface analyzer was adapted for the analysis of surface roughness of painted surfaces and the required modifications were discussed.

12372. GRIFFITH, R.H.; CHAPMAN, P.R., AND LINDARS, P.R. **The physical properties of promoted molybdenum dioxide catalysts.** *Discussions Faraday Soc.* 1950, No. 8, 258-64.—*C.A.* 45, 9989*g*.

In catalysts promoted by the addn. of small amts. of silica, changes in surface area occurred as the silica content increased, but these changes did not alone account for the differences in the activity for hydrocarbon decompn. Measurements of the compn., crystal structure, elec. cond. and thermoelec. potential suggested that MoO_2, rather than the metal, was the catalyst. The function of the promoter was to increase the surface of the dioxide. This took place to the greatest degree when the max. amt. of silica was incorporated into the MoO_2 lattice.

12373. KAZINTSEV, A.I. **Apparatus for determination of density of solids.** *Zavodskaya Lab.* 16, 369-71(1950).—*C.A.* 44, 6685*c*.

A double glass-bulb device was used with a graduated leveling flask attached to the lower bulk with flexible tube. The upper bulb was charged with the sample and xylene, the lower with xylene and water. The vol. of liquid displaced by the solid was read on the calibration scale of the leveling flask. The value of d. obtained was within 0.2% using grain, beads, etc., for test samples.

12374. KRUSHCHOV, M.M. **Microhardness, Mohs hardness, and a hardness scale.** *Doklady Akad. Nauk S.S.S.R.* 72, 779-80 (1950).—*C.A.* 44, 10424*f*.

The microhardness was defined for diamond pointers shaped as four- or three-sided pyramids, the first type with an angle of 136° of the facets. A linear function was valid between the log of the "hardness class" H_o, and the Mohs hardness no. H_o was defined as a function of the load, *H*, in kg/mm^2 required for a const. impression the microhardness test: $H_o=0.7\ X(H)^{1/3}$. The difference between corundum and diamond, only one class in Mohs scales, was in the microhardness scale not less than 6 classes.

12375. MAEDA, SHIRO. **Heat transfer in granular beds. IV. Data for small Reynolds number.** *Chem. Eng.* 14, 110-12(1950).—*C.A.* 45, 5465*g*.

In specially designed app. data were obtained for $d_k u_p/\mu<30$; λ/k can be expressed as a linear function of the Reynolds no.

12376. MOTT, R.A. **Superfine grinding of coke and other materials.** *J. Soc. Chem. Ind.* 69, 346-9 (1950).—*C.A.* 45, 4428*i*.

Cokes and coals were ground wet or dry in a porcelain ball mill by using 3/16-in. steel balls. Results were plotted on a log scale as surface area *vs.* time of grinding with mean particle size indicated. In wet grinding, freshly distd. H_2O contg. 0.6-2.0% NH_4OH was used in the amt. of 10 times the coke. Dry grinding of Parkgate clarain and durain showed a linear increase in surface area with time up to 8 hrs with no change thereafter. Dry grinding of electrode coke (low ash) gave a faster size reduction, with a particle size of 0.3 μ after 8 hrs. Grinding electrode coke with double the former charge and double the amt. of balls gave the same rate of reduction (slope of plot) up to 4 hrs when the rate decreased somewhat, but reduction continued up to 40 hrs at the lower rate, giving a particle size of 0.13 μ.

12377. NAKAI, TATSUNDO. **Contact resistance between metals and a graphite film. II.** *Repts. Sci. Research Inst.* (Japan) 26, 240-6(1950).—*C.A.* 46, 1321*e*.

The contact resistance between Cu and a graphite film increased or decreased at times with temp. and was affected by the oxidation of the Cu surface and the lowering of the film resistance. With Pt, the resistance decreased uniformly with temp., but to a higher degree than that of the lowering of film resistance, owing to a decrease of both centralized and boundary resistance of Pt. With brass the resistance decreased in proportion to the -0.068 power of pressure applied and recovered gradually with the release of the pressure.

12378. ORLOV, D.P. AND LOGGINOV, G.I. **The endurance of crystals of gypsum and of mica in periodic torsion.** *Doklady Akad. Nauk. S.S.S.R.* 70, 249-51 (1950).—*C.A.* 44, 4303*a*.

The endurance, measured in the no., *N*, of cycles of plates subjected to alternating torsion around an axis lying in the plane of greatest cohesion, and always in the same crystallographic direction, changed with increasing thickness of the plate. At equal thickness, *N* was considerably lowered when the specimen was immersed in a surface-active medium. For gypsum, with the thickness increasing from 0.8 to 2 mm and a frequency of 250/min., *N* in H_2O fell from 5300 to 1000, and in a 6% aq. soln. of $CaCl_2$ from 3000 to 600. In contrast, *N* increased for mica with the thickness; between 0.05 and 0.4 mm and at the same frequency *N* increased from 900 to 3000 in H_2O and from 350 to 1650 in a satd. (2.7%) aq. soln. of iso-AmOH. Presence of adsorbable matter always lowered *N* very distinctly.

12379. SHERLOCK, E. **Studies on some properties of Alberta coals. I. Density.** *Fuel* 29, No. 11, 245-52(1950).—*C.A.* 45, 328*d*.

The true and apparent d. of a no. of Alberta coals were measured. A relation between true sp. vol., H-content, and O-content was shown. Measurements in xylene, together with data on the penetration of a coal by xylene and tetrahydronaphthalene led to a partial evaluation of the distribution of pore size in these coals. The hydrophilic properties of coal were presumably a function of their O-content and the drop in d. proportional to the O-content. Beyond the point when water no longer penetrated into the layer planes, the d. in org. solvents equaled or exceeded that in water.

12380. SRIVASTAVA, ARVIND M. **Ultrasonic investigation of the elastic constants of iron silicate gels.** *Kolloid-Z.* 119, 146-51(1950).—*C.A.* 45, 6458*h*.

The elastic consts. of iron silicate gels were studied by an ultrasonic method over the frequency range 0.5-2.5 Mc./sec. A decrease with decreasing frequency and increasing temp. over the range 20° to 70°C was observed in Young's moduli and an increase with time of standing up to 24 hrs. The velocity of the waves in the gel increased as the frequency increased. The d. of the gel varied from 1.18 at 20° to 1.16 at 90°C.

12381. TAKAHASHI, HARUO. **Electrical resistance of carbon powders. I. The relation between the volatile-matter contents and the electrical resistance of carbon powders.** *J. Chem. Soc. Japan*, Pure Chem. Sect., 71, 29-32(1950).—*C.A.* 45, 4988*h*.

With phenol-formaldehyde resin, coal, coal-tar pitch, some kinds of wood, filter paper, and starch powder as raw materials, carbon powders were prepd. in the range 600°-1000°C. The elec. resistances R of the carbon powders were measured, all under 28 kg/cm² pressure. The volatile-matter contents V % (wt decrease by heating *in vacus* at 1000°C) were also measured. In all cases, the relation $R = AB^v$ held where A and B were consts.

12382. TAKAHASHI, HARUO. **Electrical resistance of carbon powders. II. Electrical resistance of freely heaped carbon powders.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 71, 105-8(1950).—*C.A.* 45, 4988*i*.

Carbon blacks in their freely heaped states showed a linear relation between the logs of elec. resistance R and their bulk d. d. The straight lines in the log R *vs.* d graph differed so much among the carbon blacks that the graph could be used for a test.

12383. TAKAHASHI, HARUO. **Electrical resistance of carbon powders. III. Considerations by models on the electrical resistances of freely heaped carbon powders and a report on some related experiments.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 71, 108-11(1950).—*C.A.* 45, 4989*a*.

The carbon black particles treated in various ways had varying bulk ds., but their resistances did not change appreciably. This was because the treated particles or agglomerates had many projections or were covered with tiny particles.

12384. TAKAHASHI, HARUO. **Electrical resistance of carbon powders. IV. Sedimentation volume of carbon black powders.** *J. Chem. Soc. Japan.* Pure Chem. Sect. 71, 181-3(1950).—*C.A.* 45, 4989*c*.

The sedimentation vol. of acetylene black powder did not depend on whether the powders had previously been dried or not, nor whether the powders had adsorbed moisture or not. The vol. was smaller, the higher the temp. of measurement. The sedimentation vol. in various liquids decreased with decreasing dielec. const. of the liquids. The sedimentation vol. of various sorts of carbon blacks in benzene was 5-34 ml/g.

12385. TAKAHASHI, HARUO. **Electrical resistance of carbon powders. V. Electrical resistance of carbon powders sedimented in liquid.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 71, 240-3 (1950).—*C.A.* 45, 4989*d*.

The relation between the bulk d. and elec. resistance of various kinds of carbon blacks in benzene was measured and compared with the analogous relation of carbon blacks heaped freely in air. The powders, which seemed to be solvated considerably, had very high resistance and showed small sedimentation vols.

12386. TAKAHASHI, HARUO. **Electrical resistances of carbon powders. VII. Electrical resistance versus pressure relations of compressed fine carbon powders.** *J. Chem. Soc. Japan*, Pure Chem. Sect., 71, 361-4(1950).—*C.A.* 45, 6367*g*.

For 2 types of carbon the resistivity (r) in ohm cm in the range of pressure (p) of 15-100 kg/cm² followed the equation: $r = a/p + b$ (1); for 2 others it was: $r = \alpha/p^{1/2} + \beta$ (2), where a, b, α, and β were consts. For the pressure range of 100-200 kg/cm², no definite conclusion could be drawn.

12387. TAKEUCHI, SAKAE AND IGAKI, KENZO. **Effects of the oxygen pressure on the electrical conductivity of a semiconductor, NiO.** *Nippon Kinzoku Gakkaishi* (J. Japan Inst. Metals) 14B, No. 2, 16-21(1950).—*C.A.* 46, 800*c*.

The relation of elec. cond. and temp. of a single NiO specimen was measured under different partial pressures, P, of O_2. It changes from the form $A \exp(-E/kT)$ to $A' \exp(-E/2kT)$ with increase of pressure of O_2 ($P = 10^{-3}$ —760 mm Hg). From this change the unique value of the activation energy E could be detd. ($\Delta E = 1.25$ e.v.). The dependence on the O_2 pressure at a definite temp. could be expressed generally by the formula $\sigma \infty P^{1}/x$. Exptl. value of x was 3.7 at 1000°C.

12388. AMIEL, JEAN AND RODIER, GEORGES. **The thermal analysis of activated manganese dioxides.** *Compt. rend.* 232, 1209-10(1951).—*C.A.* 45, 6472*g*.

Changes in wt of samples of MnO_2 were plotted as a function of temp. Breaks at about 230°C and 320°C were attributed to a rearrangement of the atoms of Mn and O, with loss of catalytic properties.

12389. DAHME, ADOLF AND MACKOWSKY, MARIE THERESA. **Chemical-physical and petrographic investigations of coals, cokes, and graphites. V. Microscopic, chemical, and x-ray investigations of anthracite.** *Brennstoff-Chem.* 32, 175-86(1951). —*C.A.* 45, 7772*g*.

It was not possible to establish differences in the coal formation by reflection measurements of the different vitrains of a coal vein. Reflection measurements were of more value in establishing coal rank in the high-rank region, than with low-rank coals, since the reflection-% volatile matter curve for the latter was rather flat. The regularity in crystallite arrangement, was detd. although the size of the single crystallite was far under the resolving power of the microscope, as detd. by x-ray measurements. A model representation of the position of the crystallites in bright and dull coals and the changes in coalification was developed.

12390. DRYDEN, I.G.C. **The apparent solubility of colloidal materials comprising a continuous distribution of micellar size, with special reference to coals.** *Discussions Faraday Soc.* No. 11, 28-42, discussion 89-91(1951).—*C.A.* 46, 7844*d*.

Unusual results obtained in the fractionation of coals in amine solvents necessitated a reexamn. of the factors controlling the soly. behavior of colloids. The preferred fractionation method for coals involved extn. of dried ground coal with ethylenediamine, diethylenetriamine, and ethanolamine at a series of temps. The yield was considered proportional to the fraction of coal below a crit. mol. or micellar size.

12391. Duffy, George J. **A study in black.** *Official Digest Federation Paint & Varnish Production Clubs* No. 312, 28-32(1951).— *C.A.* 46, 8385*i*.

The manufg. process and properties of channel and furnace carbon blacks were described. Optimum dispersion in a ball mill was obtained with a paste contg. as much carbon black as possible and with only enough paste to fill the voids between the balls. In alkyd enamels as much as 10% moisture on the black aided in stabilizing consistency.

12392. Dulhunty, J.A. and Penrose, Ruth E. **Some relations between density and rank of coal.** *Fuel* 30, 109-13(1951).—*C.A.* 45, 5388*h*.

A method was described for measuring in water the ds. of low rank coals which could not be dried without undergoing permanent phys. changes. Results of an investigation of ds. of coals varying from peat to anthracite provided evidence of a well defined relation between d. and rank.

12393. Egun, Sabri. **Determination of particle density of crushed porous solids; gas-flow method.** *Anal. Chem.* 23, 151-6(1951).— *C.A.* 45, 3684*f*.

Pressure drop and gas flow rates were correlated as follows: $\Delta P/LU_m = a + bG$, where ΔP = the pressure drop, L = the bed height, U_m= the av. linear gas velocity, and G = the mass flow rate of the gas; a and b were consts. involving viscosity of the particular gas, the specific surface of the enveloped particles and the fractional void vol., plus certain statistical consts. a and b were detd. from a plot of $\Delta P/LU_m$ against G. Graphical solution for a and b was possible, but a least-squares resolution was preferred. Once derived, the values of a and b were used to give independent values of particle d. A known wt of porous material was introduced into a large tube between two pressure taps, packed to different bulk ds. and pressure drop was correlated with flow rate of N_2.

12394. Forster, Michael J. and Mead, Darwin J. **Electrical properties of some carbon black-oil suspensions.** *J. Applied Phys.* 22, 705-10(1951). — *C.A.* 46, 1322*a*.

The d.c. cond. and a.c (1000 per sec.) properties of suspensions of R-40 carbon black in transformer, silicone, and linseed oils, and suspensions of Shawinigan black in linseed oil, were studied as functions of time, carbon black concns., and rotational speed of test cell. Immediately after agitation of the suspension, both a.c. and d.c. conds. increased rapidly with time and then approached a satn. value. For the d.c. cond., this value increased with increasing voltage in all suspensions studied except the highest concns. (10% by wt), which obeyed Ohm's law.

12395. Gregg, S.J. and Behrens, A. **The bulk density of kaolin.** *J. Applied Chem.* (London) 1, Suppl. Issue No. 2, S139-41(1951).— *C.A.* 46, 5285*f*.

The bulk vol. of a monodisperse sample of kaolin was detd. *in vacuo* and in the presence of varying amts. of adsorbed water vapor. The bulk vol. was detd. by measuring the vol. of a weighed sample in a 10-ml cylinder after standard tapping (tapping rate, 120 per min.; tapping time, 60 min.; distance of fall of cylinder, 1.54 cm). From an *in vacuo* value of 1.17 ml per g, the bulk vol. decreased 15% from 0 up to 0.15% adsorbed water and then varied only slightly as the water content increased up to 1.3%.

12396. Gregor, Harry P.; Gutoff, Fradelle, and Bregman, J.I. **Ion-exchange resins. II. Volumes of various cation-exchange resin particles.** *J. Colloid Sci.* 6, 245-70(1951).— *C.A.* 45, 9994*e*.

The sp. vol. of polystyrene, phenolic, and permutite resins increased with the hydrated ionic vol. of the exchange cation, except where ion-pair formation occurred. The vol. of swollen resins decreased with increasing cross-linking.

12397. Gregor, Harry P.; Held, K.M., and Bellin, Judith. **Determination of the external volume of ion-exchange resin particles.** *Anal. Chem.* 23,620-2(1951).— *C.A.* 45, 6968*h*.

Several techniques were described for the precise detn. of the external vols. of ion-exchange resin particles.

12398. Grisdale, R.O.; Pfister, A.C., and Van Roosbroeck, W. **Pyrolytic film resistors: carbon and borocarbon.** *Bell System Tech. J* 30, 271-314(1951).— *C.A.* 45, 10102*g*.

Carbon or borocarbon films were deposited on suitable ceramic supports by tumbling together with clean sand in a furnace at temps from 975° to 1300°C, in which a suitable atm. was maintained. Suitable atm. for carbon deposition contained an inert carrier such as O_2-free N_2, contg. some hydrocarbon. For deposition of borocarbon films, the film-former gas subject to pyrolysis was tripropylborane, a mixt. of a boron hydride plus a hydrocarbon, or a hydrocarbon plus a boron halide. The introduction of B (3-4%) into the carbon films lowered the temp. coeff. of resistance to values as low as, or often lower than, wire-wound resistors.

12399. Lehovec, K. and Imalis, O. **Gradual capacity changes of selenium rectifiers and ionization equilibrium of adsorption points.** *Z. physik. Chem* 198, 127-46(1951).— *C.A.* 46, 5462*e*.

If a potential was applied to a Se cell in the nonconducting direction, its capacity decreased greatly. Upon removal of the potential, the capacity increased instantaneously almost to the original value, then continued to recover slowly. Illumination greatly increased the speed of recovery, and increased capacity beyond the original value (photocapacitative effect). The amt. of increase was at first proportional to the light intensity, but at higher intensities reached a satn. value. These results were explained by the slow establishment of an equil. between adsorption points and electrons, depending on external potential. The initial rapid increase in capacity on removal of the external potential was due to an instantaneous shift in pos. "holes."

12400. LIDMAN, W.G. AND HAMJIAN, H.J. **Kinetics of sintering chromium carbide.** *Natl. Advisory Comm. Aeronaut., Tech. Note* No. 2491, 16 pp. (1951).— *C.A.* 46, 3835*h*.

The kinetics of grain growth and densification during sintering of Cr_3C_2 under pressure was investigated. The grain diam., D, and sintering time, t, was related by the equation $D^n = Kt$, where K was a rate const. The value of n was assocd. with the location, size, and shape of the pores in this compact. Densification of the sintered compact was accompanied by grain growth; d. and grain size seemed independent during this stage.

12401. LOVELL, G.H.B. **The rapid determination of powder density.** *Trans. Brit. Ceram. Soc.* 50, 1-9(1951).— *C.A.* 45, 6815*c*.

Powder d. was detd. by running a specified vol. of a liquid into an evacuated flask of known vol. and contg. a specified wt of the sample. By measuring the total vol. of liquid and solid the vol. of the sample was obtained, and its powder d. could then be calcd., or the instrument could be calibrated to read directly in powder d.

12402. MAEDA, SHIRO. **Heat transfer in granular beds. V. Theoretical equations of heat transfer accompanied by chemical reaction.** *Chem. Eng.* 15, 5-8(1951).— *C.A.* 45, 5465*g*.

A math. treatment was applied to granular beds in which there was evolution or dissipation of heat, provided the heat of reaction depended only upon the gas concn. The results were presented graphically in dimensionless groups.

12403. MAEDA, S. AND KAWAZOE, KENJIRO. **Heat transfer in granular beds. VI. Temperature distribution in completed oxidation of ammonia.** *Chem. Eng.* 15, 9-14(1951).— *C.A.* 45, 5465*h*.

Axial temp. distribution was measured in 0.5-in., and 2-in. columns packed with Co catalysts, in which NH_3 was nearly completely oxidized to N_2 by an excess of air. The exptl. results agreed fairly well with the calcd. temp. distribution.

12404. MAXWELL, LOUIS R.; SMART, J. SAMUEL, AND BRUNAUER, STEPHEN. **Thermomagnetic investigations of promoted and unpromoted iron oxide and iron catalysts.** *J. Chem. Phys.* 19, 303-9 (1951).— *C.A.* 45, 8829*h*.

The Curie temp. (θ) and intensity of magnetization of certain unreduced and reduced iron oxide catalysts were detd. For the singly promoted unreduced systems of Fe_3O_4 contg. small amts. of Na_2O, K_2O, Cs_2O, BaO, B_2O_3, Al_2O_3, or SiO_2, θ was practically the same as for Fe_3O_4, but large reductions in the satn. intensity of magnetization were observed. The doubly promoted unreduced systems studied contained addns. to Fe_3O_4 of Al_2O_3 and small amts. of Na_2O, K_2O, BaO, or SiO_2. θ for these materials varied only slightly and was equal to or less than that for Fe_3O_4.

12405. MERKEL, HEINRICH AND WEINROTTER, FERDINAND. **Thermomagnetic studies of iron catalysts for hydrocarbon synthesis.** *Brennstoff-Chem.* 32, 289-97(1951).— *C.A.* 46, 662*a*.

When pptd. Fe catalysts were reduced with tech. H_2, the low partial pressure of CO, CO_2, and CH_4 was sufficient to cause appreciable carbide formation. Catalysts treated in this way were fully active for synthesis in a few minutes, in contrast with those reduced with electrolytic H_2. In addn. to Fe_2C with a Curie point of 265°C, Fe_3O_4 and Fe were also found. The Fe content may be the cause of the CH_4 peak noted early in the synthesis.

12406. MIKLASHEVSKIĬ, A.I. AND USPENSKAYA, P.I. **Porcelain resistors with a carbon layer (not wire wound).** *Zhur. Priklad. Khim.* 24, 242-51; *J. Applied Chem. U.S.S.R.* 24, 267-77(1951) (Engl. translation).— *C.A.* 46, 3881*f*.

A paste contg. 35.0% Karelian feldspar, 26% Prosyanovsk kaolin, 20% Chasovyar clay, and 19% quartz sand produced a porcelain superior to the standard porcelain studied. The conducting layer was graphitic, contg. 95-96% C and with a sp. gr. of 2.26. Its thickness varied from 0.03 to 0.1 μ for resistors of the order of 6000-3000 ohms. The closer the coeff. of linear expansion of the porcelain was to that of the conducting layer, the better was the bond between the two. The optimum temp. for producing a coating on the porcelain by hydrocarbon cracking was found to be 900°-1000°C.

12407. MILLS, G.A. AND SHABAKER, H.A. **Factors controlling aging of cracking catalysts.** *Petroleum Refiner* 30, No. 9, 97-102(1951).— *C.A.* 46, 243*h*.

Catalysts used were Hondry synthetic silica-alumina catalyst and Filtrol TCC clay catalyst. The harmful effects of Fe, Cu, and V were given in a graphical form. The activity and selectivity depended critically on the nature of gases coming in contact with them and the temp. to which they were subjected. The factors controlling aging of cracking catalysts summarized.

12408. MOORE, A.J.W. AND TEGART, W.J. McG. **Rupture of oxide films during repeated sliding.** *Australian J. Sci. Research* 4A, 181-4(1951).— *C.A.* 45, 7493*c*.

Microscopic examn. of Cu strips subjected to repeated friction by a hard steel or diamond hemispherical slider under a 4000-g load, moving at 0.01 cm/sec, showed nonmetallic particles to be included below the surface. Subsequent annealing caused these particles to coalesce, but even on prolonged annealing no grain growth occurred in their immediate vicinity. Evidence suggested that the particles consisted of Cu_2O, formed by rupture of the oxide film at pts. of crit. plastic flow, subsequent adhesion, and surface deformation sufficient for successive oxide layers to be entrapped.

12409. NAKATOGAWA, TAKESHI. **Silicon carbide. I. Surface structure of single crystals.** *J. Chem. Soc. Japan*, Ind. Chem. Sect. 54, 441-3(1951).— *C.A.* 47, 5208*d*.

The surface structure of single crystals of SiC was studied with respect to the mechanism of rectification. Two layers were found on the surface (0001). The upper layer was of SiO_2 with the thickness less than 10^{-5} cm, not contributing to rectification.

12410. SCOTT, J.R. **Improvements in accuracy of hardness testing.** *Trans. Inst. Rubber Ind.* 27, 249-63(1951).— *C.A.* 46, 2329*g*.

To avoid errors arising from both instruments and test-specimens, the best procedure was to use both a zero load and a presser foot. Most hardness tests made no provision for avoiding errors from friction in the measuring device, and tests showed that, by gentle vibration during the test, much more consistent readings and better agreement between different labs. and instruments were obtained.

12411. SPOONER, C.E. **Swelling power of coal.** *Fuel* 30,193-202(1951).— *C.A.* 45, 9831*e*.

The swelling power of coal was directly proportional to the tar produced on thermal decompn. and inversely proportional to the amt. of porous structure of the coal. In general, swelling was proportional to (% hydrogen — 4.2)/(% oxygen)^2.

12412. STOKES, C.A. AND VIVIAN, J.E. **Application of sonic energy in the process industries. I. Fundamentals.** *Chem. Eng. Progress Symposium Ser., Ultrasonics* 47, No. 1, 11(1951).—*C.A.* 46, 294*c*.

Detailed data were given on agglomeration of carbon black smoke, specifically, lab. and pilot-plant data, to show comparison of sonic with static agglomeration technique, other uses in the gas phase, and liquid-phase application.

12413. TAKAGI, SHUNSUKE AND ABOSHI, HISAO. **Accurate determination of true specific gravity of granular or pulverulent materials.** *Rept. Inst. Sci. Technol., Univ. Tokyo* 5, 253-7(1951). — *C.A.* 46, 5931*i*.

The true sp. grs. of sand and clay were measured by carefully evacuating the pycnometer which contained the sample to a pressure of about 10^{-3} mm Hg and then filling the pycnometer with water that had been boiled to remove dissolved air. The results revealed that the air that could not be removed by the usual method occupied a vol. that amounted to 12% of the true vol. of the sample.

12414. TORKAR, K. **The effect of the pore volume of sintered materials on the magnetic characteristics.** *Powder Met. Bull.* 6, 13-17(1951).— *C.A.* 46, 5498*g*.

The satn. varied proportionately with the d. Deviations from this relation were attributed to nonmagnetic inclusions, such as oxides. The internal demagnetization factor was controlled by pore distribution.

12415. UZUMASA, YASUMITSU AND HIKIME, SEICHIRŌ. **Freezing of gelatinous precipitates. I. Freezing of aluminum hydroxide.** *J. Chem. Soc. Japan,* Ind. Chem. Sect. 54, 317-19(1951).— *C.A.* 47, 3085*a*.

$Al(OH)_3$ was subjected to freezing-thawing treatments under various conditions. The sedimentation vol. of the resulting ppt. decreased with increase in freezing time and lowering of freezing temp.

12416. WALZ, ALVIN E. AND GLOCKLER, GEORGE. **Electron emission from a carbon surface.** *Proc. Iowa Acad. Sci.* 58, 261-4(1951).— *C.A.* 46, 5426*d*.

It was possible to obtain the required temp. with a voltage drop less than the ionization potential of carbon.

12417. WEININGER, JOSEPH L. AND SCHNEIDER, WILLIAM G. **Thermal conductivity of granular beds filled with compressed gases.** *Ind. Eng. Chem.* 43, 1229-33(1951).— *C.A.* 45, 5464*a*.

Measurements of thermal cond. of granular beds of Al_2O_3 and powd. borosilicate glass when filled with He, H_2, or N_2 at varying pressures yielded linear relations between thermal cond. and pressure; CO_2 in the same beds gave rise to a parabolic relation. Except for the measurements with He and H_2, the measured values of the thermal cond. were much greater than would be predicted from calcd. values of the pressure coeff. of thermal cond. of the gas in question. This behavior was attributed to increasing gas adsorption on the solid granules with increasing pressure.

12418. YANCEY, H.F.; GEER, M.R., AND PRICE, J.D. **An investigation of the abrasiveness of coal and its associated impurities.** *Trans. Am. Inst. Mining Met. Engrs., Tech. Pub.* No. 3027-F (in *Mining Eng.* 3, 262-8)(1951).— *C.A.* 45, 4021*a*.

The test consisted of rotating four 16-gage Armco iron blades, 2 in. long × 1 in. wide, in a charge of coal for a fixed no. of revolutions and then detg. the loss in wt of the blades. A shaft-and-arm assembly rotated the blades in a mortar (pipe) 8 in. inside diam. × 9 in. deep. The edge of the blade next to the wall of the mortar was curved backward with respect to the direction of rotation on a 5/8-in. radius, to crowd or nip the coal particles between the blades and the wall of the mortar. The clearance was 0.20 in. both between the blades and the bottom of the mortar and between the blades and wall of the mortar. Tests at 6000 and 12,000 revolutions showed that doubling the length of the test did not double the abrasion loss. On 5 samples, doubling the duration increased the abrasion loss by an av. of 63%.

12419. ASHLEY, K.D. AND INNES, W.B. **Control of physical structure of silica-aluminum catalyst.** *Ind. Eng. Chem.* 44, 2857-63(1952).— *C.A.* 47, 2909*h*.

The porosity of an alumina-silica catalyst, prepd. by adding alum to the silica sol, increased with an increase in time, temp., and pH of aging, and with higher silica content during gel formation. Very rapid spray-drying gave 25% greater porosity than kiln drying. Thermal stability increased markedly with increased porosity up to a pore vol. of 0.7 ml/g. Increased porosity resulted in decreased attrition resistance. Optimum porosity for an alumina-silica catalyst was in the range of 0.6 to 0.9 ml/g.

12420. BEISCHER, D.E. **Melting phenomena of a surface of unimolecular thickness.** *Science* 115, 682-4(1952).— *C.A.* 46, 8921*g*.

A monolayer of C^{14}-labeled stearic acid was supported on mica plates. The melting process was indicated by surface diffusion of the radioactive mols. to scratches marked in the mica; the optical d. of the radioautograph showed inhomogeneities at locations corresponding to the scratches where the acid mols. were immobilized as Al stearate. The monolayers did not show phase transitions at the m.p. of the bulk acid as indicated by the lack of change of direction of the log D *vs.* 1/T relation, nor was any sharp m.p. found during the expts.

12421. BREITMAYER, THEODORE AND WEST, FRANK B. **Improving the density and strength of charcoal briquets.** *Ind. Eng. Chem.* 44, 2234-7(1952).— *C.A.* 46, 11641*c*.

At a crit. size range for charcoal particles of the order of 25-40 μ, approximating the diam. of the major cells of the original wood, "loose-packed" d. increased to 3-fold that of the coarser fraction and twice that of solid charcoal. The blending of 25-50% of moderately fine charcoal with the coarse raised briquet ds. and strengths far above those obtained from either starting material used alone.

12422. D'ORSI, GIULIO. **Determination of the density of leather.** *Cuoio, pelli, mat. concianti* 28, 35-44,93-103,156-60(1952).— *C.A.* 46, 8403*c*.

A new method and app. was suggested which permitted the detn. of d. with gas displacement on either leather or hide powder. The av. values obtained were: vegetable-tanned leather 1.535, hide powder 1.602, raw dry hide 1.715-1.735.

12423. DOWNING, V.F. AND PARKER, F.R. **Improved pycnometer for powders, precipitates, and synthetic resins.** *Anal. Chem.* 24, 229-30(1952).— *C.A.* 46, 3806*h*.

A wide-mouth glass jar similar to a weighing bottle was used fitted with special interchangeable glass caps. These were provided with ground-in thermometers and capillary vent plugs.

12424. EDGCOMBE, L.J. AND MANNING, A.B. **A special study of ash and clinker in industry. Origin and nature of ash; sampling and analysis.** *J. Inst. Fuel* 25, 166-70(1952).— *C.A.* 46, 8346*f*.

The origin of the inherent and of the extraneous mineral matter in coal was outlined. The sampling of coal for the detn. of ash was reviewed with reference to the Brit. Standard Specifications, and methods of ash analysis and of ash-fusion-temp. detn. were described. Some correlation between ash compn. and fusion temp. was observed.

12425. FRÖHLICH, H.G. **Density determination of cellulose fibers by the suspension method.** *Z. ges. Textil-Ind.* 54, 337-9(1952).— *C.A.* 46, 8365*a*.

About 30 g of cellulose fiber was dried 2 hrs at 120°C, then boiled in a 500-ml round-bottom flask with a ground-in stopper which was filled 2/3 with CCl_4. The fibers dropped to the bottom on cooling; on heating to 60°C they floated and finally came to the surface. An accuracy of ±0.002 d. units was obtainable. Mixts. of CCl_4 and C_6H_6 made measurements at lower temp. possible. The d. of the fiber (D_f) was calcd. from $D_f = D_{SM} - a(x-20°)$, where D_{SM} = d. of the solvent mixt. at 20°, x = temp. of floating, and a = change of d. per degree.

12426. GYANI, B.P. **Factors governing hardness and transparency of alumina gels.** *J. Phys. Chem.* 56, 762-3(1952).— *C.A.* 46, 8463*g*.

Gels prepd. from $Al_2(SO_4)_3$ and NH_4OH were soft and chalky when aged at room temp. in the presence of the by-product salts. When the pptn. was performed at boiling temp. and the salts were removed immediately, hard, transparent gels were obtained. A small quantity of AcOH prevented deterioration.

12427. HEWITT, F.J.; RILEY, H.L., AND SAVAGE, P. **The quality of blast-furnace coke.** *Gas World* 135, No. 3524, Coking Sect., 21-32(1952).— *C.A.* 46, 4199*i*.

The phys. and chem. properties of cokes were characterized more exactly in order to correlate them with furnace performance. The micro-strength test and the wet-oxidation test were selected as measures of the strengths and reactivities of the cokes. Sections were cut from single half-oven pieces, and the tests were applied at various points along each section between the wall end and the center of the oven. Curves obtained in tests on 24 coke samples were used.

12428. HORTON, L. **Separation of coals into fractions of different densities.** *Fuel* 31, 341-54 (1952).— *C.A.* 46, 7731*c*.

Finely divided, clean bright coals, or, where possible vitrains, were fractionated (hand selection, followed by exhaustive float and sink sepns. with C_6H_6-CCl_4 mixts. of different ds.). At a point in the scale of rank between 84.6 and 88.6% C content, coals possessed a min. d. At lower ranks, the fractions of any one vitrain had substantially const.N-contents, but this was not the case, in general, with coals of higher rank.

12429. JURA, GEORGE AND PITZER, KENNETH S. **The specific heat of small particles at low temperatures.** *J. Am Chem. Soc.* 74, 6030-2(1952).— *C.A.* 47, 3678*e*.

Each particle was treated as if it were a sep. mol., but the Debye equations were retained for the calcn. of the frequencies of given modes of oscillation in terms of macroscopic elastic consts. The calcd. sp. heats of Al from 0 to 6°K were compared for (1) the infinite crystal, (2) cubes of vol. 10^{-18} ml, and (3) rectangular parallelopipeds of 10^{-18} ml vol. with dimensions of 79.37, 79.37, and 158.74 A. At 1°K the gross translation and rotation of the whole particles made the principal contributions.

12430. KREVELEN, D.W. VAN. **Some newer views as to the chemical structure of bituminous coal.** *Brennstoff-Chem.* 33, 260-8(1952).— *C.A.* 46, 11628*b*.

A graphical-statistical method was developed in which the at. H/C and O/C relations of the bituminous coal were used. The coalification ranges of the various petrographic constituents were shown as well as the changes during the most important reaction processes of bituminous coal. By introducing the d. (or the sp. vol.) as an addnl. quantity, it became possible to calc. the percentage of C present in aromatic and nonaromatic form, as well as the magnitude of the ring condensation of the bituminous coal mols.

12431. MANNING, A.B. **Size distribution in a randomly fractured solid, and its application to coal.** *J. Inst. Fuel* 25, 31-2(1952).—*C.A.* 46, 2264*i*.

The theory of random subdivision of a magnitude was used to derive an expression for the size distribution of a randomly fractured solid.

12432. MICHEL, A. **Application of thermomagnetic analyses to the study of catalyst.** *Ind. chim. belge* 17, 643-51(1952).—*C.A.* 47, 31*e*.

The relation between the thermomagnetic and catalytic properties of Fe, Ni, and Co catalysts for Fischer hydrocarbon synthesis ($CO + 2H_2$) was studied (*a*) for a variety of conditions of catalyst prepns. and (*b*) with several catalyst promoters. Good catalysts exhibited a distinct type of thermomagnetic curve.

12433. MIZUSHIMA, SANCHI. **Thermal and electrical conductivities of carbon materials.** *Phys.Rev.*86, 1040(1952).—*C.A.* 46, 8445*g*.

Coke, prepd. from pitch coke, was prebaked at 1300°C, and then heated 20 min. at 1500°-2700°C. Curves for thermal cond. and for crystallite size in the *hk*0 direction were nearly parallel: both rose rapidly with temp. even where elec. cond. was nearly const. Curves for the elec. cond. and for crystallite size in the *hkl* direction were nearly parallel.

12434. MROZOWSKI, S. **Thermal conductivity of carbons and graphite.** *Phys. Rev.* 86, 251-2 (1952).—*C.A.* 46, 5950*b*.

The effect of heat-treatment and of microcryst. dimensions on the thermal cond. of polycryst. graphite and baked carbons was examined. For com. carbons heat-treated at 1800-2200°C, the max. thermal cond. occurred at 0-500°C.

12435. PEPPARD, D.M. **Machine for determining packed density.** *Anal. Chem.* 24, 1869-70(1952). —*C.A.* 47, 2549*b*.

A machine to perform the tapping operation mechanically was described for use with standard proportion graduates, the smallest used being 100 ml. The basic rate of drop was 30/min., but on some materials the rate may be increased to 60/min. with a time saving. Experience with $CaCO_3$ pigments showed that results obtained with coarser pigments were more reproducible than those obtained with finer pigments.

12436. QUARLES, GILFORD C. **Effects of sonic vibrations on packed granular materials.** *Ind. Eng. Chem.* 44, 213-17(1952).—*C.A.* 46, 5388*g*.

Packed wet-sand particles between 0.062 to 0.71 mm were studied in molded form and in hoppers to det. the effects of grain size, moisture content, and vibration frequency. A definite threshold amplitude existed, above which molded briquets crumbled. In the case of discharge from a hopper, sand flowed more readily with horizontal vibration.

12437. SELWOOD, PIERCE W. AND LYON, LORRAINE. **Supported oxides of manganese: influence of support modification.** *J. Am. Chem. Soc.* 74, 1051-3(1952).—*C.A.* 46, 5944*d*.

The susceptibility-isotherm method was extended to a series of modified alumina supports; the supported oxides were those of Mn. The support-phase modification had a negligible effect on the oxidation state or dispersion of the supported Mn when the specific surface area was maintained large and no appreciable amts. of alkali were present. The presence of alkali in the support caused a large change in the susceptibility isotherm.

12438. SHISHCHENKO, R.I. AND AVANESOVA, A.M. **Effect of pressure on the limiting shearing stress of clay suspensions.** *Doklady Akad. Nauk S.S.S.R.* 83, 721-3(1952).—*C.A.* 46, 6900*c*.

An increase of the pressure (1-400 atm.) increased the limiting shearing stress of suspensions of 2 kinds of local clays. The effect was more marked with the less colloidal sort. Chem. purification of the clay, e.g. with sulfite-alc., suppressed the effect of the pressure.

12439. VENSTREM, E.K. **Action of hardness-lowering adsorbed substances in the mechanical rupture of solid bodies.** *Doklady Akad. Nauk S.S.S.R.* 86, 99-102(1952).—*C.A.* 47, 2011*i*.

The effect of electrolytes ($ThCl_4$, $AlCl_3$, $FeCl_3$, $FeCl_2$, NaCl, LiCl, Na_2CO_3) in aq. soln. and of surface-active nonelectrolytes in nonpolar hydrocarbon soln. on the hardness of different minerals and rocks was investigated by the pendulum and by the grinding methods. The expts. were done with quartzite, limestone, pyrite, and orthoclase. In contrast to electrolytes, surface-active nonelectrolytes gave curves without a max., only tending to satn. H_2O lowered the hardness of quartzite and limestone by about 20-30%; this effect was enhanced by adsorption of ions, which increased the thickness of hydrate envelopes.

12440. VENSTREM, E.K. **Adsorbed substances as depressors of hardness of brittle bodies.** *Kolloid. Zhur.* 14, 297-306 (1952).—*C.A.* 47, 2012*d*.

As inverse measure of hardness, the decrement V of the amplitude of a pendulum swinging on the solid surface, of v/F, was used; v = vol. of solid ground off by a tool along 1 cm of its path and F = tangential force applied to the tool. When the solid was moistened with a soln., V and v/F increased. This increase was max. at a medium load on the pendulum or tool. This load was greater, the softer was the pendulum and the harder the solid; it was, e.g., 0.8 kg for diamond on limestone and 4.5 kg for a steel alloy on quartzite. When the concn. of the electrolyte soln. increased, V and v/F either increased to a max. and then decreased, or increased first rapidly and then gradually.

12441. WYLLIE, M.R. AND SPANGLER, M.B. **Application of electrical resistivity measurements to problem of fluid flow in porous media.** *Bull. Am. Assoc. Petroleum Geol.* 36, 359-403(1952).—*C.A.* 46, 7376*b*.

The Kozeny equation for fluid flow through isotropic unconsolidated porous medium was expanded to apply to consolidated and nonisotropic porous media. The Kozeny const. for a system having a random distribution of pores could be obtained if the tortuosity of the porous system was known.

New equations for permeability and wetting phase relative permeability were given.

12442. Anon. **Properties of electrodeposited nickel.** *Can. Metals* 16, No. 5, 38, 40, 42 (1953).—*C.A.* 47, 6276*g*.

A comprehensive study of conditions during the electrodeposition of Ni showed that hardness, tensile strength, and other properties could be varied over a wide range by the proper choice of plating bath.

12443. Bradley, R.S. **A silica microbalance; its construction and manipulation, and the theory of its action.** *J. Sci. Instr.* 30, 84-9 (1953). —*C.A.* 47, 6705*f*.

These balances could be used in studies on adsorption, solid reactions and evapn. kinetics, analysis, mass d. detns., and magnetic studies. A detailed account of its construction and method of using was given.

12444. Dryden, I.G.C. **Chemical significance of the true density of coals.** *Fuel* 32, 82-8(1953). —*C.A.* 47, 2956*i*.

Values of a "ring condensation index" in the coal series were examd. The index varied linearly with the H-C ratio. Simplification of van Krevelen's original equation led to an expression for specific vol. in terms of H-content plus either (1) C-content, (2) O-content, or (3) a log term in H-content.

12445. Piret, Edgar L. **Fundamental aspects of grinding.** *Chem. Eng. Progress* 49, 56-63(1953). —*C.A.* 47, 3626*a*.

Some of the newer area-measuring techniques, some advantageous methods of plotting, some industrial mill correlations, and indicated directions for future research were outlined. Important progress in the fields of crushing and fracture will have to be based on other concepts than those prevailing at the time.

12446. Shepherd, A.A. **The effects of oxygen on the electrical properties of oxide cathodes.** *Brit. J. Appl. Phys.* 4, 70-5 (1953).—*C.A.* 47, 6244*g*.

The mechanism of reduction of electron emission from oxide-coated cathodes by O_2, and of the recovery process after O_2 poisoning, by mass spectrometer techniques, showed that the formation of singly charged O^- in the cathode coating played a major part in the recovery process. The results showed that at temps. above 700°K the cond. of the coating and the electron emission were poisoned by O_2 in the same way; but at temps. below 700°K the cond. was scarcely affected by the introduction of O_2 into the cathode coating, even though the electron emission was reduced to 0.1 of its original value.

VI-4. Particle Size Determinations (Sieving) (Aerosols)

12447. Martin, Geoffrey; Blyth, C.E., and Tongue, Harold. **Researches on the theory of fine grinding. I.** *Trans. Ceram. Soc.* 23, 61-118 (1924).—*C.A.* 18, 3659.

The law governing the connection between the number of particles and their diams. was discussed in grinding crushed sand. Definitions were given for statistical diam. and the mean diam. of a particle, as used in connection with the frequency curve. The app. was described and the data secured in the exptl. runs shown.

12448. Martin, Goeffrey and Watson, Walter. **Researches on the theory of fine grinding. IV. The air analysis of large quantities of crushed sand.** *Trans. Ceram. Soc.* 25, 226-39 (1926).—*C.A.* 21, 1857.

The app. for elutriating large quantities of sand was described for air speeds ranging from 2 in. to 20 ft per sec. The compd.-interest law connecting particle size and number was confirmed by the fact that log (W/X^3) plotted against X formed a straight line, where W = wt of a grade and X = av. arithmetical diam. of the particles forming a grade.

12449. Martin, Goeffrey; Bowes, E.A.; Coleman, E.H., and Littlewood, T.H. **Researches on the theory of fine grinding. V. The existence and preparation of statistically homogeneous grades of crushed sand.** *Trans. Ceram. Soc.* 25, 240-52(1926).—*C.A.* 21, 1857.

Crushed sand, when subjected to careful air elutriation, can be separated into homogeneous grades. These were characterized by the fact that repeated fractional elutriation did not alter the av. arithmetical diam. of the particles composing the grade. The frequency curve (no. plotted against diam.) of such a homogeneous grade followed the probability law, $N = a\exp(-bx^3)$, where N = no. of particles in a grade, x = diam. of particles and a and b were consts.

12450. Martin, Geoffrey. **Researches on the theory of fine grindings. VI. The diameters of irregularly shaped crushed sand particles lifted by air currents of different speeds and different temperatures.** *Trans. Ceram. Soc.* 26, 21-33 (1927).—*C.A.* 21, 3692.

When regularly shaped particles were very small, Stokes' law was obeyed, the const. k depending on whether the fluid flow was in stream line or turbulent flow, and also on the shape and nature of the supported particles. As the particles became larger, at some critical diam. Stokes' law gave way to the linear law: $V + V_0$ (const. velocity) = k (diam.). At still higher fluid velocities the linear law was replaced by the parabolic law, velocity = k (diam.)$^{1/2}$. The diam. and wt of quartz particles lifted by air speeds from 0 to 328 ft/sec., together with mesh apertures of the chief industrial sieves, were tabulated.

12451. Andreasen, A.H.M. **The grinding of materials. Theoretical and experimental researches on particle-size distribution incident to the disintegration process.** *Kolloidchem. Beihefte* 27, 349-458 (1928).—*C.A.* 23, 653.

For disintegrated products no general law held for the particle-size distribution, method and material. The particle shape was not dependent upon its size if the same method of disintegration was used. The compd.-interest law did not hold for ball-mill disintegration. Nothing was found that showed the particle shape varied with particle size.

12452. Rosin, P. and Remmler, E. **The laws governing the fineness of powdered coal.** *J. Inst. Fuel* 7, 29-36(1933).—*C.A.* 28, 3870^8.
Definite laws, expressed by the exponential law of fine grinding, governed the process of coal pulverization. Fineness-characteristic curves may be extrapolated into the range of the finest particles where measurements were difficult and lengthy. Considerable reduction in the lab. work of fineness analyses was thereby effected.

12453. Pirozhkov, N.A. **Methods for evaluating "nondusting" carbon black.** *Caoutchouc & Rubber* (U.S.S.R.) 1939, No. 10, 45-9; *Khim. Referat. Zhur.* 1940 No. 3, 101.—*C.A.* 36, 2392^3.
The degree of compression of "nondusting" carbon black from the wt and vol. no. was detd. The average resistance of the aggregates to abrasion and the individual carbon-black balls to crushing was discussed.

12454. Halberstadt, H. **Determination of the size of invisible particles.** *Staub* 1940, 151-80.—*C.A.* 37, 3317^1.
The determination of particle size with the help of x-rays was reviewed, with several examples of such determinations. The determination of particle size from photographs of electron deflections and the use of the ultramicroscope for this purpose were briefly discussed.

12455. Travis, Pierce M. **Measurement of average particle size by sedimentation and other physical means.** *ASTM Bull. No.* 102, 29-32 (1940).—*C.A.* 34, 3152^4.
The rate of sedimentation in a liquid was detd. for particles from 44 to 4 μ in diam. The settling times were based on Stokes' law of sedimentation. Calibration curves were drawn so that particle size could be detd. directly from time.

12456. Bietlot, Albert. **Methods of particle-size analysis and their application to some Eocene Belgian sands.** *Ann. soc. géol. Belg., Mem.* 64, 81-169(1941).—*C.A.* 38, 3181^6.
Sieve analysis, grain counts, approved methods, possible simplifications and sources of error were discussed in some detail.

12457. Butt, Yu. M. and Plotnikov, L.A. **Separation of fine powders by air.** *Zavodskaya Lab.* 10, 650-1 (1941).—*C.A.* 40, 6894^4.
An app. for the sepn. of fine powders into uniform fractions was described. A known quantity of the powdered substance passed through a sieve (4900 openings/cm^2) was placed in a V-shaped tube in the app., and air was forced through the system at various velocities. The granulometric compn. of the fractions thus obtained was very uniform.

12458. Kammermeyer, Karl and Binder, J.L. **Particle-size determination by sedimentation.** *Ind. Eng. Chem., Anal. Ed.* 13, 335-7 (1941).—*C.A.* 35, 4654^9.
The method consisted in measuring the change in pressure exerted by the suspension as the suspended material sepd. The pressures were indicated by the deflections of a spoon gage and mirror attached to the side arm of the settling chamber. The deflections of the spoon gage were amplified by an optical arrangement.

12459. Brieghel-Müller, A. **Filtration. III. Indirect methods for the investigation of filtration with filter aids.** *Kolloid-Z.* 99, 293-301(1942).—*C.A.* 38, 1917^5.
The effectiveness of kieselguhr prepns., $CaCO_3$, kaolin and activated carbon were studied. No unequivocal relation between particle size and vol. of the sediment was found, and it was concluded that no adsorption effect could be expected when kieselguhr was used as filter aid. Adhesion should be considered in the evaluation of the efficiency of kieselguhr, but no suitable test for measuring this property was available.

12460. Humbert, R.P.; Shaw, B.T., and Caldwell, O.G. **Studies of clay particles with the electron microscope. II. The fractionation of beidellite, nantronite, magnesium bentonite and attapulgite.** *Soil Sci.* 54, 149-58 (1942).—*C.A.* 36, 6951^2.
The 2-layer method, as applied to the Sharples supercentrifuge, was used. Photographs by means of an electron microscope showed that fractionation down to very small sizes had a real meaning. The larger particles did not appear to be oriented aggregates of small particles and their compact character suggested that considerable shearing force would have to be used within the suspension to break them down.

12461. Laguarta, Eduard, M. Galvez. **A streaming method for the determination of number of particles.** *Kolloid-Z.* 101, 165-7(1942).—*C.A.* 38, 5127^5.
The no. of particles was counted which passed through a cross section normally to the direction of flow in a given time at a given flow rate, produced by hydrostatic pressure or a known elec. field.

12462. Romanovsky, Vsevolod. **Effect of ions on the settling of a suspension of quartz powder.** *Compt. rend.* 215, 531-3 (1942).—*C.A.* 38, 3532^4.
Quartz powders of 7 to 20 μ were dispersed in aq. solns. of salts, stirred for 15 min., and allowed to settle. A table was given of the vol. of the ppt., and conclusions were drawn concerning the effect of various ions on the vol.

12463. Schiel, F. **Determining the particle shape of aggregate by the "falling-particle method."** *Asphalt u. Teer* 42, 863-5(1942).—*C.A.* 40, 5221^2.
Aggregates of the same particle size were allowed to settle in a tank (1 m diam. × 1.3 m deep) in the bottom of which was a rotating shutter (0.3-3 sec. per box width). This allowed particles having increasing time of fall (in the order cubical, lamellar, acicular) to be collected in a series of radially disposed boxes in the bottom of the tank. The results were compared with those of a standard sample.

12464. TIKHOMIROV, M.V.; TUNITSKIĬ, N.N., AND PETRYANOV, I.V. **The influence of van der Waals forces on coagulation of aerosols.** *Acta physicochim. U.R.S.S.* 17, 185-96 (1942) (in English).—*C.A.* 37, 4609⁴.

The rate of coagulation of an aerosol was detd. uniquely by the 3 mean values R, T/R, and T/R^2, where R = radius of the particles. The inclusion of interaction forces increased the coagulation const. by a factor, which did not depend on the av. size of the particles. The rate of coagulation, with interaction forces taken into account, was calcd., and the graph of the dependence of the rate of coagulation on the const. of van der Waals forces was given.

12465. FAIRS, G. LOWRIE. **The use of the microscope in particle-size analysis.** *Chemistry & Industry* 1943, 374-8.—*C.A.* 38, 10⁵.

12466. KOCHENDÖRFER, A. **Determination of particle size and lattice distortion of crystalline materials by the width of the x-ray lines.** *Naturwissenschaften* 31, 506-7(1943).—*C.A.* 38, 3546³.

The corrections to be applied in detg. particle size by x-ray line width were checked carefully by variation of slit width from 0.01 to 0.7 mm. The finally corrected figures were of the order of accuracy of 30% both for particle size and for lattice distortion. The upper limit for particle size was 10^{-4} cm.

12467. MANEGOLD, ERICH AND BÖHME, CHARLOTTE. **Capillaries, capillary systems and capillary phenomena. XXIV. The Berndel filters.** *Kolloid-Z.* 103, 96-104 (1943).—*C.A.* 37, 6498⁸.

Attemps to use a Berndel filter with an av. pore size of 5.5 μ for the filtration of an aq. suspension of red blood corpuscles were unsuccessful. Some of the pore sizes of this filter were considerably larger than 5.5 μ and the suspension went through these pores. More work was required to make these filters practical.

12468. PARTRIDGE, M.W. **Particle-size distribution of kaolin for internal administration.** *Quart. J. Pharm. Pharmacol.* 16, 1-6 (1943).—*C.A.* 37, 5194⁹.

The particle-size distribution of kaolin for internal administration was investigated. A method for the detn. of particle-size distribution in terms of the d. of a suspension after sedimentation was given, including the detn. of coarse particles in kaolin for internal administration.

12469. POCOCK, BRYANT W. **Particle size.** *Products Finishing* 7, No. 6, 38, 40, 42 (1943).—*C.A.* 37, 2244⁹.

The particles responsible for chemical reactions involved in electroplating, physico-chemical processes concerned in the manufacture and application of paints, enamels, lacquers, cleaners, and rust-preventives, and the combined activities of the various agents of corrosion and rust formation were for the most part between 1 and 40,000 A. in diameter.

12470. RIGDEN, P.J. **The measurement of the fineness of powdered materials.** *Chemistry & Industry* 1943, 393-6.—*C.A.* 38, 672³.

The sieve size of fine particles gave little information on the nature and behavior of the particles. Recourse was necessary to size analysis by elutriation, sedimentation, microscopic study, detn. of total surface area, or permeability of a bed of known dimensions by a gas or liquid.

12471. SCOTT, G.S. **Application of the Rosin-Rammler law to the "missing sizes" in screened coal.** *U.S. Bur. Mines, Rept. Investigations* 3732, 9 pp. (1943).—*C.A.* 38, 1092⁴.

The Rosin-Rammler law was illustrated in studying changes in sizing characteristics which would appear in screened coals if screens of different-size openings than those employed had been used.

12472. GAUDIN, A.M. AND HUKKI, R.T. **Principles of comminution-size and surface distribution.** *Am. Inst. Mining Met. Engrs., Tech. Pub.* No. 1779, 17 pp. (1944).—*C.A.* 39, 1090⁷.

Logarithmically plotted size-distribution graphs were straight lines only in exceptional cases. At the fine end, each curve approached asymptotically a straight line of slope 1.0. In the medium fine range, the size-distribution curves had slopes less than 1.0. Repeated crushings and increased energy inputs gave flatter size-distribution lines and increased curvature. Under certain exptl. conditions, size-distribution graphs exhibited pronounced humps at the coarse end. The surface produced was studied by a gas-adsorption method.

12473. HARVEY, EDMUND N., JR. **Particle-size analysis.** *Interchem. Rev.* 3, 59-70(1944).—*C.A.* 39, 11⁶.

The subject was reviewed.

12474. LADD, W.A. **Electron microscope studies of colloidal carbon in vulcanized rubber.** *Ind. Eng. Chem., Anal. Ed.* 16, 642-4 (1944).—*C.A.* 39, 216¹.

Three new exptl. techniques for studying colloidal C in vulcanized natural and synthetic rubbers were discussed. A vulcanizing method was preferred, whereby the unvulcanized sample was pressed to a thin film between 2 disks(a crowned steel plate and a flat Al plate, both coated with collodion), vulcanized in a press, the plates soaked in AmOAc to remove the collodion, and the films digested in AmOAc and photographed. Despite some distortion, it was the most promising of the 3 methods.

12475. SMALLWOOD, HUGH M. **Limiting law of the reinforcement of rubber.** *J. Applied Phys.* 15, 758-66(1944).—*C.A.* 39, 437⁴.

Expts. were performed to check calcns. on the stress system near a spherical filler particle. Carbon black was flocculated in rubber, and P-33, Thermax and gilders' whiting were completely dispersed. Kadox and XX grades of ZnO caused abnormally large increase in modulus, presumably because of alterations in type of cure and modulus of the rubber matrix.

12476. ERNSBERGER, FRED M. AND FRANCE, WESLEY G. **Portland cement dispersion by adsorption of calcium ligno-sulfonate.** *Ind. Eng. Chem.* 37, 598-600(1945).—*C.A.* 39, 3137³.

The mechanism of dispersion of cement particles in aq. suspensions due to Ca lignosulfonate was investigated by means of the Wagner turbidimeter and spectrophotometric analysis.

12477. McCartney, J.T. **Determination of the size distribution of fine coal particles by the electron microscope.** *U.S. Bur. Mines, Rept. Investigations* 3827, 11 pp. (1945).—*C.A.* 40, 4864^7.

Uniformity of distribution or closeness of sizing was greater for fine particles, and a regular increase in uniformity was traced from run-of-mine coal to colloidal sizes. An equation for calcg. surface areas of fine coal samples from their Rosin-Rammler parameters was derived, and good agreement was shown between areas so calcd. and those obtained from the av. diams. of the particles. Distribution of sizes in samples of several petrographical constituents was similar. Subdivision of the coal particles was followed down to the practical limit of resolution of the electron microscope.

12478. Nayer, M.G. and Doss, K.S. Gururaja. **Computation of screen analysis of the product of crystallization from the screen analysis of the seeds.** *J. Univ. Bombay* 13, Pt. 5, 11-2 (1945).—*C.A.* 39, 3991^9.

The formula $W_p = [1 + (\Delta D/D)]^3 W_s$ was used in industrial crystn. studies, where W_s and W_p = the wts of crystals before and after the expt., and D = the weighted mean of D_s, the size of the sieve opening. If W_s and W_p of the samples were known, the latter equation gave the value of D directly. An error less than 1.5% was usually obtained.

12479. Artemov, I.S. **Effect of foreign vapors on the coagulation of aerosols.** *J. Phys. Chem.* (U.S.S.R.) 20, 553-60(1946).—*C.A.* 41, 20*f*.

Mists of a mineral oil, stearic acid, and purified paraffin were produced by cooling the corresponding vapors. Their av. particle radius was 10^{-5} cm, and the concn. was 25 mg/m^3. The progress of coagulation was followed by counting the particles in darkfield illumination. No measurable sedimentation took place during the expts., (3 hrs); the change in the particle no., n, was produced solely by formation of larger particles from several small ones. The rate of increase was not affected by vapors of phenol, oleic acid, glycerol, and water. The concn. of the vapor in the mist was varied from 0.5 mg/m^3 almost to satn.

12480. Bailey, Emerson D. **Particle-size distribution by spectral transmission.** *Ind. Eng. Chem., Anal. Ed.* 18, 365-70 (1946).—*C.A.* 40, 5978^1.

The method was applicable to particles in the range of 0.4-2.0 μ with approx. spherical or cubic shapes. For 4 different minerals of varying particle-size distributions, the specific extinction-projected area vs. radius (r) curves were made to coincide by multiplying r by a factor M. M was a function of the relative refractive index (n_D of particles divided by n_D of dispersing medium) and the wave length. The method was calibrated by fractionating each of 4 minerals into 6-9 homogeneous fractions. The distributions were detd. in a Svedberg low-speed ultracentrifuge, and the av. specific extinctions were detd. The radius value corresponding to the max. sp extinction could be varied by changing the wave length of the radiation.

12481. Barnes, Marion D. and LaMer, Victor K. **II. Total scattering from transmittance as a basis for the calculation of particle size and concentration.** *J. Colloid Sci.* 1, 79-91 (1946).—*C.A.* 40, 3038^3.

The form of the transmittance curve observed for light passing through mono-dispersed S sols agreed with the predictions of the Mie theory. The diam. and no. of particles per unit vol. could be calcd. from the transmittance as a function of wave length. The form of the total scattering curve was exptly. detd. for a range of (particle circumference):(wave length) ratios wherein it has been too difficult to calc. it.

12482. Böttcher, C.J.F. **A differential method for the calculation of the mean radius of particles.** *Rec. trav. chim.* 65, 14-18(1946) (in English).—*C.A.* 40, 4586^4.

The radius (r) can be calcd. from measurements of the d. (p), n, dp/dn, the mol. wt (M), and Avagadro's no. N. A formula was derived the validity of which depended on assumed constancy of the polarization (α). The truth of this assumption was demonstrated by preliminary calcns. Between 30° and 70°C dp/dn was almost const. with a value of 2.62 ± 0.01 for water; this gave r = 1.36 A for the water mol.

12483. Dotts, Walter M. **Measuring the distribution of particle size in dispersed systems.** *Ind. Eng. Chem., Anal. Ed.* 19, 326-8 (1946).—*C.A.* 40, 3654^3.

Improvement of an existing micromanometric method by the introduction of a more consistent technique, simplified calcns. The use of app. made it possible to measure with an accuracy of 1% or better the distribution of particle size in any system varying from concd. emulsions to dil. suspensions.

12484. Druett, H.A. **Determination of the variation of composition of airborne crystalline materials with particle size.** *Nature* 158, 946 (1946).—*C.A.* 41, 1524*i*.

A 4-plate sampling instrument, the "cascade impactor," was designed so that particles in successive size ranges were deposited in turn on the corresponding plate. This instrument was suitable for the study of aerosols consisting of mixed silicates and silica. The sample underwent no treatment before the x-ray diffraction pattern was obtained, coagula were deposited appropriate to their Stokes-law size, and the sample was representative of the dust in a considerable vol. of air (5 ft^3).

12485. Dunkin, H.H. **Meaning of particle size, I. II.** *Chem. Eng. Mining Rev.* 38, 129-31, 169-72 (1946).—*C.A.* 40, 3207^3.

The problem of arriving at an "average" particle diam. for masses of particulate material was discussed.

12486. Engelhardt, W. v. **Grindability and surface energy of solids.** *Naturwissenschaften* 33, 195-203 (1946).—*C.A.* 41, 7181*i*.

Work relating power required for grinding various materials, salts, glasses, cement, metals, etc., to different phys. properties were reviewed.

12487. GOODEN, ERNEST L. AND UPDIKE, ROBERT L., JR. **Preparation of standard powders for reference in particle-size measurement.** *Ind. Eng. Chem., Anal. Ed.* **18**, 802 (1946).—*C.A.* 41, 898*h*.

Glass beads used for coating moving picture screens were sepd. by sieves into closely graded portions suitable for checking app. used in particle-size measurements. A rod-shaped powder made by pulverizing glass wool in a hammer mill was also used.

12488. HELLER, W.; KLEVENS, H.B., AND OPPENHEIMER, HANS. **The determination of particle sizes from Tyndall spectra.** *J. Chem. Phys* **14**, 566-7 (1946).—*C.A.* 40, 6933^9.

The wave-length exponent n, obtained from the Tyndall spectrum, was calibrated against the particle size of aq. emulsions of polystyrene, polyisoprene, and styrene-isoprene copolymer, in the range of particle diams. from 500 to 3000A. The calibration curve changed as the ratio m of the refractive index of particle and medium changed. A curve was given for $m = 1.24 \pm 0.01$. The method was valid for any type of dispersed system with spherical particles.

12489. HEYWOOD, HAROLD. **A comparison of methods of measuring microscopical particles.** *Bull. Inst. Mining Met. No.* 477, 14 pp. (1946).—*C.A.* **40**, 2698^6.

Measurements were made by 10 experienced observers on the profile outlines of pieces of crushed sandstone graded to pass a 1-1/8 in. sq aperture and be retained on a 1 in. sq aperture. Profile comparisons were made with opaque and with transparent circles. From a statistical analysis of the measurements it was suggested that the comparison graticule was more suitable for visual work and the Martin statistical diam. method was best for profiles projected on a screen.

12490. HEYWOOD, HAROLD. **A study of sizing analysis by sieving.** *Bull. Inst. Mining Met. No.* 477, 18 pp. (1946).—*C.A.* **40**, 2699^4.

The variation in length, breadth, thickness, and vol. occurring in practice was detd. by measurements on 142 crushed sandstone particles, hand-graded to be retained on a 1 in. sq aperture and to pass through a 1-1/8 in. sq aperture. The least variation was in particle breadth. The sieving process occurred in 2 stages, the fine dust being eliminated fairly rapidly, followed by the near mesh particles at a gradually diminishing rate. The proportion of material passing the sieve was increased in all cases by wet sieving.

12491. JACOBSEN, A.E. AND SULLIVAN, W.F. **Centrifugal-sedimentation method for particle-size distribution.** *Ind. Eng. Chem., Anal. Ed.* **18**, 360-4 (1946).—*C.A.* **40**, 5977^4.

The particle-size distribution of com. TiO_2 pigment was detd. by two centrifugal sedimentation methods and by electron-microscope counts. An ordinary beaker-type centrifuge was used to sediment the pigment fractions. The particle diams. were calcd. from the modified Stoke's law equation.

12492. LAMER, VICTOR K. AND BARNES, MARION D. **Monodispersed hydrophobic colloidal dispersions and light-scattering properties. I. Preparation and light-scattering properties of monodispersed colloidal sulfur.** *J. Colloid Sci.* 1, 71-7 (1946).—*C.A.* 40, 3038^1.

Colloidal dispersions of very uniform particle size were prepd. by adding 1 ml of 1.5 N $Na_2S_2O_3$ to 1 liter of 0.0015 N H_2SO_4 at 25°C. The particles of S in the sol were at first very small but continued to grow. The sols were stabilized at any time so as to stop further change in particle size by titrating the unchanged $Na_2S_2O_3$ with I_2, leaving a slight excess of $Na_2S_2O_3$ to stabilize the dispersion. Sols with larger particles dispersed scattered light to form bands of different colors whose intensity, polarization, and angular distribution depended on the particle size.

12493. ROSE, H.E. AND LLOYD, H.B. **Measurement of the size characteristics of powders by photo-extinction methods. II. Experimental investigation of the photoextinction laws.** *J. Soc. Chem. Ind.* 65, 65-74(1946).—*C.A.* 40, 4582^4.

The linear relation between opacity and powder concn. was obtained if the solid angle subtended by the photocell at the center of the suspension was small. In these cases the linear relation held up to concns. in which 99.5% of the light was extinguished. The linear relation between opacity and the product of the concn. and the length of the path was again obtained if the solid angle subtended by the photocell was small.

12494. STEINHERZ, A.R. **Shape of particles in finely ground powders.** *J. Soc. Chem. Ind.* 65, 314-20 (1946).—*C.A.* 41, 2626*i*.

A method for measuring the mean particle shape was as follows: a fraction of nearly equal-sized particles was isolated, their mean vol. detd. by counting the particles of the same wt, and the mean of their greatest cross sections (i.e., of the images of the particles in their most stable positions) was measured. The mean thickness was then calcd. as a quotient of the mean vol. and the mean cross section, a prismoidal form of the particles being assumed. Portland cement, ground quartz sand, and ground glass were used.

12495. TÖTTERMAN, H. **Casagrande hydrometer method for determining particle size in finely dividing material.** *Finska Kemistsamfundets Medd.* 55, 34-35(1946).—*C.A.* 43, 4923*i*.

A sedimentation size analysis was made in which the variation of solids content with time was obtained by measurement of d. of the suspension with a hydrometer. The method was readily applicable to chalks, clays, etc., of particle size 1-100 μ.

12496. AMOR, ISIDORO ASENSIO. **A comparison of methods for the determination of particle size in soils.** *Anales inst. espan. edafol., ecol. y fisiol. vegetal* (Madrid) 6, 117-28(1947).—*C.A.* 43, 6346*h*.

If the soil contains an excess of org. matter, macerate with oxygenated water for 24 hrs before dispersion. Disperse 50 g soil with 2 g Na_2CO_3 and 5 ml of a soln. of Na_2SiO_3 (sp. gr. 1.36). Transfer to a 100-ml cylinder, invert several times, and sample with the pipet after 4 min. 48 sec. and after 8 hrs. Test with the densimeter at 0.5, 1.0, 2, 4, 10, 15, and 45 min., 2,4,6, and 24 hrs.

12497. ARTEMOV, I.S. **Effect of the particle shape on the rate constant of the coagulation of aerosols.** *Kolloid. Zhur.* 9, 225-30(1947).—*C.A.* 47, 941*i*.

The aerosols were produced in an elec. field and the concn. was 25 mg/m^3 and particle radius approx. 3×10^{-5} cm. Aerosols of anthraquinone and nitrosodimethylaniline coagulated at about 10°C with the rate consts. $K = 30 \times 10^{-9}$ and 27×10^{-9}, resp. In the presence of $CHCl_3$, Et_2O, PhOH, H_2SO_4, or oleic acid vapor, nitrosodimethylaniline gave nearly isometric particles, and K was 20×10^{-9}, i.e. agreed with the theoretical value. The same K was found for anthraquinone in the presence of H_2SO_4 and toluene vapors which caused these particles to be almost isometric.

12498. BARDWELL, J. AND SIVERTZ, C. **Determination of particle size by light scattering.** *Can. J. Research* 25B, No. 3, 255-65 (1947).—*C.A.* 41, 7202*a*.

An analysis of the exptl. measurements necessary for the detn. of the size of small dielec. particles from the Debye-Einstein equation was presented. Exptl. results obtained in detn. of latex particle size were, in general, in agreement with those obtained with the electron microscope.

12499. CROSS, A.H.B. **The variation of specific gravity of crushed silica brick with particle size.** *Trans. Brit. Ceram. Soc.* 46, 105-8(1947).—*C.A.* 41, 6683*h*.

The sp. gr. of crushed samples from a hard-fired silica brick, a soft-fired silica brick and glass increased slightly with fineness. This indicated that selective crushing of allotropes in silica bricks might occur.

12500. DAVIES, C.N. **The sedimentation of small suspended particles.** *Trans. Inst. Chem. Engrs.* (London) and *Soc. Chem. Ind.* (London), *Road and Bldg. Materials Group, Advance copy,* Feb. 4, 1947, 12-26.—*C.A.* 41, 2822*h*.

The types of particles considered were isolated solid spheres, liquid drops, air bubbles, ellipsoids, and particles of irregular shape. Sufficiently small liquid drops and air bubbles behaved as solid spheres but, for larger drops or bubbles, fluid viscosities and interfacial tension affected the sedimentation rate. The orientation of irregular-shaped particles changed in going from viscous flow through the transition range to turbulent flow. The effect of diffusion and also the Brownian motion on the orientation of the particle was considered. Turbulence, or random air movement, resulted in an exponential decay of the no. of suspended particles.

12501. DUBUISSON, ADRIEN. **Determination of the degree of fineness of powdered materials.** *Rév. matériaux construction trav. publ. C, No.* 383/384, 306-10 (1947).—*C.A.* 42, 799*d*.

Air was passed through a tube contg. the powd. material. The size of the particles was detd. from the air velocity required to suspend the particles, by using Stokes' law.

12502. GINELL, ROBERT; GINELL, A. MARGOT, AND SPOERRI, PAUL E. **Association phenomena. I. The growth of particles of silver chloride and the higher-order Tyndall effect.** *J. Colloid Sci.* 2, 521-5(1947).—*C.A.* 42, 1478*f*.

The formation of AgCl on mixing NH_4Cl and $AgNO_3$ in 95% EtOH was followed by measuring turbidity as a function of time. The results were correlated with the appearance of Tyndall light of different colors. Monodispersed AgCl sols formed by this method were stable for as long as 4 months. The stability was more pronounced with excess Cl^- and with more dil. solns.

12503. HANSON, E.E. AND DANIEL, J.H. **Instrument for measuring particle diameters and constructing histograms from electron micrographs.** *J. Applied Phys.* 18, 439-43(1947).—*C.A.* 41, 4972*f*.

The scanning mechanism measured the arithmetic mean of the major and minor diams.; a recording unit constructed the histogram by dropping steel balls in appropriate slots. At least 200 individual particles should be measured to get a representative figure, and they should have a major/minor axis ratio of less than 2. This method was more accurate and twice as fast as manual methods.

12504. HEYWOOD, HAROLD. **The scope of particle-size analysis and standardization.** *Trans. Inst. Chem. Engrs.* (London) and *Soc. Chem. Ind.* (London), *Roads and Bldg. Materials Group, Advance copy,* Feb. 4, 1947, 1-11.—*C.A.* 41, 2822*g*.

The basic principles in sizing analysis and the methods used, such as sieving, sedimentation, elutriation, and microscopic measurements, were reviewed. The use of the relation between particle shape and equiv. diams. was stressed.

12505. JACOBSEN, A.E. AND SULLIVAN, W.F. **Particle-size distribution for the entire subsieve range.** *Anal. Chem.* 19, 855-60(1947).—*C.A.* 42, 423*a*.

The balance pan in Odén's method was replaced by a tall cylindrical cup (polished stainless steel of inside diam. 4.5 cm, height 11.90 cm) and the weighings were made with a chainomatic balance. The amts. sedimented at various times were detd; these can be converted by a graphic method to a cumulative distribution curve. On a quartz suspension, this curve agreed reasonably well with that detd. by direct microscopic counting. By using a buoyancy factor, waiting for complete sedimentation could be avoided. The method gave the subsieve particle-size distribution down to a particle diam. of about 1μ.

12506. JOHNSON, IRVING AND LAMER, VICTOR K. **The determination of the particle size of monodispersed systems by the scattering of light.** *J. Am. Chem. Soc.* 69, 1184-92(1947).—*C.A.* 41, 5767*b*.

The particle size of monodispersed sulful sols was detd. by light scattering detg. the number and position of bands of different colors. Use was made of the red bands, called orders, which increased from 0 to 9 as the particle size increased. Measurements were made with a visual photometer of the intensities of the light scattered at different angles using two narrow-wave-length bands centered in the red (6290 A) and green (5240 A) resp. The ratios of the red and green intensities when plotted against the angle of observation had max. at the same angles. Calibration of particle-size measurements was made by detn. of the rate of deposition of the sulfur particles.

12507. Kegeles, Gerson. **A new optical method for observing sedimentation equilibrium.** *J. Am. Chem. Soc.* 69, 1302-5(1947).—*C.A.* 41, 7201*h*.

The theory and exptl. method used to observe in a single photograph both the concn. distribution and the concn.-gradient distribution required the "wt-av." mol. wt in the study of sedimentation equilibrium of polydisperse systems. The construction of the double prismatic cell and the exptl. technique connected with its use were described in detail.

12508. Klevens, H.B. **Latex particle size as determined by soap titration and light scattering.** *Colloid Sci.* 2, 365-74(1947).—*C.A.* 41, 6454*f*.

The particle size as a function of polymerization yield was detd. for synthetic latexes prepd. at 50°C by polymerizing an emulsion contg. 180 parts of a 2.5% aq. soln. of K myristate, 75 parts isoprene, 25 parts styrene, and small amts. of mercaptan and persulfate. Particle sizes were detd. by a spectrophotometric-interferometric technique and by titration of latex contg. a known excess of soap with a dye capable of undergoing a color change when the soap concn. corresponded to the crit. value for micelle formation. By the titration method the adsorptive capacity of the polymer particles for soap was detd. and from this the surface area of the particles calcd.

12509. Matheson, George L. **Modification in Roller analysis for the determination of particle-size distribution.** *Oil Gas J.* 46, No. 28, 307-10 (1947).—*C.A.* 42, 1727*e*.

For application to fluid cracking catalyst, the Roller app. was provided with a porous-plate air distributor to insure that fragmentation of the catalyst did not occur during the analysis. An investigation of the effect of moisture indicated that relative humidity of the air delivered to the catalyst during the test should be 50-70%.

12510. Rossi, Corrado. **Particle size of powders. I. Calculation of the sedimentation curve.** *Ann. chim. applicata* 37, 216-29(1947).—*C.A.* 41, 7201*h*.

The Boltzmann law was applied to the detn. of particle size as a function of the density.

12511. Smith, Mervyn L. **Particle-size measurement in the radio industry.** *Trans. Inst. Chem. Engrs.* (London) and *Soc. Chem. Ind.* (London) *Roads and bldg. Materials Group, Advance copy,* Feb. 4, 1947, 77-84.—*C.A.* 41, 2823*b*.

Particle-size analysis was extremely important for obtaining uniform products in the manuf. of radio tube parts. Methods were discussed for particle-size analysis for refractory metals in powder form, powd. metals such as Fe, Ni, Al, and Co, gas-absorbing powders, insulating materials, ceramic materials, emissive materials, black coating powders, conducting powders, and fluorescent powders.

12512. Stairmand, C.J. **Some practical aspects of particle-size analysis in industry.** *Trans. Inst. Chem. Engrs.* (London) and *Soc. Chem. Ind.* (London), *Roads and Bldg. Materials Group, Advance copy,* Feb. 4, 1947, 58-68.—*C.A.* 41, 2822*f*.

The various methods of detg. particle size for industrial applications were reviewed and comparison of the results by different methods given. A study of the cleaning of blast-furnace gas was presented.

12513. Stairmand, C.J. **Sedimentation apparatus for particle-size analysis in the subsieve range.** *Inst. Chem. Engrs. and Soc. Chem. Ind. Road and Bldg. Materials Group, Symposium on Particle Size Analysis* Feb. 4, 1947, 128-45*(Suppl. to Trans. Inst. Chem. Engrs,* 25, (1947).—*C.A.* 44, 5158*d*.

The app. was based on the Andreasen sedimentation tube and a special technique was used which allowed the use of much lower concns. than possible with the original Andreasen app. App. dimensions (sketch) and the method of operation were given. Little particle interference occurred during sedimentation at concns. up to 0.5% by vol. Quantities weighed were such that 0.05% could be used without loss of accuracy which were sufficient for plant control or general research work.

12514. Vendramini, Renzo. **Measurement of aerosol particles.** *Boll. Soc. med. chir. Modena* 47, 276-82 (1947).—*C.A.* 43, 6883*e*.

Various methods were critically discussed.

12515. Druse, J. **Measurement of carbon black in rubber by the microscope.** *Kolloid-Z* 110, 125-32(1948).—*C.A.* 43, 4887*e*.

The technique of prepg. samples and of detg. particle size were described. Dark-field photographs were shown and discussed. A table of results for 5 types of carbon black gave information of active and inactive portions of the material.

12516. Frenkel, Ya. I. **Mechanism of the electrification of solids and liquids in dusts and mists.** *Zhur. Eksptl. Teoret. Fiz.* 18, 799-806 (1948).—*C.A.* 45, 9402*e*.

Ionic holes with the sign corresponding to the smaller energy of formation were accumulated at the surface, while holes of the opposite sign formed the diffuse elec. layer. Smallest grains of the material carried a charge of the same sign as the surface; that charge decreased with increasing size. In an ascending air current, the lighter particles were sepd. from the heavier grains which carried the opposite charge. The fields arising in this process could be of the order of 1000 v./cm.

12517. Mills, Gervase L. **Particle-size measurement.** *Nature* 161, 313-14(1948).—*C.A.* 42, 3624*f*.

A simple app. was described and an equation given for measuring the mean radius of particles of a powder. The mean error of an observation by the method was 0.0008mm.

12518. Olevskii, V.A. **Preferred size of balls for ballmills.** *Gornyi Zhur.* 122, No. 1, 30-3(1948). —*C.A.* 43, 3247*g*.

In calcg. the size of balls, the particle size of the product should be taken into account. Where the balls were of one size, the following formula was derived for the preferred size balls: $D < 6(\log d_k)\ (d^{1/2})$, where D_m = diam. of the balls in mm, d = upper diam. of feed particles in mm, and d_k = diam. of product in μ. The finished product was considered as having a residue of 10% on a screen with d_k meshes.

12519. Powers, H.E.C. **Determination of the grist of sugars using the mean aperture and coefficient of variation numbers.** *Intern. Sugar J.* 50, 149-50(1948); *Sugar J.* 12, 9-11 (June, 1949).—*C.A.* 42, 6560*a*.

Hundreds of different sugars were sieved and cumulative percentage of each was plotted against aperture size on arithmetic probability paper. In all cases a straight line was obtained between 10 and 90%. It was possible to construct the curve for any sugar from the results obtained by using only two sieves, providing the points fell between the extremes of 10 and 90%. The results were reported as "Mean Aperture" (M.A.) and "Coefficient of Variation (C.V.). M.A. was the aperture corresponding to 50% on the graph; C.V. was given by [(aperture corresponding to 16%) − (aperture corresponding to 84%) divided by (M.A. × 2)] × 100.

12520. Rose, H.E. and French, C.C.J. **The extinction coefficient: particle-size relationship for fine mineral powders.** *J. Soc. Chem. Ind.* 67, 283-9(1948).—*C.A.* 43, 2843*c*.

A curve relating the extinction coeff., K, to the particle size of material in suspension in the range 0-50μ was derived exptly. The assumption that K was independent of particle size led to errors of about 100% in the estn. of specific surface and this observation reduced the probability of developing accurate, single-measurement methods. In view of the rapid variations in the value of K with particle size, observations of light intensity must be taken at small intervals of particle size.

12521. Sharratt, E. **The industrial control of size grading.** *Trans. Brit. Ceram. Soc.* 47, 22-37(1948).—*C.A.* 43, 2388*h*.

A sieve test to control the coarse material and a surface-area test to control the fine material were used. Intermediate size grading will then be automatically decided provided the grinding is normal. Data showed that the Murex "Spekker" surface-area method gave results in good agreement with those found by air permeability. Comparison was also made between the results obtained for full-size analyses by means of the pipet, turbidimetric, or microscopic methods, where again good agreement was shown.

12522. Simon, Leslie E. **Variation in materials, testing, and sample sizes.** *Proc. Am. Soc. Testing Materials* 48, 21-5, discussion, 26-9 (1948).—*C.A.* 43, 5515*f*.

The design of expt. involved identification of the test phenomena, evidence of state of predictability in material sampled, and a tech. procedure designed to yield a max. of information with a min. of cost and effort. The execution phase must contemplate the variability in the material and precision and accuracy of measuring processes.

12523. White, Locke Jr. **The determination of the particle size of aerosols by scattered light.** *J. Colloid Sci.* 3, 251-3(1948).—*C.A.* 42, 6201*d*.

A method, which depended on the measurement of the amplitude of vibration of a charged particle in an alternating elec. field, was used to det. the particle size of aerosols with radii in the range 0.15-0.59μ. The results agreed well with those obtained by the optical method of LaMer.

12524. Wilks, S.S. **Sampling and its uncertainties.** *Proc. Am. Soc. Testing Materials* 48, 3-19 discussion, 20(1948).—*C.A.* 43, 5515*h*.

Math. and statistical methods were discussed for analyzing sampling results and describing sampling laws at each stage of sampling. In sampling from lots of bulk material the sampling laws for the least and greatest measurements in a sample and their application in making inferences about the lot were described. Representative sampling as a method of overcoming nonuniformity in lots and the conservative nature of inferences from representative samples were considered.

12525. Ackerman, L. **Errors in routine screening tests.** *Chem. Eng. Mining Rev.* 41, 211-14(1949). —*C.A.* 43, 5885*h*.

Variations were noted in screening methods, in screening machines, and errors due to carelessness and other factors. A no. of recommendations were given.

12526. Blake, P.D. **Comparison of methods for determining surface area and other particle-size data of fine powders, especially welding electrode powders.** *J. Soc. Chem. Ind.* (London) 68, 138-48(1949).—*C.A.* 43, 6883*i*.

Use was made of Stokes' equiv. statistical diam. with the modified Roller method which gave the closest approximations to the abs. hydrometric values. Other advantages were that it used only points on the wt-distribution curve measurabl accurately, required only 4 points on the curve, and provided data on max. wt and no. frequency and the no. of particles/g.

12527. Coughanour, L.W. and Norton, F.H. **Fundamental study of clay IX. Influence of particle shape on properties of suspensions.** *J. Am. Ceram. Soc.* 32, 129-32(1949).—*C.A.* 43, 4436*h*.

Suspensions contg. mono-disperse particles of muscovite, kaolinite, halloysite, and orthoclase were studied at various concns. to det. the influence of particle shape on flow properties. The shapes had a considerable effect on dispersed suspensions, the more isometric particles yielding the lower viscosity. Particle shape made no difference in flocculated suspensions. There was some evidence that isometric particles in any suspension were nonthixotropic.

12528. Davies, C.N. **The sedimentation and diffusion of small particles.** *Proc. Roy. Soc.* (London) A200, 100-13(1949).—*C.A.* 44, 3768*d*.

The concn. of particles that settled and diffused while in suspension in a fluid was given as a function of time and position for a dil. suspension that was initially uniformly dispersed in a wide vessel. All particles that struck the surfaces of the container were assumed to be adsorbed. Solns. were obtained for a liquid with a free surface and also for a gas or liquid that entirely filled the space between 2 horizontal planes.

12529. Forsythe, W.L. Jr. and Hertwig, W.R. **Attrition characteristics of fluid cracking**

catalysts. *Ind. Eng. Chem.* 41, 1200-6(1949).— *C.A.* 43, 7217*f*.

A simple lab. accelerated attrition test was developed to evaluate particle breakdown of catalysts for fluid cracking units. The catalyst was subjected to the action of a high-velocity air jet and the extent of breakdown measured by screen and Roller analyses. Com. grades of fresh natural, SiO_2-Al_2O_3, and SiO_2-MgO ground catalysts had the same range of attrition resistance. Fresh microspheroidal catalysts had better breakdown resistance than ground catalysts except where there were excessive proportions of agglomerates.

12530. Fréchette, V.D. and Sephton, H.I. **A method of particle-size determination by means of the microscope.** *Am. Ceram. Soc. Bull.* 28, 496-7(1949).— *C.A.* 44, 1779*d*.

The sample was dispersed in warm raw Canada balsam, and the particles classified with respect to Martin's diam. by means of an external scale that was visible through the camera lucida. This was done at 3 successive magnifications. Either a micrometer-driven stage or an internal standard was used to reduce the counts to the same basis, as percentage of the total sample.

12531. Hartley, A.W. **Measurement of particle size.** *Mfg. Chemist* 20, 108-12(1949).— *C.A.* 43, 3687*h*.

12532. Johnstone, H.F. and Roberts, M.H. **Deposition of aerosol particles from moving gas streams.** *Ind. Eng. Chem.* 41, 2417-23(1949).— *C.A.* 44, 2674*e*.

For dusts contg. particles larger that 2 μ in diam., the cyclone spray scrubber had a max. efficiency at accelerations of 100 X gravity with droplets approx. 100 μ in diam. The removal of fine dusts and fumes by the atomization of a liquid injected into a high velocity gas stream, and accelerated by a Venturi tube, was 92-99% efficient. The efficiency varied as the specific drop surface developed per unit vol. of gas, and depended on the nature of the fume.

12533. Kidvidze, R.E. **Effect of the size of the original particles of lead on the distribution function in alcohol suspensions.** *Soobshcheniya Akad. Nauk Gruzin. S.S.R.* 10, No. 3, 133-8 (1949).— *C.A.* 46, 8932*i*.

Pb particles (filings) of known granulometric compn. were shaken with EtOH under identical conditions, for the same length of time (60 min.), and the surface area *S* of the resulting suspension was detd. by ultracentrifugal analysis. Detns. of *S* were made with size fractions (in 10^{-2} mm): 110.0-64.2, 64.2-32.4, 32.4-20.0, 20.0-13.5, 13.5-7.0. After 60 min. dispersion, the corresponding *S* values were 55.65, 71.59, 73.54, 71.11, and a very coarse suspension. On still more prolonged dispersion, *S* decreased again.

12534. Klovers, E.J. **How you can predict product screen analyses.** *Eng. Mining J.* 150, No. 6, 80-1(1949).— *C.A.* 43, 5885*i*.

12535. Kuczyński, G.C. **Self-diffusion in sintering of metallic particles.** *J. Metals* 1, No. 2, Trans. 169-78(1949).— *C.A.* 43, 2557*e*.

The mechanism of sintering of 2 metallic particles or of a metallic particle and a flat metallic block at atm. pressure was predominantly that of vol. diffusion for large particles and higher temps.

12536. Manning, A.B. **A theory of coal sampling.** *Fuel* 28, No. 3, 49-56(1949).— *C.A.* 43, 3168*f*.

The accuracy with which a sample of coal represented the bulk was calcd. from the wt of the sample taken, the particle-size distribution, and the results of a float and sink test. Conversely, the min. wt of sample required for a given accuracy was calcd. The theory was developed from the calcd. distribution of samples drawn at random from a mixt. of two different kinds of particles, e.g. particles of coal and particles of dirt, and extended to ternary mixts.

12537. Marshak, F.M. **Fractionation of fine polydisperse powders by an air current.** *Kolloid. Zhur.* 11, 30-3(1949).— *C.A.* 43, 7290*c*.

Fractions below 0.9 μ and 0.7 μ, resp., were obtained from quartz and goethite.

12538. Mörtsell, Sture. **Accuracy of sieve analyses made by means of sieving machines.** *Acta Polytech. No.* 30, *(Mech. Eng. Ser. 1). No.* 6, 44 pp. (1949); *Kgl. Tek. Hogskol. Handl. No.* 17 (1948).— *C.A.* 43, 6007*b*.

12539. Sinclair, David and LaMer, Victor K. **Light scattering as a measure of particle size in aerosols. The production of monodisperse aerosols.** *Chem. Revs.* 44, 245-67(1949).— *C.A.* 43, 6039*d*.

12540. Spektor, A.G. **Rapid calculation of size distribution of spherical particles in nontransparent solid.** *Zavodskaya Lab.* 15, 1134-5 (1949).— *C.A.* 44, 10458*i*.

The vol. V, surface S, no. of particles per unit area of field n, and max. diam. of particle $D_{max.}$ of the dispersed phase was detd. by microscopic observation of several fields. If $a = D_{max.}/6$, $A = n/a$, $B = S/\pi a^2$, and $C = 6V/\pi a^3$, it was shown that the total no. of particles present per unit vol., $N = (23A - 9B + C)/15$.

12541. Spektor, A.G. **Relation between the characteristics of the dispersity of heterogeneous structures.** *Zavodskaya Lab.* 15, 1314-16(1949).— *C.A.* 46, 2375*g*.

In the case of a 2-phase system, it was shown that $\bar{a} = 4(1 - V_B)/S$, where $\bar{a}$ was the av. distance between dispersed particles, V_B the vol., and S the surface of the dispersed phase per unit vol. of the system. When V_B was small, $\bar{a}$ approached $4/S$.

12542. Srikantan, B.S. **Limits of supersaturation and the particle size of the solute.** *J. Indian Chem. Soc.* 26, 60-2(1949).— *C.A.* 43, 8241*f*.

Supersoly. could exist only for particles whose radii were between 5 μ and 50 mμ. A much higher supersoly. could be maintained on cooling for substances with high soly. and temp. coeff. of soly. than for others.

12543. Tourky, A.R. and El Wakkad, S.E.S. **Solubility and particle size from a study on**

silver oxide. *J. Phys. & Colloid Chem.* 53, 1126-34(1949).—*C.A.* 44, 904*f*.

Ag_2O was prepd. from dil. solns. of $AgNO_3$ and $Ba(OH)_2$, and the particle size detd. by a petrographic microscope or by sedimentation. By the disintegration of pure Ag_2O in H_2O, it was found that the particles could not be broken down below a certain limiting value, 26.8 mμ, irrespective of their initial size. The concn. of the OH^- on the surface of the particles showed an unequal distribution of both Ag^+ and OH^- from the solid wall of the particles into the bulk soln. The soly. of a slightly sol. electrolyte such as Ag_2O ceased to depend on the particle size whenever the condition of equal distribution of ions in the bulk soln. was not fulfilled.

12544. VÉLON, PIERRE. **Particle size of raw materials for face powders.** *Ind. parfum.* 4, 394-9(1949).—*C.A.* 44, 7023*d*.

A brief discussion was given of the screening, microscopic examn., turbidity, elutriation, and sedimentation methods for detg. particle size. The Andreasen sedimentation technique was applied to talc, kaolin, TiO_2, Zn stearate, and Zn oxide.

12545. VOLKOVA, Z.V. **The probability characteristics of separation of solids.** *Zhur. Priklad. Khim.* 22, 1231-6(1949).—*C.A.* 46, 5371*f*.

A more detailed evaluation was given of separability based on calcn. of probability characteristics of sepns., degree of recovery of separable components in the concentrate, and content of sepd. component in the concentrate. Particles of heterogeneous compn. were formed at the phase boundaries in the solid body. Math. formulas were given for calcn. of area of a particle at the phase boundary and for calcn. of probability of sepn. of a particle from the phase boundary. Calcns. were carried out for 3 powder fractions having av. particle sizes 0.380 mm, 0.200 mm, and 0.050 mm.

12546. WALL, CLARENCE J. AND ASH, WILLIAM J. **Fluid-solid air sizer and drier.** *Ind. Eng. Chem.* 41, 1247-9(1949).—*C.A.* 43, 6471*g*.

A unit was developed for the continuous drying and sizing of dolomite, the fluid-solid technique was used. The unit now operated on a com. scale in the prepn. of dry, sized feed for a rotary lime kiln. Hot air was used to evap. the moisture and the feed was sized by differential entrainment from a fluidized bed. Removal and recovery of marketable fines from the feed gave an improved product and effected a fuel saving in the kiln operations.

12547. YEOMANS, A.H. **Directions for determining particle size of aerosols and fine sprays.** *U.S. Bur. Entomol. and Plant Quarantine* **ET-267**, 7 pp. (1949).—*C.A.* 43, 6883*f*.

Microscopic measurements were made of the particles of nonvolatile materials collected on slides coated with a 1% alc. soln. of mannitan monolaurate or a Si product called Dri-film 9987. Volatile materials were collected on slides coated with MgO or carbon soot, and size estns. were made by measuring the craters left at the point of contact.

12548. YEOMANS, ALFRED H.; ROGERS, E.E., AND BALL, W.H. **Deposition of aerosol particles.** *J. Econ. Entomol.* 42, 591-6(1949).—*C.A.* 44, 262*e*.

Aerosol particles in still air tend to settle directly downward unless deviated by a force greater than gravity. Usually air currents prevented downward settling, but nearly all deposition occurred on horizontal surfaces or on horizontal protrusions from vertical surfaces. The optimum particle size for insecticidal aerosols increased with the size of the insect (for mosquitoes 15.81 μ in diam., for house flies 22.4 μ).

12549. BOYE, ERICH. **For the laboratory: a colloid mill in laboratory glassware.** *Chem.-Ztg.* 74, 721(1950).—*C.A.* 45, 4493*b*.

Two oppositely rotating disks on a concentric axis had several slotted rings attached to one face, each ring having the same axis as the disks, and moving in the annular space between a pair of similar rings attached to the facing side of the opposing disk. The mixt. to be emulsified entered through slots near the center of each disk and was forced by centrifugal action through a series of changes of direction and pressure in its passage through the narrow spaces between the intermeshing, oppositely moving rings. Stable emulsions of water and light mineral oil were thus prepd. without using emulsifying agents.

12550. CARPENTER, FRANK G. AND DEITZ, VICTOR R. **Methods of sieve analysis with particular reference to bone char.** *J. Research Natl. Bur. Standards* 45, 328-46(1950)(Research Paper 2143)

Sieve openings in the range between U.S. Standard Sieves No. 8 and No. 80 were studied. The largest source of error was in the testing sieves due to the tolerences permitted by the present specifications. It was feasible to calibrate testing sieves by the use of a calibrated sample of glass spheres. An analysis with seven Ro-Tap machines indicated that, in general, best results were obtained when the Ro-Tap was operated at 115 taps/min. of the knocker mechanism. The other variables concerned with shaking need not be rigidly controlled. The shaking time should be adjusted to the weight and the particle size distribution of the sample according to relationships developed.

12551. COLLINS, FRANK C. **Diffusion in chemical reaction processes and in the growth of colloid particles.** *J. Colloid Sci.* 5, 499-505 (1950).—*C.A.* 45, 3684*d*.

The Smoluchowski theory was applied to generalized processes involving diffusion. The probability a of a mol. diffusing up to the sink being absorbed was investigated. For planar sinks, the effective flux became independent of a at sufficiently long times. For spherical sinks, the effective flux became independent of a at sufficiently large radius.

12552. COSBY, W.T. **The formation and stability of aerial disperse systems.** *Bull. Brit. Coal Utilisation Research Assoc.* 14, 201-11(1950).—*C.A.* 45, 3219*i*.

The formation and behavior of systems of particulate solid and liquid materials dispersed in a gaseous medium were reviewed.

12553. Deshpande, V.V. and Telang, M.S. **Pipet method of sedimentation analysis rapid determination of distribution of particle size.** *Anal. Chem.* 22, 840-1(1950).— *C.A.* 44, 7592*i*.
Simultaneous suspension samples were drawn from a 1000-ml cylinder through tubes of different lengths into two 10-ml pipets. The time required for a detn. was lowered from 1130 min. for a single pipet of the Andraesen type to 480 min. for this double pipet method.

12554. Evva, Ferenc. **Sedimentation analysis of alumina hydrate suspensions.** *Aluminium* 2, 148-53(1950).— *C.A.* 45, 5486*g*.
On the basis of the expts. the following method was proposed for practical sedimentation tests: Pour the hydrate suspension into a 500-ml cylinder to the 100 or 200-ml mark, let stand until the hydrate is settled, add sufficient aluminate soln. so that the height of the settled hydrate layer is 5-6% of the total column height of the settled hydrate each 5-10 mins. When the liquid becomes quite clear, decant, and measure the d. with a hydrometer and the viscosity with an Ostwald viscometer.

12555. Hayakawa, Sohachiro. **A theoretical attempt on the packing of powder.** *Rept. Inst. Sci Technol.* 4, 87-92(1950).— *C.A.* 45, 7846*c*.
A quantity corresponding to the free energy of a unit cell was introduced for the assembly of powder particles in analogy to the mol. theory of the crystal lattice. A potential energy between particles was assumed to be inversely proportional to the degree of irregularity of shape, resulting in an exponential function of the distance between the particles. The relation between the void and particle size was obtained by calcg. the condition of the most stable packing.

12556. Jullander, Ingvar and Olsson, Bertil. **Physical-chemical investigation of fly ash from pulverized coal.** *Svensk Papperstidn*, 53, 199-204(1950)(in English).— *C.A.* 45, 844*d*.
Screen analyses of the pulverized coal and fly ash were given. Special app. for fractionating 18 fractions by sp. gr. was based on floating fractions on various mixts. of butanol (sp. gr. 0.807) and acetylene tetrabromide (sp. gr. 2.942). Size distribution of the fly ash particles was detd. microscopically after placing sample in glycerol on a blood-counting chamber.

12557. Kramer, Harris P. and Rigby, Malcolm. **Selective annotated bibliography on cloud physics and "rain making."** *Meteorol. Abstr.* 1, 174-205(1950).— *C.A.* 46, 9352*c*.
Many of the references (1895-1950) were to recent works on cloud seeding by means of solid CO_2 or AgI; to papers on aerosols or the atmosphere as a colloid; on chem. and phys. properties of, measurement and frequency of condensation, sublimation, and freezing nuclei, etc.

12558. Kunkel, W.B. **Charge distribution in coarse aerosols as a function of time.** *J. Applied Phys.* 21, 833-7(1950).— *C.A.* 44, 10447*h*.
The neutralization of highly charged dust particles, if suspended in air, was treated in detail. The result was in qual. agreement with expt. Multiply charged particles should be present in appreciable no. in coarse aerosols at times. This was confirmed by expts. both for initially charged quartz dust and for initially neutral NH_4Cl smoke.

12559. LaMer, Victor K. and Dinegar, Robert H. **Theory, production, and mechanism of formation of monodispersed hydrosols.** *J. Am. Chem. Soc.* 72, 4847-54(1950).— *C.A.* 45, 2745*g*.
Monodispersed colloids exhibiting higher-order Tyndall spectra were prepd. by pptn. of S_8 from EtOH and Me_2CO solns. by the careful addn. of H_2O. The relation between the concn. of S and the vol. fraction of H_2O at the crit. point of S-EtOH-H_2O solns. was investigated. Sols prepd. by this diln. method were investigated as to dispersion of wave length in their angular scattering of visible light and their transmission as a function of wave length. The size, no., and charge of the particles of such sols were in the same range as those prepd. by the acid decompn. of $Na_2S_2O_3$.

12560. LaMer, Victor K.; Inn, Edward C.Y., and Wilson, Irwin B. **The methods of forming, detecting, and measuring the size and concentration of liquid aerosols in the size range of 0.01 to 0.25 microns diameter.** *J. Colloid Sci.* 5, 471-96(1950).— *C.A.* 45, 926*c*.
The homogeneous-aerosol generator was used to form aerosol droplets of 0.01-0.08 μ radius from a variety of liquids, such as H_2SO_4 or dibutyl phthalate. H_2SO_4 formed a homogeneous aerosol by self-nucleation. Droplets of this size were too small to measure by established optical methods. Their size was estd. by growing the droplets by exposure to an appropriate vapor (e.g., H_2O for H_2SO_4 or toluene for dibutyl phthalate) to form radii above 0.08 μ, in which size-range optical methods could be used.

12561. Langstroth, G.O.; Diehl, C.H.H., and Winhold, E.J. **The evaporation of droplets in still air.** *Can. J. Research* 28A, 580-95(1950).— *C.A.* 45, 1831*h*.
The evapn. of droplets of 1 to 2 mm in diam. into still air was studied with the following 9 liquids forming a series of graded volatility: toluene, PrOH, glacial AcOH, ethylbenzene, o-chlorotoluene, AmOH, aniline, water, and BuOH. The exptl. results agreed with calcns. based on diffusion and heat-transfer theory.

12562. Ljunggren, Gustaf and Wilner, Torsten. **Aerosol indicator for rapid test of the dust content of air.** *Tek. Tid.* 80, 551-2(1950).— *C.A.* 44, 8704*i*.
The aerosol indicator functioned as a small ultramicroscope, through which the air was driven by an elec. blower. The suspended particles were illuminated from the side by a very strong light and appeared luminous against a dark background. The particles, which were too small to appear under an ordinary microscope, became noticeable.

12563. Mazurak, Andrew P. **Aggregation of clay separates from bentonite, kaolin, and a hydrous-**

mica soil. *Soil Sci. Soc. Am., Proc.* **15**, 18-24 (1950)(Pub. 1951).— *C. A.* 46, 206*h*.

Particles $> 1.15\ \mu$, 1.15-$0.58\ \mu$, 0.58-$0.29\ \mu$, 0.29-$0.15\ \mu$, and $< 0.15\ \mu$ were obtained from bentonite, kaolin, and Hesperia sandy loam and suspensions of these separates were electrodialyzed and air dried. The stability of the dry aggregates formed was detd. The ratio of ultimate particles $> 1.15\ \mu$ for kaolin was larger than for the other 2. The kaolin aggregates after 2-min. shaking in water showed the largest ratio (geometric mean of the aggregates/geometric mean of the ultimate particles) while those after 2000-min. shaking showed the smallest.

12564. Reiss, Howard and LaMer, Victor K. **Diffusional boundary value problems involving moving boundaries, connected with the growth of colloidal particles.** *J. Chem. Phys.* **18**, 1-12 (1950).— *C. A.* 44, 5680*d*.

In a naphthalene-like aerosol system, growing by means of the diffusion of vapor toward sinks (nuclei) that could not support supersatn., spontaneous nucleation did not occur if the no. d. of nuclei exceeded 100/ml. Several curves that depicted the rate of growth of S hydrosols were calcd. This supported the idea that the particles grew by means of a simple diffusion mechanism rather than by a surface-catalyzed deposition. The crit. supersatn. concn. for S in aq. soln. was 4.7×10^{-6} g/atom/liter, and the diffusion coeff. of S_8 was 2×10^{-6} cm^2/sec. A unit larger than S_8 may be diffusing, e.g., a polythionate.

12565. Rose, H.E. **Powder-size measurement by a combination of the methods of nephelometry and photo-extinction.** *J. Soc. Chem. Ind.* (London) **69**, 266-72(1950).— *C. A.* 45, 2744*f*.

An app. for the simultaneous measurement of the light transmitted and the light scattered by a powder was investigated. In the photo-extinction method of powder-size analysis, the single equation connecting the light transmitted by a suspension with the phys. characteristics of the suspension contained 2 unknown variables – the extinction coeff. K for all particle sizes, and the frequency of occurrence of the particles of every size.

12566. Stokes, C.A. **Sonic agglomeration of carbon black aerosols.** *Chem Eng. Progress* **46**, 423-32(1950); *Colloid Chem.* **7**, 403-29(1950).— *C. A.* 44, 9138*e*; 10301*d*.

Sonic-collection efficiencies as good as with electrostatic agglomeration systems were obtained. The sonic app. was simple and dependable. Further exptl. data and correlations were required to put sonic collection on a firm design basis.

12567. Viland, C.K. **Gravity separation of inactive catalyst.** *Oil Gas J.* **49**, No. 30, 74-5, 78, 80(1950).— *C. A.* 45, 2656*g*.

Cracking catalyst d. increased with catalyst age. A fraction of the circulating stream was centrifuged and the fines returned to the system; the coarse material (greater than 200 mesh) was conducted to a Sutton, Steele, and Steele gravity sepn. air table. Here, the heavy material was rejected and the light returned to the system. Mixts. of natural and synthetic catalyst and straight natural were successfully processed.

12568. Wolf, Karl. **Particle classification in uniform spiral-forming air-streams.** *Zement-Kalk-Gips* **3**, 141-7(1950).— *C. A.* 44, 9653*e*.

The operation of the Wolf and Rumpf equipment and factors affecting the sepn. of fine dusts into closely-sized fractions were discussed. Photographs were given of the fractions produced with various materials. The method was applied successfully in the manuf. of special cements.

12569. Amstein, E.H. and Scott, B.A. **Measurement of particle-size distribution by sedimentation methods.** *J. Applied Chem.* (London) **1**, Suppl. No. 1, S10-20(1951).— *C. A.* 46, 4321*b*.

The amt. of suspended material was detd. at a predetd. depth after certain intervals under conditions of free fall (up to 3% concn.). Samples were withdrawn from a Dewar flask by means of a pipet at the predetd. depth. The liquid was evapd. and the concn. of solids detd. by weighing. The exptl. details and results were given for calcined Al_2O_3, hydrated Al_2O_3, Al powder, and various cokes and anthracites.

12570. Andreev, S.E. **Average-diameter formulas.** *Gornyĭ Zhur.* **125**, No. 11, 32-6(1951).— *C. A.* 46, 2856*i*.

Thirteen formulas for calcg. the av. diam. of loose material were quoted and analyzed mathematically. For a mixt. of sizes with relatively narrow limits and a modulus not exceeding $2^{1/2}$ the formula $D = (d_1 + d_2)/2$ could be used. However, where the limits were wide, use of an arbitrary formula resulted in considerable error.

12571. Bredl, J. and Grieve, T.W. **A thermal precipitator for the gravimetric estimation of solid particles in flue gases.** *J. Sci. Instruments* **28**, 21-3(1951).— *C. A.* 45, 5979*a*.

An instrument was designed to collect all the solid matter from a flue-gas sample, which was large enough for the deposit to be easily weighed. The use of Al foil collecting surfaces facilitated accurate weighing. The advantages of the instrument over the usual filtering methods were mentioned.

12572. Cadle, R.D. and Magill, P.L. **Preparation of solid- and liquid-in-air suspensions for use in air-pollution studies.** *Ind. Eng. Chem.* **43**, 1331-5(1951).— *C. A.* 45, 7830*g*.

Aerosol generators were developed which dispersed liquids by an aspirating action. They could also be used for dispersing certain solids. In a device for dispersing powders at a uniform and easily controllable rate, the material was spread on a long brass trough which was drawn beneath an air-operated glass aspirator. The methods and equipment are well-suited for air-pollution studies.

12573. Carpenter, Frank G. and Deitz, Victor R. **Glass spheres for the measurement of the effective opening of testing sieves.** *J. Research Natl. Bur. Standards* **47**, 139-47(1951)(Research Paper No. 2238).— *C. A.* 46, 2857*e*.

The "effective" opening of testing sieves was generally somewhat larger than the av. opening or the nominal opening. A method of measuring the effective opening with a calibrated mixt. of glass spheres was described. Glass beads of the type used for highway markings were a suitable source of glass spheres for sizes from 80 to 1,000 μ (U.S. Sieves No. 170 through 18). Details were given for the selection of the spheres, the prepn. of the desired mixt. of spheres, subdivision of the samples, the measurement of the diams., and the calcn. of the wt-size distribution. From a statistical analysis of the calibration data, both the reproducibility and accuracy of the method were about 1%.

12574. Chomse, Heinz. **Sedimentometric analysis: model experiments on space factors.** *Mikrochemie ver Mikrochim. Acta* 36/37, 1026-41(1951). —*C.A.* 45, 5486*i*.

The quant. relations between the wt of a material deposited from a soln. as a component of a ppt. and the vol. of the sediment depended not only on chem. and other phys. factors, but particularly on spatial factor. The "sp. suitability" for the attainment of reproducible forms was fundamentally conditioned by the particle form; possible variations in the arrangement of the particles produced the variability of the interstitial vol.

12575. Corner, J. and Pendlebury, E.D. **The coagulation and deposition of a stirred aerosol.** *Proc. Phys. Soc.* (London) 64B, 645-54(1951).—*C.A.* 46, 9932*e*.

The variation of the deposition rate of NH_4Cl smoke with size was due to the effect of diffusion and ordinary sedimentation. The min. of the deposition, near 1/2 micron radius for a velocity of air motion of 50 m/min., explained why the stirred aerosols took up a size distribution with a peak in this neighborhood, whereas in a still aerosol the most common radius soon became much larger, roughly 1 μ.

12576. Dalla Valle, J.M.; Orr, C. Jr., and Blocker, H.G. **Fitting bimodal particle-size distribution curves; comparison of methods.** *Ind. Eng. Chem.* 43, 1377-80(1951).—*C.A.* 45, 8323*a*.

Methods of describing two bimodal distribution curves that occurred in studies of aerosol aggregation were presented. A selected-ordinate method was developed and described these bimodal distributions better than did the more complicated methods of moments and least squares.

12577. Goeb, August. **Particle size and particle shape of pigments, and their significance.** *Farbe u. Lack* 57, 14-18(1951).—*C.A.* 45, 3165*h*.

Pigments suitable for paints have av. particle sizes of 0.5-5 μ. The max. of hiding power and tinting strength was found in pigments of 0.2 to 0.3 μ; below this size, undesirable effects (poor hiding power, colloidal soly., tendency to agglomerate, high reactivity, poor flow, poor gloss) may result. Colors also varied with the particle size of a given pigment (e.g. Siegle red 1 and BB).

12578. Gregg, C.C. and Kopelman, Bernard. **Particle-size analysis of metal powders.** *Trans. Am. Soc. Metals* Preprint No. 32, 12 pp. (1951). —*C.A.* 45, 9336*e*.

A rapid, routine method was described for com. control of particle size and size distribution of 6 metal and 7 inorg. powders.

12579. Ivey, F. Emerson, Jr. **The particle-size analysis of fluid cracking catalyst.** *Petroleum Refiner* 30, No. 6, 99-103(1951).—*C.A.* 45, 8238*c*.

The 4 variables of significance in screening were size of sample, time of shaking, moisture preconditioning of the sample, and physical variation in and between the screens. A test procedure was developed which involved a 2-hr sample humidification with air of 60% relative humidity to eliminate static electricity, followed by 30-min. shaking of a 25-g sample on a Ro-Tap machine. Analysis of a microspherical catalyst indicated that a substantial variability in screen-analysis data for screens finer than 80 mesh was due to periodic changes in the screens used, all of which met the manufacturers specifications.

12580. Ivey, F. Emerson Jr. **The particle-size analysis of fluid cracking catalysts. II.** *Petroleum Refiner* 30, No. 7, 141-5(1951).—*C.A.* 45, 9251*g*.

The Roller test as applied to fluid catalytic cracking catalysts had the following disadvantages: poor precision (± 2.1% at 0-20 μ size to ± 7.6% at 80+ μ size), poor accuracy based on a microscope standard, presence of attrition, and sensitivity to electro-static charge.

12581. Ivey, F. Emerson, Jr. **The particle-size analysis of fluid cracking catalysts. III.** *Petroleum Refiner* 30, No. 9, 127-32(1951).—*C.A.* 46, 717*c*.

The elutriation d. vs. change in measured diam. was a straight line: $R = 1.854-0.982\ \rho_E$, where R = d. ratio and ρ_E = elutriation d. The theoretical effect of air rate in the Roller app. for various particle diams., Roller cylinder diams. and pore diams. was discussed. Statistical analyses showed that the precision of the screen analysis was ± 0.79% with the 100-mesh sieve and ± 3.34% with the 200-mesh. Precision was independent of the particle-size distribution; 31.6% of the variability of the 100-mesh analysis and 68.6% of the variability of the 200-mesh analysis were caused by the variance between the supposedly matched screens.

12582. Jottrand, René. **Application of dielectric-constant measurement to determination of the concentration of solids in a suspension.** *Chem. Eng. Sci.* 1, 81-5(1951).—*C.A.* 46, 3830*h*.

The concn. of a suspension at any point was rapidly and precisely detd. by measuring the capacity of a condenser suspended at the point to be measured. Expts. with silica powder of 56 μ diam. in a mixt. of benzene and nitrobenzene indicated that the degree of packing of the sediment was a function of its height and not of the time left in the settling tank.

12583. Kandilarov, G.G. **Sedimentation volumes of polydisperse kaolin suspensions in electrolyte solutions.** *Kolloid. Zhur.* 13, 357-65(1951).—*C.A.* 46, 2375*c*.

The sedimentation vol. (V) of 2.5 g kaolin (dried at 250°-300°C) in 10 ml liquid was 5.5 ml in 10^{-3} M, 7.8 ml in 10^{-2} M, 5.2 ml in 0.5 M, and 8 ml in 10 M H_3PO_4 after 24 hrs' standing. Similar sequence of max., min., and final rise was observed also in AcOH. In $Ca(OH)_2$ solns., *V* was 5.5 in $10^{-5}-10^{-3}$ *M* and 7.0 in 10^{-2} *M*. *V* decreased when sedimentation lasted longer, e.g. in *M* AcOH *V* was 6.08 after 24 hrs and 5.75 after 24 days. Pretreatment of kaolin with H_3PO_4 or AcOH raised its *V* in $Ca(OH)_2$ solns. and also affected *V* in Na_2CO_3 solns.

12584. LEITH, CARLTON J. **Sedimentation cylinder for particle-size analysis.** *Science* 113, 412-13(1951).—*C.A.* 45, 5459*h*.

Particles of 1/16-1/32 mm diam. were isolated. A liter ungraduated cylinder was furnished with a side tube with stopcock control. The tube was far enough above the base that flow through it did not affect the sediment on the bottom. Graduations were etched into the cylinder 5, 10, and 20 cm above the outlet tube.

12585. NAUMANN, ERICH. **Construction and operation of rapid filters; new goals and points of view.** *Gas-u. Wasserfach* 92, No. 20 (Water), 250-6(1951).—*C.A.* 46, 294*g*.

Interfacial forces of an elec. nature played an important role in catalytic-adsorptive processes. The relation between internal surface and water content of the filter had important implications for the structure of the filter bed, the filter velocity and the form of the filter base and the supporting layers. Filters were generally washed with air and water in Germany because of the necessity for removing Fe and Mn; in the U.S. water washing was generally used alone. The water- and air-washing process must be carried out with consideration of the individual installation.

12586. NISSAN, ALFRED H. **Particle-size analysis from sedimentation curves.** *Discussions Faraday Soc.* No. 11, 15-27, discussion 86-9(1951).—*C.A.* 46, 7843*h*.

Best results in particle-size analysis required direct visual observation of particle dimensions and shape as well as accurate detn. of sedimentation curves. The frequency distribution was best calcd. by an algebraic method based on the *T* tables of Fisher and Yates.

12587. OYAMA, TADASHI AND YASHIMA, SABURO. **The sizing analysis of fine particles by the phototube method.** *Technol. Repts. Tohoku Univ.* 16, 66-85(1951).—*C.A.* 46, 7843*e*.

Analyses of particle-size distribution in the range 66-1 μ were obtained by measuring the light transmission *vs.* time for a sedimenting system and applying Stokes' law. The effect of dispersion medium on the particle-size distribution of magnetite powder was given for nitrobenzene, H_2O, MeOH, EtOH, and mixed benzene-liquid paraffin.

12588. RAMMLER, E. **Particle-size distribution curves of powdered coal and other ground materials.** *Braunkohlenarch.* 1951, No. 58, 52-7.—*C.A.* 45, 10544*a*.

The rapid solution of Bennett's equation for particle-size distribution in pulverized materials was presented in tables and graphs.

12589. ROBINSON, JAMES V. **The viscosity of suspensions of spheres. II. The effect of sphere diameter.** *J. Phys. & Colloid Chem.* 55, 455-64 (1951).—*C.A.* 45, 5487*f*.

The viscosities of suspensions in sugar solns. of 3 sizes of glass spheres were measured, the sphere diams. being 3-4, 4-10, and 10-30 microns, resp. The viscosities showed some decrease as the rate of shear varied from 101 to 639 sec^{-1}, but were assumed to be Newtonian for this treatment. The sedimentation vols. of the largest spheres were nearly the same in glucose solns. and in water, whereas the sedimentation vols. of the smaller spheres were substantially greater in glucose soln. than in water.

12590. ROSSI, CORRADO. **Particle size of sulfurs and anticryptogamic activity.** *Chimica e industria* (Milan) 33, 794-8(1951).—*C.A.* 46, 5771*i*.

The anticryptogamic activity of S was mainly detd. by the size of the particles. The method of sedimentation gave reproducible values which were in good agreement with direct size measurements. The sedimentation method was used to show that in a well-ground S powder the statistical distribution of particle size corresponded to a Boltzmann distribution.

12591. ROSSI, CORRADO AND BALDACCI, RUFFO. **Determination of the particle size of fine powders—kaolins.** *J. Applied Chem.* (London) 1, 446-52(1951).—*C.A.* 46, 6900*b*.

The sedimentation curves for several kaolin suspensions were simply obtained by using a hydrostatic balance provided with a normal plunger. Sp. gr. of the suspension was plotted *vs.* time, and the tangent to the curve at zero time was related to the av. diam. of the particles.

12592. SCHROEPFER, GEORGE J. **Effect of particle shape on porosity and surface area of trickling filter media.** *Sewage and Ind. Wastes* 23, 1356-66(1951).—*C.A.* 46, 3687*h*.

If the surface areas were corrected to the average median size of plant-run material, they did not vary appreciably with shape ratio. The shape factor had very little effect on filter efficiency. Increasing the shape ratio resulted in increasing the percentage of voids which was desirable in filter design and operation. Material of high shape ratio did not tend to pile to such an extent that filter operation was affected.

12593. SEYER, PIERRE. **Errors in particle-size analyses.** *Ann. mines* 140, No. 4, 3-6(1951).—*C.A.* 46, 3387*b*.

Sieve analyses were discussed in general.

12594. SMIRNOV, N.I. AND LI, DE EP. **A suspended layer of spherical particles.** *Zhur. Priklad. Khim.* 24, 383-91; *J. Applied Chem. U.S.S.R.* 24, 419-26(1951)(Engl. translation).—*C.A.* 47, 380*b*.

Exptl. studies were made on suspensions of glass and Pb balls in H_2O, kerosine, air, and CO_2. The balls used varied from 0.805 to 1.972 mm in diam. The Reynolds no. varied from 4.3 to 630.

12595. SMIRNOV, N.I. AND LI, DE EP. **A suspended layer of particles of different shapes.** *Zhur. Priklad Khim.* 24, 439-38; *J. Applied Chem. U.S.S.R.* 24, 479-87(1951)(Engl. translation).—*C.A.* 47, 380*c*.

The equation developed was tested on irregular particles of Al, NaCl, and sand in kerosine, water, air, and CO_2. The value of the shape simplex may be computed from the simple ratio of the surface of a sphere whose vol. was the same as that of the suspended particle to the surface of that particle.

12596. Sproull, Wayne T. and Nakada, Yoshinao. **Operation of Cottrell precipitators—effects of moisture and temperature.** *Ind. Eng. Chem.* 43, 1350-8(1951).—*C.A.* 45, 7829*b*.

The temp. and moisture content of the gases being treated had a great effect on the performance of Cottrell precipitators. Most dusts reached their max. resistivity around 95° to 120°C. Moisture reduced the resistivity, especially at temps. below this peak value. This behavior was treated mathematically. Expts. revealed that the elec. characteristics of the precipitator were sensitive to moisture and temp., even though there was no dust.

12597. Stoyanovskiĭ, A.F. **Apparatus for counting the number of dust particles in the air.** *Gigiena i Sanit.* **1951**, No. 1, 16-20.—*C.A.* 45, 5459*i*.

A metallic cylinder was made in 2 halves which could be opened by means of a hinge. The cylinder was mounted on a shaft of a small elec. motor. In use, the cylinder was opened to the test atm., until dust equil. was established, then it was clamped shut. The cylinder was spun by means of the motor for settling the dust on the interior walls, along two of which were clamped glass slides coated with sticky material, such as castor oil. The dust particles settled per unit area of the glass slides gave the dust population per given vol. of air.

12598. Suito, Eiji and Taki, Koiji. **Measurement of the particle-size distribution of powder by the thermal analysis of reaction velocity. II. Particle-size distribution of calcium carbonate powders.** *J. Chem. Soc. Japan, Pure Chem. Sect.*, 72, 715-17(1951).—*C.A.* 46, 1330*i*.

The velocities of soln. of 6 kinds of $CaCO_3$ powders in acetic acid were measured by the method of thermal analysis. The particle-size distribution was calcd., and was compared with those obtained by other methods. The agreement was fairly good. From the expts. on the mixt. of $CaCO_3$ and TiO_2 powders, only the distribution curve of the former could be obtained.

12599. Volkova, Z.V. **Distribution of inclusions of an inhomogeneous solid in the disperse systems obtained from it.** *Kolloid Zhur.* 13, 416-21(1951).—*C.A.* 46, 2375*h*, 8463*b*.

If a solid consisted of a matrix and inclusions, and if these behaved equally when comminuted, then comminution of the solid gave largest no. N of sep. particles when inclusions were present as flat plates, a smaller N when inclusions were cylinders, and a smaller still when inclusions were spheres. If a solid contg. many inclusions was comminuted, the probability that a particle of the diam. b contain fraction c of inclusions depended on the initial vol. ratio of the inclusions, their particle size, and their shape. The shape factor was calcd. for spheres, circular cylinders, plates, cubes, and prisms.

12600. Volkova, Z.V. and Smirnova, I.V. **The separability of solid bodies.** *Zhur. Priklad. Khim.* 22, 965-9(1951).—*C.A.* 46, 5371*d*.

The efficiency of sepn. by grinding of the components of a heterogeneous solid was dependent on the degree of exposure of the components. A math. derivation of the formulas was given for calcg. degrees of exposure. The degree of exposure of included phase did not depend on its content in the heterogeneous solid, but the degree of exposure of including phase increased sharply with decreasing content of included phase. The degree of exposure of both the phases depended on the form of the distribution function of the including grains.

12601. Voyutskiĭ, S.S.; Zaionchkovskiĭ, A.D., and Rubina, S.I. **Causes of the granulation of powders.** *Doklady Akad. Nauk. S.S.S.R.* 78, 307-10(1951).—*C.A.* 45, 7846*e*.

Fine lampblack powder was granulated by tumbling in the presence of compact flakes obtained by rolling lampblack between cylinders; however, any large-size body, such as plant seed, sugar crystals, etc., acted similarly. Adsorbed gases definitely counteracted granulation; *in vacuo*, granulation was approx. 3-4 times as fast as in air, and the granules were more compact and stronger. Chalk and kaolin could be granulated in the same way as lampblack, but not sulfur, activated carbon, or graphite.

12602. Wilson, B.W. **Principles of filtration.** *Plating* 38, 831-5(1951).—*C.A.* 46, 1305*f*.

Variables affecting power consumption sepn. mechanisms, and effects of particle size and concn. were discussed.

12603. Alércio, John S. and Harley, John H. **Evaluation of α-particle absorption by filter paper.** *Nucleonics* 10, No. 11, 87(1952).—*C.A.* 47, 4212*i*.

Air in the A.E.C. plants was routinely sampled for U contamination by collection of dusts and mists on No. 41 Whatman paper and counted in an α-counter where the max. U level (50 γ/m^3 of air) should give 30 counts per min. equiv. to 70 disintegrations per min. Only 70% of this count could be realized because the dust and mist penetrated into the paper to such a depth that 30% of the α-particles were absorbed by the paper.

12604. Atherton, E. **Photoelectric turbidimeter for particle-size determination.** *J. Textile Inst.* 43, T173-8(1952).—*C.A.* 46, 6438*b*.

The instrument measured, photoelectrically, the intensity of light scattered from a suspension or soln. over a range of angles from 40 to 150°. It was particularly adapted to measurements on solns. of polymers.

12605. Atherton, E. and Peters, R.H. **Determination of the particle size of dispersed resins by two optical methods.** *J. Textile Inst.* 43, T179-87(1952).—*C.A.* 46, 6904*h*.

The dissymmetry and turbidity methods of light scattering were investigated as means of particle-size measurement. The results of the 2 methods agreed with each other, but were generally lower than those provided by electron micrographic study. Reasons were found why the micrographs might provide misleading evidence.

12606. BOSTOCK, W. **A sedimentation balance for particle-size analysis in the subsieve range.** *J. Sci. Instr.* 29, 209-14(1952).—*C.A.* 47, 1986*h*.
A torsion balance was used to measure the cumulative weight of material setting from a suspension as a function of time.

12607. BRITISH STANDARDS INST. **Methods for the use of British Standard fine-mesh test sieves.** *Brit. Standards* 1796:1952, 27 pp.—*C.A.* 46, 5481*h*.
Details were given of methods for both wet and dry sieving. Methods of subdividing bulk samples, details of sample dividers, notes on procedure, and details of an auxiliary vibrator were included.

12608. BUECHE, F. **Size distribution of spheres by light scattering.** *J. Am. Chem. Soc.* 74, 2373(1952).—*C.A.* 47, 6769*d*.
The method made use of the fact that for a soln. of spheres of unequal size the position of the 1st angular intensity min. did not yield the same sphere size for 2 different wave lengths.

12609. CREMER, E.; CONRAD, F., AND KRAUS, TH. **The adhesion of powders and its application in determination of particle size.** *Angew. Chem.* 64, 10-1 (1952).—*C.A.* 46, 2877*h*.
The adhesion of powders on an inclined support (plate) was a function of the friction factor and an adhesive force. The latter depended on the particle size of a single powder or resp. particle sizes of mixed powders. Exptl. values were given for burned and unburned magnesite, as well as Fe and Mo powders on different supports.

12610. DELFOSSE, P. **The particle-size distribution of a mineral pigment.** *Peintures, pigments, vernis* 28, 774-82(1952).—*C.A.* 47, 5696*f*.
The method of graphically representing particle-size distribution data was reviewed. A distribution curve was given for a naturally occurring $CaCO_3$ mineral.

12611. DINEGAR, ROBERT H. AND SMELLIE, ROBERT H. **Stability of monodispersed sulfur hydrosols.** *J. Colloid Sci.* 7, 370-81(1952).—*C.A.* 46, 10785*g*.
S hydrosols made by the chem. reaction method of LaMer and Barnes were unstable with respect to a change in ionic environment. The instability resulted from a reversal of the decompn. reaction $S_2O_3^{2-} \rightleftarrows SO_3^{2-} + S$. The rate of consumption of S by the reverse reaction was strongly favored by high pH. Beer's law was obeyed with respect to the scattering and scattering plus absorption of light.

12612. FUJITANI, YOSHIYASU. **Aerosols. I. Coagulation process of ammonium chloride smoke resulting from aging. II. Size of the particles forming the sedimentation boundary.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 73, 418-23; 423-6(1952).—*C.A.* 47, 4168*c*.
The sedimentation velocity of the particles of NH_4Cl smoke in a polydisperse aerosol was detd. at 20 ± 2°C by means of a microscope. The change of the particle distribution with time was discussed in relation to Smoluchowski's theory of coagulation. The av. size of the particles obtained by the detn. of the sedimentation velocity of macroscopic boundary surface was compared with the particle-size distribution curve obtained by the detn. of the sedimentation velocity of individual particles.

12613. FUJITANI, YOSHIYASU. **Aerosols. III. Adhesion of microscopic particles on the inclined glass surface.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 73, 578-80(1952).—*C.A.* 47, 4689*h*.
The smokes of starch, $CaCO_3$, Al_2O_3, ZnO, NH_4Cl, glass, and clay were made to settle, and the numbers of the particles settled on a microscope slide tilted at various inclinations were detd. The mode of adhesion of the particles was discussed in the light of surface phenomena.

12614. GAYLE, JOHN B. **Theoretical precision of screen-analysis results.** *U.S. Bur. Mines, Rept. Invest.* No. 4933, 9 pp.(1952).—*C.A.* 47, 1442*f*.
The exptl. detn. of the standard deviation for a particular set of conditions required tests on a large no. of duplicate samples, which was laborious. An equation was, therefore, developed for predicting standard deviations from theoretical considerations. The equation: $\sigma^2 = G(100 - G)W_1/W$, where σ = standard deviation of plus-K result, K being any given screen. G was the detd. % of plus-K material in the samples, W the sample wt, and W_i the wt of a particle just fitting the given screen.

12615. GILESPIE, T. AND LANGSTROTH, G.O. **Coagulation and deposition in still aerosols of various solids.** *Can. J. Chem.* 30, 1003-11 (1952).—*C.A.* 47, 4689*i*.
Aerosols of MgO, ZnO, C, copal resin, and SiO_2 powder were studied as regards changes with time in the no. of particles in suspension and in the no. of particles lost from the system by deposition on container surfaces. A 60-cm-cube chamber was used with still air at 20°C and 15-40% relative humidity. Humidity had little or no effect. Particle shape and structure were not predominantly responsible for difference in k, the coagulation const.; k did not increase in the order of bulk d. of the aerosol.

12616. HARKORT, H. **The determination of particle grain sizes by elutriation analysis.** *Glas-Email-Keramo-Tech.* 3, 165-8(1952).—*C.A.* 46, 8905*f*.
The app. was constructed with 2 elutriation cones with stainless steel nozzles with 1-6-mm openings. They could be accurately adjusted in the vertical axis of the feeding tube. The depth of the elutriation level was 250 mm for a const. pressure of the liquid column. The rate of elutriation was tabulated for H_2O, and the equiv. grain diams. of the particles defined by Stokes' formula. Slight defects in the nozzles, or obstructions, were easily detected.

12617. HOUNAM, R.F. **Some colloidal properties of inert dusts.** *Arch. Ind. Hyg. Occupational Med.* 5, 375-86(1952).—*C.A.* 46, 10489*b*.
In a series of dye-absorption (methylene blue) and sedimentation studies, dusts that produced

silicosis and pneumocosis formed negatively charged hydrophobic sols when suspended in H_2O or 50% EtOH soln. The neg. charge varied directly with toxicity, and non-toxic dusts generally formed positively charged sols, although some may carry a very small neg. charge.

12618. KIRCHBERG, HELMUT. **Definition and formularization of screening processes.** *Bergakademie Frieberg. Forsch. A, Bergbau* 4, 3-11 (1952).—*C.A.* 46, 10702*b*.
Ambiguities existed in the definition of particle size, av. diam., specific screening efficiency, and, in general, of terms used in screening analysis. The terminology used in related fields such as in grinding, in the construction industry, etc., should be considered.

12619. KYNCH, G.J. **A theory of sedimentation.** *Trans. Faraday Soc.* 48, 166-76(1952).—*C.A.* 46, 7843*f*.
It was assumed that at any point in a dispersion the velocity of fall of a particle depended only on the local concn. of particles. The settling process was then detd. entirely from a continuity equation, without knowing the details of the forces on the particles. Starting with uniform initial dispersions the formation and existence of layers could be treated where the d. suddenly changes its value. These occurred in dil. solns.

12620. LEHMANN, KURT. **Sugar sieves and sifting machines and their use.** *Zucker* 5, 180-2, 202-6 (1952).—*C.A.* 47, 3015*g*.

12621. MANLEY, R. ST. J. AND MASON, S.G. **Particle motions in sheared suspensions. II. Collisions of uniform spheres.** *J. Colloid Sci.* 7, 354-69(1952).—*C.A.* 47, 1461*b*.
The interaction of model glass spheres in suspensions subjected to velocity gradients was studied in detail. Abs. inelastic collision frequencies were measured and found to be in excellent accord with a theory based upon simple geometric considerations. A doublet rotated as a rigid dumbbell at a known const. angular velocity, and sepd. at a point that was a mirror image of the point of contact. This memory effect persisted through interruptions of motion of the suspension, which cast some doubt on the otherwise definite evidence of true contact of the spheres.

12622. MASTERMAN, F.E. **Particle size of clay, its determination and effects.** *Tappi* 35, 420-5 (1952).—*C.A.* 47, 313*b*.
By centrifuging for a certain time, and recentrifuging the decanted liquid, several clays were fractionated into groups having diams. of over 10, 2-10, 0.6-2, 0.2-0.6 and under 0.2 μ. These fractions were made into coating slips and coated on paper. The properties of the coatings were measured and found to vary widely with the particle size. For an American clay, some of the properties were (in the same order as the fractions listed above): G. E. brightness, 80, 79.5, 81.5, 81.5, 81.0; B. and L. gloss, calendered, 29, 27, 41, 52, 56; wet rub rating (low = good), 5, 6, 4, 2, 1; adhesive demand, 10,5, 11, 12.5, 14.7, 16.5. This centrifuge technique was used for control work on incoming clays.

12623. MELDAU, ROBERT AND ROBERTSON, ROBERT H.S. **The fracture surfaces of finely ground mineral powders.** *Tonind.-Ztg.* 76, 365-8(1952).—*C.A.* 47, 2571*c*.
Recrystn. in wet grinding, grid slippage, shapeless fracture, size range, adhesion of finest particles to larger ones, and other properties were discussed.

12624. NAESER, G. AND PEPPERHOFF, W. **Optical determination of the size of soot particles.** *Kolloid-Z.* 125, 33-4(1952).—*C.A.* 47, 2587*e*.
From the relation $k \sim \lambda^{-n}$, where n, a const. for the visible spectrum, depended on the size of soot particles, estn. of particle size were made. Changes in temp. as observed with the "Bioptex" pyrometer for a beam of light passing through a layer of soot on a glass slide, also led to a particle size estimate.

12625. RAMMLER, ERICH. **Evaluation of particle-size analysis in sieves.** *Bergakademie Freiberg. Forsch.* A, *Bergbau* 4, 12-22(1952).—*C.A.* 46, 10702*a*.
A common language should be adopted for the study of particle- size analysis. Test standards should be based on a logical sequence and not on some arbitrary no. system. Work on the standardization of sheet-metal screens with sq. holes should be continued.

12626. RANZ, W.E. AND JOHNSTONE, H.F. **The physical behavior of atmospheric aerosols.** *Proc. Natl. Air Pollution Symposium* 2, 35-41(1952).—*C.A.* 47, 5590*i*.
The forces acting on the individual particles of highly dispersed atm. aerosols (0.05-10 μ diam.) were discussed. The effect of atm. elec. field on deposition of dust particles, the washout of dust by raindrops, the coagulation by thermal and turbulent motion, and the decay and growth of aerosol particles were reviewed.

12627. RANZ, W.E. AND WONG, J.B. **Jet impactors for determining the particle-size distributions of aerosols.** *Arch. Ind. Hyg. Occupational Med.* 5, 464-77(1952).—*C.A.* 46, 10488*d*.
Particle-size distribution data were collected for NH_4Cl and H_2SO_4 aerosols by passage through jet impactors with open space of 1 to 3 jet diams. onto microscope slides and microscopic examn. Classification occurred approx. for the product of the square root of particle d. and the effective particle diam.

12628. RANZ, W.E. AND WONG, J.B. **Impaction of dust and smoke particles on surface and body collectors.** *Ind. Eng. Chem.* 44, 1371-81(1952). —*C.A.* 46, 7829*d*.
The systems analyzed were rectangular and round aerosol jets impinging on flat plates (jet impactors and impingement separators) and cylindrical and spherical collectors placed in aerosol streams (fibrous filters and wet scrubbers). Rates of collection of glycerol and H_2SO_4 aerosol particles of nearly uniform size were measured by impaction on wires and spheres in streams moving at various velocities and by impingement on flat plates from jets of different sizes and velocities.

12629. ROSE, H.E. **Determination of the extinction coefficient-particle size relationship for**

spherical bodies. *J. Applied Chem.* (London) 2, 80-8(1952).—*C.A.* 46, 7402*i*.

By refinement of method, extinction coeff. for particles of 2 to 85μ were exptly. detd. and found to be in good agreement with calcd. values.

12630. Schweyer, Herbert E. **Sedimentation procedures for determining particle-size distribution.** *Eng. Progr. Univ. Florida* 6, No. 6, Bull. Ser. No. 54, 19 pp. (1952).—*C.A.* 46, 9461*i*.

Three standardized exptl. procedures (the pipet, the hydrometer, and the turbidimeter methods) were described in detail for use in routine particle-size analyses in the range from 44 to 0.1 μ.

12631. Seely, Ben K. **Detection of micron and submicron chloride particles.** *Anal. Chem.* 24, 576-9(1952).—*C.A.* 46, 6037*f*.

Particles were brought into contact, by impaction or otherwise, with a gelatin-glycerol film sensitized with Hg_2SiF_6 and H_2SiF_6. The reaction product formed a spot or halo which could be recognized under the microscope. This procedure was capable of detecting individual chloride particles approx. 0.2 μ in diam., representing a mass about 10^{-14} g. Carbonates, sulfates, fluorides, nitrates, borates, and phosphates did not interfere. Iodides and bromides formed halos similar to those of the chlorides.

12632. Silverman, Leslie and First, Melvin W. **Edge and variable compression filters for aerosols.** *Ind. Eng. Chem.* 44, 2777-83(1952).—*C.A.* 47, 353*g*.

The most important features of edge filters for air and gas cleaning were the high efficiencies and the ability to regulate resistance without a significant change in performance. The variable compression filter permitted operation at variable d. to give a greater range of resistance regulation with Fiberglas and plastic filters than with felted media in the same construction.

12633. Tanaka, Tatsuo. **Particle-size distribution in a concentric mill.** *J. Ceram. Assoc. Japan* 60, 99-102(1952).—*C.A.* 46, 6438*c*.

Particle-size distribution of cement clinker was studied in a concentric mill in which the fine-grinding space was divided into 5 segments by partitions parallel to the axis. The relation of the 0.088-mm oversize value *vs.* the distance from the mill entrance showed that the rate of movement of the particles through the mill was heterogeneous and that mixing by counterflow took place especially near the entrance and just behind the screens.

12634. Thomas, D.J. **Fibrous fillers for fine-particle filtration.** *J. Inst. Heating Ventilating Engrs.* (London) 20, 35-55, discussion 55-70 (1952).—*C.A.* 46, 10698*h*.

Dry fibrous filters for particles of less than 1 μ diam. were discussed theoretically.

12635. Tsuji, Mikio and Hattori, Isamu. **The size distribution of colloidal particles.** *Kagaku* (Science) 12, 476-7(1952).—*C.A.* 46, 9935*i*.

Smoluchowski's theory of time change of size distribution of colloidal particles was extended to include various initial conditions besides uniform initial distribution.

12636. Vonnegut, Bernard. **Thin films of supersaturated solutions for detecting, counting, and identifying very small crystalline particles.** *Science* 116, 300-1(1952).—*C.A.* 47, 942*f*.

Films of soln. satd. with respect to a cryst. substance were prepd. by the use of two miscible, one quite volatile and the other nonvolatile, solvents in which the substance was readily sol. Mixts. of the two liquids increasingly rich in solute were made by adding an unsatd. soln. of the substance in the volatile solvent to the nonvolatile solvent. When a drop of the mixt. was smeared on a microscope slide, the volatile solvent evaporated, leaving a thin film of the substance dissolved in the nonvolatile solvent. As the ratio of solute to nonvolatile solvent was increased, a point was reached at which the residue appeared milky because of the formation of large numbers of small crystals.

12637. Voyutskiĭ, S.S.; Zaĭonchkovskiĭ, A.D., and Rubina, S.I. **The causes of the granulation of powders.** *Kolloid. Khur.* 14, 28-36(1952).—*C.A.* 46, 4321*a*.

The rate of formation of granules of lamp black was studied. The av. diam. of granules increased with the temp. (20-95°C).

12638. Wilkening, M.H. **Natural radioactivity as a tracer in the sorting of aerosols according to mobility.** *Rev. Sci. Instruments* 23, 13-16 (1952).—*C.A.* 46, 4884*d*.

By means of an ion separator the particles of aerosols of submicroscopic range were ionized and deposited in size-distribution pattern. A proportional counter was used to detect the distribution of atm. radioactivity on these particles. Most of the radioactivity attached itself to particles of the diam. range 0.001 to 0.04 μ with predominant grouping in the vicinity of 2 particle diams.: 0.009 and 0.018 μ.

12639. Wilson, B.W. **The sedimentation of dilute suspensions of microscopic spheres in water.** *Australian J. Appl. Sci.* 3, 252-6(1952).—*C.A.* 46, 9936*a*.

A continuous photographic method showed that the settling rates of 2.5-10-μ Pyrex spheres in water were in accordance with Stokes' law. Temp. uniformity was a more crit. factor than were electroviscous effects in dil. suspensions of very fine particles.

12640. Fullman, R.L. **Measurement of particle sizes in opaque bodies.** *J. Metals* 5, *Trans.* 447-52(1953); *AIME Trans.* 197, 447-52 (1953).—*C.A.* 47, 4263*d*.

Methods were developed for the analysis of particle-size measurements by area and lineal analysis when the particles were in the form of spheres, plates, or rods. The usual types of observation did not permit measurement of the length of rod-shaped particles. For such particles there was a negligible probability that a cross-sectioning plane would cut along the rod length, so that statistical observations of the dimensions of intersections of the particles with a cross-sectioning plane would depend only on the rod's radius.

12641. GARMSEN, W. **Particle-size measurements on paints.** *Farbe u. Lack* 59, 92-7(1953).—*C.A.* 47, 6669*d*.

A new device consisted of 2 mirror glass plates, 122 × 48 mm, 12 mm thick, which had a cm scale etched into their edges, and a selection of exchangeable gages (60, 80, 100, 150, and 300 μ thick). The selected gage was placed on one of the plates at the 10-cm mark, the paint poured on, the 2nd plate placed above the 1st, and the 2 plates now joined by a strong clamp at each end; after removing the excess of paint and a short wait, the clamps were removed and the plates carefully slid apart along their contact level. In this way, each plate retained half of the paint wedge. Immediately (15 sec for nitrocellulose lacquers 1 min. for paints or enamels) after sepn., the surface was scanned for the easily countable visible particles and their no. noted along with their location on the cm scale. Each cm equaled 1/20 of the gage thickness.

12642. GOETZ, ALEXANDER. **Application of molecular filter membranes to the analysis of aerosols.** *Am. J. Pub. Health* 43, 150-9(1953). —*C.A.* 47, 3046*i*.

12643. KÄNDLER, W. AND MILLER, L. **New sedimentation apparatus.** *Kolloid-Z.* 130, 172-6(1953).—*C.A.* 47, 6710*i*.

A glass sedimentation cylinder was mounted on a plate so that the surface of the base of the cylinder contained either of 2 microscope slides. One slide could be removed and replaced by the second slide without disturbing the app. This was done by slipping the base plate from the original position centered over the first slide to an alternate position over the second slide. The size of particles sedimented from a suspension was detd. as a function of time by microscopic observation of the slide samples.

12644. KANE, EDWARD D. **Microfiltration with resin-impregnated wool filters.** *Ind. Eng. Chem.* 45, 860-4(1953).—*C.A.* 47, 6190*d*.

The woolen fiber resin-impregnated type of cartridge was classified under the oriented depth-type filter. In the manuf. of these cartridges important considerations were fiber crimp level, fiber stiffness, felting temp., wool consistency, fiber diam., and water pH. The wool-type cartridge could be used for most common org. solvents and aq. solns. of salts, up to a pH of 10. The cartridges were stable with nonoxidizing acid solns.

12645. KOHL, J. AND ZENTNER, R.D. **The preparation and utilization of metallic aerosols for filter-paper testing.** *J. Phys. Chem.* 57, 68-72(1953).—*C.A.* 47, 5044*f*.

Carbonyl iron powder, 1-20 μ av. diam., was dispersed in air to test dust-filter efficiencies at air-flow rates of 200-2000 ft/min. Fe was detd. colorimetrically with mercaptoacetate. The collection efficiencies of 5 paper filters were presented.

12646. ROSENFELD, MELVIN A.; JACOBSEN, LYNN, AND FERM, JOHN C. **A comparison of sieve and thin-section technique for size analysis.** *J. Geol.* 61, 114-31(1953).—*C.A.* 47, 5179*h*.

When grain-size analyses of 32 samples made by thin-section and sieving techniques were compared, no const. relationship between the two methods was found.

12647. SMITH, JAMES S. AND GARDENIER, RANSEN JR. **Determination of particle-size distributions by a sedimentation method.** *Anal. Chem.* 25, 577-81 (1953).—*C.A.* 47, 6710*h*.

A simple Pyrex-glass app. for the detn. of particle-size distributions as functions of the Stokes diam. in liquid media was described. The distributions were described in terms of their mean Stokes diam. and their second moments about the mean.

VI-5. Surface Area Determinations

12648. MARTIN, GEOFFREY; BOWES, E.A., AND CHRISTELOW, J.W. **The theory of fine grinding. II. A method of accurately determining experimentally the surface of crushed sand particles.** *Trans. Ceram. Soc.* 25, 51-62 (1925).—*C.A.* 20, 2034.

Weighed samples were placed in celluloid containers with definite excesses of 5 N-H_2F_2 solutions and were shaken for an hr at 25°C. The reaction was stopped by diluting the H_2F_2 solution with an equal vol. of H_2O at 0°C, followed promptly by filtration through paper pulp in Pt Gooch crucibles. The loss in wt compared with the loss by a known surface of the same material under identical conditions gave the surface of the unknown sample.

12649. MARTIN, GEOFFREY; BOWES, E.A., AND TURNER, F.B. **The theory of fine grinding. III. Connection between the surface area produced and the work done in tube-mill grinding of quartz sand.** *Trans. Ceram. Soc.* 25, 63-78 (1926).—*C.A.* 20, 2035.

The work required to grind standard sand was detd. by electrical and by the brake methods. In ordinary tube-mill grinding the surface produced was directly proportional to the work done. To increase the surface of sand by 1 ft^2 60.9 ft-lbs of work were required when 1-in. steel balls were used for grinding in the 18″ × 18″ mill. For very fine grinding the "cushioning" effect of dust was pronounced and efficiency was increased by the dust removal in the air stream.

12650. SULLIVAN, R.R. AND HERTEL, K.L. **Surface per gram of cotton fibers as a measure of fiber fineness.** *Textile Research* 11, 30-8 (1940).—*C.A.* 35, 321^4.

An air-flow method of detg. surface per g to within a standard error of 3% was described and calibration curves for high- and for low-porosity wads of fiber were given.

12651. BLAINE, R.L. **The measurement of specific surface by air permeability.** *ASTM Bull.* No. 108, 17-20 (1941).—*C.A.* 35, 2392^4.

The method of Carman for the measurement of surface areas of powders by detn. of the permeability to fluids of a bed of powder was applied to a variety of solids including cements, lime and mixts. of the two. Air was used as the fluid. The method appeared to afford a rapid and reproducible method for detg. the surface areas of finely divided powders.

12652. KURBATOV, J.D. **Evaluation of the surface area of catalysts of cubic form by the emanation method.** *J. Phys. Chem.* 45, 851-66 (1941). —*C.A.* 35, 5775^7.

A detailed analysis of the theory and practice of measuring surface area by the radio-active indicator method was presented. Correct use of the method involved the incorporation of both Ra and Th X in the catalyst.

12653. SMITH, W.R.; THORNHILL, F.S., AND BRAY, R.I. **Surface area and properties of carbon black.** *Ind. Eng. Chem.* 33, 1303-7 (1941).—*C.A.* 35, 7797^3.

Adsorption isotherms of N_2 on carbon blacks were detd. at -195.8° up to 600 mm pressure. The B.E.T. value of V_m was multiplied by 4.38 m^2/ml to give the total surface. Assuming uniformity and a density of 1.85, the calcd. diam. of a standard grade 6 rubber black from the adsorption data was 284 A., in agreement with published electron-microscope value of 280 A.; for an acetylene black, the calcd. diam was 533 A. in comparison to 510 A. by electron microscope. A linear relation was found between I_2 adsorption from 0.05 *M* soln. and surface area, indicating that 100 m^2 of surface was assocd. with 130 mg I_2. If more than 10% volatile matter was chemisorbed, I_2 adsorption was reduced. Adsorption of diphenylguanidine did not give a simple relation between adsorbed amt. and total surface.

12654. COLUMBIAN CARBON CO. RESEARCH LABORATORIES. **The surface area of colloidal carbons. I. Measurement of surface area by the electron microscope.** *Columbian Colloidal Carbons* 3, 13-52 (1942).—*C.A.* 37, 745^2.

The phenomena of particle size (microscopy, ultramicroscopy, sedimentation, adhesion tension, diffraction, and adsorption) and the electron-microscope method were reviewed.

12655. IMRE, LAJOS. **Applicability of the radioactive-indicator method for determination of the surface area of solids.** *Kolloid-Z.* 99, 147-57 (1942).—*C.A.* 37, 4286^9.

The statistical meaning of the adsorption vol., or the no. of adsorption positions, or the exchangeable positions was discussed. It was indicated that the Paneth equation for exchange adsorption had only a limited application. Results were given showing the adsorption of Th B on lead sulfate, at various low concns., with increasing time, from both aq. and alc. solns. The exptl. results could not be explained according to Paneth's equation, but were in agreement with a given extended law of distribution.

12656. JAGITSCH, R. **A note on the work of K. E. Zimens: Surface determinations and diffusion measurements by means of radioactive inert gases.** *Z. physik. Chem.* 192, 56-9(1942).—*C.A.* 38, 2564^6.

Curves of emanating power vs. temp. for solid salts gave values for the temp. increment of diffusion of the emanation that were double those for the diffusion of the lattice particles. These temp. increments were related to the heats of "loosening" of the corresponding particles. This was contrary to the observation that the activation energy for the diffusion of foreign particles was less than that for self-diffusion. Hence, there must be some unrecognized factors involved in the migration mechanism.

12657. RAMMLER, E. **The Schuhmann particle-size equation and its relation to the exponential law of particle-size distribution.** *Z. Ver. Deut. Ing., Verfahrenstech.* 1942, No. 4, 103-8. —*C.A.* 38, 4492^3.

Exptl. values were given for 12 different materials and for 9 different finenesses of a flint. Neither Schuhmann's equation nor any other general parabolic function was satisfactory because the deviation of the calcd. results from the measured results was excessive except in a relatively narrow range. Schuhmann's equation, however, gave satisfactory agreement for surface calcns.

12658. TISELIUS, ARNE. **A new method of adsorption analysis and some of its application.** *Advances in Colloid Sci.* 1, 81-98 (1942).—*C.A.* 36, 3413^8.

A detailed description was given of the application of the striation photographic technique to the Tswett chromatographic analysis of a no. of org. acids and proteins.

12659. ZEIMENS, K.E. **Surface determination and diffusion measurements by radioactive noble gases. (Practice and quantitative method.) II. The valuation of data.** *Z. physik. Chem.* A191, 95-128 (1942).—*C.A.* 37, 5648^7.

Changes in magnitude of the surface or diffusion phenomena were utilized in all cases. The dependence of these factors on time, temp. and treatment of solid substances studied was considered. The method was useful in studies of decompn., water removal, dissocn., lattice change, reactions, etc., and also in comparing the data with those obtained in other ways.

12660. AMON, F.H.; SMITH, W.R., AND THORNHILL, F.S. **Identification of carbon black by surface-area measurements.** *Ind. Eng. Chem., Anal. Ed.* 15, 256-8 (1943).—*C.A.* 37, 3631^4.

The HNO_3 method was found to be the best one for sepg. carbon black, especially in Buna-S mixts. The temp. of digestion should be 60-70°C for not over 3-4 hrs; under such conditions the correction factor was 1.08 instead of 1.05. The exptl. data indicated that carbon black underwent no appreciable change in B.E.T. surface area during incorporation in, and subsequent vulcanization of, a rubber mixt. This made it possible to identify the carbon black in an unfamiliar mixt., provided only that 1 grade of carbon black was present. The fact that carbon black could be completely recovered in unchanged form from vulcanized rubber supported the concept of phys. reenforcement of rubber.

12661. CONSTABLE, F.H. **Apparent heats of activation and surface activity in surface catalysis over wide ranges of temperature.** *Rév. faculté sci. univ. Istanbul* 8A, 112-19 (1943) (in English).—*C.A.* 38, 5133^3.

Cremer's formula, relating the no. of active centers N on a catalyst surface and the heat of activation ϵ of each active center was used: $\delta N = Ae^{\epsilon/h}\,\delta\epsilon$, where A was a const. per unit area of catalyst surface under const. conditions of prepn. and h a const. regarded as measuring the displacement from the mean conditions of the lattice. Equations were derived for the heat of activation on a surface and the fraction of the surface causing half the reaction velocity.

12662. FRICKE, R. **Properties and effects of active solids and surface chemistry.** *Naturwissenschaften* 31, 469-82(1943).—*C.A.* 38, 3529^6.

Estimates were made of the surface energy of active solids. For microcrystals of nonpolar materials the edges and corners became sharper and hence more active, for polar (ion) lattices the shape did not change with decrease in size, but the no. of active spots increased. The adsorptive and the catalytic activities increased noticeably at a crystal size around 10^{-4} cm. Heterogeneous catalysis was to a large extent 2-dimensional surface chemistry on such crystals.

12663. HARKINS, WILLIAM D. AND JURA, GEORGE. **An absolute method for the determination of the area of a fine crystalline powder.** *J. Chem. Phys.* 11, 430 (1943).—*C.A.* 37, 6518^3.

The powder was outgassed in a Pyrex tube, sepd. by a glass membrane from a tube which contained a liquid. The liquid must give a zero angle of contact with the solid. The app. was placed in a good thermostat (at 25°C), the membrane broken, and the vapor and surface of the solid allowed to come into equil. (this may require days). The powder was then immersed in a considerable vol. of the same liquid in an extremely sensitive calorimeter. The total heat in ergs/g, divided by the total surface energy of the liquid (118.5 ergs/cm^2 for water) gave the area per g of powder. The surface of such a film had the surface energy of the liquid itself. With water on anatase, the film was about 9 mol. layers thick; the effect of a solid on a water film could not be measured beyond 5 mol. layers.

12664. HARKINS, WILLIAM D. AND JURA, GEORGE. **An adsorption method for the determination of the area of a solid without the assumption of a molecular area, and the area occupied by nitrogen molecules on the surfaces of solids.** *J. Chem. Phys.* 11, 431-2 (1943).—*C.A.* 37, 6518^7.

It was shown that $S = 4.06s^{0.5}$ where S = area in m^2/g, s = slope of the isotherm. The surface areas of 58 of 60 solids investigated, detd. by this method, agreed within ± 9% with detns. made by the B.E.T. procedure. The area of the N_2 mols. on these solids was calcd. to be in the range 13.6-16.9 A^2. Langmuir's isotherm was found to apply only to unimol. adsorption.

12665. KISTLER, S.S.; FISCHER, E.A., AND FREEMAN, I.R. **Sorption and surface area in silica aerogel.** *J. Am. Chem. Soc.* 65, 1909-19 (1943).—*C.A.* 38, 10^1.

Sorption data on silica aerogel and silica xerogel were presented. The area under the sorption curve, when plotted with log p_o/p as the abscissa, was a direct measure of the total surface area of the gel. Capillary condensation greatly affected the course of all the curves studied, and with nonaq. liquids on silica gel may account for nearly all of the sorption measured. Thorough removal of residual water from the surface of silica gel did not transform the sorption curve to another type.

12666. MAGGS, F.A.P. **The relation between heat of wetting and the absolute value of the surface area of coals.** *J. Inst. Fuel* 17, 49-54 (1943).—*C.A.* 38, 1622^9.

Two modifications of the Gibbs adsorption isotherm were used to det. the internal surface area of coals. The 2 methods showed mutual agreement and gave the same correlation with heat of wetting as did the area calcd. from electron-microscope measurements of particle size of artificial graphite. The heat of wetting of coal by MeOH was detd. calorimetrically. Surface area varied from 100,000 to 1,000,000 ft^2 per lb of coal, being larger for lower-rank coals. Artificial graphite, mean particle diam. 1000 A. ± 300 A., coals and charcoal showed the same order of surface area and the same relation between heat of wetting and surface area.

12667. NELSON, R.A. AND HENDRICKS, S.B. **Specific surface of some clay minerals, soils, and soil colloids.** *Soil Sci.* 56, 285-96 (1943).—*C.A.* 39, 4420^7.

Montmorillonite in the vacuum-dry state had a relatively small B.E.T. surface (15.5 m^2/g). This was also true of its brucine salt. The submicrocryst. hydrous clay minerals tested (kaolinite, illite) did not change their sp. surface significantly upon loss by heating of essential water, although the crystallinity, as judged by the change in x-ray diffraction patterns, was greatly modified. Measurement of surface areas of soils and clays by adsorption of C_2H_6 at dry-ice temp. was found to be entirely practical.

12668. SPEEDY, ALAN. **The surface area of colloidal carbons. I. The colloidal-carbon spectrum. II. III. IV. The electron-microscope method.** *Rubber Age* (London) 24, 81-2, 114-15, 136, 138, 162 (1943).—*C.A.* 37, 6855^7; 38, 5107^5.

The published data on particle size, x-ray diffraction, and adsorption were summarized and discussed. A table giving the mean diams. and surface areas of 8 types of carbon black was discussed.

12669. TRILLAT, J.J. **States of surfaces and their measurement.** *Tech automobile* 34, 56-60(1943).—*C.A.* 38, 5709^3.

Surfaces were divided into 8 classes and the phys. and physicochem. properties discussed. Measurements of surfaces were either direct or indirect, both of which were considered.

12670. Zimens, K.E. **Surface determinations and diffusion measurements by means of radioactive inert gases. III. The process of emission of the radiation from disperse systems. Conclusions about the evaluation of emanating-power measurements and about the interpretation of the results.** *Z. physik. Chem.* **192**, 1-55 (1943).—*C.A.* **38**, 2563^9.

The emanation method of Hahn was critically investigated. By the emanating power (EP) was meant the fraction of the total emanation (produced by the admixed radioactive material) that escaped from the sample into the surrounding space. Expressions were developed for the fraction of the total EP furnished by the recoiling atoms, as a function of the range of these atoms, for emanation originating within a single granule. When the recoil EP was used for surface detn., no assumptions about the shape of the granules were necessary; also, irregularities of the surface of the order of size of the recoil range (approx. 3×10^{-6} cm) were detectable. It was shown that the emanation diffused along the intersecting pores rather than back into the surrounding material.

12671. Balma-Perrier, F. **Polarimetric measurement of the surface of silica.** *J. phys. radium* [*8*], **5**, 150-2(1944).—*C.A.* **39**, 3191^5.

In a 0.5 *M* soln. of a mixt. of tartaric acid, and SbF_3, the velocity of mutarotation at 30°C, was detd. in the presence of transparent fused SiO_2 of known dimensions (430 cm^2), for fused SiO_2 pulverized in a metallic mortar washed with HCl, chromic acid mixt., and distd. H_2O, and carefully dried, for SiO_2 pptd. by HCl from a soln. of silicate obtained by alk. fusion of pure quartz, and for SiO_2 pptd. from SiF_4 by H_2O. The velocity was proportional to the surface of the SiO_2, and unknown surfaces could be calcd. from the slopes of the straight lines obtained by plotting log $(\alpha_\infty - \alpha_t)$, where α was the rotation, against time in hrs and verified microscopically and colorimetrically. The surface of the pptd. SiO_2 was considerably greater than that of the ground SiO_2 (1000 cm^2 per g), but varied with the mode of prepn. (fused quartz, 30, 800, pptd. quartz, 346,000 and 191,000 cm^2 per g).

12672. Bell, John W. **A method for the measurement of the surface of finely divided material.** *Trans. Can. Inst. Mining Met.* **47**, 424-36 (in *Can. Mining Met. Bull. No.* **391**) (1944).—*C.A.* **39**, 1090^9.

A simple app. was described which permitted detn. of amt. of solid to bring a pulp to a standard opacity from which total surface of particles could be calcd.

12673. Emmett, P.H. **Measurement of the surface of finely divided and porous materials by low-temperature adsorption isotherms.** *Colloid Chemistry, Theory and Methods* **5**, 434-43 (1944). —*C.A.* **38**, 2862^8.

The B.E.T. method was used to measure the surface area of metallic Fe, Ni and Cu catalysts, silica gel, Cr oxide gels, soils, powd. bacteria, carbon blacks, paint pigments, etc., and homogeneously sized glass beads.

12674. Gaudin, A.M. and Bowdish, F.W. **Surface measurement by van der Waals adsorption.** *Mining Technology A.I.M.M.E.* **8**, No. 3, 1-6 No. 1666 (1944).

Apparatus was described to det. the B.E.T. surface area. The specific surface of glass spheres, 12 microns in diam., was found to be 2160 cm^2/gm. A minus 400-mesh sample of quartz was found to have a surface of 3610 cm^2/gm.

12675. Harkins, William D. and Jura, George. **Surfaces of solids. XII. An absolute method for the determination of the area of a finely divided crystalline solid.** *J. Am. Chem. Soc.* **66**, 1362-6 (1944)—*C.A.* **38**, 5125^9.

An abs. method was developed for the detn. of the area of a solid covered with a film in equil. with the satd. vapor of liquid. The area was given by a relation based on the heat of emersion of the satd. powder in cals per g and the "total energy" of the surface of the liquid. The equation was valid only if the contact angle was zero. If the solid was a finely divided crystal, the area of the clean powder could be obtained from the area of the satd. powder by the relation $\Sigma = \Sigma'/(1 + \alpha(T/d))$ where Σ (very nearly equal to Σ') was the area of the clean powder, T the thickness of the film, and d the edge of the av. cube. The areas of two different samples of TiO_2 were detd. by this method. The areas found for these samples were 13.8 and 8.9 m^2/g, whereas the B.E.T. area was 13.9 and 9.6 m^2/g, resp., with 16.2 A^2 as the area of the N_2 mol.

12676. Harkins, William D. and Jura, George. **Surfaces of solids. XIII. A vapor-adsorption method for the determination of the area of a solid without the assumption of a molecular area, and the areas occupied by nitrogen and other molecules on the surface of a solid.** *J. Am. Chem. Soc.* **66**, 1366-73 (1944).—*C.A.* **38**, 5126^4.

A plot was made of log p against the reciprocal of the square of the vol. adsorbed. In general, a straight line was obtained over a considerable range. The area (S) of the solid was given by the equation $S = ks^{1/2}$, where s was the slope of the straight line and k a const. for a given adsorbed vapor at a given temp. The value of k for N_2 at -195.8°C was 4.06; water at 25°C, 3.83; n-butane at 0°C, 13.6, and n-heptane at 25°C, 16.9. The areas of anatase, $TiO_2 + Al_2O_3$, $ZrSiO_4$, $BaSO_4$ and SiO_2 were given. The criterion for the existence of a condensed film was that the equation $\pi = b - a/\sigma$ or log $(p/p_0) = B - A/v^2$, represented the data. If a condensed film was not formed, the temp. must be lowered until this two-dimensional phase appeared.

12677. Hawksley, P.G.W. **Particle-size measurement.** *Brit. Coal Utilization Research Assoc. Bull.* **8**, 245-57(1944).—*C.A.* **39**, 236^4.

Methods of particle size detn. were reviewed with particular regard to subsieve sizes of less than 76μ. Various methods have been developed to meet particular needs for relative rather than abs. size measurement. Attempts to obtain abs. dispersion were abandoned in favor of conditions under which the material was used. Concn. and mech. conditions affect the dispersion and, therefore, the apparent particle size particularly for sedimentation tests. The choice of method must be based largely on experience. Packed powders could be examd. by liquid- or air-permeability methods.

12678. HENGLEIN, F.A. **Particle sizes and the work of subdivision of substances in the three states of aggregation.** *Chem.-Ztg.* 68, 23-5 (1944).—*C.A.* 38, 5448^7.

The relation between useful work and the work of phys. subdivision was discussed and the following general law derived: $A = (O_n - O_v/V) \times \zeta$, in which A was the work of phys. subdivision per unit vol. of a substance, V the vol. of the substance to be subdivided, O_v the surface before the subdivision, O_n the surface after the subdivision, and ζ the specific surface energy (surface tension for liquids). The application of this to particles, drops and gas bubbles was worked out mathematically.

12679. KRIEGER, K.A. **Apparatus for surface-area measurement.** *Ind. Eng. Chem., Anal. Ed.* 16, 398-9 (1944).—*C.A.* 38, 4473^9.

The app. consisted of an absorbent vessel, gas buret with 4 bulbs, a mercury leveling flask, and a manometer.

12680. LIVINGSTON, H.K. **Cross-sectional areas of molecules adsorbed on solid surfaces.** *J. Am. Chem. Soc.* 66, 569-73 (1944).—*C.A.* 38, 2541^9.

Adsorption isotherms were measured both by the low-temp. N_2-adsorption volumetric technique and by the McBain-Bakr method, with vapors from substances that boil well above room temp. By comparison of the various isotherms, the cross-sectional area values for the adsorbed mols. (A^2 per mol.) were found to be H_2O, 10.6; PrOH, 20.0; heptane, 55.0, if N_2 was taken to be 15.4. These areas were in every case in good agreement with the mol. areas of the mols. as detd. from d., x-ray, or film-balance measurements. The finely-divided solids were TiO_2, SiO_2, $BaSO_4$, and graphite.

12681. MAGGS, F.A.P. **The absolute evaluation of surface areas of solid materials.** *Proc. Conf. Ultra-fine Structure of Coals and Cokes, Brit. Coal Utilisation Research Assoc.* 1944, 95-109.—*C.A.* 39, 1266^8.

The adsorbents included 2 samples of weakly caking Northumberland coal, a sample of this coal extd. with MeOH, a long-flame, free-burning Warwickshire coal, and a finely divided, artificial graphite. Except for η-hexane on one Northumberland sample, adsorption isotherms for MeOH were detd. on all samples. All measurements were made at 25°C by a volumetric method. The graphs showed no linear portion and hence the surface area could not be evaluated with certainty. Plots of p/p_o vs. $p/s\ (p_o - p)$ showed a linear relation for MeOH adsorption on 3 coals, a slight curve for η-hexane on Northumberland coal, and an *s*-shaped curve for MeOH on graphite.

12682. SHAW, T.M. **The surface area of crystalline egg albumin.** *J. Chem. Phys.* 12, 391-2 (1944).—*C.A.* 38, 6153^4.

With N_2 at -183°C, the surface area of egg albumin was found to be 2.42 m^2/g; with H_2O vapor at 25°C, it was found to be 210-220 m^2/g the difference between the heat of adsorption in the first adsorbed layer E_1 and the heat of liquefaction E_L was 648 cal/mol. for N_2 and 1100 cal/mol. for H_2O. These areas were equiv. to particles of egg albumin contg. 10^8 mols., calcd. from N_2 adsorption, or 100 mols calcd. from H_2O adsorption. Where the area desired was that of the organized crystallite, it must first be detd. that the adsorbate could not penetrate the mol. lattice.

12683. BEEBE, RALPH A.; BECHWITH, JOHN B., AND HONIG, JURGEN M. **Determination of small surface areas by krypton adsorption at low temperatures.** *J. Am. Chem. Soc.* 67, 1554-8 (1945).—*C.A.* 39, 5149^8.

The B.E.T. method was applied with sucess to the measurement of specific surface areas in solids as low as 0.04 m^2/g with Kr vapor at liquid-N_2 temps. The use of Kr had the advantage of low satn. pressure (approx. 2 mm) at the conveniently obtainable liquid-N_2 temp. By use of an anatase (TiO_2) sample of known area, the value of the area occupied by the Kr atom in the monolayer was 19.5 ± 0.4 A^2. This was considerably higher than predicted on the assumption that the Kr atoms in the monolayer formed a close-packed liquid monolayer.

12684. CASSEL, HANS M. **The possibility of estimating the average surface area of solid particles.** *J. Chem. Phys.* 13, 249 (1945).—*C.A.* 39, 3991^9.

Difficulties in the exptl. detn. of the surface area of cryst. powders by heat of wetting techniques was discussed.

12685. DAMERELL, V.R.; GAYER, K., AND LAUDENSLAGER, H. **Effect of surface-active agents on dispersions of silica in xylene.** *J. Phys. Chem.* 49, 436-42(1945).—*C.A.* 40, 2374^5.

Silica was dispersed in xylene in the presence of 16 surface-active materials and the particle-size distribution was detd. by sedimentary analysis. The surface area detd. by the B.E.T. method was 118 m^2/g. Silica was positively charged in xylene suspension and was coagulated by the addn. of H_2O, alc., acetone, and ether. Heating also produced coagulation. Increasing the stirring time substantially increased the percentage of intermediate-size particles, but did not greatly affect the percentage of colloidal material; increasing the concn. of surface-active agent resulted in a greater degree of dispersion.

12686. DAVIES, W. AND REES, W.J. **The specific surface and grain-shape of silica sands used for glassmaking.** *J. Soc. Glass Tech.* 29, 279-88(1945).—*C.A.* 40, 2949^4.

Methods for detg. the specific surface and shape of sand grains were reviewed. The permeability of a vertical bed of sieved sizes of sand grains was detd. in a gas train equipped with manometers and a flowmeter. Grain shape varied with grain size and the variation was dependent in large measure on the mode of origin of the sand. The coeff. of angularity based on the sphere as unity ranged between 1.03 and 1.17 for some unconsolidated sands and between 1.18 and 1.29 for sands obtained by crushing sandstones.

12687. Elkin, P.B.; Shull, C.G., and Roess, L.C. **Silica-alumina gels. Specific surface and particle-size distribution.** *Ind. Eng. Chem.* 37, 327-31 (1945).—*C.A.* 39, 2241^{6}.

Silica-alumina gels of various compns. were made by 3 methods: (1) pptn. of alumina from $AlCl_3$ in the presence of a dil. slurry of silica gel; (2) mixing wet alumina gel with wet silica gel; and (3) impregnating partially dried silica gel with $Al(NO_3)_3$ and drying. The sp. surfaces of the gels were detd. by the B.E.T. method and the particle-size distributions were detd. by small-angle x-ray scattering. Sp. surfaces calcd. from particle-size data were found to change uniformly with area values from adsorption but were always higher.

12688. Emmett, Paul H. **Gas adsorption methods for measuring surface area of adsorbents.** *Ind. Eng. Chem.* 37, 639-44(1945).—*C.A.* 39, 3989^{1}.

Methods of measuring surface areas by gas adsorption could be subdivided into 2 groups. The first postulated the existence of multilayers of physically adsorbed gas and made use of adsorption isotherms of gases near their b. ps. The second assumed that the adsorption was a combination of unimol. phys. adsorption and capillary condensation. The use of low-temp. adsorption of some gas such as N_2 near the b.p. was capable of yielding reliable values for the surface areas of porous and finely divided materials or even of materials that have relatively small surface areas.

12689. Harkins, William D. and Jura, George. **An absolute method for the determination of the area of a fine crystalline powder.** *J. Chem. Phys.* 13, 449-50(1945).—*C.A.* 40, 264^{1}.

12690. Joyner, Leslie G.; Weinberger, Edward B., and Montgomery, C.W. **Surface-area measurements of activated carbon, silica gel, and other adsorbents.** *J. Am. Chem. Soc.* 67, 2182-8 (1945). —*C.A.* 40, 1376^{1}.

The adsorption and desorption isotherms for N_2 at -195°C for 2 Al silicates, six activated carbons, and a silica gel were detd. These isotherms had values of *n* (see B.E.T. theory) ranging between 1.15 and 4.2. The isotherms for *n*-butane at 0°C for one of the Al silicates and the silica gel were also detd. When the isotherm corresponded to a value of *n* greater than about 3, both the B.E.T. free surface equation and the Harkins and Jura equation were applicable. For isotherms with *n* less than 3, only the complete B.E.T. equation yielded results that agreed with the exptl. data to a reasonable extent.

12691. Kiselev, A.V. **New adsorption methods for determining the surface area of adsorbents.** *Uspekhi Khim.* 14, 367-94(1945).—*C.A.* 40, 3036^{3}.

Detailed reviews were presented of the heat-of-wetting and the gas-adsorption methods for detn. of the specific area of nonporous adsorbents. A general thermodynamic treatment of capillary condensation and formation of surface films was given. Results on the same materials usually agreed to better than 15%.

12692. Langille, R.C.; Braid, P.E., and Kenrick, F.B. **A comparison of two methods for determining the surface area of a powder.** *Can. J. Research* 23B, 31-9 (1945).

The surface area of Ba crown glass powder (between 230 and 270 mesh) was detd. by (a) comparison of adsorption of methylene blue on the powder and on large measurable broken surfaces, (b) measurement of the projection areas of randomly oriented particles. Averaged results were 682 cm^2 per g by the first method and 568 cm^2 per g by the second method. The methylene blue was found to be Zn-free and was made up in a pH 7 buffer soln. The mixt. of dye and powdered glass were sepd. in a centrifuge.

12693. Maggs, F.A.P. **Assessment of specific surface of powders and porous solids by adsorption methods.** *Brit. Coal Utilisation Research Assoc. Bull.* 9, 253-61(1945).—*C.A.* 40, 264^{2}.

12694. Ries, Herman E. Jr; Van Nordstrand, Robert A., and Teter, John W. **Surface area of catalysts. Effect of sintering on area and structure of a supported catalyst and its components.** *Ind. Eng. Chem.* 37, 310-17(1945).—*C.A.* 39, 2248^{4}.

Low-temp. N_2 adsorption isotherms were used to follow area changes of a supported pelletized catalyst after heating for various periods at 340-650°C. B.E.T. areas indicated losses in area due to sintering of as much as 75%. The area of the supported catalyst was considerably greater than that of either the unsupported material or the support. Adsorption-desorption isotherms were presented and hysteresis effects considered.

12695. Sharratt, E.; Van Someren, E.H.S., and Rollason, E.C. **A rapid optical method for estimating the specific surface of powders.** *J. Soc. Chem. Ind.* 64, 73-5(1945).—*C.A.* 39, 3476^{5}.

Surface areas of fine powders were detd. by observing the optical d. of their dil. suspensions. the method was adapted to routine testing of opaque powders between 2.5 and 150 μ. Transparent powders gave low results, but the method was suitable for comparison. No knowledge of the sp. gr. of the powder was necessary. The method was suitable for mixed powders and could also be used to test the dispersing powers of different deflocculants.

12696. Thiessen, P.A. **The absolute surface of finely divided materials.** *Naturwissenschaften* 32, 158-9(1945).—*C.A.* 40, 2055^{5}.

The surface area of a fine dispersion was detd. by adsorbing on it ultramicroscopically visible particles of a second test colloid like Au sol. The no. of test particles adsorbed was then counted microscopically.

12697. Arnell, J.C. **Permeability. I. Surface-area measurements using a modified Kozeny equation.** *Can. J. Research* 24A, 103-16 (1946). —*C.A.* 42, 807*i*.

12698. Bobrov, F.F. **Theory of specific surface in technology of paper making.** *Bumazhnaya Prom.* 21, No. 5/6, 5-9 (1946).—*C.A.* 41, 2575*c*.

The surface area of either stock or paper was the ratio of the total surface area of the fibers to their wt. If *n* was the wt of a quantity of matter, *i* the no. of particles in this wt, *m* the wt of one particle, and *f* the surface area of one particle, then $n = im$ and $F = if$, where F was the total surface area. The sp. surface area $f_o = F/n = f/m$. Dry pulp (1 g) consisting of fibers 2.55 mm long and 0.0445 mm thick had a calcd. f_o of 466 cm^2/g. Similar fibers 2.4 mm long and 0.038 mm thick had 630 cm^2/g.

12699. BOER, J.H. DE. **The determination of surface areas by adsorption methods.** *Rec. trav. chim.* 65, 576-9(1946)(in English).—*C.A.* 41, 1908*a*.

Adsorption isotherms for I_2 on $BaCl_2$ or CaF_2 layers sublimed on glass walls had the sigmoid shape assocd. with the multilayer adsorption theory of Brunauer, Emmett, and Teller. The data agreed with the theory at relative pressures from 0.05 to 0.35, but surface areas calcd. from the theory were lower than the true surface areas by a factor of 2 to 4. The true areas were detd. by the surface action of alizarin or by measuring the chemisorption of H_2O. The sigmoid form of the isotherm was not a proof of the multimol. character of the adsorption.

12700. BREGER, A. KH. AND ZHUKHOVITSKIĬ, A.A. **The superficial density of specific heat.** *J. Phys. Chem.* (U.S.S.R.) 20, 1459-70 (1946).—*C.A.* 41, 3359*e*.

By taking into account the presence of the surface area, the sp. heat of a solid at low temps. consisted of two parts, a bulk term that was proportional to the vol. and to the cube of the abs. temp., and a second term that is proportional to the surface area and to the square of the abs. temp. The energy of thermal vibration of a solid with proper boundary conditions was calcd. for both the two-dimensional and three-dimensional problems. The predicted effect of the surface area on the sp. heat should be easily capable of verification even if materials having relatively low surface areas (e.g., 12.5 m^2/g) were used.

12701. BUGGE, P.E.; KERLOGUE, R.H., AND WESTWICK, F. **Surface-area determination.** *Nature* 158, 28 (1946).—*C.A.* 40, 5616^9.

In the detn. of surface area by the B.E.T. method, it was usual to det. the dead space on each sample with He. For routine detns. on substances known to give S-shaped isotherms, the dead-space detn. was avoided by the use of a math. formula. For carbons, chalks, Paris white, clay, and asbestos, the calcd. area per g was slightly below that obtained by dead-space detn.

12702. CASSEL, HANS M. **Estimation of the surface area of solid particles.** *J. Chem. Phys.* 14, 217(1946).—*C.A.* 40, 3324^2.

Difficulties in the detn. of the surface areas of solids were discussed.

12703. DERYAGIN, B. **Measurement of the specific surface of porous and disperse bodies by their resistance to the flow of rarefied gases.** *Compt. rend. acad. Sci. U.R.S.S.* 53, 623-6(1946) (in English).—*C.A.* 41, 2626*h*.

Knudsen flow through a porous diaphragm was calcd. and from the conclusions it was possible to compute the specific surface.

12704. D'EUSTACHIO, D. **Note on thickness of quartz wafers for observed surface phenomena.** *Phys. Rev.* 70, 229 (1946).—*C.A.* 40, 6315^4.

The thickness of the wafers used was ~ 10 μ, instead of the 25-30 μ previously reported.

12705. FRITH, F. AND MOTT, R.A. **A rapid method for the determination of the specific surface and mean particle size of black powders.** *J. Soc. Chem. Ind.* 65, 81-7(1946).—*C.A.* 40, 4582^1.

The tinting-strength test was standardized so as to obtain complete dispersion of carbon blacks down to a size of 50 mu or less. Standardization of the test was possible with carbon blacks whose size (within the range of 300 to 30 mμ) was detd. by the electron microscope. The relation between surface area and mean particle size for particles (spherical, cubic, or even slightly prismatic) showed that the method could be used to assess mean specific surface or mean particle size for black powders below 50 μ (0.050 mm or 240 B.S. mesh).

12706. GAUDIN, A.M. AND PRELLER, GUSTAV S. **Surface area of flotation concentrates and the thickness of collector coatings.** *Am. Inst. Mining Met. Engr., Mining Technol.* 10, No. 3, *Tech. Pub.* No. 2002, 9 pp. (1946).—*C.A.* 40, 4007^6.

Specific surface areas of concentrates from 6 large plants were measured by the gas-adsorption method. From these data and the quantity of collector used at each mill, the concentrate surface available for each ion of collector was calcd. in order to find out what could be expected as far as the packing of these ions on the mineral surface was concerned. The results indicated that the collector coating was an incomplete monoionic layer, and the recovery was higher the denser the packing in the monolayer.

12707. HEINEMANN, HEINZ; KRIEGER, K.A., AND McCARTER, W.S.W. **Some physical properties of activated bauxite.** *Ind. Eng. Chem.* 38, 839-42 (1946).—*C.A.* 40, 5316^6.

Data were presented on bulk, apparent, and true ds., void and pore vols., percentage voids and pores, surface areas, and equiv. pore diams. for Arkansas and South American bauxites, a synthetic alumina, and silica gel. The changes of these phys. properties with increasing activation temp. investigated were interpreted. The apparent d. was detd. by Hg displacement, the true d. by He displacement, and the surface area by the B.E.T. method. Bulk d., void vol., and percentage voids depended on granule size distribution. The other properties were independent of granule size, but were altered by changes in structure of the adsorbents produced by increasing activation temps.

12708. HOLMES, W.R. **Flow of gases through fine powders and the measurement of specific surface.** *Nature* 157, 694 (1946).—*C.A.* 40, 5317^5.

If the voids were much narrower than the mean free path, the flow ceased to be governed by the viscosity of the gas and became a process of diffusion. The mass flow per unit area per unit time was given by $Q = -(8/3)(2M/\pi RT)^{0.5}[\epsilon^2/S(1-\epsilon)\rho](dp/dx)$, where the mean free path, $\lambda = 4\epsilon/[S(1-\epsilon)\rho]$, was detd. by the dimensions of the voids. The sp. surface of a powder could be calcd. from permeability measurements made at a suitable gas pressure.

12709. Keyes, William F. **Determination of specific surfaces by permeability measurements.** *Ind. Eng. Chem., Anal. Ed.* 18, 33-4 (1946).—*C.A.* 40, 1377^2.

The effect of varying porosity on air permeability of powder was investigated. The relation between permeability K, specific surface S_o, and porosity ϵ, could be expressed by the following modification of Kozeny's equation: $K = \{g(1 + a)/5\eta S_o^2\}\{(\epsilon - [a/(1 + a)])^3/(1 - \epsilon)^2\}$. For ground limestone, quartz and portland cement $a/(1 + a)$ was found to be about 0.11.

12710. Kiselev, A.V. and Krasil'nikov, K.G. **Specific area and heat of wetting of asbestos fiber.** *J. Applied Chem.* (U.S.S.R.) 19, 316-21 (1946).—*C.A.* 40, 6966^3.

The specific area of dry asbestos fiber, measured by adsorption of butyl alc. or butyric acid from CCl_4 soln., was 2.10×10^5 cm²/g, as compared with an external fiber surface area of 460 cm²/g measured by the microscope. The integral molar heat of wetting of dry, out-gassed (by evacuation) material was 10.3 ± 0.1 kcal/mol.

12711. Pechukas, Alphonse and Gage, F.W. **Rapid method for determining specific surface of fine particles.** *Ind. Eng. Chem., Anal. Ed.* 18, 370-3 (1946).—*C.A.* 40, 6268^9.

The surface areas of pigments (0.1-1.0 μ diam.) were detd. by a modified air-permeability method. The effect of variable porosities on the detn. were minimized by the use of a simplified equation: $K_3^2/d_m^2 = t/Q_2$, where K was a const. that was a function of the gas used (air), the pressure drop across the pigment plug, the thickness and cross-sectional area of the plug, and the d. of the pigment. The mean diam. of the pigment particles was d_m; Q_2 was the vol. of air flowing through the plug in time t. Curves of t/Q_2 vs K_3^2 for various values of d_m made rapid detns. of d_m possible.

12712. Ries, Herman E. Jr; Johnson, Marvin F.L., and Melik, John S. **Nitrogen and stearic acid adsorption by supported and unsupported catalysts.** *J. Chem. Phys.* 14, 465-6(1946).—*C.A.* 40, 5317^1.

Unsupported catalysts and catalysts supported on diatomaceous earth and on TiO_2 were studied. The catalyst pptd. in the absence of diatomaceous earth formed finely divided essentially nonporous particles, whereas the catalyst pptd. in the presence of low-area diatomaceous support developed a small pore structure of much greater area.

12713. Rigden, P.J. **Flow of gases through fine powders and the measurement of specific surface.** *Nature* 157, 694(1946).—*C.A.* 40, 5317^6.

A formula similar to that of Holmes was derived. Such a formula was valid only if the diam. of all the pores in the bed of powder was considerably less than the mean free path. At atm. pressure, only powders as fine as carbon black of 50 m²/g would meet this requirement.

12714. Russell, Allen S. and Stokes, John J. Jr. **Surface area in dehydrocyclization catalysis.** *Ind. Eng. Chem.* 38, 1071-4 (1946).—*C.A.* 40, 6945^9.

Activated aluminas were impregnated with varying quantities of MoO_3, and their catalytic activities were detd. for dehydrocyclization of heptane to toluene at atm. pressure. Surface areas were detd. by the sorption of C_4H_{10} at 0°C and results expressed as millimol. C_4H_{10}/g activated alumina. The standard catalyst was activated alumina of area 0.38 impregnated to an at. ratio of 0.05 Mo:1 Al. Comparison of the calcd. molybdena area with the exptl. value for max. catalytic activities showed that the alumina surface was covered with a monolayer of molybdena at max. catalytic activities.

12715. Skolnik, Sol; Tarbutton, Grady, and Bergman, W.E. **Particle size and surface area of red phosphorus as functions of the percentage conversion.** *J. Am. Chem. Soc.* 68, 2310-14 (1946).—*C.A.* 41, 639*i*.

In connection with the prepn. of red P by the partial conversion of liquid white P at its b.p., the particle-size distribution and specific surface of the red P were studied as functions of the degree of conversion in the range 6 to 60%. The sp. surface, as measured by the gas-adsorption method with propane at -78.6°C as the adsorbate, was a linear function of the reciprocal of the percentage compn. Application of the adsorption data to calcn. of particle sizes yielded values significantly smaller than those measured by sedimentation. Also, the existence of well-defined hysteresis loops in the adsorption data at high relative pressures were consistent with the hypothesis that the particles of red P were porous.

12716. Smith, Hilton A. and Fuzek, John F. **Adsorption of fatty acids on nickel and platinum catalysts.** *J. Am. Chem. Soc.* 68, 229-31 (1946).—*C.A.* 40, 2724^1.

The surface area of Raney Ni was detd. by adsorption of capric, lauric, palmitic, nonadecylic, and behenic acids; of palmitic acid from solns. of methanol, acetone, heptane, benzene, cyclohexane, and cyclohexene; and for the adsorption of these fatty acids as compared with other methods of detg. surface areas. The results with Pt indicated that the adsorption method could be used to calc. the specific surface of this catalyst. Values ranged from 50 to 75 m² per g depending on the individual prepn., as well as on the conditions of reduction of the oxide. The adsorption of fatty acids gave the same results for Raney Ni, using acids varying from 10 to 22 C atoms. These results also agreed with those found by the N_2-adsorption method. The assumption of the cross-sectional area occupied by a fatty acid chain was probably better than the assumptions made concerning the cross-sectional area of the N_2.

12717. Sutherland, K.L. **The surface area of fine powders.** *Australian J. Sci.* 8, 155-9 (1946).—*C.A.* 41, 20*h*.

12718. Zimens, Karl E. **Surface exchange of solids and the determination of surface area.** *Arkiv Kemi, Mineral. Geol.* A21, No. 17, 26 pp. (1946) (in German).—*C.A.* 41, 895*h*.

The limitations of Paneth's method were discussed. The results of previous workers with Pb and Ag salts were tabulated and the conditions were given for which Paneth's equation could be operative. There must be no marked exchange with the inner crystal, and all the atoms lying in the phase boundary must undergo exchange.

12719. ANDERSON, ROBERT B.; HALL, W. KEITH; HEWLETT, HARLAN, AND SELIGMAN, BERNARD. **The Fischer-Tropsch synthesis. II. Properties of unreduced cobalt catalysts.** *J. Am. Chem. Soc.* 69, 3114-19(1947).—*C.A.* 42, 2739*g*.

Surface area and pore vol. were studied on two types of unreduced Co Fischer-Tropsch catalysts, prepd. with and without promoters and kieselguhr. The pptd. catalysts were of the type Co: thoria: kieselguhr (100:18:100) and Co: thoria:magnesia: kieselguhr (100:6:12:200). The surface areas of the unreduced catalysts of the latter type contg. kieselguhr ranged from 58.6 to 149.6 m^2/g whereas that of the kieselguhr ranged from 1.9 to 37.3 m^2/g. Pelleting decreased the surface area 10 to 20%. Av. pore diams. varied from 500 to 770 A. (granular) and 165 to 310 A. (pelleted). Catalysts prepd. in small batches had fairly reproducible surface areas.

12720. ARNELL, J.C. **Permeability. II. Surface-area measurements of inorganic pigment powders.** *Can. J. Research* 25A, 191-209(1947).—*C.A.* 42, 808*a*.

Permeability data for carefully packed beds of powd. SiO_2, Fe_2O_3, and Cr_2O_3, and of 2 com. pigments were used to calc. the surface areas, shape factors, and pore radii, by use of the modified Kozeny equation. The results obtained with different beds of the same powder were found to be consistent within ± 10%. The greatest error in the method appeared to lie in the difficulty of packing the bed in exactly the same way in repeat runs. The one powder with which no consistent results could be obtained was hydrated Cr_2O_3.

12721. BALMA-PERRIOR, FRANCOISE AND DARMOIS, EUGÈNE. **The measurement of the specific surface of silica powders.** *Compt. rend.* 224, 1562-4(1947).—*C.A.* 41, 6107*e*.

The detn. of the sp. surface of powd. silica was based on the speed of mutarotation of a contacted aq. soln. of tartaric acid and SbF_3. It was applied to fused SiO_2 rods, powd. SiO_2 prepd. from SiO_2 rods, and pptd. SiO_2 prepd. either from SiF_2 and H_2O, or from Na_2SiO_3 and HCl. The powd. SiO_2 gave a value of 1000 cm^2/g, compared with 1300 by microscopic examn., and 800 by adsorption of Diamond Magenta dye. The surface area of pptd. silica fell from 6.1 to 0.3×10^5 cm^2/g for one prepn. as the temp. increased from 280° to 1270°C.

12722. BERING, B.P. AND SERPINSKIĬ, V.V. **Method of measuring adsorption of gases and vapors by solids.** *Compt. rend. acad. sci. U.R.S.S.* 55, 731-4(1947)(in English).—*C.A.* 41, 6791*b*.

By use of a McBain-type balance with a sensitivity of the order of 10^{-5} g, with an adsorbent wt of about 50 g and a mol. wt of the adsorbate of 30 to 100, the sensitivity of the method was 10^{-6} millimoles/g. The method was suitable for studying the low-pressure region of the adsorption isotherm, in the investigation of adsorption of gaseous mixts. and adsorbents of small sp. surface, and in measuring differential heats of adsorption.

12723. BROWN, CALLAWAY AND UHLIG, HERBERT H. **Surface area of chrome-plated nickel.** *J. Am. Chem. Soc.* 69, 462-4(1947).—*C.A.* 41, 3380*g*.

A large ratio of accessible to apparent area existed for electrodeposited Cr and the magnitude of the accessible area was sensitive to the previous history of the surface. Results were given for samples etched with warm 1.5 *N* HCl until H_2 was evolved over all the surface. Typical data for the ratio of plated and plated-etched samples were: 15, 27; 12, 9.4; 53.

12724. BUGGE, P.E. AND KERLOGUE, R.H. **The determination of the surface area of powders by means of low-termperature adsorption iostherms.** *J. Soc. Chem. Ind.* (London) 66, 377-81(1947).—*C.A.* 42, 2836*d*.

The "deadspace" detn. was eliminated for routine procedure where the substance was known to give an S-shaped isotherm. The degree of vacuum obtained by a rotary oil pump (10^{-2} to 10^{-3} mm) was sufficient. The following areas m^2/g were given: Carbon A, 790; Carbon B, 847; Carbon C, 814; Carbon D, 460; Carbon E, 280; Chalk A, 30; Chalk B, 19; Paris white, 2; Clay, 10; Asbestos, 18.

12725. GAPON, E.N. **Electrochemical method for determining the surface of adsorbents and colloids.** *Kolloid. Zhur.* 9, No. 1, 29-36(1947).—*C.A.* 41, 4350*h*.

The cation adsorption by soils was given by: $S = \alpha + \beta$ pH $- \gamma$ pM, where α, β and γ were const. and pM was the neg. log of cation concn. in the soln. From thermodynamic considerations the following relations was derived $\gamma = 1/n\ \beta$, where n was the valency of the cation. The equation thus became $S = \alpha + \beta\ [\text{pH} - (1/n).\text{pM}]$. $\beta = 2.303.$ $pCRT/F^2$, where p was the area of adsorbent, C was the capacity of the elec. double layer, F was the Faraday const., and R was the gas const. The equation was used to det. the surface area of adsorbents.

12726. GAPON, E.N. **Specific surface area of soil humus.** *Kolloid. Zhur.* 9, 329-34(1947).—*C.A.* 43, 7617*g*.

If S = the amt. of cation adsorbed and x = pH, the const. β in the equation $S = \alpha + \beta x$ was proportional to the surface area of the adsorbent. If the adsorbent was a mixt. of several substances, this term was the sum of the β values of the components. Humus in soil had a smaller (3-30 times) adsorbing surface than humic acid. Usual soil humus had a surface of 1900 m^2/g.

12727. GREGG, S.J. **Adsorption and heat-of-wetting methods of measuring surface area.** *Soc. Chem. Ind.* (London), *Roads and Bldg. Materials Group*, Advance copy, Feb. 4, 1947, 27-33.—*C.A.* 41, 5374*d*.

The exptl. methods and the comparative advantages of detg. a surface area by the adsorption of gases, adsorption of solutes from soln., and heat of wetting were discussed.

12728. OWEN, J.R. **Correlation of surface area and dehydrogenation activity for a chromia-**

alumina catalyst. *J. Am. Chem. Soc.* 69, 2559-60(1947).—*C.A.* 42, 442*b*.

In the dehydrogenation of butane, the data showed a definite correlation between surface area and dehydrogenation activity for the CrO_3-Al_2O_3 catalyst.

12729. RIGDEN, P.J. **The specific surface of powders. A modification of the theory of the air-permeability method.** *J. Soc. Chem. Ind.* 66, 130-6(1947).—*C.A.* 41, 6107*g*.

By correcting the equation for slip of air at the walls good agreements were obtained between air and water, acetone and *n*-hexane on surfaces between 0.4 and 5 m^2/g. The av. of 5 sp.-surface detns. on a portland cement gave a value of 0.395 with air compared with 0.390 using acetone and 0.399 using *n*-hexane.

12730. SCHOFIELD, R. KENWORTHY. **Calculation of surface areas from measurements of negative adsorption.** *Nature* 160, 408-10(1947).—*C.A.* 42, 17*i*.

An equation for the calcn. of neg. adsorption was derived. When applied to anions of Na salts in aq. Na bentonite, the surface area per 100 g of bentonite was 4.7×10^8 cm^2, whereas a "complete dispersion" of 100 g of pure montmorillonite should have a surface area of 8×10^8 cm^2. Jute fiber was found to have a surface area of 8×10^8 cm^2 per 100 g of dry fiber.

12731. TOVAREV, V.V. **Apparatus for determination of the surface area of cement by air permeability.** *Tsement* 13, No. 3, 15-19(1947).

12732. TOVAREV, V.V.; GINSBURG, YU. N., AND MASSIL'ON, T.K. **Determination of the specific surface area of cements by means of a pneumatic surface-meter.** *Tsement* 13, No. 7, 12-17 (1947).—*C.A.* 43, 1937*f*.

The instrument proved suitable for plant lab. use. The specific surface of samples from various cement mills was 2100-3900 cm^2 per g. The residue on the screen having 4900 mesh per cm was 2-18%. There was a definite relation between the residue on the screen and the specific surface area for the same clinker ground to various degrees of fineness; where cements from different clinkers were tested, this relation was no longer const.

12733. ZETTLEMOYER, A.C. AND WALKER, W.C. **Active magnesia. Surface areas and pore structures from nitrogen adsorption.** *Ind. Eng. Chem.* 39, 69-74(1947).—*C.A.* 41, 1140*a*.

The B. E. T. surface areas of 7 samples of com. MgO were detd. ranging from 0.8 to 200 m^2 per g; areas detd. by iodine adsorption from CCl_4 soln. were about 35% lower. In the relative-pres. range 0.3 to 0.5, the N_2 adsorption exceeded by a few percent that predicted by the B. E. T. theory. From the Kelvin equation and the N_2 adsorption isotherms, the approx. diam. of the holes was estd. to be about 50 A. Two electron photomicrographs were interpreted as confirming the plate structure.

12734. ZETTLEMOYER, A.C. AND WALKER, W.C. **Active magnesia. III.** *J. Phys. & Colloid Chem.* 31, 763-7(1947).—*C.A.* 41, 4992*a*.

The particle sizes of a no. of activated magnesias were measured by x-ray line broadening and found to vary from 53.4 to 120 A.; one inactive grade gave a particle size of 374 A. The cell const. increased with a decrease in particle size from 4.201 A. for the inactive grade to 4.211 for the sample with a particle size of 53.4 A. The surface areas calcd. from the x-ray results agreed with those measured by N_2 adsorption for samples having areas of about 300 m^2/g.

12735. ZHURAVLEV, V.F. AND SYCHEV, M.M. **Determination of the specific surface area of cement by the method of P. C. Carman.** *J. Applied Chem.* (U.S.S.R.) 20, 171-8(1947)(in Russian).—*C.A.* 42, 1717*b*.

The method of Carman was somewhat modified by using air over pressure instead of rarefaction. True sp. areas were obtained by calibration with cement powder of known granulometric compn., previously detd. by the sedimentation method.

12736. ANDERSON, R.B. AND EMMETT, P.H. **Measurement of carbon black particles by the electron microscope and low-temperature nitrogen adsorption isotherms.** *J. Applied Phys.* 19, 367-73(1948).—*C.A.* 42, 6602*g*.

Electron micrographs and N_2 adsorption isotherms were compared on 6 com. carbon blacks as methods for detg. particle size and surface areas of finely divided materials. Good agreement (within 4%) was obtained between the 2 procedures for 4 of the 6 blacks: Grade 6, P 33, acetylene black, and lampblack.

12737. ARNELL, J.C. AND HENNEBERRY, G.O. **Permeability studies. III. Surface-area measurements of carbon blacks.** *Can. J. Research* 26A, 29-38 (1948).—*C.A.* 42, 5743*a*.

Surface areas of 12 com. carbon blacks were detd. by application of a modified Kozeny equation, and were found to range from 42 to 428 m^2/ml. In each case the results were compared with those obtained by electron microscopy or from N_2 adsorption as calcd. by the B.E.T. or Harkins-Jura methods. Surface areas obtained by any of the methods were probably subject to an error of about 10% when applied to carbon blacks.

12738. CARMAN, P.C. AND ARNELL, J.C. **Surface-area measurements of fine powders using modified permeability equations.** *Can. J. Research* 26A, 128-36(1948).—*C.A.* 42, 8573*b*.

Several modified Kozeny equations for measuring the specific surface of fine powders by gas-permeability methods were compared. Permeability data for powd. quartz, inorg. pigments, cements, carbon black, and other materials were used in the calcns. The equations gave very similar surface-area values for a set of data.

12739. DERYAGIN, B.; DRIDLYAND, R., AND KRYLOVA, V. **New method of measurement of the specific surface area of porous bodies and of powders.** *Doklady Akad. Nauk S.S.S.R.* 61, 653-6(1948).—*C.A.* 43, 18*f*.

The surface area S (cm^2/ml) was detd. from the rate of flow Q (ml/sec) of a gas of mol. wt M across unit cross-section of the body of porosity δ, under a pressure gradient dp/dx, in the low-pressure range of Knudsen flow. *Q* was actually proportional to Δp for ZnO powder up to about 120 ml/sec for exit pressure below 0.3 cm. Measurements on adsorbents gave the values (m^2/g): corundum powder 1.20, ZnO 2.6, $BaSO_4$ 9.5, heavy soil 0.94, silica gel 14.2, cement 0.64. The B.E.T. method gave fair agreement with the Knudsen-flow method for the nonporous corundum (1.17) and ZnO (2.7), but much too high values for porous substances (soil 3.9, silica gel 56.0, cement 1.9).

12740. Granquist, W.T. and Amero, R.C. **Low-temperature nitrogen-adsorption studies on attapulgite (floridin).** *J. Am. Chem. Soc.* 70, 3265-70(1948).— *C.A.* 43, 2840*b*.

A gradual decrease in surface area and increase in pore vol. with activation temp. from 400° to 700°C were followed by abrupt decrease of both properties at higher temps. Structure calcns., based on the Kelvin equation, resulted in curves showing the distribution of pore vol. over a large range of pore radii. Radius values taken from the max. of these curves showed increase with activation temp., and were of the same magnitude and varied in the same order as the "geometrical" av. pore radius based on twice the pore vol. surface area.

12741. Hahn, Otto. **The use of radioactive methods for the determination of surface areas and changes in surfaces.** *Festskr, J. Arvid Hedvall's* 1948, 227-30 (in German).— *C.A.* 42, 5761*a*.

The importance of Hedvall's early work for later radioactive research was emphasized.

12742. Kiselev. A.V. and Mikos, N.N. **Determination of the surface area of adsorbed films on porous adsorbents.** *Zhur. Fiz. Khim.* 22, 1043-57(1948).— *C.A.* 43, 460*h*.

The equation was based on the assumption that the adsorption in the hysteresis region was capillary condensation. For coarse pores, the area of the adsorbed film was nearly equal to the area of the adsorbent calcd. by the B.E.T. method. Adsorbents with fine pores gave values smaller than the areas of the adsorbent.

12743. Lafitte, M. and Reis, T. **Gas adsorption apparatus.** *Rev. inst. franc. petrole et Ann. combustibles liquides* 3, 285-92(1948).— *C.A.* 43, 2474*f*.

A precise, yet rugged and flexible adsorption unit was described for the detn. of surfaces and related parameters of porous solids. The theoretical principles and method of operation of the instrument were discussed.

12744. May, D.R. and Kolthoff, I.M. **The aging of precipitates and coprecipitation. XL. The solubility of lead chromate as a function of the particle size.** *J. Phys. & Colloid Chem.* 52, 836-54(1948).— *C.A.* 42, 6607*f*.

A true detn. of the increase of soly. was obtained by measuring ion concns., chromate by amperometric titration and Pb and chromate also polarographically. 0.1 *M* $HClO_4$ was used as solvent in the expts. and specific-surface measurements were made by the wool violet adsorption method. Fresh (very small particle) and aged chromate of Pb were studied. The former had about a 70% greater soly. than the latter. At 25°C aging of the fresh product (prepd. from K chromate and Pb nitrate) occurred rapidly, normal soly. being found after 20 min. The fresh Pb chromate had a specific surface of 5.6 m^2 per g (particle radius 0.086μ). After aging 20 min. at 25°C in the acid the surface decreased to 1.7 m^2 per g (radius 0.28μ).

12745. Mennessier, André and Boucher, Raymond. **Measurement of the specific surface of an adsorbent or of a catalyst accessible to gaseous molecules.** *Compt. rend.* 226, 1448-9(1948).— *C.A.* 42, 5319*c*.

Measurements of the B.E.T. surface area of adsorbents using mols of different shapes and sizes presented a method for estg. the area of small fissures in a catalyst. The surface area of a specimen of active carbon was detd. at 20°C by use of methylisobutyrate, 1, 2, dichloroethane, acetone, and methanol. The calcd. surface area increased from 712 to 1095 m^2/g as the cross-sectional area of the adsorbed mol. decreased from 37.7 to 18.5 A^2.

12746. Ross, Sydney. **Physical adsorption. II. A comparison of methods of estimating surface areas of crystalline solids by gas adsorption.** *J. Am. Chem. Soc.* 70, 3830-7(1948).— *C.A.* 43, 2066*b*.

Adsorption isotherms were detd. for ethane at -183°C on carefully prepd. cubic crystals of NaCl and KCl. Probable mol. areas were estd. for the mols. of ethane in the "gassy" and the condensed phases, and the total area of the samples calcd. from these estd. mol. cross-sections. For NaCl, the areas (2250 and 2433 m^2 per g) compared favorably with those deduced from the B.E.T. plots (2260 m^2 per g) and from the plots of Harkins and Jura (2350 m^2 per g). Similarly for KCl, the two Gregg values for the areas were 3190 and 3416 m^2 per g compared to a value of 3430 for the B.E.T. method.

12747. Saunders, L. **Measurement of specific surfaces of calcined and hydrated alumina powders by adsorption of heptoic acid from aqueous solutions.** *J. Chem. Soc.* 1948, 969-73.— *C.A.* 42, 8575*d*.

The adsorption of heptoic acid from dil. aq. soln. yielded surface-area values for a series of calcined alkali-free alumina hydrate powders that were in good agreement with areas detd. by an air-permeability method, provided the areas were less than 1 m^2/g. For more finely divided samples, the adsorption method gave area values much larger than those obtained by permeability measurements.

12748. Scott, B.A. **Photometric measurement of specific surface.** *Nature* 161, 358-9(1948).— *C.A.* 42, 4020*f*.

Expts. to measure the light transmission of dispersions of fine alumina powder in aq. media showed that the effective projected area per unit wt of powder gave a straight line of neg. slope when plotted against the 4th power of the wave length of the incident light.

12749. TOVAROV, V.V. **Measurement of the specific surface area of powdery materials.** *Zavodskaya Lab.* 14, 68-76(1948).—*C.A.* 44, 403*i*.

The powder was placed in a steel tube on a perforated disk and compressed with a plunger. Air was sucked through the compressed mass by means of a hydraulic aspirator at a const. rate, and the amt. of the air passed was measured by the vol. of H_2O flowing out of the aspirator per sec. The pressure on both sides of the layer was measured with manometers. The surface area, S, in cm^2/g, was calcd. Detns. on powd. quartz samples of av. particle sizes ranging from 724 to 69.9μ showed good agreement with detns. by the gas-adsorption method.

12750. ZETTLEMOYER, ALBERT C. **Gas adsorption-a new printing-ink research tool.** *Am. Ink Maker* 26, No. 1, 25-7, 59(1948).—*C.A.* 42, 2835*h*.

Methods for surface-area measurement and pore-size detn. by gas adsorption were described. Phys. adsorption of gases on solids was considered to take place with a close-packed first layer. The area occupied per mol. could be calcd. from the d. of the normal condensed phase. Total surface areas calcd. from the adsorption of various substances on active magnesias by using these values were nonconcordant.

12751. ARNELL, J.C. **Permeability studies. IV. Surface-area measurements of zinc oxide and potassium chloride powders.** *Can. J. Research* 27A, 207-12(1949).—*C.A.* 44, 3333*c*.

From gas-permeability measurements, the modified Kozeny equation, contg. a term correcting for slip, gave values for specific surfaces that were in good agreement with those obtained from gas adsorption or from liquid-permeability detns.

12752. BLAINE, RAYMOND J. AND VALIS, HAROLD J. **Surface available to nitrogen in hydrated portland cements.** *J. Research Natl. Bur. Standards* 42, 257-67(1949)(Research Paper 1967). —*C.A.* 43, 4826*e*.

The adsorption of N_2, O_2 and A (at or near the b.p. of the adsorbate) was detd. on samples of hydrated portland cement. The influence of storage, age, and water-cement ratio on the surface areas available to N_2 was also studied. Pastes using water-cement ratios of 0.25, 0.40, and 0.55 by wt were tested. The surface area as measured by adsorption of N_2, O_2, or A was much lower than that reported by others using water vapor. Cement ground to pass a No. 10 sieve and retained on a No. 20 had higher surface values than did the whole specimens. Surface values of granulated specimens were lower for the smaller granules.

12753. DUNCAN, JAMES F. **Determination of the surface area of a solid from an adsorption isotherm.** *Trans. Faraday Soc.* 45, 879-91(1949). —*C.A.* 44, 402*h*.

Two methods of estg. surface area were applied to adsorption isotherms of ethylene at liquid-air temp. and led to the same results for a given isotherm. A quick method of detg. the surface areas of a large no. of solids to about 20% accuracy was based on the assumption of a value for the Anderson const., K, and the linearity of the p/p_o vs. $1/V$ plot over the range of p/p_o from 0.25 to 0.75.

12754. HOUGHTON, G. AND WINTER, E.R.S. **Exchange of oxygen^{18} between oxides and gaseous oxygen.** *Nature* 164, 1130-1(1949).—*C.A.* 44, 3340*a*.

The data for MgO indicated a first-order reaction. Provided a similar heat-treatment was used, the calcd. reactive surface areas of the oxide were of the same order as those calcd. from low-temp. N_2 isotherms by the B.E.T. method.

12755. JOHNSTON, A.L. **Surface area and its effect on exchange capacity of montmorillonite.** *J. Am. Ceram. Soc.* 32, 210-14(1949).—*C.A.* 43, 6036*b*.

The bonds on the faces normal to the *a* and *b* crystallographic axes were more than enough to account for the entire exchange capacity of the samples studied. The thickness of particles of montmorillonite below 0.1μ was in the order of 40 A.; kaolinite particles had a thickness of about 600 A.

12756. KOMAROV, V.A.; DROZDOVA, V.M., AND CHERNIKOVA, E.A. **Surface determination by the method of adsorption of vapors.** *Zhur. Fiz. Khim*, 23, 1141-51(1949).—*C.A.* 44, 1302*g*.

Adsorption of N_2 by MgO, ZnO, CdO, and Cr_2O_3 (all pptd. from nitrate solns., with NH_3 and heated to 500°C), by Cr_2O_3 from $(NH_4)_2Cr_2O_7$, by a natural and 3 artificial samples of SiO_2, and by metallic Mg and Zn was detd. at -185°C. Adsorption of butane at 0°C was detd. for ZnO, MgO, the 4 silica samples, and one of the Cr_2O_3 samples. If the areas occupied by N_2 and butane were 16.2 and 38 A^2, resp., the surface accessible to butane after long adsorption was in all instances smaller than that accessible to N_2.

12757. KREIMER, G.S.; VAKHOVSKAYA, M.R.; SAFONOVA, O.S., AND BOGINO, E.E. **Methods of determination of the dispersity and specific surface area of powders of tungsten and tungsten carbide.** *Zavodskaya Lab.* 15, 159-67(1949). —*C.A.* 44, 1304*b*.

Detns. of the rate of adsorption of methylene blue (from 100 ml of a 0.2 g/liter per 5 g powder), the equil. adsorption (from the same soln. per 2 g), the limiting max. equil. adsorption (5 g in soln. of increasing concn.), the oxidizability in concd. HNO_3, the rate of catalytic decompn. of H_2O_2, and the vol. contraction on sintering were made on samples of W powders. The av. amts. of O_2 evolved at 25°C, per min., during the 1st 25 min., per g of powder were detd. For W, the order of the catalytic activities paralleled that of the oxidizabilities, but not for the WC samples. The vol. contraction on compression under 500 kg/cm^2, followed by sintering under H_2 at 1550°C, was detd.

12758. LIVINGSTON, H.K. **The cross-sectional areas of molecules adsorbed on solid surfaces.** *J. Colloid Sci*, 4, 447-58(1949).—*C.A.* 44, 19*c*.

The ratio between the cross-sectional area of adsorbed N_2 and of other adsorbed mols. was detd. from published data. The abs. area of the adsorbed area was calcd. from these ratios, by taking a value of 15.4 A^2/mol. for the N_2 mol. adsorbed at -196°C. The values obtained for 22 mols. (giving mol., cross-sectional area in A^2, and adsorption temp. °C) were: H_2, 8.3, -253°; D_2, 7.2, -253°; CH_4, 16.0, -183°; C_2H_2, 21.1, -78°; C_2H_6, 22.5, -183°; 1-butene, 40.6, 0°; C_4H_{10}, 44.6, 0°, C_6H_6, 32.3, 25°; C_7H_{16}, 59.4, 24°; NH_3, 14.6, -32°; O_2, 14.6, -183°; H_2O, 10.8, 25°; PrOH, 19.8, 25°; CO, 16.3, -183°; CO_2, 19.5, -78°; N_2O, 20.4, -78°; Ne, 10.0, -253°; CS_2, 37.9, 0°; $CHFCl_2$, 38.2, 0°; EtCl, 24.8, 0°; A, 14.6, -195°; Kr, 18.5, -195°.

12759. LOEBENSTEIN, W.V. AND DEITZ, V.R. **Simplified technique for surface-area determination by adsorption of nitrogen.** *J. Chem. Phys.* 17, 1004-5(1949).— *C.A.* 44, 2323*f*.

A new simplified procedure for detg. B.E.T. surface areas was described. It was based on the preferential adsorption of N_2 from N_2-He mixts. The method had the advantage that no vacuum pumping system was required.

12760. LONG, EARL A. AND MEYER, LOTHAR. **Anomalous adsorption of helium at liquid-helium temperatures.** *Phys. Rev.* 76, 440-1(1949).—*C.A.* 43, 8777*i*.

The adsorption of He^4 on jeweler's rouge (Fe_2O_3) was investigated at 2.45, 2.11, 1.78, and 1.53°K. The He II isotherms were identical (± 2% at 1.53-2.11°K) with 25-80% satn. The entropy of adsorbed layers was higher than that of liquid He. The He II isotherms showed anomalously high adsorption, starting at $P/P_o \sim 0.7$ (P = measured equil. pressure, P_o = satn. pressure of the bulk liquid He) and increasing enormously at high satns. The isotherm at 2.45°K gave v_m = 0.9 ml/cm^2.

12761. ROBERTSON, A.A. AND MASON, S.G. **Specific surface of cellulose fibers by the liquid permeability method.** *Pulp Paper Mag. Can.* 50, No. 13, 103-10(1949).— *C.A.* 44, 4250*a*.

The theoretical basis of the Kozeny-Carman equation was discussed. A relatively simple exptl. app. was constructed to permit the evaluation of the effective vol. and the sp surface. The pulp was confined between 100-mesh screens in a glass tube. Const.-level feed and permanent removal devices provided const. head, pressure head, and pad thickness were measured with a cathetometer. The upper of the 2 restraining screens was attached to a rod protruding from the liquid surface.

12762. SVENSSON, JONAS. **Determination of the specific surface of finely divided materials according to the gas-permeability method.** *Jernkontorets Ann.* 133, 33-86(1949).— *C.A.* 43, 4076*h*.

Two different exptl. arrangements were used: (1) air at atm. pressure, (2) a closed app. in which the permeability was detd. at pressures between 1 and 76 cm Hg, with both air and N_2. The permeability of the bed was compared with that of a bed of glass beads of known permeability. Nineteen expts. were made with pulverized quartz. The permeability was always found to be a linear function of the mean pressure in the bed; the sp surface was independent of the gas used. The increase in surface generally decreased with the grinding time, although in some cases with quartz the sp surface increased approx. linearly during the first 7.5 hrs of grinding.

12763. SWINTOSKY, JOSEPH V.; RIEGELMAN, S.; HIGUCHI, T., AND BUSSE, L.W. **Pharmaceutical powders and the state of subdividion. I. The application of low-temperature nitrogen-adsorption isotherms to the determination.** *J. Am. Pharm. Assoc.* 38, 210-15(1949).— *C.A.* 43, 8610*b*.

Low-temp. N_2-adsorption isotherms were used in the detn. of specific surface areas and surface diams. of pharmaceutical powders. Data were given for TiO_2, ZnO, and $BaSO_4$. The correlation of specific surface areas of slightly sol. medicinal powders with soln. rates, adsorption rates, and therapeutic response was discussed.

12764. SWINTOSKY, JOSEPH V.; RIEGELMAN, S.; HIGUCHI, T., AND BUSSE, L.W. **Pharmaceutical powders and the state of subdivision. II. Surface-area measurments of some pharmaceutical powders by the low-temperature nitrogen-adsorption isotherm technique.** *J. Am. Pharm. Assoc.* 38, 308-13(1949).— *C.A.* 43, 8610*d*.

Measurements made by the N_2-adsorption method on $Bi_2O_3CO_3$, $BiONO_3$, HgS, and sulfanilamide indicated that the particle sizes and specific surface areas of different pharmaceutical powders varied over wide ranges. The results depended on the compn. of the material and the method of manuf. The efficacy of sparingly sol. drugs may vary directly with the surface areas.

12765. ANDREEV, S.E. **Calculation of the mean diameter.** *Gornyi Zhur.* 124, No. 4, 28-31(1950). — *C.A.* 44, 8706*i*.

A formula was derived from the mean diam. of particles of a granular mixt. This formula was used to calculate total surface area, sp surface area, total vol. sedimentation, and power required to grind a certain particle size to a smaller one.

12766. BESSON, P. AND SANLAVILLE, J. **The possibility of using adsorption from solution in measuring the specific surfaces of solids.** *J. chim. phys.* 47, 108-12(1950).—*C.A.* 44, 7619*a*.

The adsorption of I_2 was detd. after one-hr exposure of a sample of acetylene black to a soln. The surface-area values were in good agreement with those obtained by using the low-temp. adsorption of N_2 and agreed with those from electron micrographs of the carbon black.

12767. CARMAN, P.C. AND MALHERBE, P. LE R. **Routine measurement of surface of paint pigments and other fine powders.** *J. Soc. Chem. Ind.* 69, 134-43(1950).— *C.A.* 44, 8736*b*.

An air-permeability method for the detn. of the surface area of powders was modified to include mol. and slip flow. There was no significant change in the sp surface when different gases were used. The surface area increased exponentially as the porosity decreased. The surfaces obtained by air-permeability were compared with N_2-adsorption measurements and if the normal porosity was chosen, the two methods agreed within 32%.

12768. CARMAN, P.C. AND MALHERBE, P. LE R. **Diffusion and flow of gases and vapors through micropores. II. Surface flow.** *Proc. Roy. Soc.* A203, 165-78(1950).— *C.A.* 45, 4605*d*.

Flow through porous plugs was measured under conditions where surface flow of adsorbed gases made an important contribution. Surface diffusion coeffs. were calcd. and indicated conditions likely to reduce the correction for flow in the gaseous phase to small proportions. This was confirmed by studying the effect of variations of porosity. Surface diffusion coeffs. increased with "coverage" of the adsorbent surface. Data were given for flow of SO_2 through Linde silica, of CF_2Cl_2 in silica and Carbolac, of He, H_2, N_2, CO_2, also in Carbolac.

12769. Catalano, Elsiades. **Determination of the specific area of portland cement by permeability measurements. II. Experimental arrangements.** *Rev. obras sanit. nacion.* (Buenos Aires) 14, 45-59(1950).—*C.A.* 45, 5386*e*.

Various methods were discussed based on the use of gases with different const. pressures and of those with variable pressures.

12770. Davis, Raymond T. Jr.; Shuler, Luke, and Weaver, Virginia. **The adsorption of gases by solids.** *Proc. Penna. Acad. Sci.* 24, 133-9 (1950).—*C.A.* 45, 7406*d*.

The surface areas of 4 activated carbons and MgO were detd. by use of N_2, C_4H_{10}, and Kr. The results obtained by various methods of calcn. were compared.

12771. Deryagin, B.V.; Krylova, V.I., and Fridlyand, P.M. **New methods of measurement of specific surface (cm^2/g) and specific adsorption (g/cm^2). I.** *Zhur. Fiz. Khim.* 24, 1371-82 (1950).—*C.A.* 45, 9992*c*.

The method utilized the Knudsen flow of a rarefied gas through a plug of porous or nonporous disperse material the sp surface of which had to be detd. Gas-kinetic theory led to the formula $Q = k\Delta p/\Delta x$, where Q was the flow rate per unit surface of a gas experiencing a pressure drop Δp over a length Δx of material; k was given by $k = A(2/\pi)^{1/2}(\delta^2/S_o)(MRT)^{-1/2}$; S_o, the sp surface; δ, the ratio of pore vol. to total vol. of material; M, the mol. wt of the flowing gas, $A = 8/3$ or 24/13 according to the elasticity or nonelasticity of the gas mol. collisions with the pore walls. With porous adsorbents, the method which did not measure the surface of dead-end pores gave low values, e.g. silica gel: Deryagin 14.2, B.E.T. 56 cm^2/g.

12772. Ewing, Warren W. and Rhoda, Richard N. **Determination of relative specific surface of zinc oxide pigments.** *Anal. Chem.* 22, 1453-5 (1950).—*C.A.* 45, 1783*c*.

Samples of the pigments were weighed into centrifuge tubes, aq. solns. of various concns. of a surface-active agent, Daxad No. 11, added, and the tubes stoppered and manually shaken and rotated end over end for at least 8 hrs. The samples were centrifuged until clear, and clear portions withdrawn for analysis. The adsorption isotherms for each pigment were extrapolated to zero concn. and these intercepts, in the units of Daxad adsorbed in mg per g of pigment, were plotted against the specific surface values of the pigments as detd. from electron micrographs; 1 mg of adsorbed Daxad covered 0.864 m^2 of ZnO surface.

12773. Fu, Ying. **Remarks on Mizushima's method for the determination of surface areas of powders.** *J. Chem. Phys.* 18, 899-900(1950).—*C.A.* 45, 4516*i*.

12774. Gray, Vincent R. **Surface films and particle-size determination of powders.** *Can. J. Research* 28B, 277-91(1950).—*C.A.* 45, 1406*b*.

By compression of the monoparticulate surface layer of a powder on water and from the surface pressure-area relation by film-balance techniques, its mean particle dimensions could be detd. A sprinkler consisting of a fine Cu gauze set by means of paraffin wax in a wide glass tube closed by a rubber stopper and joined at right angles to a narrower tube was used with compressed air to spread the powder. Flotation agents such as castor oil and fatty acids caused the powders to float on the surface. A point on the compression curve representing a rigid film and suitable for detg. a reproducible mean film thickness was selected as the first position of max. curvature near the region where the film appeared compact visually.

12775. Griffith, R.H. and Lindars, P.R. **Physical properties of promoted molybdenum catalysts.** *Nature* 165, 486-7(1950).—*C.A.* 44, 7638*e*.

A pronounced max. in the surface area was found at a ratio of 5 atoms of Si to 100 of Mo. This max. was superimposed on a curve that gradually rose with increasing amts. of Si.

12776. Hall, W. Keith; Tarn, William H., and Anderson, Robert B. **The Fischer-Tropsch synthesis. VIII. Surface area and pore volume studies of iron catalysts.** *J. Am. Chem. Soc.* 72, 5436-43(1950).—*C.A.* 45, 5907*h*.

Two fused Fe_2O_3-MgO-K_2O catalysts were compared to two Fe_2O_3-CuO-K_2CO_3 pptd. catalysts. The surface areas of unreduced fused catalysts were negligible, but the raw pptd. catalysts had large surface areas and small-pore diams. The surface area and pore vol. of the fused catalysts increased linearly with reduction but the pore diams. remained const. The pore structure was a function of the extent of reduction and could be established by surface-area measurement and a complete chem. analysis.

12777. Harris, B.L. and Wolock, I. **Surface area-permeability studies of pigmented films.** *Paint Ind. Mag.* 65, 192-3, 194(1950).—*C.A.* 45, 1356*f*.

The porosity of a pigmented oil film was studied to see if there was a variation of porosity with pigment vol. concn. The method of detg. the porosity, the vehicles used, etc., were outlined.

12778. Hirst, W. and Lancaster, J.K. **Estimation of the surface areas of powders from the temperature dependence of adsorption from solution.** *Research* 3, 336-7(1950).—*C.A.* 44, 8736*a*.

The surface areas of powders was detd. by variation of concn. with temp. and hence satn. kept const., and by variation of temp. and, hence, satn. concn. while relative concn. was kept const. Both methods used solns. of $C_{17}H_{35}CO_2H$ in C_6H_6. Measurements of powd. TiO_2, SiO_2, TiC, and SiC by both methods gave good agreement.

12779. Kraus, Gerard and Thiem, John R. **Simplified air-flow method for the determination of the surface area of powders.** *J. Applied Phys.* 21, 1065(1950).— *C.A.* 45, 21*d*.

12780. Matouschek, F. **Determination of particle size of cements.** *Rev. materiaux construction trav. publ., Ed. C, No.* 417, 197-201(1950).— *C.A.* 44, 7507*b*.

Approx. methods for calcg. the specific surface of ground materials were reviewed, and the effects of different methods of grinding on specific surface discussed.

12781. Maxted, E.B.; Moon, K.L., and Overgage, E. **Relation between sensitivity to poisoning and catalytic surface.** *Discussions Faraday Soc.* 1950, No. 8, 135-40.— *C.A.* 45, 9987*b*.

The inverse variation of sensitivity to catalyst poisoning with the surface area was confirmed by expt. for Pt hydrogenation catalysts poisoned with Me_2S. The relation obtained was of the type $\alpha_1 s_1 = \alpha_2 s_2$, where α and s were measures of sensitivity and surface area, resp. A characteristic value for the product αs made possible the calcn. of the surface area of Pt catalysts by sensitivity tests performed on small quantities.

12782. Moore, Alice E. **Specific-surface measurement-light-absorption methods.** *J. Soc. Chem. Ind.* 69, Suppl. No. 1, 533-6(1950).— *C.A.* 45, 5486*d*.

A method of detg. the surface area of fine powders was based on the light absorption of the powder when in a suspension. The powder suspension was placed in a wedge-shaped cell through which the light passed to a photo-cell connected to a galvanometer. From the known wt of the powder and the detd. absorption, the surface area could be calcd. Despite the error caused by the opacity of the powder, this method was rapid and had greater accuracy than the hydrometer method.

12783. Prettre, Marcel. **The conditions for utilizing surface-area measurements by adsorption in the study of adsorbents, catalysts, and their constituents.** *J. chim. phys.* 47, 99-103(1950).— *C.A.* 44, 7615*f*.

Surface-area measurements by low-temp. gas adsorption were useful in studying adsorbents and catalysts. However, in comparing surface area and catalytic activity, cognizance must be taken of the many variables such as catalyst compn., temp., time of evacuation, and nature of prior chem. treatment that might cause marked variation in the activity per unit surface area.

12784. Roxburgh, J.M. and Winkler, C.A. **The surface area of cadmium and copper, and the mechanism of cadmium polarization.** *Can. J. Research* 28B, 383-90(1950).— *C.A.* 45, 25*f*.

The areas of mechanically cleaned Cd electrodes were found (by measurement of the rate of build-up of H_2 overvoltage) to be up to 1500 times the apparent area and decreased with time of immersion in air-free dil. H_2SO_4. The decrease in area was independent of acid concn. and was accelerated by exposure to air. The area increased with decrease in current. Cu electrodes did not show these effects. Cd polarization was linearly dependent on current and independent of the measured electrode area.

12785. Russell, Allen S. and Cochran, C. Norman. **Surface areas of heated alumina hydrates.** *Ind. Eng. Chem.* 42, 1336-40(1950).— *C.A.* 44, 8735*d*.

The adsorption of n-butane at 0°C was detd. on Al_2O_3 hydrates: α-trihydrate, β-trihydrate, α-monohydrate, β-monohydrate, and amorphous Al_2O_3. The greatest B.E.T. areas were obtained by heating trihydrates; area began to develop in α-trihydrate at 220°C, went through a max. of 1.4 millimols. of butane adsorbed per g at 400°C, diminished at 550°C to 0.9, and declined slowly to 0.1 at 1200°C (millimols. of butane multiplied by 235 equals area in m^2/g). Dry inert gas flowing over the surface during heating produced greatest areas, whereas gases that might react or that contained water produced smaller area.

12786. Teichner, Stanislas. **Measurement of the specific surfaces of certain clays.** *Compt. rend.* 231, 1063-4(1950).— *C.A.* 45, 4013*c*.

The specific surface of a solid was measured from the adsorption isotherm of N_2 at its b.p. The method of prepg. the clay must be standardized. Small amts. of water must be excluded and the clay should not be neutralized by base. Optimum conditions were obtained by heating the acid montmorillonite clay in vacuum for 1.5 hrs at 150°C giving a surface of about 310 m^2/g.

12787. Teichner, Stanislas and Pernoux, Émile. **Ultrasonic fractionation of kieselguhr used to support Fischer catalyst.** *Compt. rend.* 230, 1063-4(1950).— *C.A.* 44, 5679*e*.

Silica gel, resulting from the acid treatment of kieselguhr, was subjected to ultrasonic treatment. Two fractions formed; 12% constituted a stable dispersion; the rest pptd. B.E.T. measurements of the evapd. dispersion yielded a surface of 40 m^2/g, contrasting with 27 m^2/g in the original unsepd. material. Electron-microscope examns. were made of fractions.

12788. Arnell, J.C. **Measurement of surface areas of powders by permeability methods.** *Chemistry in Can.* 3, 21-4(1951).— *C.A.* 45, 3684*e*.

The development of various permeability equations was reviewed.

12789. Avgustinik, A.I. and Dzhansis, V.D. **Measuring the changes in the specific surface of highly dispersed materials by the torsion-balance method.** *J. Applied Chem. U.S.S.R.* 24, 471-7(1951)(Engl. translation).— *C.A.* 46, 4188*d*.

Air-penetrability methods were not satisfactory to det. the surface of flaky heterogeneous particles. A method was devised for use with a torsion balance to weigh the samples collected by sedimentation in aq. suspension. Specific surfaces were: Glukhovetsk kaolin 10.8; Prosyanovsk kaolin 11.5; Borovichi clay 12.5; Chasovyari clay 15.0; Oglanlino bentonite 28.6 m^2/g.

12790. Bloecher, F.W. Jr. **A new surface-measurement tool for mineral engineers.** *Trans. Am. Inst. Mining Met. Engrs., Tech. Pub.* No. 3013-B (in *Mining Eng.* 3, 255-8)(1951).— *C.A.* 45, 3661*d*.

The method involved low-temp. Kr adsorption measurements in a Pyrex glass app. consisting of

He and Kr storage flasks, a McLeod gage, a manifold, Hg valves, a thermocouple gage, and vacuum pumps. Coarse materials (35 to 48-mesh) as well as clays or colloidal slimes were measured. Kr offered the advantage of low satn. pressures (2 to 3 mm) at the conveniently obtained liquid-N_2 temp.; hence, the vacuum system need not be designed to measure or withstand internal gas pressure above 1 atm. as in the N_2 gas method.

12791. BUPP, LAMAR P. AND SCOTT, ALLEN B. **A technique for the study of solid-gas surface reactions; the decomposition of nitrous oxide on iron oxide-zinc oxide catalysts.** *J. Am. Chem. Soc.* 73, 4422-6(1951).—*C.A.* 45, 9346*e*.

A method for the measurement of surface area, magnetic susceptibility, and catalytic efficiency for solid catalysts was described. The decompn. of N_2O at 500°C and 1 atm. pressure over α-Fe_2O_3 catalysts was studied by this method. Pure α-Fe_2O_3 was the most efficient of the catalysts studied. The efficiency for equal molar mixts. of ZnO and Fe_2O_3 pretreated at a series of temps. showed a regular decrease in activity with pretreatment temp. The surface area decreased regularly with pretreatment temp. and the loss of catalytic activity may be due to this effect, though other possibilities were discussed. No correlation was observed between magnetic susceptibility and catalytic activity.

12792. CALVET, ÉDOUARD. **Thermal effects associated with adsorption. I. Application to the measurement of the surface area of powders.** *Compt. rend.* 232, 964-6(1951).—*C.A.* 45, 5506*b*.

The solid sample under study was placed in a recording microcalorimeter, sepd. from a liquid by a small valve that could be controlled from the outside. A discontinuity in the plot of the heat transfer rate vs. time indicated the point at which the unimol. surface film was completed. The surface area was then calcd. from the known area covered per mol. of liquid.

12793. CARMAN, P.C. AND MALHERBE, P. LE R. **Routine measurement of surface of paint pigments and other fine powders. II.** *J. Applied Chem.* (London) 1, 105-8(1951).—*C.A.* 45, 6009*a*.

The gas permeability method for surface area and particle-size measurement was applied to solids such as Pyrex glass spheres, powd. W, $CaCO_3$ ZnO, carbon black, silica, and γ-Al_2O_3. The results obtained were compared with those obtained by one or several of the following methods: N_2 adsorption, liquid permeability, Me stearate adsorption, light microscope, electron microscope, and sedimentation. For the finest particles (Carbolac I, carbon black), 30 A. diam., surface flow of adsorbed mols. may interfere.

12794. CHARLES, R.J.T. **Photometric measurement of particle size and relative surface area.** *Trans. Can. Inst. Mining Met.* 54. (in *Can. Mining Met. Bull.* No. 475, 722-9)(1951).—*C.A.* 46, 1307*e*.

The light source was mounted in a tee-shaped tube and a condenser lens was mounted in each arm of the tee. The focal lengths of the lenses were such that the rays of light after passing through them were parallel. A plastic block in which glass windows had been set was fixed to the end of one arm of the tee. On the other side of the plastic block one of the phototubes was mounted. The circulating tubes passed vertically through the plastic block. Another plastic block was attached on the opposite arm of the tee. A slot was cut in this block so that a piece of ground-glass screen could be inserted, cutting off a portion of the light reaching a phototube mounted on the other side of the block. An elec.-eye vacuum tube (6E5) arranged in a bridge circuit served to balance the outputs of the phototubes. The circulating chamber was built of clear plastic, and had built-in baffles. An impeller was installed which had enough power to prevent even the heaviest of minerals from settling out.

12795. DODD, CHARLES G.; DAVIS, JAMES W., AND PIDGEON, FRANCES D. **Measurement of specific surface areas of nonporous powders by a pressure-decline liquid-permeability method.** *J. Phys. & Colloid Chem.* 55, 684-98(1951).—*C.A.* 45, 6895*b*.

A pressure-decline liquid-permeability app. for the measurement of surface area of a packed powder was presented. A sample of 70-100-mesh glass spheres yielded a surface area in good agreement with one obtained independently by electron microscopic examn. of the samples. Measurements of quartz powder consisting of particles ranging from less than a μ to 7 μ in diam. confirmed the applicability of the method to the measurement of permeability. The surface area for the fine quartz powder measured by using isoöctane as a fluid was smaller by about 40% than the surface area obtained with water as a fluid.

12796. EMSCHERMANN, H.H. AND KRUSE, J. **Measurement of changes in paper surface area by means of a surface extensometer.** *Das Papier* 5, 299-302(1951).—*C.A.* 45, 9267*c*.

By use of the Pfender extensometer, the surface-area changes of board and paper samples were detd. at 20°C with changes in relative humidities (65 → 30%, and 30 → 90%). The method was rapid and highly reproducible.

12797. FEDORCHENKO, I.M. **Specific surface area of metal powders.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* 1951, 411-18.—*C.A.* 45, 6453*a*.

Sp surface areas S were detd., on Fe, Cu, and Ni powders of different prepns., by measurements of the rate of flow Q, in moles of gas of mol. wt M flowing per sec through 1 cm^2 of a layer of powder of thickness dx under a pressure gradient dp/dx, with the use of Deryagin's formula $S = (24/13)(2/\pi)^{1/2}(\delta^2/Q)(1/MRT)^{1/2}(dp/dx)$, where δ = vol. of pores per unit vol. This equation was applicable to the range of Knudsen flow, which was practically reached at pressures below 0.3 mm Hg. For powders of corundum and ZnO, the method gave values of S practically identical with those obtained by adsorption of N_2. The method permitted detn. of the surface area of through pores, and that in dead-end pores remained unnoticed.

12798. FU, YING AND BARTELL, F.E. **Surface area of porous adsorbents.** *J. Phys. & Colloid Chem.* 55, 662-75(1951).—*C.A.* 45, 6894*i*.

The surface area of porous solids was detd. using only low-temp. gas adsorption data. Values for $a\phi$ were derived as a function of relative pressure by applying the Gibbs equation directly to the adsorption data. The difference between the limiting value of $a\phi$ at a relative pressure of 1 and the value of $a\phi$ at the point corresponding to the meeting of the two straight portions of the plot gave a reasonable value for the surface area of the catalyst when divided by the surface tension of the particular adsorbate being used in the measurements. The method gave values for surface area of porous glass that were in excellent agreement with those obtained by the usual B.E.T. plots of the same adsorption data.

12799. Gamboa, J.M. and Maddock, A.G. **Exchange reactions with radioactive tracers and the determination of specific surface. I. Laboratory technique. II. Experiments with Pb_3O_4. III. Experiments with Fe_2O_3.** *Anales real soc. espan. fís. y quím.* 47B, 401-12, 471-88, 489-94 (1951).—*C.A.* 46, 7854*c*.

The kinetics of exchange between Pb^{++} ions in aq. soln. and powd. cryst. Pb_3O_4 was detd. with ThB as a tracer. ThB was prepd. by electrolysis of solns. of $Th(NO_3)_4$ or of mesothorium. There was a fast initial exchange due to surface reaction followed by a much slower process due to reaction with ions in the body of the crystal. The kinetics of exchange of Fe^{+++} in aq. soln. and powd. cryst. Fe_2O_3 were detd. with Fe^{59} as a tracer. As in the case of Pb, the reaction was initially rapid but had a slower secondary phase. Calcn. of sp surface was based on the 1st phase.

12800. Innes, W.B. **Apparatus and procedure for rapid automatic adsorption, surface area, and pore volume measurement.** *Anal. Chem.* 23, 759-63 (1951).—*C.A.* 45, 8320*g*.

Surface area was measured in less than 15 min. The method was based on the const. slow flow of gas into an adsorbent chamber at approx. equil. pressure and the amt. adsorbed was proportional to time. The surface area was calcd. from the time for the pressure to reach a relative pressure of 0.2, by using N_2 at liquid-N_2 temp. Surface-area measurements were within 5% of those by the B.E.T. method and were reproducible within 3%.

12801. Jockers, K. **The emanating power and surface area of various aluminum hydroxides and oxides.** *Z. anorg. u. allgem. Chem.* 265, 49-55 (1951).—*C.A.* 46, 7840*c*.

The emanating power (*EP*) of the bayerite and boehmite series of Al oxides was measured. The *EP* of the series had a very simple relation to the surface area calcd. from a unimol. layer: surface area = $k.EP$. For γ-Al_2O_3: k_{20}°C = 440, k_{175}°C = 400.

12802. Kiesskalt, S. and Matz, G. **Determination of specific surfaces of granules.** *Z. Ver. deut. Ing.* 93, 58-60(1951).—*C.A.* 45, 5486*f*.

Available sp-surface tabulations were revised and a simple relation found to express the theoretical surface area. The actual sp surface could be computed from the theoretical one, taking into account the sp. gr. of the material and the Heywood shape factor of the granule, which was detd. under the microscope.

12803. Kimura, Ichiji. **Thickness measurement of thin films by polonium α-rays.** *Ôyô Butsuri* (J. Applied Phys.) 20, 223(1951).—*C.A.* 46, 5922*g*.

The thickness (a few μ) and its inhomogeneity was measured. Examples were reported on the measurement with Al film used for electrolytic capacitor and with insulating paper.

12804. Liang, S. Chu. **Some measurements of thermal transpiration.** *J. Applied Phys.* 22, 148-53 (1951).—*C.A.* 45, 3672*h*.

Measurements were made of the pressure ratio, R, due to thermal transpiration in H_2, He, A, and N_2 between a warm temp of 297°K and cold temps. of 77.3 or 195°K. R depended on X, the product of the pressure and tube diam. according to the empirical relation, $R = P_1/P_2 = (AX^2 + BX + R_m)/(AX^2 + BX + 1)$, where A and B were consts. that depended on the gas and on the warm and cold temps., and $R_m = (T_1/T_2)^{1/2}$. The use of these results to correct measurements of adsorption equil. and vapor pressures at low pressures and low temps was discussed.

12805. Loebenstein, W.V. and Deitz, Victor R. **Surface-area determination by adsorption of nitrogen from nitrogen-helium mixtures.** *J. Research Natl. Bur. Standards* 46, 51-5 (1951) (Research Paper No. 2174).

The sample was heated initially in a stream of He. The adsorption of He in mixts. with N_2 was negligible at the temp. concerned and temp. equilibration was rapidly attained. Thermomol. pressure differences were negligible under the conditions of the expt. The surface-area detn. for 8 materials were in good agreement with results obtained by the conventional B.E.T. method.

12806. Rubinshtein, A.M. and Vasserberg, V.E. **Causes of the optimum of the catalytic activity as a function of the dispersity and effective specific surface area of a catalyst.** *Doklady Akad. Nauk S.S.S.R.* 79, 263-6 (1951).—*C.A.* 45, 10020*i*.

A ppt. of $Al(OH)_3$ obtained from a boiling Al $(NO_3)_3$ soln. with 5% NH_4OH was sepd. into 3 portions of increasing particle size. The 3 portions were converted into γ-Al_2O_3 by heating, and their sp surface areas S and crystal sizes d detd. The data (S, m^2/g by adsorption of MeOH and C_5H_{12}, d in A.) were: (1) 286 and 182, $\leqslant$ 35; (2), 286 and 179, 35; (3), 286 and 264, 51.4. The striking feature was the strong discrepancy of S values detd. by adsorption of MeOH and C_5H_{12} in the 1st two cases. Detn. of the sp surface area only by low-temp. adsorption of N_2 was insufficient for the characterization of the catalytic activity. With BuOH, the ratio of the activities of the 1st and 3rd was about the same as with EtOH, although the abs. activities were about 10% higher.

12807. Schwarz, W. **Local cell action and oxide coating on passive iron.** *Z. Elektrochem.* 55, 170-2(1951).—*C.A.* 45, 7447*f*.

By measuring the excess quantity of Fe dissolved during the initial period, the quantity of oxide could be calcd. from the equiv. amt. of local current developed by the dissolving Fe, which cathodically reduced the oxide coating. Then, by assuming the oxide layer to be Fe_2O_3 and if the geometrical surface area was known, the av. thickness of the oxide was calcd. For Fe passivated in HNO_3 (d. = 1.4) and satd. with urea, the av. oxide coating thickness was calcd. to be 80 A.

12808. Tesner, P.A. and Rafal'kes, I.S. **New method of measurement of the specific surface area of carbon black.** *Doklady Akad. Nauk S.S.S.R.* 80, 401-3 (1951).—*C.A.* 46, 239*b*.

The amt. of carbon deposited under const. conditions was proportional to the carbon surface area on which the decompn. took place. The decompn. was carried out on known amts. of 2 samples of carbon black, one of known, the other of unknown sp surface area. Detns. with mixts. of 15% C_6H_6 with N_2, 30 min. at 800°C, samples of 100 mg, were reproducible within 7-10%, and the sp areas detd. checked satisfactorily with values detd. by electron microscopy. The method was not suitable for porous carbon black.

12809. Weidenhammer, Fritz. **Calculation of the surface of granular material according to Rosin-Rammler.** *Tonind.-Ztg.* 75, 133-5 (1951). —*C.A.* 45, 6898*h*.

An empirical formula was derived and auxiliary graphs presented for its solution based on coeff. of uniformity and lower grain-size limit.

12810. Zwietering, P.; Oele, A.P., and Krevelen, D.W. van. **Pore structure and internal surface of coal.** *Fuel* 30, 203-4 (1951).—*C.A.* 45, 9243*g*.

The values for the internal surface of coal, detd. from the adsorption of N_2 at -196°C showed that the "heat-of-wetting method" gave results many times too high. The provisional results of an investigation of the change of internal surface during carbonization were given.

12811. Arakawa, Masafumi; Arakawa, Teru, and Suito, Eiji. **Measurement of the specific surface area of powders by permeability method.** *Bull. Inst. Chem. Research, Kyoto Univ.* 29, 78(1952)(in English).—*C.A.* 46, 10782*h*.

$CaCO_3$, ZnO, cement, and polyvinyl chloride were measured. With regard to the packing of the sample bed, it was confirmed that the sp surface area decreased linearly with increase in the porosity function of the same sample. The sp area measured satisfactorily agreed with the values by other methods at the min. porosity function.

12812. Barrer, R.M.; Mackenzie, N., and Macleod, D. **The adsorption method of measuring surface areas.** *J. Chem. Soc.* 1952, 1736-44.-*C.A.* 46, 8459*e*.

New multilayer equations similar to that of B.E.T. were derived. These equations were examd. with the exptl. isotherms of N_2 on montmorillonite and of N_2 and NH_3 on attapulgite. The characteristic plots of a no. of the new isotherm equations were linear to large relative pressures. The ratio of the extreme values of v_m, the vol. of gas adsorbed when the entire adsorbent surface was covered with a complete unimol. layer, on montmorillonite for 12 equations was 1.57:1 and that on attapulgite for 11 equations was 1.39:1. The corresponding ratios for the 3 or 4 best-fitting equations were 1.15:1 and 1.12:1, resp.

12813. Bower, C.A. and Gschwend, F.B. **Ethylene glycol retention by soils as a measure of surface area and interlayer swelling.** *Soil Sci. Soc. Am., Proc.* 16, 342-5(1952).—*C.A.* 47, 5596*f*.

The ethylene glycol-retention method for detg. interlayer swelling and the surface areas of clays was modified for use on soils. Values for external surface areas of soils obtained by this method agreed satisfactorily with those obtained by the B.E.T. method. The nature of the exchangeable cation had no significant influence upon values obtained for external retention by soils. Total retention by Ca- and H-satd. samples tended to be higher than that by Na- and Mg-satd. samples. The lowest values for total retention were obtained on K- and NH_4- satd. samples.

12814. Courtney-Pratt, J.S. **An optical method of measuring the thickness of adsorbed monolayers.** *Proc. Roy. Soc.* (London) A212, 505-8(1952). —*C.A.* 46, 8461*f*.

A unimol. layer of fatty acid was spread over mica. A highly reflecting layer of Ag was then deposited on both sides of the mica specimen, and the thickness of the acid layer detd. by multiple-reflection interferometry. The values so obtained were in agreement with x-ray data on the length of the fatty-acid mol. The layers were uniform in thickness; multimol. layers were absent. The method provided direct and independent evidence that mols. of a fatty acid, spread by the retraction technique, were adsorbed on a solid surface as a uniform unimol. layer.

12815. Deryagin, B.V.; Mel'nikova, M.K., and Krylova, V.I. **The effective magnitude of the spreading angle during imbibition of porous bodies and a method for its evaluation.** *Kolloid. Zhur.* 14, 423-7 (1952).—*C.A.* 47, 3082*c*.

The sp surface S was calcd. from the rate of imbibition; $l^2/t = 2KS\sigma \cos\theta/\delta^2$, where l was the depth of imbibition during time t, K ratio of the vol. rate of filtration to pressure gradient, σ surface tension, θ contact angle, and δ the relative pore vol. This equation was tested for quartz sand in H_2O and compared with the Kozeny-Carman equation; to achieve agreement, θ must be 60-70°.

12816. Ergun, Sabri. **Determination of geometric surface area of crushed porous solids (gas-flow method).** *Anal. Chem.* 24, 388-93 (1952).—*C.A.* 46, 7398*a*.

The flow equation developed was for beds having sp surfaces less than 2000 cm^2 per ml and limited to particles larger than 0.1 mm. The following linear expression was developed for pressure drop through granular beds: $\Delta P/LU_m = a + bG$, where ΔP = pressure drop, L = height of bed, U_m = av. gas velocity, G = mass flow rate and a and b were straight-line coeff. intercept and slope, resp., and were represented by $a = k_1 \mu S_V^2[(1 - \epsilon)^2/\epsilon^3]$ and $b = k_2 S_V[(1 - \epsilon)/\epsilon^3]$, where μ was abs. viscosity of gas, S_V the sp surface area of particles, ϵ the fractional void vol. of bed, and k_1 and k_2 were consts. $\epsilon = 1 - (p_B/p)$, where p_B was the bulk d. and p was particle d.

12817. Franck, E.U. and Biedermann, H. **Surface development of platinized platinum.** *Kolloid-Z.* 129, 137-40(1952).—*C.A.* 47, 4686*c*.

Measurements of the surface of electrolytically and chemically pptd. Pt black were made. The surface obtained by the polarization-capacity method was too high, because of the soly. of H_2 in Pt. The methylene blue value was too low because of the large size of the dye mol. The most probable value of the surface area of Pt black made by the electrolytic method was that obtained by the A-adsorption method, which was of the order of 200 m^2/g.

12818. Jopling, D.W. **The determination of the specific surface of barium sulfate.** *J. Appl. Chem.* (London) 2, 642-51(1952).—*C.A.* 47, 3082*a*.

Surface detns. obtained by air permeability, dye adsorption, and light extinction methods, and by calcn. from grain-size distributions obtained from pipet and centrifuge sedimentation methods were compared. The comparison was for $BaSO_4$ particles in the size range of 0.1 μ to 5 μ. The results for the dye adsorption and air permeability methods agreed well with each other, but did not always agree with the values calcd. from grain-size distribution. Electron micrographs showed that the deviation was due to aggregates settling in the sedimentation analysis.

12819. Kulp, J. Laurence and Carr, Donald R. **Surface area of deep-sea sediments.** *J. Geol.* 60, 148-59(1952).—*C.A.* 46, 3919*h*.

The theory and measurement of surface areas by the gas-adsorption method were discussed. Data obtained from the measurement of a representative suite of specimens from deep-sea cores were presented. The values ranged from 2.5 m^2/g. (fine red silt) to 48.0 m^2/g. (continental clay).

12820. Niwa, Makoto and Yamaguchi, Mitsuo. **Sintering of catalysts. I. Sintering of copper catalysts and the effects of traces of promoters.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 73, 159-62(1952).—*C.A.* 46, 10488*a*.

The surface area of the reduced catalyst was detd. by the adsorption of methylene blue. The surface area decreased as the sintering time at 190°-250°C increased. The data were expressed by $A = a\exp(-bt)$ where A = adsorbed methylene blue in mg/g Cu, t = sintering time and a and b = consts. The activation energies of sintering were 16 and 37 kcal for CuO pptd. by $(NH_4)_2CO_3$ and NaOH, resp. When promoters such as Ni. ThO_2, PbO, and $NaNO_3$ were added in 0.1-0.5%, they prevented the sintering. $NaNO_3$ was most effective and PbO had no effect.

12821. Orr, Clyde Jr. and Bankston, P.T. **A rapid liquid-phase adsorption method for the determination of the surface area of clays.** *J. Am. Ceram. Soc.* 35, 58-60 (1952).—*C.A.* 46, 3365*c*.

A dry sample of clay was exposed to a soln. of fatty acid of known concn., and the fatty acid remaining after a period of agitation detd. The amt. of fatty acid adsorbed by the clay provided a basis for calcg. the total surface area.

12822. Orr, Clyde Jr.; Blocker, H.G., and Craig, Susan L. **Surface areas of metals and metal compounds. A rapid method determination.** *J. Metals* 4, *Trans.* 657-60(1952).—*C.A.* 46, 6059*i*.

The validity of the gas adsorption method as a means of measuring surface areas was confirmed; fatty acid adsorption was a valuable companion technique. Liquid-phase adsorption, because extensive sample evacuation or heating was unnecessary, and because the method was rapid, should be usable with heat-sensitive and high-vapor pressure materials.

12823. Rose, H.E. **The assessment of specific surface by single-observation photoextinction methods.** *J. Applied Chem.* (London) 2, 217-20 (1952).—*C.A.* 46, 7843*i*.

By combination of equations $\log_e(I_o/I_2) = ClK_mS_t/4$, $S_m = K_m6/pd_m$, and $S_m = K_mS_t$, the sp surface of a suspension was obtained by making one optical transmission measurement; C = concn. of suspension in g/ml, l = cell length, K_m = mean extinction coeff. for the powder, S_t = true sp surface, cm^2/g, p = d. of powder, g/ml, d_m = mean particle diam., S_m = measured sp surface, cm^2/g, I_2 = intensity of emergent beam for particle diam., d_2. Flint, cement, and iron oxide had surfaces 1730, 1980, and 13,900 cm^2/g, resp.

12824. Rose, H.E. **Permeability method of specific-surface determination: a correction factor.** *J. Appl. Chem.* (London) 2, 511-20 (1952).—*C.A.* 47, 2571*f*.

A semiempirical correction factor was developed upon the thesis that the mol. flow term required correction by a factor that depended on the true sp surface, S_t, of the powder and the percent voids. The S_t was obtained by plotting S_c vs. the corresponding value of voidage and extrapolating until the curve became horizontal. Further calcns. were made to obtain a corrected S_t which was then plotted versus S_c to give a set of iso-voidage lines. The correction factor was then obtained from a plot of S_t vs. percent voidage giving a series of iso-S_c lines. This family of curves was used by detg. S_c according to Carman's equation.

12825. Schellinger, A. Kenneth. **Solid surface energy and calorimetric determinations of surface-energy relationships for some common minerals.** *Trans. Am. Inst. Mining Met. Engrs.*, *Tech. Pub.* No. 3223-B(in *Mining Eng.* 4, 369-74) (1952).—*C.A.* 46, 4901*c*.

Quartz, pyrite, calcite, and halite were tested separately in a grinding calorimeter designed to give an accurate measure of all of the heat energy output from a small tumbling mill using cast-Fe shot as the grinding medium. The surface-energy values obtained were quartz 107,000, pyrite 60,000, calcite 32,400, and halite 26,100 ergs per cm^2. Surface-area detns. were made by the B.E.T. method on CO_2 adsorption measurements.

12826. Schubert, Y. and Kopelman, B. **Determination of particle size in the submicron range.** *Powder Met. Bull.* 6, 105-9 (1952).—*C.A.* 46, 10782*g*.

Particle sizes below 1000 A. were detd: (1) the gas-adsorption technique based on the exptl. detn. of an adsorption isotherm of an inert gas near its b.p., and (2) the x-ray line broadening technique which utilized the relationship between line broadening of the diffracted beam and crystal size. Good agreement between the results of both methods was found. Particles of superfine Fe down to 242 A. were measured.

12827. Smith, Dan E. **A simplified surface-area apparatus and catalyst tester.** *Petroleum Engr.* 24, No. 12, C-52-6(1952).—*C.A.* 47, 4658*h*.

A simplified app. and procedure were described for detg. surface area by adsorption of N_2.

12828. WARNER, B.R. **Surface areas of tobaccos by low-temperature nitrogen absorption.** *Arch. Biochem. Biophys.* 40, 143-52(1952).—*C.A.* 47, 1900^e.

Tobacco-leaf tissue was porous with a surface area of 1-10 m^2/g. Force aging greatly increased the area. The heats of low-temp. adsorption of N_2 on tobacco surfaces indicated changes in the chem. compn. of the leaf surfaces, which were caused by the specific treatment of the tobacco.

12829. ZAVARITSKAYA, T.A. AND GRIGOROV, O.N. **Determination of the true surface area of solid dispersoids by the air permeability.** *Doklady Akad. Nauk S.S.S.R.* 86, 757-8 (1952).—*C.A.* 47, 944^g.

Measurements of the surface area of samples of Al and of polystyrene powders by filtration of air gave divergent results depending on whether the filtration expts. were done under atm. or under reduced pressure. Homogeneous dispersions, obtained by emulsion polymerization of styrene, and composed of regularly spherical particles within the size limits of 10-15, 15-20, and 40-60 μ, were studied. Only air permeability measurements under reduced, not under atm. pressure, gave the correct sp surface area.

12830. KARAGOUNIS, GEORG. **A simple method for determining the internal surface of finely divided solids.** *Helv. Chim. Acta* 36, 282-90 (1953) (in German).—*C.A.* 47, 4691^g.

Org. substances spreading on finely divided solids reached a crit. surface concn. (X) expressed in g of spread substance per g of solid. The specific surface of a solid in cm^2/g of solid was calcd. from X/dD, where d = d. of the spreading substance, and D = the min. thickness (in cm) of a surface film that will cause crystn. The method was applied to Fe, Cu, CuO, Al_2O_3, talcum, and graphite powders. Close agreement on any powder sample was usually obtained with at least 2 of the spreading liquids.

12831. KRAUS, G.; ROSS, JOHN W., AND GIRIFALCO, L.A. **Surface-area analysis by means of gas-flow methods. I. Steady-state flow in porous media.** *J. Phys. Chem.* 57, 330-3 (1953).—*C.A.* 47, 5733^c.

Steady-rate flow rates were measured for 7 fractions of glass microspheres, $BaSO_4$, $PbCrO_4$, TiO_2, and CuO in packed columns ranging in B.E.T. surface area from 0.30 to 8.0 m^2/g. The exptl. data suggested that the surface area deduced from the Poiseiulle flow contribution represented the geometric area of particles, while the Knudsen flow area was identified with the total surface of the continuous pore space. In no case did steady state flow areas include the surface of blind pores.

12832. KRAUS, G., AND ROSS, JOHN W. **Surface-area analysis by means of gas-flow methods. II. Transient state flow in porous media.** *J. Phys. Chem.* 57, 334-6 (1953).—*C.A.* 47, 5733^d.

Transient-state flow rates in the Knudsen flow region were measured. Surface areas calcd. from the transient flow data with N_2 were found to agree well with adsorption areas, even in cases where steady-state measurements yielded too small a surface area. The flow measurements resulted in somewhat larger areas, suggesting that more surface was accessible to He than to N_2.

VI-6. Porosity Determinations, Flow Through Beds, Pressure Drop

12833. FOWLER, J.L. AND HERTEL, K.L. **Flow of a gas through porous media.** *J. Applied Phys.* 11, 496-502 (1940).—*C.A.* 35, 677^6.

Exptl. results obtained with cotton, wool, rayon and glass-wool fibers were given, and were in good agreement with those obtained from independent detns. The hydrodynamic method using air seemed to be well adapted to the detn. of the sp surface of fibrous materials.

12834. HATCH, L.P. **Flow through granular media.** *J. Applied Mechanics* 7, 109-12 (1940).—*C.A.* 35, 4998^7.

Formulas for detg. the resistance of flow through granular media were evolved. Exptl. results showed close agreement between calcd. and observed values.

12835. SULLIVAN, R.R. AND HERTEL, K.L. **Flow of air through porous media.** *J. Applied Phys.* 11, 761-5 (1940).—*C.A.* 35, 677^7.

The values of the const. in the equation for permeability in terms of porosity and sp surface were found to be approx. 4.5 for small glass beads (random orientation), 3 for glass fibers (cylinders) parallel to the flow, and 6 for glass fibers perpendicular to the flow.

12836. SULLIVAN, R.R. **Further study of the flow of air through porous media.** *J. Applied Phys.* 12, 503-8(1941).—*C.A.* 35, 5016^7.

For high porosities, where the shape factors were different for wads of different fiber, the flow at a given porosity may not be considered proportional to the inverse square of the specific surface, but to a lower inverse power.

12837. HANCOCK, R.T. **Interstitial flow.** *Mining Mag.* 67, 179-86 (1942).—*C.A.* 37, 554^7.

The resistance experienced by a fluid as a function of its velocity was studied. The "voidage" was the ratio of the space unoccupied by the solid to the total vol. occupied by both solid and fluid. Equations relating to the former could be made applicable to suspensions and immobilized beds by embodying in them a factor which employed the sixth power and the fourth power, resp., of the voidage. The derivation and application of various empirical formulas were discussed.

12838. DROTSCHMANN, C. **Porosity measurements.** *Batterien* 11, 207-9(1943); *Chem. Zentr.* 1943, I. 1391.—*C.A.* 38, 5127^8.

The following methods were considered suitable for detg. the apparent porosity: (1) the air-expansion method, with and without vapor-pressure correction, (2) the displacement method, and (3) the method for measuring the porosity of storage battery plates, in which a fluid of known viscosity was forced through the pores.

12839. KUCHARSKI, W. **Viscosity of heterogeneous liquids as a function of velocity.** *Samml. wissenschaftl. Arbeit schweiz. interniert. Pol.* **1**, 101-19 (1943).—*C.A.* 45, 4509^d.

A glycerol soln. showed signs of being heterogeneous. The coeff. calcd. by Poiseuille's formula increased with decrease in velocity. For a suspension of carbon in glycerol, a heterogeneous "liquid," Poiseuille's law could not be used. The coeffs., detd. exptly. on different days, lie on a regular hyperbolalike curve which, with increasing velocity, approached a limiting value which was reached just before the occurrence of turbulence.

12840. MÖSER, ADOLF. **Simple plant methods for the determination of porosity and water absorption of fire brick.** *Sprechsaal* 76, 147-51 (1943); *Chem. Zentr.* **1943, II**, 1304.—*C.A.* 38, 6060^7.

New methods, based on satn. and drying curves, showed structure better and allowed a differentiation of the usual porosity values. Instead of the quantity of water passing through, the quantity of test liquid absorbed was measured. Speed of absorption, penetrability, capillary porosity and progressive porosity were detd.

12841. ANDREÉ, H. **Apparatus for the measurement of very low flow rates of gases I.** Measurement of the porosity of rocks. *Oel u. Kohle* 40, 117-19(1944).—*C.A.* 38, 6136^8.

Very low flow rates of gases were measured by means of a 2-necked bottle filled with water and equipped with a precisely adjustable overflow siphon. The position of the outer arm of the siphon was set so that the system was in a labile equil. and water neither flowed out nor returned into the bottle. When gas was admitted at a very low rate of flow, the equil. was disturbed and the flow rate detd. from the time required for a definite vol. of water to flow out. The rates measurable with the app. ranged from 1 to 0.0001 ml/sec.

12842. BOGATY, HERMAN AND CARSON, FREDERICK T. **Measurement of rate of flow of water through filter paper.** *J. Research Natl. Bur. Standards* 33, 353-62 (1944).—*C.A.* 39, 1329^4.

The paper was used as a cone in the usual manner and special app. was not required. An equation was derived with which a water-filtration coeff. was detd. from the filtration data. A correlation was shown between the air permeability of filter paper and the rate of filtration; this enabled one to make a good estimate of the speed of a filter paper without wetting it. A recommended procedure for detg. the rate of flow of water through filter paper was given.

12843. DERYAGIN, B.V. AND KRYLOV, N.A. **Anomalous phenomena in the flow of liquids through fine pores of rigid filters.** *Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk. Inst. Mashinovedeniya, Soveshchanie po Vyazkosti Zhidkosteĭ i Kolloid. Rastvorov (Conf. on Viscosity of Liquids and Colloidal Solns.)* 2, 52-3(1944).—*C.A.* 40, 3314^1.

The rate of flow of water through porous ceramic and carbon filters was measured as a function of the pressure P applied by means of a Hg column. No. anomalies were observed with pores of 0.3 μ diam. or more, the rate of flow being directly proportional to P. With pores of 0.1 μ diam., the flow followed Poiseuille's law only at relatively high P. At lower pressures, the flow was no longer viscous but nearly plastic in character, following approx. Bingham's law. Carbon filters showed anomalies even with pores of diam. of the order of 0.7 μ; addn. of isoamyl alc. and of isovaleric acid resulted, resp., in 4- and 5- fold increases in the rate of filtration.

12844. BABCOCK, A.B. **The porosity of bone black.** *Intern. Sugar J.* 47, 209-11 (1945).—*C.A.* 39, 4742^7.

The percentage porosity of a bone char was calcd. as 100 [1 - wt per ft^3/(% grain vol. × 182.4)]. A bone char of zero porosity would weight 93.64 lb/ft^3. The accuracy of the figure for the porosity was based upon the percentage grain vol. corresponding to the wt/ft^3 and to the value 182.4, the wt/ft^3 of the material of which bone char was composed.

12845. DRAKE, L.C. AND RITTER, H.L. **Pore-size distribution in porous materials. II.** Macropore size distributions in some typical porous substances. *Ind. Eng. Chem., Anal. Ed.* **17**, 787-91 (1945).—*C.A.* 40, 786^9.

The macropore size distributions of samples of activated clay, Fuller's earth, diatomaceous earth, bauxite, activated Al_2O_3, silica gel, activated carbons, silica-Al_2O_3 gels, flint quartz, Coors porous plate, porous iron, and fritted glass were detd. by means of the pressure porosimeter.

12846. GRIMLEY, S.S. **Liquid-flow conditions in pack towers.** *Soc. Chem. Ind.*(London) *Chem. Eng. Group Proc.* 27, 228-35; *Trans. Inst. Chem. Engrs.* (London) 23, 228-35 (1945).—*C.A.* 43, 1614^d.

The flow of liquids on vertical surfaces was investigated. Significant departures from theoretical values in the streamline flow range were related to channeling and wetting phenomena in a lab. column packed with 3/8-in. rings. Departures from theoretical in streamline flow occurred in a "ripple" region, which, for water at room temp., occurred over a range of Reynolds no. from 25 to approx. 1000.

12847. LEIBENZON, L.S. **Fundamental law of gas motion through a porous medium.** *Compt. rend. acad. sci. U.R.S.S.* 47, 16-18 (1945); *Doklady Akad. Nauk S.S.S.R.* 47, 15-17(1945).—*C.A.* 40, 3961^2.

A differential equation was developed which, when integrated, described the movement of a gas or an incompressible fluid through a porous medium. The movement may be laminar or turbulent.

12848. LEPINGLE, MARCEL. **Determination of the porosity of refractory products.** *Chaleur et ind.* 26, 101-6(1945).—*C.A.* 40, 3244^3.

Comparative porosity tests showed that values obtained by immersion in H_2O at room temp. were only 60-70% of the values given by immersion in cold H_2O, boiling, and recooling under H_2O and immersion in H_2O and then evacuating by a H_2O pump. Immersion in cold H_2O, boiling, and recooling under H_2O gave max. values most rapidly. Cut test cubes gave generally higher values than were given by whole pieces. Immersion in H_2O and then evacuating by a H_2O pump was modified by immersion of the test piece in H_2O after the piece was under vacuum which modification gave max. values more rapidly with no loss of precision. Test pieces were dried to const. wt in an oven at 110°C before test to eliminate humidity effects.

12849. Ries, Herman E. Jr.; Van Nordstrand, Robert A.; Johnson, Marvin F.L., and Bauermeister, Herman O. **Adsorption-desorption isotherm studies of catalysts. I. Supported catalysts in the powder and pellet forms.** *J. Am. Chem. Soc.* 67, 1242-5(1945).—*C.A.* 39, 4786^4.

N_2 adsorption-desorption isotherms were studied at low temps. with supported catalysts in the powder and pellet forms. Hysteresis effects were very similar for both forms of two catalysts widely different in area. The pore structure responsible for the hysteresis effect was not produced by pelleting nor was it affected by subsequent grinding to 100-mesh powder. Hysteresis extended from 0.4 relative pressure to p_o. The vol. of the adsorbate, V_s, may be detd. more precisely on desorption than on adsorption. Pore vols. were in agreement with those obtained in He-Hg displacement measurements.

12850. Ritter, H.L. and Drake, L.C. **Pore-size distribution in porous materials. Pressure porosimeter and determination of complete macropore size distributions.** *Ind. Eng. Chem., Anal. Ed.* 17, 782-6 (1945).—*C.A.* 40, 786^9.

The macropore size distribution in porous materials was detd. by measuring the vol. of Hg that entered the pores when a mass of Hg surrounding the sample was subjected to varying external pressure. A description of the porosimeter was given. The complete distribution curves of a diatomaceous earth, a Coors porous plate, an ultrafine fritted glass, an activated clay, and a pelleted silica-Al_2O_3 gel were detd.

12851. Rose, H.E. **An investigation into the laws of flow of fluids through beds of granular materials.** *Inst. Mech. Engrs., Applied Mechanics, Proc.* 153, *War Emergency Issue* No. 5, 141-8 (1945).—*C.A.* 40, 3306^9.

An equation governing liquid flow through a bed of granular materials was derived by dimensional analysis and verified by expt. for liquids having abs. viscosities ranging from 16.0 to 0.01 poise. The bed material was spherical shot graded to a mean size. The curve relating fluid resistance to Reynolds no. was similar in form to that for a single sphere moving in an infinite fluid and wall effect was negligible. Resistance to flow was proportional to depth of bed and varied inversely as the fourth power of the voidage approx. for beds of normal density of packing.

12852. Rose, H.E. **The isothermal flow of gases through beds of granular materials.** *Inst. Mech. Engrs., Applied Mechanics, Proc.* 153, *War Emergency Issue* No. 5, 148-53(1945).—*C.A.* 40, 3307^1.

Pressure-drop data for sand (0.042 cm diam.) packed to various heights in a brass tube 1.5 in. inside diam. by 4 ft long using air, H_2, O_2, and C_2H_2 was compared with calcd. values. Discrepancies were attributed to the uncertainty in the relation between resistance coeff. and Reynolds no.

12853. Rose, H.E. **The resistance coefficient--Reynolds number relationship for fluid flow through a bed of granular material.** *Inst. Mech. Engrs., Applied Mechanics, Proc.* 153, *War Emergency Issue* No. 5, 154-61(1945).—*C.A.* 40, 3307^2.

Literature data for nonspherical particles was correlated with those for spherical particles by use of appropriate shape-factors. Values of the resistance coeff. correlated well in the viscous and turbulent flow ranges but scattered widely in the transition region. Curves for beds of particles of various degrees of angularity were presented.

12854. Sackmann, L.A. and Hughes, L. **The permeability of filter beds. Precision measurements.** *J. phys. radium* 6, 134-44 (1945).—*C.A.* 40, 1065^4.

Terminology, history, and laws were reviewed for the detn. of permeability of various beds.

12855. Kocatopcu, Sahap S. **Fundamental study of clay. VII. Effect of particle size on properties of casting slips.** *J. Am. Ceram. Soc.* 29, 99-107(1946).—*C.A.* 40, 3578^9.

Binary and ternary mixts. were made of 0.2-0.4 μ and 0.8-1.6 μ purified fractions of clay and of 16-44 μ purified flint. Sp. gr., deflocculation point, and H-ion concn. detns. were made on each compn. to obtain the same apparent viscosity. Small cylinders were prepd. by solid casting, and the shrinkage, porosity, and modulus of rupture of the dried specimens were measured. Porosity of the dried casts was greatly affected by particle-size distribution. The min. porosity of 28.5% obtained in this work was much lower than the 35.5% of the standard sanitary body.

12856. Morcom, A.R. **Fluid flow through granular materials.** *Trans. Inst. Chem. Engrs. (London) and Soc. Chem. Ind. (London), Chem. Eng. Group*, Advance copy, Mar. 12, 1946, 8 pp.—*C.A.* 40, 3943^2.

The "normal" packing was obtained by dropping in a thin stream on the bed from a height of several ft. The containers were large in most cases compared to the particle size, ranging from 3.7 to 15.1 cm in diam. Air, CO_2, and H_2 were used. No general shape factors were predicted from the data for glass spheres, broken coke, iron oxide, spherical nodules, marble chips, irregular iron oxide nodules, iron oxide cylinders and kaolin cylinders.

12857. Pshezhetskiĭ, S.A. and Rubinshtein, R.N. **Kinetics of heterogeneous reactions on porous catalysts.** *J. Phys. Chem.* (U.S.S.R.) 20, 1127-36(1946)(in Russian); *Acta Physicochim. U.R.S.S.* 21, 1075-88(1946)(in English).—*C.A.* 41, 2972c.

The diffusion of the reactants to the surface of a porous catalyst was discussed. The conditions were defined under which (1) no hydrodynamic flow was created by the reaction, (2) the diffusion of only one reactant need by considered, and (3) the temp. gradient within the catalyst grain had a measurable effect.

12858. Zakharov, B.A. and Frost, A.V. **Pressure drop through granular materials in contact packed tubes.** *Bull. acad. sci. U.S.S.R., Classe sci. tech.* **1946**, 421-41.—*C.A.* **41**, 2300*b*.

The value of Δp (pressure drop in kg/m^2) detd. by Chilton and Colburn was too low. The following equation was established: $\Delta p = K_o NH/D_1^m D_2^n$, where H = height of packing in m, D_1 = av. diam. of packing particle in m, D_2 = diam. of tube in m, N = d. X kinematic viscosity X linear velocity of gas, and K_o, m, and n were tabulated for different values of D_1/D_2.

12859. Arthur, J.R. and Linnett, J.W. **Interchange of heat between a gas stream and solid granules.** *J. Chem. Soc.* **1947**, 416-24.—*C.A.* **41**, 5348*b*.

The app. consisted of a tube contg. a bed of graded charcoal granules. Heat was supplied to the charcoal bed at one section by an elec. heater. Small thermocouple elements were used to study the temp. distribution while air streamed through the bed. A plot of the logarithm of the temp. difference at the steady state as a function of the distance down the column gave a straight line. The slope of this line depended on the flow rate and was independent of the rate at which heat was supplied by the heater. Since the const. for heat interchange was much greater than the thermal cond., the air temp. was very close to the charcoal temp. throughout the column under steady-state conditions.

12860. Brownell, L.E. and Katz, D.L. **Flow of fluids through porous media. II. Simultaneous flow of two homogeneous phases.** *Chem. Eng. Progress* 43, No. 11, *Trans. Am. Inst. Chem. Engrs.* 601-12(1947).—*C.A.* 42, 4*d*.

In the simultaneous flow of 2 fluid phases, each was treated as a single phase with modifications for the effect of one fluid on the other. An addnl. correlation was developed to predict the quantity of fluid held in a porous bed by capillary forces. By use of the general flow equation both countercurrent and parallel flow of the 2 phases could be calcd.

12861. Brownell, L.E. and Katz, D.L. **Flow of fluids through porous media. III. Application to rotary vacuum filtration.** *Chem. Eng. Progress* 43, No. 12, *Trans. Am. Inst. Chem. Engrs.*, 703-12(1947).—*C.A.* 42, 422*g*.

"Unsteady" states resulting from changing cake thickness during deposition and from changing effective satn. during air flow necessitated integration of the "steady" state relations. Graphical integration methods could be used for either turbulent or laminar flow. Formal integration methods for predicting cake deposition were used when flow was known to be laminar. The calcn. of cake deposition, air flow, and final moisture content in the filter cycle was possible.

12862. Carman, P.C. **Slip flow in granular beds.** *Nature* 160, 301-2(1947).—*C.A.* 42, 4020*e*.

An equation was derived introducing a factor k_o/k which equals $(L_e/L)^2$ and had a value between 1.5 and 2.

12863. Heywood, Harold. **Fluid flow through stable particulate systems.** *J. Imp. Coll. Chem. Eng. Soc.* 3, 7-21 (1947).—*C.A.* 42, 5725*f*.

A stable particle packing was unmoved by the fluid because of the wt or some other constraint. Diagrams were presented to show how the cross section of the interspace element varied with three packing systems consisting of spheres. In the case of random packing, either of spheres or irregularly shaped particles, the variation of av. interspace area will not be so great as with the regular packings described. A numerical example was given of a calcn. of pressure drop for H_2O flowing through a bed of sand particles. The rate of air flow through this bed was also calcd.

12864. Hougen, O.A. and Marshall, W.R. **Adsorption from a fluid stream flowing through a stationary granular bed.** *Chem. Eng. Progress* 43, No. 4, *Trans. Am. Inst. Chem Engrs.*, 197-208, (1947).—*C.A.* 41, 3343*a*.

An analytical method was developed for isothermal conditions where a linear equil. relation existed between the adsorbate content of the gas and of the solid. Schumann-Furnas charts were modified to fit this particular case of adsorption.

12865. Leva, Max. **Heat transfer to gases through packed tubes - general correlation for smooth spherical particles.** *Ind. Eng. Chem.* 39, 857-62 (1947).—*C.A.* 41, 4972*h*.

Heat transfer to gases through tubes filled with spherical packing of low thermal cond. was investigated for ratios of D_p/D_t varying from 0.05 to 0.3. The equation developed allowed prediction of heat-transfer coeffs. if the value of the Prandtl no. was in the range of 0.74-0.80. A max. heat-transfer coeff. was found when D_p/D_t was equal to 0.15. The effect of voids in the packing was studied, but no coordinated relation with the heat-transfer coeff. was found.

12866. Leva, Max and Grummer, Milton. **Pressure drop through packed tubes. II. Effect of surface roughness.** *Chem. Eng. Progress* 43, No. 11, *Trans. Am. Inst. Chem. Engrs.* 638-8 (1947).—*C.A.* 42, 4*b*.

Exptl. data were obtained for pressure drop through particles of different degrees of surface roughness. It was found that particles as rough as clay or alundum increased the pressure drop by 50%. For particles such as irregularly shaped dense Aloxite granules, which were much rougher than clay particles, the pressure drop was more than twice as high as was observed with smooth particles.

12867. Leva, Max and Grummer, Milton. **Pressure drop through packed tubes. III. Prediction of voids in packed tubes.** *Chem. Eng. Progress* 43, No. 12, *Trans. Am. Inst. Chem. Engrs.*, 713-18(1947).—*C.A.* 42, 421*e*.

Correlations for voids in packed tubes were developed. Investigations were made with uniform and mixed size smooth spheres, with rough spheres, smooth and rough cylindrical particles, and

Raschig rings. A chart was prepd. which summarized the results observed with these materials and which could readily be used for design calcns.

12868. Metrot, Roger. **A simple apparatus for the measurement of air permeabilities.** *Rev. inst. franc. petrolé* 2, 518-20 (1947).—*C.A.* 42, 4003*i*.

A glass or metal tube was fitted with a gasket which served to hold test samples of material. The bottom of the glass or metal tube was connected to an outlet furnished with a stopcock. Another graduated tube extended through the center of the bottom of the glass or metal tube into a vessel filled with water. After insertion of the test sample in the glass or metal tube, the water in the graduated tube was made to rise to a calibrated mark by evacuation through an outlet. The stopcock in the outlet was closed, and the time was measured which elapsed before the water returned to a standard mark in the graduated tube.

12869. Rzhevkin, S.N. and Tumanskii, S.S. **The measurement of the internal friction of air in porous materials by uniform flow and by the use of sound waves.** *Zhur. Tekh. Fiz.* 17, 681-92 (1947); *Chem. Zentr.* 1948, II, 1160.—*C.A.* 44, 8736*h*.

Detns. were made of the diminished pressure of air drawn through a porous material held between perforated plates. The resistance of the porous material was calcd. Measurements were made on cotton, glass wool, spun silk, dust, and Mikal (a fine cotton fabric) for the range 0.3-300 cm/sec. The exptl. values agreed with the results of approx. calcns. in which a laminar flow was assumed.

12870. Takagi, Sadashige. **Flow of gases through porous media. I. II.** *J. Chem. Soc. Japan* 68, 5-6 (1947).—*C.A.* 43, 7288*c*.

The temp. rise of active charcoal on adsorption of various org. solvent vapors was measured. The temp. rose sharply, passed through a max. and then decreased. The dynamic pressure distribution of air flow through porous media was also measured. Some irregularities were ascribed to the inhomogenous distribution of flow velocity of vapors through a cylinder filled with charcoal grains.

12871. Zenz, Frederick A. **Mechanism of counter-current gas-liquid flow through packed towers.** *Chem. Eng. Progress* 43, No. 8, *Trans. Am. Inst. Chem. Engrs.*, 415-28 (1947).—*C.A.* 41, 5759*b*.

The characteristics of counter-current flow through packed towers was studied which permitted a definition of the "flooding point". Data were given that correlated as well or better than "visual" detns. and permitted a correlation of pressure drops at this "flooding point." An equation was derived which could be used to calc. the pressure drop at various flow rates.

12872. Zettlemoyer, A.C. and Walker, W.C. **Active magnesia. Surface areas and pore structures from nitrogen adsorption.** *Ind. Eng. Chem.* 39, 69-74 (1947).—*C.A.* 41, 1140*a*.

The B.E.T. surface area of 7 samples of com. MgO were detd. ranging from 0.8 to 200 m²/g; areas detd. by I_2 adsorption from CCl_4 soln. were about 35% lower. In the relative-pressure range 0.3 to 0.5, the N_2 adsorption exceeded by a few percent that predicted by the B.E.T. theory. A structure was assumed consisting of plates made up of a checker work of cubic crystals and holes.

12873. Allen, F.A. **Porosity. Another approach.** *Light Metals* 11, No. 121, 90-101(1948).—*C.A.* 42, 3712*d*.

The odor of C_2H_2 apparent when Al alloys were fractured, was discussed. Active solid impurities present in Al were chiefly carbides and nitrides. Nitride formation was suspected when dry N_2 was used as a flux for Al. As the combined total of carbides and nitrides in Al alloy rarely exceeded 0.5%, they were generally ignored in considering fractures in subsequent production stages. As metal contg. carbides and nitrides was poured into the mold, reactions were instantaneous and gaseous products were formed progressively as new surfaces were thrown up by turbulence during pouring. Control of carbide contamination was considered a more difficult problem to solve than the control of H_2.

12874. Barrer, R.M. **Fluid flow in porous media.** *Discussions Faraday Soc.* 1948, No. 3, 61-72.—*C.A.* 43, 2139*h*.

The displacement of one fluid by another was examd. together with the relative roles played by pressure-head and surface tension. Mol. mechanisms of gas or vapor flow in single capillaries and in porous media and transition regions from one flow mechanism to another were particularly examined. High-pressure flow in wide tubes to pore radii so small that the diffusing species move entirely within the range of surface forces were considered.

12875. Ciborowski, Janusz. **The fundamentals of the fluidization process.** *Przegląd Chem.* 6, 164-72 (1948).—*C.A.* 44, 2*e*.

A glass column (30 mm diam. and 120 cm long) was used in the study of the process. A min. gas flow was necessary for the fluidization to take place. This crit. velocity for incompressible powders was independent of their amt. The flow friction was proportional to flow velocity and the amt. of powder, also to particle diam. and d. Two phases could be distinguished in a fluidized system: a "dense" phase, whose concn. was const., and a "dilute" phase, showing a barometric effect.

12876. Cross, A.H.B. and Young, P.F. **The measurement of apparent porosity and bulk density.** *Trans. Brit. Ceram. Soc.* 47, 121-47 (1948).—*C.A.* 43, 2388*e*.

Porous materials were evacuated to pressures of 0.3 to 2 in. Hg. A few min. at atm. pressure after evacuation sufficed to fill the pores almost completely (99.7%). Test pieces weighing about 100 g were preferred. Removal of too much liquid while wiping the test piece led to greater errors than insufficient wiping. A modified method achieved almost complete soaking within a few min. by an immersion of samples at 110°C directly in boiling water at atm. pressure, followed by cooling to room temp.

12877. Ferrandon, Jean. **The laws of flow in filtration.** *Genie civil* 125, 24-8(1948).—*C.A.* 42, 8536*d*.

Physical coeffs. detg. speed and hydrodynamic action on solid particles of a filter such as clay or sand were discussed and evaluated.

12878. KOPELMAN, B. AND GREGG, C.C. **The pore size of hydrogen-reduced tungsten powder.** *Am. Inst. Mining Met. Engrs. Inst. Metals Div., Metals Technol.* 15, No. 5, Tech Pub. No. 2434, 6 pp.(1948).—*C.A.* 42, 8739*h*.

The existence of pores of mol. size in com. H_2-reduced W powder was proven. The d. of a gaseous-reduced product or sintered material in a liquid of large mol. vol. was a better criterion of the nature of the material than the d. detd. in H_2O or other conventional liquids of small mol. vol.

12879. LEDOUX, EDWARD. **Dynamic cooling of adsorbent beds.** *Ind. Eng. Chem.* 40, 1970-7(1948).—*C.A.* 43, 1253*g*.

Cooling curves for a bed of any broken solids was detd. graphically. The curves were plotted in dimensionless coordinates so that they may be used with any consistent system of units for the soln. of cooling problems. Practical application was illustrated by numerical examples which also served as a basis for the comparison between open- and closed-circuit cooling of adsorbent beds.

12880. LEVA, MAX; GRUMMER, MILTON, AND WEINTRAUB, MURRAY. **Introduction to fluidization.** *Chem. Eng. Progress* 44, No. 7, 511-20 (1948).—*C.A.* 42, 5724*c*.

Counter-gravity flow of air, CO_2 and He through beds of round and sharp sands was investigated. The point of bed expansion in connection with the onset of fluidization was correlated with the fluid rate necessary for initial bed expansion. The proposed equation applied to narrow cuts as well as mixts., provided the diam. of the particles in the mixt. was defined according to the rule proposed in the paper. Fluidization phenomena in a 2.5 and 4 in. glass tube were discussed and possible explanations for the slugging and channeling behavior of fluidized beds were proposed.

12881. LEVA, MAX; GRUMMER, MILTON; WEINTRAUB, MURRAY, AND POLLCHIK, MORRIS. **Fluidization of solid nonvesicular particles.** *Chem. Eng. Progress* 44, No. 8, 619-26(1948).—*C.A.* 42, 7583*a*.

The exptl. work was carried out with round and sharp silica sands varying in size from 0.01505 to 0.00202-in. effective diam. The flow of air, CO_2, and He through beds of these particles in 2.5-in. and 4-in. tubes was investigated. A bed of fine particles must have a certain min. voidage before fluidization could set in. This min. fluid voidage was correlated with the effective diam. of the bed particles for the various shapes considered.

12882. NORMAN, W.S. **Fluid friction, heat, and mass transfer in turbulent flow with particular reference to the performance of packed towers.** *Trans. Inst. Chem. Engrs.* 26, 81-90(1948).—*C.A.* 45, 3201*i*.

12883. OULTON, T.D. **The pore size-surface area distribution of a cracking catalyst.** *J. Phys. & Colloid Chem.* 52, 1296-1314 (1948).—*C.A.* 43, 3180*g*.

The N_2 adsorption-desorption isotherm (Type II) for an activated natural-clay cracking catalyst (Filtrol) was used. The basic assumptions were: (1) the shape of the desorption branch detd. the pore-size distribution; (2) the closing of the hysteresis loop detd. the radius of the smallest pore present; (3) at satn. the liquid condensed in the capillaries could be divided into a portion close to the solid wall and a portion of the adsorbate which possessed the properties of the bulk liquid-an "inner capillary vol.". The B.E.T. surface could be allocated to categories of pores within selected radius ranges. The surface-area distribution and the type of pore structure was interpreted in terms of an idealized structure model whereby the av. crystallite size was calcd. and the calcd. surface area of the model was in good agreement with the true surface area.

12884. RITTER, H.L. AND ERICH, L.C. **Pore-size distribution in porous materials: interpretation of small-angle x-ray scattering patterns.** *Anal. Chem.* 20, 665-70 (1948).—*C.A.* 42, 7599*e*.

The theory of small angle x-ray scattering was applied simply and approximately to porous agregates, and the results reduced to continuous distributions of pore size. Pore-size distributions were calcd. for some silica-alumina gels and for a Fuller's earth. The results were correlated with those obtained from adsorption expts. and by means of the Hg porosimeter.

12885. WEINTRAUB, MURRAY AND LEVA, MAX. **Pressure drop in packed tubes. A nomogram.** *Chem. Eng. Progress* 44, 801-2 (1948).—*C.A.* 43, 2*e*.

A nomogram was presented for aid in the rapid calcn. of pressure drop through packed tubes when the flow was turbulent and the packing smooth.

12886. WILHELM, RICHARD M. AND KWAUK, MOOSON. **Fluidization of solid particles.** *Chem. Eng. Progress* 44, No.3, *Trans. Am. Inst. Chem. Engrs.* 201-18 (1948).—*C.A.* 42, 2480*a*.

Expts. were performed in the fluidization of solid particles by means of air and H_2O in 3-in. and 6-in. diam. columns. Spherical and uniformly sized particles of sand, glass, silicate catalyst, and Pb shot ranging in size from 5 to 0.3 mm in diam., and in d. from 1.125 to 10.792 g/ml were used. Pressure drop, fraction void, and velocity were measured and correlated in generalized terms through 4 dimensionless groups.

12887. AGAFONOV, A.V. AND KALIKO, M.A. **Porous structure and catalytic activity of catalysts.** *Zhur. Obshchei Khim.* (J. Gen. Chem.) 19, 39-46 (1949); *J. Gen. Chem. U.S.S.R.* 19, 33-9 (1949). —*C.A.* 43, 6336*b*; 44, 6052*i*.

For a series of silica gel catalysts, the catalytic activity *K* was a function at const. total porosity *P* of the mean pore radius (detd. by capillary condensation of H_2O vapor at 18.7°C) with a max. at 9-10 A. For the 7 catalysts examd. *P* ranged from 24.5 to 45.8% and the total surface area from 205 to 880 m^2/ml. Catalyst activated by $Al(OAc)_3$ had a 25% higher activity than catalysts activated under the same conditions by $Al_2(SO_4)_3$ of the same concn. of Al_2O_3. Catalysts with finer porosity gave, throughout, lower yields of gasoline and greater amts. of gas than catalysts with coarse pores. For highest efficiency, aluminosilicate catalyst should be chosen with pores predominantly larger than the diam. of the reacting mols., and a low development of ultrapores.

12888. Anderson, S.L. and Warburton, F.L. **Porous plug and fiber diameter measurement. Effect of fiber orientation and use of plugs of randomized fibers.** *J. Textile Inst.* **40**, T749-58(1949).—*C.A.* 44, 1262*i*.
A method was devised for cutting short lengths of fiber, randomizing by shaking with petr. ether, and packing into a brass tube. This gave results independent of initial fiber arrangement.

12889. Badollet, M.S. **Filterability of asbestos fibers used in wet processes.** *Trans. Can. Inst. Mining Met.* **52**, 594-8 (in *Can. Mining Met. Bull. No.* 451) (1949).—*C.A.* 44, 1627*a*.
A simple lab. procedure was devised for measuring the filterability of asbestos in H_2O or of asbestos in combination with H_2O and cement. The presence of asbestic fines or shorts decreased the filterability in proportion to the quantity of fines or shorts present in the mixt. In the tests made, minus-20, plus-35-mesh material gave the max. improvement in filtration; with smaller sizes, the filtration rate began to decrease, owing to decreasing porosity of the mixt.

12890. Belden D.H. and Kassel, Louis S. **Pressure drops encountered in conveying particles of large diameter in vertical transfer lines.** *Ind. Eng. Chem.* **41**, 1174-8 (1949).—*C.A.* 43, 6476*e*.
In the vertical transport of spherical catalyst, the total pressure drop was expressed as a static term based on actual particle density in the transfer line, and a friction term which involved the particle mass velocity, but was independent of particle diam. and density.

12891. Bond, R.L. and Maggs, F.A.P. **Particle size and pore structure of finely ground coal chars.** *Fuel* 28, No. 8, 172-5(1949).—*C.A.* 43, 7208*i*.
The fine structure of the coal char behaved as a mol. sieve penetrable to small mols. but impenetrable to large ones, such as dibutyl phthalate. The immersion of the powd. char in a liquid of sufficiently large mol. vol. led to the generation of a wetting energy which was proportional to the external surface area of the particles. A powder heated to a sufficiently high temp. became impenetrable to the mols. of all of the liquids used in the expts. Heating to still higher temps. caused a smoothing of the external surface.

12892. Brinkman, H.C. **Calculations on the flow of heterogeneous mixtures through porous media.** *Applied Sci. Research* **A1**, 333-46(1949).—*C.A.* 44, 3311*c*.
Analytical soln. of Muskat's basic differential equations for the general case of flow of fluids through porous materials were obtained for two special cases: (1) flow of a liquid through a column originally satd. with a second liquid with which it was immiscible, and (2) flow from a vertical porous column filled with liquid satd. with gas when opened at its lower end. In both examples the expression for satn. through the bed had a three-valued soln.

12893. Carman, P.C. **Flow of adsorbed molecules.** *Nature* **163**, 684-5(1949).—*C.A.* 43, 6883*d*.
The transition from viscous to mol. flow (H_2, air, CO_2, Freon-12, and SO_2) through a medium (Linde silica) having pores comparible in size to the mean free path of the mols. was studied. Consistent values for the specific surface were obtained with all gases except SO_2. The flow rate of SO_2 was higher than expected.

12894. Drake, L.C. **Pore-size distribution in porous materials. Application of a high-pressure mercury porosimeter to cracking catalysts.** *Ind. Eng. Chem.* 41, 780-5(1949).—*C.A.* 43, 5575*c*.
The technique for the detn. of macropore size distribution with the high-pressure Hg porosimeter was extended to include the pore diam. range 200-35 A. Pressures from 25 to 60,000 p.s.i. were used. Representative data were presented for com. cracking catalysts with average pore diameters of 44-98 A. including activated clay, and silica-alumina gels in the form of beads and pellets.

12895. Ellis, J.N. **Some applications of fluidization bed technique. I.** *Chem. Eng. Mining Rev.* 41, 295-9(1949).—*C.A.* 43, 9414*g*.
The field of fluidization and a description of the Winkler method of brown-coal gasification and the fluid catalytic process were reviewed.

12896. Ergun, Sabri and Orning, A.A. **Fluid flow through randomly packed columns and fluidized beds.** *Ind. Eng. Chem.* 41, 1179-84(1949).—*C.A.* 43, 6475*f*.
The ratio of pressure gradient to superficial fluid velocity in packed columns was a linear function of fluid mass-flow rate. Particle specific surface, fractional void vol., and fluid velocity were consts. in this relation, and were used to predict the degree of bed expansion with increasing gas flow after the pressure gradient reached the buoyant wt of solids per unit vol. of the bed. A const. product of gas viscosity and superficial velocity may serve as a criterion of a standard state in fluidized systems used for reaction kinetic studies.

12897. Farbar, Leonard. **Flow characteristics of solids-gas mixtures in a horizontal and vertical circular conduit.** *Ind. Eng. Chem.* 41, 1184-91(1949).—*C.A.* 43, 6475*h*.
The isothermal flow characteristics of a solids-gas mixt. ($Al_2O_3—SiO_2$ catalyst and air) in a horizontal and in a vertical glass conduit were studied. Qual. observations were made on the flow in the solids feed line, mixing nozzle, horizontal and vertical sections of the conduit, and short and long radius bends. Several types of nozzles were compared to find the type yielding the most uniform mixing.

12898. Fox, J.W. **Onset of turbulent flow in certain arrays of particles.** *Proc. Phys. Soc.* (London) 62B, 829-32(1949).—*C.A.* 44, 1290*d*.
Reynold's no. were found for the onset of turbulence in H_2O flowing through a perfectly packed hexagonal array of uniform spheres. Expts. were

carried out on an imperfectly packed array of the same spheres and on an array of irregular particles (marble chips). A differential manometer, which read differences of the order of a hundredth of a mm of H_2O was described. Imperfections of packing appeared to make little difference as regards the onset of turbulence.

12899. Fuks, G.I. **The flow of structured dilute sols and suspensions.** *Doklady Akad. Nauk S.S.-S.R.* 66, 1125-8(1949).—*C.A.* 43, 7291*g*.

Radial distribution curves of the velocity of flow of colloidal systems with anomalous viscosity were obtained by observations of (0.5-mm) particles of carbon, ZnO, or Al spread on the surface of the liquid. For 0.8% $Fe(OH)_3$ + 6 mg-equiv. NaCl, a 0.15% suspension of bentonite (0.1-0.5 μ) satd. with K^+ + 0.5 mg-equiv. KCl, and a 1.2% soln. of rubber in kerosene, the curves consisted of a portion of Newtonian or near-Newtonian distribution. This confirmed the occurrence of local turbulence at Reynolds nos. well below the crit. no. and long before the appearance of general turbulence of the flow. Another type, macroscopically Newtonian, but microscopically showing local circulation layers extending not over 0.1 mm was shown by $Fe(OH)_3$ sols at low speeds; at higher speeds, these sols go over into the 1st type.

12900. Gilliland, E.R. and Mason, E.A. **Gas and solid mixing in fluidized beds.** *Ind. Eng. Chem.* 41, 1191-6(1949).—*C.A.* 43, 6475*i*.

The internal flow of gas and solid in a fluidized bed was studied by tracer gas and heat flow methods. With a high ratio of length to diam., back-mixing of the gas was found to be relatively small. The heat flow measurements indicated that solid mixing was relatively rapid, and that the sensible heat carried by the solid was sufficient to maintain essentially const. temp. throughout the reactor.

12901. Happel, John. **Pressure drop due to vapor flow through moving beds.** *Ind. Eng. Chem.* 41, 1161-74(1949).—*C.A.* 43, 6476*c*.

An investigation was made of the flow of vapors through moving beds of catalyst in which the entire bed moved with respect to the walls of the container, but the moving particles remained in a fixed position relative to each other. Air was passed in concurrent and countercurrent flow through such beds of granular, spherical, and pellet catalysts.

12902. Hariu, O.H. and Molstad, M.C. **Pressure drop in vertical tubes in transport of solids by gases.** *Ind. Eng. Chem.* 41, 1148-60(1949).—*C.A.* 43, 6476*b*.

Total-pressure and static-pressure drops were measured in the transport of solid particles through vertical glass tubes by an air stream, using sized sand and SiO_2-Al_2O_3 cracking catalyst as solids. The total-pressure drop was the sum of the drop due to the carrier gas alone plus a solids pressure drop. A residual obtained by subtracting the solids static head from the total solids pressure drop was treated as an apparent solids friction drop, but later measurements showed the major portion of the apparent friction was caused by particle acceleration in the test section.

12903. Hobson, Mer and Thodos, George. **Mass transfer in the flow of liquids through granular solids.** *Chem. Eng. Progress* 45, 517-24(1949).—*C.A.* 43, 8751*e*.

Mass-transfer coeffs. were correlated as linear functions of the modified Reynolds no. over the limited range studied. Sep. correlations were produced for each system and for each particle diam. These coeffs. varied approx. as the 0.23 power of the modified Reynolds no. Mass-transfer factors for *iso*-BuOH-water and Me, Et, ketone-water were found to produce an identical function when correlated with a modified Reynolds no. The correlation was independent of particle diam.

12904. Houpeurt, A. **Apparatus for porosity studies.** *Rev. inst. franc. petrole* 4, 95-102 (1949).—*C.A.* 43, 5234*e*.

The construction of porosimeters for the investigation of air adsorption of rock beds was described in detail.

12905. Juhola, A.J. and Wiig, Edwin, O. **Pore structure in activated charcoal. I. Determination of micro pore size distribution.** *J. Am. Chem. Soc.* 71, 2069-77(1949).—*C.A.* 44, 309*a*.

By detg. the molar vol. of adsorbed water as a function of relative pressure and the variation of the surface area as a function of the vol. of adsorbed water, it was possible to calc. the pore diam. of cylindrical pores at any relative pressure. Substitution of these values in the Kelvin equation applied to the desorption isotherm gave values of cos θ = 0.49 over practically the entire relative pressure range for two charcoals. The adsorption isotherm for one charcoal gave cos θ = 0.28.

12906. Juhola, A.J. and Wiig, Edwin O. **Pore structure in activated charcoal. II. Determination of macro pore size distribution.** *J. Am. Chem. Soc.* 71, 2078-80(1949).—*C.A.* 44, 309*c*.

The pressures at which known quantities of Hg were forced into charcoal pores were detd. Using the capillary rise equation, the pore size distribution in the pore diam. range 1200-160,000 A was obtained.

12907. Kuczynski, G.C. **Study of the sintering glass.** *J. Applied Phys.* 20, 1160-3(1949).—*C.A.* 44, 1661*h*.

The mechanism of sintering of spherical glass particles was that of viscous flow. The viscosities of the investigated glass were detd. in the range from 575° to 744°C. These viscosities were in good agreement with those obtained by other methods.

12908. Leva, Max. **Fluid flow through packed beds.** *Chem. Eng.* 56, 115-17(1949).—*C.A.* 43, 4906*d*.

The subject was reviewed.

12909. Leva, Max; Weintraub, Murray, and Grummer, Milton. **Heat transmission through fluidized beds of fine particles.** *Chem. Eng. Progress* 45, 563-72(1949).—*C.A.* 43, 8753*g*.

The study was made in tubes of 2- and 4-in. diam. with round sand, sharp sand, and an Fe Fischer-Tropsch catalyst (Fe_3O_4) in the particle size range of 400-100 mesh. The effect upon rates of heat transfer of various bed, particle, fluid, tube, and fluidization variables was investigated.

12910. LEWIS, W.K.; GILLILAND, E.R., AND BAUER, W.C. **Characteristics of fluidized particles.** *Ind. Eng. Chem.* 41, 1104-17(1949).—*C.A.* 43, 6474*h*.

The flow characteristics for both batch and continuous fluidization of fine glass spheres were investigated. The sphere diam. had a strong influence upon the flow characteristics.

12911. McCUNE, LEROY K. AND WILHELM, RICHARD H. **Mass and momentum transfer in solid-liquid system; fixed and fluidized beds.** *Ind. Eng. Chem.* 41, 1124-34(1949).—*C.A.* 43, 6475*e*.

Mass transfer between an upward stream of liquid and solid particles in fixed and in fluidized beds was studied by investigating the partial soln. of spherical and flaked particles of difficultly sol. 2-naphthol in a rising stream of H_2O. The mass transfer and friction measurements in fixed and fluidized beds were correlated and compared. Mass transfer per unit pressure drop, the importance of fraction void, and the effect of nonuniformity of flow pattern were also considered for fixed and fluidized beds.

12912. MEYER, K.S. **Practical aspects of industrial filtration.** *Ind. Chemist* 25, 5-8(1949).—*C.A.* 45, 7388*g*.

The impurities in the cake were of 3 types: (1) arranged in an orderly manner, the smallest being at the bottom, giving the best rate of filtration but not necessarily the brightest filtrate, (2) semiabsorbing cake in which an irregular distribution of some impurities tended to choke and lower the rate of filtration, and (3) double-layer cake in which completely irregular distribution of all the impurities led to rapid choking and a short filtration cycle. An initial pressure just sufficient to overcome frictional resistance gave a lower initial rate of filtration but a longer cycle and a greater total quantity, and, usually, a better quality of filtrate.

12913. MORSE, ROLLIN D. **Fluidization of granular solids-fluid mechanics and quality.** *Ind. Eng. Chem.* 41, 1117-24(1949).—*C.A.* 43, 6474*h*.

Observed differences between fluid flow in fixed and in fluidized beds were explained in terms of the flocculation of small particles, kinetic energy losses from turbulent motion of large particles, and the inherent instability of gas-fluidized systems. Fluidized-solid reactor performance was highly dependent upon quality of fluidization (defined as uniformity of the fluid and particles).

12914. ONUSAĬTIS, B.A. AND YUR'EVSKAYA, N.P. **Changes in the structure of coke at high temperatures.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk*, 1949, 519-31.—*C.A.* 45, 6367*e*.

During the roasting of samples of coke at 900-1200°C in an inert or oxidizing atm., no shrinkage occurred. Roasting in a stream of CO_2 caused an enlargement in pore vol., predominantly of the larger pores, and increased the absorptive capacity of the coke owing to its loosened structure.

12915. OVCHINNIKOV, L.N. AND MAKSENKOV, V.G. **Experimental investigation of the filtration effect in solutions.** *Izvest. Akad. Nauk S.S.S.R., Ser. Geol.* 1949, No. 3, 82-94.—*C.A.* 43, 8213*d*.

The filtration of different solns. through quartz sand was dependent on the nature of the soln. and on the magnitude of the filter pores. Dependency of the magnitude of the filtration effect on the concn. of the soln., the temp., and the height of the filtering shaft were detd.

12916. POSNER, A.M. AND ALEXANDER, A.E. **New technique for the determination of dynamic surface tensions.** *Trans. Faraday Soc.* 45, 651-61(1949).—*C.A.* 43, 8790*e*.

The method utilized the changes in contact potential to det. the dynamic surface tension and the amt. of adsorption. The solute mol. was adsorbed upon a freshly formed surface in 3 types of app.: a simple trough suitable for systems in which adsorption equil. required a time greater than a few min.; a Perspex channel suitable for times between about 0.01 and 1 sec; and a jet suitable for times between about 0.001 and 0.01 sec. Typical results were given for aq. soln. of *iso*amyl alc. and *sec*-octyl alc.

12917. BALL, CLEO GRIFFITH AND TALIAFERRO, D.B. **A Bureau of Mines method for determing porosity: A list of porosities of oil sands.** *U.S. Bur. Mines, Rept. Invest. No.* 4548 28 pp. (1949).—*C.A.* 44, 311*d*.

The data required were the vol. of the sand grains and the bulk vol. of the specimen. After removal of the contained fluids by extn., the specimen was dried, and the vol. of sand grains detd. by noting the reduction of void space in a vessel or bomb of known capacity when the specimen was placed in it. The void space in the bomb was detd. More than 2000 porosity detns. were made on cores from wells in 13 states and the results were given.

12918. SCHWERTZ, F.A. **The structure of porous materials from gas penetration rates.** *J. Applied Phys.* 20, 1070-5(1949).—*C.A.* 44, 403*h*.

Gas penetration rates were used to study the structure of 3 com. grades of sintered Pyrex glass. Specific surface areas, "av. pore diams.," pore population ds., av. particle diams., and particle population ds. were calcd. on the basis of the data obtained.

12919. SCHWERTZ, F.A. **Fluid-flow study of porous glass.** *J. Am. Ceram. Soc.* 32, 390-3(1949).—*C.A.* 44, 1661*i*.

Two methods were used to det. sp surface area, av. pore diam., and pore-population d. of Vicor glass. The first was based on Knudsen's equation for the diffusive flow of gases and the second on Poiseuille's equation for the viscous flow of liquids. The calcd. values of the two methods were approx. in agreement with each other and with results obtained by use of the B.E.T. adsorption technique.

12920. TAECKER, R.G. AND HOUGEN, O.A. **Heat, mass transfer of gas film in flow of gases through commercial tower packings.** *Chem. Eng. Progress* 45, 188-93(1949).—*C.A.* 43, 3248*d*.

Mass and heat-transfer factors were established for the gas film in air flowing through Raschig rings, partition rings, and Berl saddles. These data were obtained by measuring the rate of evapn. of H_2O into a stream of air from wetted packings during the const. drying-rate period. With the given method of correlation the same results were obtained with both random dense and staggered arrangement of the rings.

12921. Aerov, M.E. and Umnik, N.N. **Measurement of gas velocity in a real granular layer.** *Zhur. Priklad. Khim.* 23, 1009-17(1950); *J. Applied Chem. U.S.S.R.* 23, 1071-8(Engl. translation).— *C.A.* 46, 7858*d*.

Gas speed was detd. by measuring movement of front of sorption of an admixt. of H_2S from the gas stream on the surface of grains treated with sugar of lead. This method was used to det. the distribution of gas speeds along the wall of the app. and in the center of the layer of a spherical catalyst (diam. of particles 6 mm). Along the wall of the app., the speed was 30-70% higher than in the central layers.

12922. Arthur, J.R.; Linnett, J.W.; Raynor, E.J. Mrs., and Sington, E.P.C. **Flow of an air stream through a layer of granules.** *Trans. Faraday Soc.* 46, 270-89(1950).— *C.A.* 44, 8705*e*.

The distribution of air-flow through the granular bed was very sensitive to the detailed pressure conditions above and below the bed. There was always an excess flow rate down the outer regions of the charcoal bed because the smooth wall reduced the density of packing near it. Neither of these conclusions was altered when the wall of the tube was corrugated.

12923. Bernard, Robert A. and Wilhelm, Richard H. **Turbulent diffusion in fixed beds of packed solids.** *Chem. Eng. Progress* 46, 233-44(1950).— *C.A.* 44, 5652*i*.

Liquid-phase expts. were performed with a methylene blue soln. diffusing from a point source into water flowing through a bed of packed solids; gas-phase expts. used CO_2 diffusing into an air stream in a similar bed. The basic differential equation was solved for the special case when the tube wall provided a boundary condition. Aq. expts. were performed in a 2-in. tube with the following particles: 1-,3-,5-, 8-mm spheres; 3/16 × 3/16-in. and 1/4 × 1/4-in. cylinders; 1/8-in. cubes; 10-14 mesh granules; and a mixt. of 1- and 3-mm spheres. Gaseous expts. were performed in an 8-in. tube with 3/8-in. spheres. Pressure-drop data also were recorded and correlated.

12924. Breckenfield, R.R. and Wilke, C.R. **Limiting flows in packed extraction columns.** *Chem. Eng. Progress* 46, No. 4, 187-94(1950).— *C.A.* 44, 4289*d*.

An app. was described, with a discussion of packing materials, the effects of densities, interfacial tension, viscosity of the liquids, the wall effects of the columns and the correlation of data.

12925. Brownell, L.E.; Dombrowski, H.S., and Dickey, C.A. **Pressure drop through porous media. IV. New data and revised correlation.** *Chem. Eng. Progress* 46, 415-22(1950).— *C.A.* 44, 8705*c*.

New data on flow through porous media were presented for packed beds covering a range from completely laminar to highly turbulent flow, and a porosity range from 40 to 94%. Observed pressure drops were compared with those predicted by various correlations.

12926. Brownscombe, E.R.; Slobod, R.L., and Caudle, B.H. **Laboratory determination of relative permeability.** *Oil Gas J.* 48, No. 40, 68-9, 81-2, No. 41, 98, 100-2, 123(1950).— *C.A.* 44, 5082*h*.

Methods for lab. detn. of relative permeability were: (1) capillary pressure displacement, wherein satn. was controlled by pressure difference between phases maintained by the use of diaphragms permeable to only one of the phases; (2) dynamic displacement wherein satn. was controlled by the ratio of flowing phases; and (3) soln. gas displacement, where satn. was controlled by release of gas from soln. in oil by lowering the pressure. It was proposed that relative permeability be defined as the permeability to gas or oil divided by the permeability to reservoir brine.

12927. Calkins, Edward W.S. **Some comparisons of fiber "fineness" measurements.** *Textile Research J.* 20, 426-33(1950).— *C.A.* 44, 8117*a*.

Any air-permeability instrument, properly calibrated, would satisfactorily measure surface area of fibers. Fibers of the same surface area varied widely in wt per in., and no conversion from surface area to wt per in. could be accurate unless one other variable was held const., namely, wall thickness, fiber diam., or their ratio.

12928. Carman, P.C. **Diffusion and flow of gases and vapors through micropores. I. Slip flow and molecular streaming.** *Proc. Roy. Soc.* (London) A203, 55-74(1950).— *C.A.* 45, 4506*b*.

The slight min. found by Knudsen for circular capillaries was very much exaggerated for noncircular cross-sections. Expts. on flow were made with the following systems: H_2-Ag; H_2-Al; H_2-Cu; H_2-Fe; H_2-glass; C_2H_2-glass; C_3H_8-glass; air-glass; air-fresh shellac; air or CO_2-old shellac or machined brass; air-Hg; air-oil; CO_2-oil; H_2-oil; He-oil; He, H_2, air, or O_2-Ag oxide. The exptl. technique was described in detail. Flow of H_2, air, CO_2, CF_2Cl_2 through crushed chromite, fine glass spheres, α-Al_2O_3 polishing powder, $CaCO_3$, and Ag plugs were studied.

12929. Chernenko, L.E. and Rebinder, P.A. **Filtration analysis and characterization of the structure of suspensions and sediments.** *Kolloid. Zhur.* 12, 386-91(1950).— *C.A.* 45, 927*i*.

If a suspension contg. c g/ml solids was filtered, the amt. of the ppt. was cV after a vol. V passed through. If the amt. cV occupied the vol. acV and the area of the filter was S, the thickness h of the ppt. was acV/S. From Darcy's equation, $dV/dt = KS^2p/\eta acV$; t = time, p driving pressure, and η viscosity. Hence, $V^2 = 2KS^2pt/\eta ac$. The proportionality between V^2 and t was confirmed by filtering suspensions of rye flour and clay in H_2O, and of ZnO in toluene.

12930. Dorner, Hans. **Separation of solid and liquid substances by industrial filtration.** *Seifen-Öle-Fette-Wachse* 76, 296-9, 338-9, 355-7, 380-2, 400-1(1950).—*C.A.* 45, 910*e*.

Problems of industrial filtration were discussed, and filter app., media, and supports described.

12931. Elgin, Joseph C. and Foust, Harold C. **Countercurrent flow of particles through moving continuous fluid—pressure drop and flooding in spray-type liquid towers.** *Ind. Eng. Chem.* 42, 1127-41(1950).—*C.A.* 44, 6683*h*.

Data on ΔP and flooding velocity were given for solids falling through rising water (or aq. $MgSO_4$, d. 1.20 g/ml, viscosity 3.0 centipoise) at 20-24° C. The solids were bead catalysts of 3 diams. (0.127, 0.167, and 0.213 in.) having d. of 1.66 g/ml when satd. with water, 1.74 g/ml when satd. with the aq. $MgSO_4$.

12932. Fundator, V.I. **Determination of gas permeability of mold mixes on the basis of their water permeability.** *Zavodskaya Lab.* 16, 635-6 (1950).—*C.A.* 47, 3624*e*.

Water was poured into a glass tube contg. a tamped mix and resting on filter paper, and the time required for the liquid to pass through the mix was recorded. The gas permeability of the mix was detd. separately. Comparison of water- and gas-permeability curves made it possible to det. conversion factors from water to gas permeability.

12933. Ginstling, A.M. and Brounshtein, B.I. **The diffusion kinetics of reactions in spherical particles.** *J. Applied Chem.* (U.S.S.R.) 23, 1327-38(1950)(Engl. translation).—*C.A.* 46, 9959*c*.

If R = original radius of a spherical particle B reacting with a substance A according to A + B = AB to form a bed of AB of a thickness x around B, and G = degree of conversion of B (in fractions of unity), then the following equations held: $x^2[1 - (2x/3R)] = K'r$; $1 - 2/3G - (1 - G)2/3 = K'(1/R^2)r$, where r = time and K' a const. K' depended in the same manner on the phys. properties of the reactants as in the case of diffusion through a plane surface.

12934. Hambersin, J. **Determination of the permeability of beds of precipitated granules.** *Ind. chim. belge* 15, 269-83(1950).—*C.A.* 45, 4495*b*.

The permeability of $CaCO_3$ formed from gypsum by double decompn. with $(NH_4)_2CO_3$ was measured. Only a small amount of material was needed to give data which could be interpreted to predict the results of industrial filtration under a given degree of vacuum.

12935. Ishkin, I.P. and Kazaner, M.G. **The distribution of pores according to size in porous bodies.** *Zhur. Fiz. Khim.* 24, 943-52(1950).—*C.A.* 45, 1405*h*.

The system gas/liquid was studied experimentally and theoretically. The method was useful for the construction of the structural curves for cemented porous bodies with a pore radius of from 10 to several hundred microns. The distribution according to size agreed with the Maxwell distribution equation.

12936. Johnson, E. **A theory of fluidization and its application to sulfur recovery by solvent extraction.** *Inst. Gas Engrs.*, Copyright Pub. No. 378(a), 39 pp.(1950).—*C.A.* 45, 1823*f*.

A theory was developed from considerations of the free fall of a single sphere in a viscous fluid, the sedimentation of suspensions of solids in liquids, and by regarding a bed of fluidized solid merely as an expanded static bed. Exptl. data were obtained for SiC, coke, Al_2O_3, and spent oxide, fluidized by air, water, and a glycerol-water soln.; particle size, solid d., fluid d., fluid mass, and bed mass were also investigated.

12937. Kanagy, Joseph R. and Vickers, Robert A. III. **Factors affecting the water-vapor permeability of leather.** *J. Research Natl. Bur. Standards* 44, 347-62(1950)(Research Paper No. 2083); *J. Am. Leather Chemists' Assoc.* 45, 211-42(1950).—*C.A.* 44, 8145*e*.

Water-vapor permeability was measured and expressed as g H_2O per 25 cm^2 per 100 min., measured after rate of H_2O uptake became const. Most measurements were made at 100°F and 53% relative humidity in the external air. Time required was 4 to 5 hrs. The water permeability for 16 diverse leathers varied from 0.003 to 0.76. Evidence was presented to show that H_2O vapor passed through leather by conduction (activated diffusion) in addn. to gaseous diffusion through the pores.

12938. Kasten, Paul R. and Amundson, Neal R. **An elementary theory of adsorption in fluidized beds. Mathematics of adsorption in beds.** *Ind. Eng. Chem.* 42, 1341-6(1950).—*C.A.* 44, 7618*f*.

Calcns. were made for the adsorption by uniform, porous, spherical adsorbent particles that moved in a completely random manner in a fluid stream of uniform concn. The theory applied only to linear equil. isotherms and to nonequil. cases that were linear and reversible.

12939. Pennington, W.A. **The role of adsorption-type desiccants within refrigeration units.** *Modern Refrig.* (Brit.) 53, 218-20, 252-5(1950); *Refrig. Eng.* 59, 272-5, 300-1(1951).—*C.A.* 45, 6774*d*.

The adsorption capacity of the gel was found to increase with decreasing temp. in each phase of the refrigerant and to be much higher in the liquid than in the vapor at the same temp., the H_2O concn. of the refrigerant being the same for all the comparisons. The desiccant should be placed where the weighed H_2O satn. value for both phases was a min. By using equil. data for 37.8°C and 100% liquid, an equation was predicted in which the H_2O content of CCl_2F_2 was given as a parabolic function of the H_2O content of the gel for a desired set of conditions.

12940. Pillsbury, A.F. **Effects of particle size and temperature on the permeability of sand to water.** *Soil Sci.* 70, 299-300(1950).—*C.A.* 45, 4386*e*.

Under sterile conditions the variation of permeability with temp. was wholly a viscosity effect. Permeability appeared to be an exponential function of particle size when the medium was washed silica sand uniformly packed. The permeability was decreased at least tenfold when the particle diam. was reduced from 360 microns to 110 microns.

12941. UCHIDA, HIROSHI AND KURITA, MINORU. **Catalysts for synthesis of ammonia. VII. Size and distribution of micropores in the catalysts containing various promoters.** *Repts. Govt. Chem. Ind. Research Inst. Tokyo* 45, 173-87 (1950).—*C.A.* 46, 2246*f*.

The micropores of pure Fe_2O_3 and that contg. various promoters were detd. from 10 μ to 107 A. with Ritter-Drake's porosimeter.

12942. VERSCHOOR, H. **Pressure drop of fluids in single-phase flow through a layer of catalyst.** *Ingenieur* (Holland) 62, Ch. 29-32 (1950). —*C.A.* 44, 10383*b*.

The Carman correlation predicted the max. pressure drop within about 25% if the external area of the catalyst per unit vol. of packed space and the intergranular porosity of the layer *in situ* were known. These two parameters could be detd. in a lab. expt. with air as fluid at gas rates in the laminar-flow region.

12943. VERSCHOOR, H. AND SCHUIT, G.C.A. **Heat transfer to fluids flowing through a bed of granular solids.** *Applied Sci. Research* A2, 97-119 (1950).—*C.A.* 44, 5654*b*.

The effective coeff. of thermal cond. in a packed bed through which a fluid passed was calcd. Expts. were conducted in steam-jacketed tubes, 29.7, 43, or 50 mm diam. Glass beads (3-, 4-, 5-, 6-, and 8-mm) Pb balls (10-mm), steel balls (6-mm), terrana cylinders (5.2 × 5.2-mm), and pumice (6-8 mesh) were detd. with air, and with H_2 and 8-mm glass beads. Bed depths were 210-300 mm.

12944. WEINTRAUB, MURRAY AND LEVA, MAX. **Pressure drop through fixed and fluidized beds—a nomogram.** *Chem. Eng.* 57, No. 1, 110-13 (1950).—*C.A.* 44, 2804*i*.

Nomograms were presented for the calcn. of pressure drops through beds of granular material, for flow of gas or liquid in the streamline range and in the transitional range.

12945. AGARWAL, O.P. AND STORROW, J. ANDERSON. **Pressure drop in fluidization beds. I.** *Chemistry & Industry* 1951, 278-86.—*C.A.* 45, 6436*c*.

Fluidization tests were run on crushed coal, crushed hard brick, Geon, sand, flake graphite, absorption carbon, crushed soft brick, and crushed ceramic Raschig rings, in varying particle sizes, masses of material, and bed depths, with glass tubes (1.5-in.) as the retaining vessels and filter paper or sintered metal disks as the air distributors.

12946. AGARWAL, O.P. AND STORROW, J. ANDERSON. **Heat transfer in fluidization beds. II.** *Chemistry & Industry* 1951, 321-4.—*C.A.* 45, 7391*c*.

Heat transfer from a heated wall to the air flowing through fluidized and packed beds was investigated in a 1.5-in. I.D. Cu tube equipped with a steam jacket. Sand, graphite, soft brick, and crushed Raschig rings in different particle sizes were used as bed materials. The surface conductances for the packed and fluidized beds increased at approx. const. rate with increasing mass velocity, *G*.

12947. BARTH, W. **Pressure drop in packed towers with and without liquid flow.** *Chem.-Ing.-Tech.* 23, 289-93 (1951).—*C.A.* 45, 7825*f*.

The variations in packing types and systems were introduced by means of factors which in turn were obtained from tabular and graphical correlations of available exptl. data.

12948. BRÖTZ, WALTER. **Heat and mass transfer and pressure drop in fluid flow through packed beds.** *Chem.-Ing.-Tech.* 23, 408-16 (1951).—*C.A.* 46, 6*c*.

Measurements were made with N_2, H_2, and CO_2 on glass beads and catalyst particles of various sizes. A special app. was used for expts. at low gas velocities. Mass transfer expts. were carried out by observing mixing coeffs. of methylene blue in water flowing over glass beads. Pressure drop readings were made on all packings used.

12949. CAMPBELL, JOHN M. AND HUNTINGTON, R.L. **Heat transfer and pressure drop in fixed beds of spherical and cylindrical solids. I. Pressure drop and packed bed characteristics.** *Petroleum Refiner* 30, No. 12, 127-33 (1951).—*C.A.* 46, 1821*b*.

A study was made with cylindrical silica-alumina, hydrated alumina, tabular alumina and glass, and spherical Al and glass packing. The test chambers were made of 2-, 4-, and 6-in. standard pipe in sections 3, 4, and 6 ft in height, resp. Com. natural gas was used as the fluid. Particle surface area was correlated with equiv. diameter of chamber, fraction voids, and the area-vol. shape factor; a theoretical pressure-drop equation was derived.

12950. CHRISTENSEN, G.N. AND WILLIAMS, E.J. **Diffusion in wood. I. A quantitative theory of diffusion in porous media and its application to wood.** *Australian J. Applied Sci.* 2, 411-29 (1951).—*C.A.* 46, 5244*h*.

For diffusion under nonsteady-state conditions, it was not possible to characterize the diffusion system completely in terms of the single diffusion coeff. D detd. at the steady state. A second parameter k, and a diffusion coeff. D' such that $D = kD'$ was necessary; k was a function of the vol. occupied by the solute and solvent within the porous medium. For diffusion of NaCl through laminae, close agreement with Fick's law was observed, but with wood blocks changes in moisture distribution during diffusion caused complications.

12951. COBERLY, C.A. AND MARSHALL, W.R. JR. **Temperature gradients in gas streams flowing through fixed granular beds.** *Chem. Eng. Progress* 47, 141-50 (1951).—*C.A.* 45, 3662*b*.

Exptl. data showed that the resistance to heat transfer in the gas film at the inside of the tube wall was not negligible. Measurements of the velocity distribution of air flowing through packed tubes appeared to justify the assumption that rod-like gas flow occurs.

12952. DEADMORE, DANIEL L. **Sintered alumina for filter purposes.** *Ceram. Age* 56, No. 7, 15-17, 23-4 (1951).—*C.A.* 45, 3571*f*.

A com. grade of activated Al_2O_3 was used to prep. dry-pressed filter sections. Samples were sintered to 1720°C. Porosity, shrinkage, and filtering resistance were detd. and av. pore radius and specific surface area were calcd. Activated Al_2O_3 grains between 28- and 48-mesh sintered at 1720°C to a fairly rigid porous body when 10% of grains finer than 325-mesh were added. Grains between 36- and 65-mesh sintered with no addn. of fines.

12953. DOTSON, B.J.; SLOBOB, R.L.; MCCREERY, P.N., AND SPURLOCK, JAMES W. **Porosity-measurement comparisons by five laboratories.** *Trans. Am. Inst. Mining Met. Engrs.* **192**, *Tech. Pub.* No. 3231 (in *J. Petroleum Technol.* 3, 341-6) (1951).—*C.A.* 46, 4774*h*.

The porosities of 10 selected natural and synthetic core samples were measured, each lab. with its own method or methods of measurement. The av. deviation of porosity from the mean or av. values for the group of samples was ±0.5 porosity %.

12954. DOW, WILLARD M. AND JAKOB, MAX. **Heat transfer between a vertical tube and a fluidized air-solid mixture.** *Chem. Eng. Progress* 47, 637-48(1951).—*C.A.* 46, 789*f*.

The transfer of heat from a vertical-tube wall to fluidized beds of small solid particles was investigated experimentally in 2-in. and 3-in. diam. tubes. The fluidized mixt. consisted of particles of 3 different solid materials: Aerocat, pitch coke, and Fe, suspended in an upward flowing stream of air entering at av. velocities of 1/4 to 1 ft/sec.

12955. FRICKE, R. AND JOCKERS, K. **Porosity and surface of various aluminum hydroxides and oxides.** *Z. anorg. u. allgem. Chem.* **265**, 41-8 (1951).—*C.A.* 46, 7840*b*.

Bayerite consisted of compact crystals, whereas boehmite was porous without macropores. The oxides from boehmite were more accessible to impurities and also more stable than those from bayerite.

12956. FUKUDA, YOSHITAMI AND KAWASOE, KUNITARO. **Fundamental studies on adsorption in beds.** *Japan Sci. Rev.* 2, No. 1, 13-20(1951).—*C.A.* 47, 21*b*.

A derivation was given of equations for stripping adsorption in packed beds. Data were given for adsorption of methylene blue on 20-30-mesh sand and on powd. Pyrex glass.

12957. GOSTKOWSKI, KAZIMIERZ. **Determination of porosity.** *Hutnik* **18**, 484-5(1951).—*C.A.* 46, 7376*i*.

A comparatively simple app. for detn. of the porosity of porous materials based on displacement method was described. The time required for a single detn. did not exceed 30 min.

12958. GREEN, LEON, JR. AND DUWEZ, POL. **Fluid flow through porous metals.** *J. Applied Mechanics* 18, 39-45(1951).—*C.A.* 45, 3201*i*.

The pressure gradient attending the flow of a fluid through a porous medium was expressed as a function of flow rate by a simple quadratic equation. An equation of this type defined two length parameters necessary for characterization of a porous structure and permitted a general definition of the Reynolds no. for a structure of arbitrary complexity.

12959. HAWKSLEY, P.G.W. **The physics of particle-size measurement. I. Fluid dynamics and the Stokes diameter.** *Bull. Brit. Coal Utilisation Research Assoc.* **15**, 105-46(1951).—*C.A.* **46**, 1330*f*.

Size of nonspherical particles, methods of particle-size measurement, shape of particles, purpose of particle-size measurement, motion of particles at infinite diln., motion of clouds of particles, and motion of fluids through packed beds were reviewed.

12960. HOFFING, EDGAR H. AND LOCKHART, FRANK J. **Resistance to filtration.** *Chem. Eng. Progress* 47, No. 1, 3-10(1951).—*C.A.* 45, 1821*f*.

Theoretical equations for permeability should be directly applicable to filtration. Direct exptl. data were reported.

12961. HOUGEN, JOEL O. AND PIRET, EDGAR L. **Effective thermal conductivity of granular solids through which gases are flowing.** *Chem. Eng. Progress* 47, 295-303(1951).—*C.A.* 45, 6437*f*.

The solids investigated included five sizes of Celite cylinders, and two sizes of spherical Celite pellets. Flow rates ranged from 75 to 3700 $lb/(hr)(ft^2)$, and initial air temps. from 75 to 800°F. The mixed outlet air temp. was measured. The cooling water around the tube was maintained near 60°F.

12962. JONES, W. MERVYN. **Mobility in a sorbed layer. I. Flow of gases and vapors through porous media.** *Trans. Faraday Soc.* 47, 381-92 (1951).—*C.A.* 45, 8848*g*.

The sorbed vapor was treated as an ideal two-dimensional gas on the surface. Equations for flow through a hole in a plane sheet, through a fine capillary and through a porous material were derived. For a monolayer of Et_2O or EtCl on graphite the equations were used to describe the flow quantitatively. For the lower concns., and for other expts., an approx. solution was obtained when the surface field was taken into account, provided Langmuir's equation for unimol. adsorption was obeyed.

12963. KAUFMAN, DONALD J. AND THODOS, GEORGE. **Mass-transfer properties of commercial packings.** *Ind. Eng. Chem.* 43, 2582-6(1951).—*C.A.* 46, 2855*e*.

Analysis by a statistical method of existing data on transfer processes in single-phase flow through com. packings indicated that the effective area of the packing was the product of the total surface and a factor, f_A, defined as the "effective area factor." The av. critical effective area factors (based on spheres, $f_A = 1.00$) for the types of packing investigated were: Raschig rings 0.52; partition rings 0.75; regular cylinders 0.90; and Berl saddles 1.09.

12964. KRAMERS, H. **The viscosity of a bed of fluidized solids.** *Chem. Eng. Sci.* 1, 35-7 (1951).—*C.A.* 46, 3333*f*.

A dumbbell was rotated under constant torque applied to the rotating shaft while suspended in a fluidized bed. The fluidizing agent was air and the solid particles were sand, silica gel, and glass beads. No definite phys. properties could be ascribed to a bed of fluidized solids because it was essentially nonhomogeneous and nonuniform.

12965. Krevelen, D.W. van. **Mass transfer and kinetics in contact catalysis.** *Chem. Weekblad* 47, 427-35(1951).—*C.A.* 46, 1339*b*.
Transport of reactants toward, and products away from, the surface of a catalyst was largely convective, whereas transport within the pores was diffusive. Equations were derived for 3 types of diffusion: (1) normal, where the pore diam. was large with respect to the mean free path; (2) Knudsen, when the opposite was the case; and (3) surface, which was important when the adsorbed mols. were mobile and the pores were narrow.

12966. Leva, Max. **Elutriation of fines from fluidized systems.** *Chem. Eng. Progress* 47, No. 1, 39-45(1951).—*C.A.* 45, 1823*h*.
Basic observations on the elutriation of fines from fluidized beds were reported. The systems were composed of one coarse and one fines component. Rates of elutriation could be expressed by way of the law governing first-order chem. reactions, and typical rate consts. could be calcd. The rate consts. were related to such variables as linear gas velocity, size of coarse and fines constituents, material d., and bed height.

12967. Leva, Max; Weintraub, Murray; Grummer, Milton; Pollchik, M., and Storch, H.H. **Fluid flow through packed and fluidized systems.** *U.S. Bur. Mines, Bull.* No. 504, 149 pp.(1951).—*C.A.* 46, 788*d*.
The design of new equipment in which fluids were brought into contact with granular materials was studied.

12968. Martin, J.J.; McCabe, W.L., and Monrad, C.C. **Pressure drop through stacked spheres. Effect of orientation.** *Chem. Eng. Progress* 47, No. 2, 91-4(1951).—*C.A.* 45, 4972*i*.
Pressure drops for the flow of fluids through beds of spheres packed in various geometrical patterns were detd. experimentally, air and viscous oil being used. Pressure drop was markedly affected by geometric orientation as well as porosity.

12969. Miller, Clark O. and Logwinuk, A.K. **Fluidization studies of solid particles.** *Ind. Eng. Chem.* 43, 1220-6(1951).—*C.A.* 45, 5460*b*.
A "crit. mass velocity" was related to the fluid and solids properties and was found to be independent of wt or bed height for a given material. Heat-transfer studies from a hot, dense fluid bed to a vertical, cool tube were carried out; 3 gases and 2 solids were utilized. The coeffs. ranged from 40 to 200 B.t.u./hr ft^2 °F. Electrostatic effects prevalent during fluidization were discussed.

12970. Miller, Frank G. **Steady flow of two-phase single-component fluids through porous media.** *Trans. Am. Inst. Mining Met. Engrs.* 192, *Tech. Pub.* No. 3079 (in *J. Petroleum Technol.* 3, No. 7, 205-16)(1951).—*C.A.* 45, 8303*b*.
Propane entered the column entirely as a liquid, started to vaporize at a considerable distance from the inlet, and then flowed in 2 phases throughout the remainder of the column. Math. theory was developed to calc. the total rate of flow and the pressure distn. along the column of sand, for a given pressure and temp. of the all-liquid entering stream, a given pressure or temp. of the discharging gas-liquid mixt., and given sand and fluid characteristics.

12971. Morales, Maximo; Spinn, C.W., and Smith, J.M. **Velocities and effective thermal conductivities in packed beds.** *Ind. Eng. Chem.* 43, 225-32(1951).—*C.A.* 45, 3659*i*.
The variation in fluid velocity with radial position in a packed bed was detd. experimentally.

12972. Morse, R.D. and Ballou, C.O. **The uniformity of fluidization—its measurement and use.** *Chem. Eng. Progress* 47, 199-204 (1951).—*C.A.* 45, 6436*g*.
Based on the oscillograph records, a Uniformity Index was proposed which combined empirically the two factors of the extent of the deviations in the curve and the duration of the deviations. Thus, Uniformity Index = (Av. Deviation, %)/Frequency. The lower the Index, the better was the uniformity of the bed. Examples showed the effect of particle-size distribution, gas velocity, initial gas distribution, and bed height, and uniformity at various levels within the bed.

12973. Olin, H.L. and Patterson, J.S. **Fluidization.** *Petroleum Engr.* 23C, No. 6, 5-9 (1951).—*C.A.* 45, 10552*h*.
Fluidization of sands and siliceous catalysts, either clean or fouled with tar, resin, wax, or petroleum jelly, was characterized by measuring pressure drop as a function of modified Reynolds no.

12974. Osberg, G.L. and Charlesworth, D.H. **Elutriation in a fluidized bed.** *Chem. Eng. Progress* 47, 566-70(1951).—*C.A.* 46, 297*d*.
Narrow cuts of Scotchlite bead dust were elutriated from fluidized Scotchlite bead beds in a lab. unit 3-in. in diam. At low initial dust concns., the rate data could be represented by a first-order plot, the slope of which was taken as the elutriation rate const.

12975. Piret, Edgar L.; Ebel, R.A.; Kiang, C.T., and Armstrong, W.P. **Diffusion rates in extraction of porous solids. II. Two-phase extractions.** *Chem. Eng. Progress* 47, 628-36(1951).—*C.A.* 46, 789*i*.
The rates of extn. or diffusion of sol. materials from capillaries, porous slabs, and spheres in the unsteady state were studied. The use of a pore-shape factor to characterize the retarding effect of the porous structure of the inert solid which had been previously proposed for single-phase extns. was shown to be applicable also to two-phase systems.

12976. Prager, Stephen. **The calculation of diffusion coefficients from sorption data.** *J. Chem. Phys.* 19, 537-41(1951).—*C.A.* 45, 9333*d*.
The dependence of the diffusion coeff. on the concn. of diffusing material was calcd. from data obtained by studying the rates of sorption of vapors by films. The actual concn. dependence was approximated by a step function. For such a

function the differential equations involved could be solved analytically and the heights of the individual steps computed; the step function was then smoothed out by an averaging process. The method was tried out for the sorption of isobutane by polyisobutylene at 35°C and found to be satisfactory.

12977. SMIRNOV, N.I. AND LI, DE EP. **Motion of a flow across a layer of solid particles.** *Zhur. Priklad. Khim.* (J. Applied Chem.) 24, 56-60(1951).—*C. A.* 47, 379*i*.

The phenomenon of solid particles maintained in suspension by a countercurrent of a liquid or gas was studied. It consisted of 3 processes, one being the flow of the liquid or gas through the tube filled with the solid particles, the 2nd an increase of the height of the solid layer as a result of the sepn. of the particles by the flow, and the 3rd the maintenance of the upper level of the layer at the attained height.

12978. SMITH, NORMAN L. AND AMUNDSON, NEAL R. **Intraparticle diffusion in catalytic heterogeneous systems.** *Ind. Eng. Chem.* 43, 2156-67 (1951).—*C. A.* 46, 29*e*.

A simple reversible reaction, 1st order in each direction, was assumed to take place inside the particle. The equations obtained related the phys. and chem. parameters of the system to the operating variables. In order to obtain exptl. confirmation, the hydrolysis of an ester, Et formate, was studied; Dowex 50, a cation-exchange resin, was used as catalyst.

12979. SUITO, EIJI AND HIRAI, NISHIO. **Measurement of the particle-size distribution of powder by the thermal analysis of reaction velocity. I. Theory.** *J. Chem. Soc. Japan*, Pure Chem. Sect., 72, 713-15(1951).—*C. A.* 46, 1330*g*.

If the reaction velocity was proportional to the surface area of monodisperse powders, the relation between the time variation of reaction velocity and the time should be represented by a straight line. The theory was extended to the case of polydisperse systems, in which case the time variation of reaction velocity *vs.* time curve was no longer linear.

12980. THIRION, P.; AMERONGEN, G.J. VAN, AND CHASSET, R. **Reduction by fillers of the permeability of natural rubber to gases.** *Rev. gén. caoutchouc* 28, 684-91(1951).—*C.A.* 46, 2327*e*.

The theoretical reduction in permeability of vulcanized rubber by a spherical or lamellar filler could be calcd. if the assumption was made that it was dispersed uniformly and that the orientation remained unchanged. The validity of this theory was verified in a qual. way by lab. measurements of the permeability coeffs., of N_2, and of rubber mixts. contg. a spherical filler (whiting) and a lamellar one (mica). Quant. verification necessitated knowledge of the degree of orientation and shape factor of the particles.

12981. VLUGTER, J.C. AND VERSCHOOR, H. **Introduction to the technology of catalytic processes.** *Chem. Weekblad* 47, 465-71(1951).—*C.A.* 46, 1668*c*.

Fixed-bed, slurry, fluid, and moving-bed processes were compared in their approaches to the problems of mass and heat transfer and of catalyst regeneration.

12982. VOGT, WALTHER. **A simple apparatus for constant flow through adsorption columns.** *Chem.-Ing.-Tech.* 23, 580-1 (1951).—*C.A.* 46, 3330*g*.

A capillary tube arrangement suitable for either downward or upward flow was used.

12983. WILHELM, RICHARD H. AND VALENTINE, STEPHEN. **The fluidized bed. Transition state in the vertical pneumatic transport of particles.** *Ind. Eng. Chem.* 43, 1199-1203(1951).—*C.A.* 45, 5460*d*.

Expts. were made in a 4-in. vertical tube contg. clay spheres in 3 sizes between 0.02 and 0.03 ft in diam. Fluidized beds were formed as the direction of motion of the particles changed from cocurrent to countercurrent, relative to the rising air stream. The fluidized bed in an open, vertical tube depended upon particle properties and upon flow rates of supporting fluid and particle streams.

12984. WILLIAMS, P.S. **Some effects on the flow of concentrated suspensions of variations in particle size and shape.** *Discussions Faraday Soc.* No. 11, 47-55, discussion 86, 94-5(1951).—*C.A.* 46, 8871*f*.

Fundamental data having application in paint technology were obtained from a study of shear stress-shear rate data for concd. suspensions of glass or SiO_2 spheres. The spheres were made by melting fine glass or SiO_2 powders and fractionated by settling and continuously siphoning off the suspension contg. the finer particles. Shear measurements were made in a coaxial cylinder viscometer with fractionated spheres suspended in aq. glycerol or hydrocarbon oil.

12985. WILSON, L.H.; SIBBITT, W.L., AND JAKOB, M. **Flow of gases in porous media.** *J. Applied Phys.* 22, 1027-30(1951).—*C.A.* 46, 1330*e*.

Exptl. data indicated that viscous flow existed if the ratio of mol. mean free path to pore diam. was less than 0.025; free mol. flow if it was 1.6 or more. These ratios could be used to indicate the nature of flow in a porous medium provided the pore size was known, or they could be used to det. pore size experimentally.

12986. YAGI, SAKAE AND TAKAGI, KAZUMI. **Fluidization of powdered beds.** *Chem. Eng.* (Japan) 15, 212-17(1951).—*C.A.* 45, 8418*i*.

Expts. detd. various conditions of fluidization of pyrrhotite particles. The crit. height of the bed, where slugs were cast, was inversely proportional to the 1/2 power of the diam. of the particle.

12987. YOSHIDA, FUMITAKE AND TANAKA, TATSUO. **Air-water contact operations in a packed column.** *Ind. Eng. Chem.* 43, 1467-73(1951).—*C. A.* 45, 7391*e*.

Mass and heat-transfer coeffs. for the 3 operations, const. water-temp. humidification, water cooling, and dehumidification, were detd. in columns packed with ceramic Raschig rings. The same equations for gas and liquid-film coeffs. could be applied to all 3 operations.

12988. Balluffi, R.W. and Alexander, B.H. **Development of porosity during diffusion in substitutional solid solutions.** *J. Appl. Phys.* 23, 1237-44(1952).—*C.A.* 47, 1453*i*.

A metallographic study was made of the diffusion zones present in Cu-α-brass, Cu-Ni, and Au-Ag diffusion couples. Usual sandwich-type couples and also vapor-solid-type couples in which the higher vapor pressure component was diffused either into or out of the couple through the vapor phase were investigated. Significant porosity was always generated by diffusion in the sandwich couples and also in the vapor-solid couples when the higher-vapor-pressure component was diffused out of solid soln.

12989. Bartholomew, Richard N. and Katz, Donald L. **Heat transfer from the wall of a tube to a fluidized bed.** *Chem. Eng. Progress Symposium Ser.* 48, No. 4, *Reaction Kinetics and Transfer Processes,* 3-10(1952).—*C.A.* 47, 1437*g*.

Heat-transfer coeffs. to fixed fluidized beds were detd. in a steel reactor 4 in. in diam. and 30 in. high. Bed materials consisted of sand, Al, and Ca carbonate particles in mixts. of both wide and narrow size ranges, fluidized by air. The heat-transfer data, obtained at wall temps. of 400° and 600°F, were correlated in terms of 4 dimensionless groups.

12990. Brötz, Walter. **Principles of fluidization processes.** *Chem.-Ing.-Tech.* 24, 60-81(1952).—*C.A.* 46, 3810*d*.

A comprehensive treatise was presented covering pressure drop, min. and max. fluid velocities for stability of the fluidized bed, bed expansion, viscosity behavior, flow angle, mass and heat transfer, attrition of solids and equipment erosion, and chem. reactions in fluidized beds.

12991. Campbell, John M. and Huntington, R.L. **Heat transfer and pressure drop in fixed beds of spherical and cylindrical solids. II. Heat transfer and temperature gradients.** *Petroleum Refiner* 31, No. 2, 123-31(1952).—*C.A.* 46, 3333*c*.

Heat transfer was studied in several vertical cylinders in packed beds of packing materials previously described having widely different phys. and thermal properties. Two basic approaches were used, one based on dimensional analysis and the other based on differential heat balances.

12992. Chatenever, Alfred. **An introduction to flow of oil and water in porous media.** *Oil Gas J.* 51, No. 3, 174-5(1952).—*C.A.* 46, 7747*f*.

The behavior of fluids in porous media at a microscopic level with porous matrices of 1 or 2 layers was reviewed.

12993. Chrétien, André and Papée, Denis. **The porosity of some adsorbent products.** *Compt. rend.* 234, 214-16(1952).—*C.A.* 46, 4881*d*.

Microporosity, a property specific to a substance, was detd. from the proportion of vapors of H_2O, CCl_4, $CHCl_3$, and C_2HCl_3 at 20°C adsorbed by boehmite, bayerite, silica gel, and pptd. SiO_2, all having been heated at 400°C for 14 hrs. The total pore vol. was detd. by immersion, and macroporosity by difference. The silica gel lost microporosity when heated at 800°C, but this was partly restored by treatment with water vapor.

12994. Chu, P.C. and Storrow, J. Anderson. **Heat transfer to air flowing through packed tubes.** *Chem. Eng. Sci.* 1, 230-7(1952).—*C.A.* 47, 1438*h*.

The effect of packing diam., packing thermal cond., and ratio of packing length to tube diam. was studied in the transfer of heat from the wall of a steam-heated 1-in.-bore copper tube to air for *Re* up to 3500. The length of the packed tube was an important variable, but the packing diam. had little effect on the heat transfer.

12995. Eichhorn, Jacob and White, Robert R. **Particle-to-fluid heat transfer in fixed and fluidized beds.** *Chem. Eng. Progress Symposium Ser.* 48, No. 4, *Reaction Kinetics and Transfer Processes,* 11-18(1952).—*C.A.* 47, 1437*d*.

Steady-state heat transfer between solid and gas in fixed and fluidized beds was studied as a function of particle size, gas velocity, and gas properties. In the fixed-bed runs the particle diam. ranged from 0.0658 cm (24/28 mesh) to 0.0102 cm (150/170 mesh) and the modified Reynolds no. from 1 to 18. In the fluidization runs, particles 0.0841 cm (20/24 mesh) to 0.0140 cm (100/115 mesh) were used. The modified Reynolds no. extended from 0.7 to 28. Dielec. heating was used to generate heat continuously in a system of plastic particles, and the heat was removed by a gas stream flowing through the bed of heated particles.

12996. Engelhardt, W.v. and Schindewolf, E. **The filtration of clay suspensions.** *Kolloid-Z.* 127, 150-64(1952).—*C.A.* 47, 282*g*.

Test with suspensions of a natural clay indicated that a proposed simplified representation was not very accurate. However, it was sufficiently accurate for the 1st hr of filtration and also for certain ranges during the course of filtration.

12997. Ergun, Sabri. **Fluid flow through packed columns.** *Chem. Eng. Progress* 48, 89-94(1952). —*C.A.* 46, 2859*f*.

Pressure losses were caused by simultaneous kinetic and viscous energy losses, and a comprehensive equation applicable to all types of flow was proposed. The equation was examd. from the point of view of its dependence upon flow rate, properties of the fluids, and fractional void vol., orientation, size, shape, and surface of the granular solids. Whenever possible, conditions were chosen so that the effect of one variable at a time could be considered.

12998. Flood, E.A.; Tomlinson, R.H., and Leger, A.E. **The flow of fluids through activated carbon rods. I. II. The pore structure of activated carbon. III. The flow of adsorbed fluids.** *Can. J. Chem.* 30, 348-71, 372-85, 389-410(1952).—*C.A.* 46, 8787*g*; 47, 1461*d*.

Total flow rates consisted of the sums of comparatively independent flows through macropores and micropores. The flow rate through the macropore system was related to the relevant adsorption isotherm by an empirical equation that fitted the data within exptl. error. A simple flow equation, qualitatively in agreement with results, gave a mean micropore diam. of the order of 10^{-7} cm. Surface forces may increase flow rates of adsorbable gases by very large factors, owing mainly to the greatly increased ds. and to the increased pressure gradients resulting from action of surface forces.

12999. Gilliland, E.R. and Mason, E.A. **Gas mixing in beds of fluidized solids.** *Ind. Eng. Chem.* 44, 218-24(1952).—*C.A.* 46, 4859*e*.

Experimental work was divided into 2 phases, back-mixing and residence time studies. In back-mixing a tracer gas, He, was introduced into the fluidized bed and gas samples were taken from various positions and analyzed. In residence time studies the solid was fluidized with a He-air mixt. and the compn. of the exit gas detd. as a function of time after tracer gas addn. was discontinued. No correlation was observed between residence time curves and superficial gas velocity. Exptl. results indicated nearly complete mixing with considerable gas bypassing.

13000. Kasten, Paul R.; Lapidus, Leon, and Amundson, Neal R. **Mathematics of adsorption in beds. V. Effect of intra-particle diffusion in flow systems in fixed beds.** *J. Phys. Chem.* 56, 683-8(1952).—*C.A.* 47, 9065*b*.

Equations were derived for heat and mass-transfer operations in fixed beds of solids. Intraparticle diffusion or conduction was considered as well as transfer at the particle surface, assuming a linear adsorption isotherm and negligible longitudinal diffusion.

13001. Klute, Arnold. **A numerical method for solving the flow equation for water in unsaturated materials.** *Soil Sci.* 73, 105-16(1952).—*C.A.* 47, 3081*i*.

An equation describing the flow of water in unsatd. porous materials was derived from Darcy's law and the equation of continuity. A numerical method of solution for semi-infinite horizontal systems of flow was described and applied to 2 examples. The phenomenon of a wetting front was indicated when the variation of the diffusivity with moisture content was considered.

13002. Lewis, E.W. and Bowerman, Ernest W. **Fluidization of solid particles in liquids.** *Chem. Eng. Progress* 48, 603-10(1952).—*C.A.* 47, 924*f*.

Flow characteristics for batch fluidization of fine nonuniformly sized solids in liquids were investigated and compared with the results when glass spheres of const. diam. were used in the Stokes' law region. Data were correlated through free-motion considerations of these systems.

13003. Maeda, Shiro. **Heat transfer of granular catalysts. I. Theroretical equations and experiments for the heat transfer between the gas flowing through granular solids and the cylindrical wall.** *Technol. Repts. Tohoku Univ.* 16, No. 2, 1-17(1952).—*C.A.* 47, 3627*f*.

Hot air was passed through a small column packed with granules while the wall temp. was maintained constant. Temps. of inlet and outlet gas and distribution through the cylinder were measured by thermocouples. The differential equation for heat transfer was solved, and exptl. results checked theoretical values closely. Internal heat transfer was influenced by granules and the turbulent gas stream.

13004. Matthews, David E. **The semipermeability of silver membranes.** *Univ. Microfilms* (Ann Arbor, Mich.), *Pub.* No. 4403, 60 pp. (microfilm $1.00, paper enlargements $6.00); *Dissertation Abstracts* 12, 830-1(1952).—*C.A.* 47, 3081*g*.

13005. Molino, Donald F. and Hougen, Joel O. **Thermal conductivity of granular solids through which gases are flowing.** *Chem. Eng. Progress* 48, 147-9(1952).—*C.A.* 46, 4859*b*.

The effective thermal cond. of certain granular solids through which gases were flowing was studied. The gas (air) was heated during downward flow through the cylindrical bed of granular material. The results on Celite were given in tables and in graphs with Reynolds nos. as ordinates.

13006. Morrison, H.L. and Rogers, F.T. Jr. **Significance of flow-patterns for initial convection in porous media.** *J. Appl. Phys.* 23, 1058-9(1952).—*C.A.* 47, 357*d*.

A modification of theory, supported by new observations of flow patterns, led to more nearly valid understanding of available data on convection of a liquid in a porous medium.

13007. Nagata, S.; Matsuyama, T.; Hashimoto, N., and Hase, H. **Studies on the fluidized catalyst with mechanical agitation.** *Chem. Eng.* (Japan) 16, 301-6(1952).—*C.A.* 46, 9747*e*.

The direct synthesis of org. silicon compds. was carried out in the small-scale reactor (4 cm in diam. and 60 cm long) with mech. agitation (100 ~ 450 r.p.m.). The results obtained were superior to that obtained in the fixed beds or in the ordinary fluidized beds without agitation.

13008. Pinkus, Oscar. **Pressure drops in the pneumatic conveyance of solids.** *J. Appl. Mechanics* 19, 425-31(1952).—*C.A.* 47, 924*h*.

Expts. were performed to det. the relationship between pressure loss, solids flow rate, and air velocity, and to obtain values for the frictional consts. involved in the analysis. The presence of the solid phase caused an appreciable pressure loss which was a linear function of both solid- and gas-flow rate; this justified the theoretical equations which predicted such a relationship. Expts. with two sizes of the same sand showed a higher pressure drop for the larger particles, other conditions being equal.

13009. Ranz, W.E. **Friction and transfer coefficients for single particles and packed beds.** *Chem. Eng. Progress* 48, 247-53(1952).—*C.A.* 46, 5896*f*.

Transfer rates and friction factors for spheres were related through the application of a simple model to heat- and mass-transfer rates and pressure drops in beds packed with spherical particles. Equations for estg. effective thermal cond. and diffusivity were derived and parametric consts. relating the actual fluid velocity and the av. lateral velocity to the superficial velocity were shown to characterize the performance of a packed bed.

13010. ROSEN, J.B. **Kinetics of a fixed-bed system for solid diffusion into spherical particles.** *J. Chem. Phys.* 20, 387-94(1952).—*C.A.* 46, 7410*c*.
A solution was presented for the general problem of the transient behavior of a linear fixed-bed system where the rate of adsorption was detd. by the combined effect of a liquid film and solid diffusion into spherical particles. The result obtained was an expression for the effluent following a sudden change in the influent concn. The approx. solution and the error term were given as closed trigonometric expressions which could be easily evaluted.

13011. SCHULER, R.W.; STALLINGS, V.P., AND SMITH, J.M. **Heat and mass transfer in fixed-bed reactors.** *Chem. Eng. Progress Symposium Ser.* 48, No. 4, *Reaction Kinetics and Transfer Processes*, 19-30(1952).—*C.A.* 47, 1439*b*.
New exptl. conversion *vs.* catalyst-bed-depth data were obtained for analyzing the design procedures proposed for gas-solid catalytic reactors. Radial-heat-transfer data in terms of effective thermal conds. were presented for 1/8-, 3/16-, and 1/4-in. cylindrical pellets in a 2-in. internal diam. tube through which air flowed at mass velocities from 150 to 750 lb/hr ft^2. An approx. breakdown into sep. contributions owing to radiation, solid-solid conduction, eddy transfer, etc., was presented. Measurements indicated that the usual assumption of const. mass velocity in packed tubes was not warranted in cases where the tube diam. was relatively small.

13012. TANAKA, TATSUO AND SAITO, NOBUKI. **Ball-mill grinding of several ceramic materials. I.** *J. Ceram. Assoc. Japan* 60, 228-30(1952).—*C.A.* 46, 8340*f*.
The residue *(R)* on a 0.088-mm sieve and the specific surface area (S_a) were compared detd. by air permeability. S_a increased with time of grinding in the decreasing order: limestone, ganister, coal, cement clinker; while the decreasing order of *R* was lime, cement clinker, coal, ganister. This was due to the difference in particle distribution. Limestone formed many flakes.

13013. TOOMEY, ROBERT D. AND JOHNSTONE, H.F. **Gaseous fluidization of solid particles.** *Chem. Eng. Progress* 48, 220-6(1952).—*C.A.* 46, 5896*i*.
The system was assumed to attain the most stable configuration, and the particles were shown to be at their terminal velocities. From these considerations the av. Reynolds no. in the dense continuous phase was essentially independent of the superficial gas velocity. The gas flow through the interstices of the bed, both at incipient fluidization and at higher velocities, could be estd.

13014. TRAWINSKI, H. **Heat transfer between fluidized beds and container wall.** *Chem.-Ing.-Tech.* 24, 444-6(1952).—*C.A.* 46, 9898*c*.
An interpretation of the heat-transfer mechanism was given. The effects of gas velocity, particle size, phys. properties of particles and gas, bed d. and bed dimensions were combined into an empirical formula.

13015. VAN BAVEL, C.H.M. **Gaseous diffusion and porosity in porous media.** *Soil Sci.* 73, 91-104 (1952).—*C.A.* 47, 3081*h*.
A method was proposed for measuring the diffusivity of vapors through porous media. The exptl. results showed that the ratio between diffusivity in a porous medium and in gaseous phase was of the order of 0.6.

13016. WICKE, EWALD AND BRÖTZ, WALTER. **Proposed nomenclature for the flow of fluids through porous beds.** *Chem.-Ing.-Tech.* 24, 58-9(1952).—*C.A.* 46, 3810*h*.

13017. WICKE, E. AND HEDDEN, K. **Fluid patterns and heat transfer in fluidized beds.** *Chem.-Ing.-Tech.* 24, 82-91(1952).—*C.A.* 46, 3810*b*.
Heat transfer from a suspended heater to the air-fluidized bed was compared with the fixed bed and the empty tube. Coeffs. in the fluidized bed and the fixed bed, resp., were approx. 8 and 4 times the coeffs. obtained for the empty tube. Optimum coeffs. were obtained at a velocity which corresponded to about twice the velocity at which the bed started to expand.

13018. WICKE, EWALD AND VOLLMER, W. **Flow of gases through micropores.** *Chem. Eng. Sci.* 1, 282-91(1952).—*C.A.* 47, 4142*a*.
Experimental information on the flow of the gases CH_4, N_2, NH_3, CO_2, H_2, and CO through micropores was given. The region of special study was that in the transition zone between laminar and mol. flow. The effect of the mean gas pressure and of the temp. on the flow was examd.

13019. YAGI, SAKAE; MUCHI, IWAO, AND AOCHI, TETSUO. **Conditions of fluidization.** *Chem. Eng.* (Japan) 16, 307-12(1952).—*C.A.* 46, 9348*b*.
Expts. were made to study the effects of various factors which det. the conditions of fluidization in fluidized beds of air and particles (Fe, pyrrhotite, sand, coke, coal, etc.). A nomograph was constructed to det. easily the suitable conditions of fluidization for given particles.

13020. YAGI, SAKAE AND SHIRAI, TAKASHI. **Fluid flow through fluidized solid beds—a nomograph.** *Chem. Eng. (Japan)* 16, 2-6(1952).—*C.A.* 46, 2351*i*.
A nomograph was presented. Numerical examples of use of nomograph agreed well with data for Fischer-Tropsch Fe catalyst and with published water fluidization data of sand.

13021. CHU, JU CHIN; KALIL, JAMES, AND WETTEROTH, WM. A. **Mass transfer in a fluidized bed.** *Chem. Eng. Progr.* 49, 141-9(1953).—*C.A.* 47, 4142*b*.
Transfer was studied between regular-shaped solids and a turbulent gas stream for both fixed and fluidized granular beds. The data were found in agreement with practically all the fixed-bed data of widely varying systems, as well as with data for fluidized liquid-solid beds. The Chilton-Colburn analogy of mass transfer and pressure drop for flow in conduits was modified for flow in granular beds. The resulting relation

held remarkably well over a wide range of Reynolds and Schmidt nos., making possible the prediction of mass-transfer data in granular beds from the more easily obtained pressure-drop data.

13022. Cornell, David and Katz, Donald L. **Flow of gases through consolidated porous media.** *Ind. Eng. Chem.* 45, 2145-52(1953).—*C.A.* 48, 411*d*.

Data were obtained for 4 gases (air, N_2, He, CH_4) passing through 24 specimens of sandstones, limestones, and dolomites. These were correlated by using flow equations expressed in terms of measurable quantities, including permeability, porosity, and elec. resistivity. In the absence of complete flow data, these equations and procedures could be used to predict gaseous flow through consolidated porous media.

13023. Dryden, C.E.; Strang, D.A., and Withrow, A.E. **Mass transfer in packed beds at low Reynolds number.** *Chem. Engr. Prog.* 49, 191-6 (1953).—*C.A.* 47, 5179*i*.

Exptl. data were given for the transfer of mass from solid pellets in packed beds to water flowing at low velocities in the surrounding voids. Solids employed were 2-naphthol and benzoic acid. Other variables not prevalent in the turbulent region were discussed for the transition and laminar regions. The need for further work in all regions for both liquids and gases was pointed out with specific recommendations.

13024. Gilliland, E.R.; Mason, E.A., and Oliver, R.C. **Gas-flow patterns in beds of fluidized solids.** *Ind. Eng. Chem.* 45, 1177-85(1953).—*C.A.* 47, 8422*c*.

The gas-flow pattern in small fluidized-solid reactors had an important effect on chemical conversion. Residence-time data could be used to predict the magnitude of this effect for all orders of homogeneous reactions. He and CO_2 were used as tracers in studying residence times and gas-mixing. The oxidation of NO was studied in glass reactors by using glass beads as the fluidized solid.

13025. Grace, H.P. **Resistance and compressibility of filter cakes.** *Chem. Eng. Progr.* 49, 303-18(1953).—*C.A.* 47, 7835*g*.

Exptl. development and application of a compression-permeability technique were described for studying the properties of compressible cakes. Results were presented for cakes of 17 materials of subsieve and submicron ultimate particle size. Data on specific cake resistance, cake porosity, effective specific surface of cake solids, and phys. cake compressibility were correlated over a range of uniform compressive pressure of from 1 to 2700 p.s.i.

13026. Grace, H.P. **Resistance and compressibility of filter cakes. II. Under conditions of pressure filtration.** *Chem. Eng. Progr.* 49, 367-77(1953).—*C.A.* 47, 8420*d*.

Methods for interpreting compression-permeability data in terms of actual pressure filtration conditions were applied to prediction of av. specific cake-resistance values for 10 materials. These predicted values were found to agree within ± 10% with values detd. from actual pressure filtration over a range of filtration pressure drop from 10 to 450 p.s.i. With several materials this agreement remained valid when suspensions were used that were characterized by different degrees of particle flocculation of the same material and that yielded cakes of widely different properties.

13027. Grace, H.P. **Resistance and compressibility of filter cakes. III. Under conditions of centrifugal filtration.** *Chem. Eng. Progr.* 49, 427-36(1953).—*C.A.* 47, 9676*a*.

Interpretation of compression-permeability data in terms of conditions of centrifugal filtration was considered for general and simplified cases. Forces existing in centrifugal filtration were analyzed, and a simplified centrifugal-rate equation was developed. Results of centrifugal-drainage rate and centrifugal-filtration runs for 4 materials were correlated in terms of this simplified-rate equation.

13028. Grumer, Joseph; Schultz, Harold, and Harris, Margaret E. **Calibration of glass-wool flowmeters.** *Anal. Chem.* 25, 840(1953).—*C.A.* 47, 8418*d*.

A single gas calibration of the National Bureau of Standards glass-wool, porous-plug flowmeter was extended to gaseous mixts. by a simple calcn. based on the d. and viscosities of the gases.

13029. Martin, Jean. **Experimental study of fluidized solid-gas systems.** *Chimie & industrie* 69, 57-71(1953).—*C.A.* 47, 5180*c*.

Finely divided solid material fluidized by gas was investigated on a lab. scale. Sand and coke (70-100 mesh, 100-140 mesh, 140-200 mesh, 200-300 mesh) were used in the expts. The min. rate of fluidization for a finely divided solid could be calcd. with high accuracy by applying hydrodynamic equations.

13030. Ponomarev, V.D. and Ni, L.P. **Dependence of specific resistance in filtration on the diameter of particles and on porosity.** *Izvest. Akad. Nauk Kazakh. S.S.R. No.* **118**, *Ser. Khim. No.* 6, 3-10(1953).—*C.A.* 48, 2419*b*.

The dependence of the resistance on particle size and porosity for ppts. of quartz and galenite agreed well with the theoretical calcn. made by the equation: $r = k(1 - e)^2/d^2e^3$, where $k = 1/C$, C being the coeff. depending on the form or cross section of pores of the ppt. and on viscosity of the liquid; r was the specific resistance of ppt. layer; d was the particle diam.; e was the porosity. For Fe oxide ppts. and for alumina an empirical equation was satisfactory: $r = k(1 - e)^{4.5}/d^{1.6}e^3$.

13031. Schwartz, C.E. and Smith, J.M. **Flow distribution in packed beds.** *Ind. Eng. Chem.* 45, 1209-18(1953).—*C.A.* 47, 3425*e*.

Variations in velocity profiles may be important in catalytic reactors and packed-bed heat exchangers. For ratios of pipe-to-pellet diams. of less than 30, divergence from a flat profile increased as the ratio decreased. A correlation was given for pellets 0.125-0.5 in. in diam. in pipes 2-4 in. in diam.

13032. Sittig, Marshall. **Fluidized solids.** *Chem. Eng.* 60, No. 5, 219-31(1953).—*C.A.* 47, 6194*e*.

The design of modern fluidization equipment was discussed in detail, including methods of solids prepn., solids addn. to the system, types and arrangement of reaction vessels, methods of reactant sepn. and heat exchange, and instrumentation. Applications of fluidization were discussed for phys. processes such as heat transfer, evapn., adsorption, drying, pollution control, and size reduction, and for chem. processes such as pyrolysis, halogenation, oxidation, or reduction.

13033. Sutherland, K.L. and Winfield, M.E. **Transient rates of gas sorption. II. Rate equations for transport and adsorption in porous adsorbents.** *Australian J. Chem.* 6, 234-43(1953).—*C.A.* 48, 21*g*.

Equations were derived to describe the rate at which gas passed into a bed of adsorbent under conditions of const. vol. and diminishing pressure. Processes considered were: (1) Knudsen flow within the bed, or within granules of which the bed was composed together with simultaneous adsorption that was too fast to be a limiting factor; (2) chemisorption controlled by rate of Knudsen flow, (3) unrestricted chemisorption.

13034. Weiss, D.E. **Countercurrent adsorption separation processes. II. Shell adsorbents.** *Australian J. Appl. Sci.* 4, 510-18(1953).—*C.A.* 48, 3071*c*.

A theoretical discussion was given of the advantages of an adsorbent having a porosity limited to its outer shell. The suitability for mech. handling, rapid attainment of equil., and a consequent high rate of mass transfer made such adsorbents of particular value for use in continuous countercurrent adsorption processes.

13035. Wicke, E. and Trawinski, H. **Mixing of the fluid medium in liquid-porous media systems.** *Chem. Ing.-Tech.* 25, 114-24(1953).—*C.A.* 47, 5179*d*.

The flow of water through beds of glass beads (d. 2.84) of varying diam. (0.9-10.0 mm), pressed beads (d. 1.33, 9.8 mm diam.) and clay beads (d. 1.50, 12 mm diam.) was studied by observing the dispersion of indicator streams of HCl and hot water. The dispersion followed the diffusion laws and "mixing coeffs." could be detd. from observed distribution profiles.

13036. Wilson, B.W. **The sedimentation of dense suspensions of microscopic spheres.** *Australian J. Appl. Sci.* 4, 274-99(1953).—*C.A.* 47, 9065*d*.

Concd. suspensions of Pyrex microspheres 3.5 to 15 μ in diam. were used to interpret the roles of viscous friction and surface forces during the sedimentation of microscopic particles in liquids. Within the limits of collective sedimentation viscous forces resembled those acting on a sphere settling in a narrow cylinder and those acting in liquids flowing through beds of spheres, while surface forces were confined to kinetic friction and adhesion between the spheres.

13037. Wilson, B.W. **The permeability of beds of microscopic spheres.** *Australian J. Appl. Sci.* 4, 300-15(1953).—*C.A.* 47, 9065*e*.

Thin filter membranes formed by sintering Pyrex microspheres were used to support beds of spheres measuring between 1 and 10 μ in diam. The permeability to water of both compacted and highly porous beds were compared with that predicted by semiempirical theory based on large scale models, and a theory of agglomeration proposed to account for changes in porosity and permeability.

VI-7. X-Ray Investigations—Electron Microscope

13038. Hendricks, Sterling B. and Fry, William H. **The results of x-ray and microscopical examinations of soil colloids.** *Soil Science* 29, 457-79(1930).—*C.A.* 24, 3848.

Microscopical examn. and x-ray powder diffraction photographs of finely divided materials sepd. from soil by suspension methods showed that these fractions contained cryst. substances. The colloids showed diffraction patterns of 3 general classes: montmorillonite, halloysite and ordovician bentonite. Each of the types of x-ray pattern was found over a considerable range of values of the SiO_2-R_2O_3 ratio. Colloids from a specific type of soil obtained from widely different localities gave the same type of diffraction pattern.

13039. Kelley, W.P.; Dore, W.H., and Brown, S.M. **The nature of the base-exchange material of bentonite, soils and zeolites, as revealed by chemical investigation and x-ray analysis.** *Soil Science* 31, 25-55(1931).—*C.A.* 25, 1317.

Replaceable bases of several samples of bentonite were detd. before and after grinding in a ball mill for different lengths of time. Grinding greatly increased the exchangeable bases, particularly the Mg and K. Seventy-two hrs grinding served to render most of the bases exchangeable. X-ray studies of these various colloidal materials showed them to be cryst., and the lines in the x-ray patterns were greatly dimmed by grinding. Certain of the soil colloids were closely related to the montmorillonite-beidellite clays, others to the potash bentonites and still others to the halloysite type of clay minerals.

13040. Hofmann, Ulrich; Endell, Kurd, and Wilm, Diederich. **The crystal structure and the swelling of montmorillonite.** *Z. Krist.* 86, 340-8(1933).—*C.A.* 28, 2237^7.

Analysis of montmorillonite gave SiO_2 49.0, Al_2O_3 23.0, Fe_2O_3, CaO 1.6, MgO 2.9, H_2O 23.0. The unit cell was orthorhombic, with $a = 5.095$, $b = 8.83$ and $c = 15.2$ A. The structure consisted of layers of double SiO_4 sheets, with the free O atom of each SiO_4 tetrahedron toward the center. The Al ions and OH groups were between the SiO_4 sheets. The swelling with water was one-dimensional and reversible. The distance between layers varied from 19.6 A. with over 30% H_2O to 9.6 A. when heated to 550°C (4.6% H_2O).

13041. Hofmann, Ulrich; Endell, Kurd, and Wilm, Diederich. **X-ray and colloid-chemical investigations on clay.** *Angew. Chem.* 47, 539-47 (1934).—*C.A.* 28, 6961^3.

Exptl. data, photometer curves and x-ray photographs were presented. The SiO_2 content in some bentonites, which was in excess of the montmorillonite compn. ($Al_2O_3:SiO_2 = 1:4$), crystallized according to the geological age.

13042. ALEXANDER, L.T.; HENDRICKS, S.B., AND NELSON, R.A. **Minerals present in soil colloids. II. Estimation in some representative soils.** *Soil Sci.* 48, 273-9(1939).—*C.A.* 33, 9508[6].

Minerals present in the colloidal fraction of 15 soils from various parts of the United States were identified and their amts. estd. by the use of chem., thermal and x-ray diffraction methods. Kaolinite and free oxides and hydrous oxides of Fe were the predominant components of the red podzolic soils examd. Colloids of gray-brown podzolic soils contained these minerals assocd. with hydrous mica. A composite estn. based on analytical, x-ray and thermal data indicated the following minerallogical compn. for the colloid of a Carrington soil of the prairie group: kaolin 40, hydrous mica 40, montmorillonite 10 and Fe_2O_3 10%.

13043. FAVEJEE, J. CH. L. **Quantitative x-ray soil investigation.** *Z. Krist.* **101**, 259-70(1939). —*C.A.* 33, 8879[2].

By detg. the intensities of the powder photograph lines in synthetic mixts. of known components, it was possible to det. the compn. of the clay fraction of some soils.

13044. HENDRICKS, STERLING B. AND ALEXANDER, LYLE T. **Minerals present in soil colloids. I. Descriptions and methods for identification.** *Soil Sci.* 48, 257-71(1939).—*C.A.* 33, 9507[9].

The (001) spacing of montmorillonite varied with the water content and this variation was used as an aid in identification. Hydrous mica and kaolinite were identified with certainty by the use of oriented samples. The mixed-layer minerals, however, had a strong reflection with a spacing of about 3.0 A., and this was confused with that of montmorillonite.

13045. KELLEY, W.P.; DORE, W.H.; WOODFORD, A.O., AND BROWN, S.M. **The colloidal constituents of California soils.** *Soil Sci.* 48, 201-55(1939).—*C.A.* 33, 9507[4].

X-ray examns., dehydration curves and various chem. analyses and tests were made on a large group of California soils. Every soil colloid examd. was composed chiefly of clay minerals. More than one type of clay mineral was usually present in a particular sample. Variable amts. of quartz were probably present in the colloids which affected SiO_2-Al_2O_3 ratio. Distribution of particle sizes may differ substantially and this also might affect base-exchange capacity. There appeared to be no definite relation between content of nonreplaceable bases and base-exchange capacity or other properties of the colloids.

13046. ARDENNE, M. V.; ENDELL, K., AND HOFMANN, U. **Observations on finest fractions of bentonites and clay soils with the universal electron microscope.** *Ber. deut. keram. Ges.* 21, 209-27(1940).—*C.A.* 35, 411[6].

A Wyoming bentonite consisted of packets of montmorillonite flakes 100 to 300 mμ wide, sepd. like org. fibers, and at intervals of 15 mμ. Individual flakes were only 1 mμ thick, the thickness of an elementary layer of the lattice. A Ponza bentonite from Italy possessed a flaky appearance but contained also granular particles about 100 mμ in size which were probably opal in view of the cristobalite x-ray lines. Kaolin consisted of plates about 20 mμ thick and 100 to 500 mμ in breadth, the ratio being 5 to 25/1.

13047. EDELMAN, C.H. AND FAVEJEE, J. CH. L. **The crystal structure of montmorillonite and halloysite.** *Z. Krist.* **102**, 417-31(1940).—*C.A.* 35, 2448[8].

A structure was proposed in which (001) contained OH groups that were able to polarize water and other polar mols., i.e., $Al_2(OH)_4O_2Si_4O_6(OH)_2 \cdot nH_2O$, introducing in the place of Si_2O_5, which could be written $O_2Si_2O_3$, the layer OSi_2O_3OH. It was not possible to deduce from the available x-ray data the definite structure. The dehydration took place so easily even at a low temp. that it was impossible to make a distinction between adsorbed water and lattic water.

13048. MIDDEL, V.; REICHMANN, R., AND KAUSCHE, G.A. **Supermicroscopic investigation of the structure of bentonites.** *Wiss. Veroffentl. Siemens-Werken, Werkstoff-Sonderheft* **1940**, 334-41.—*C.A.* 35, 4167[3].

With 15,000-40,000 enlargement it was seen that only the American Na bentonites were suitable for strong films. European Ca bentonites, mostly transformed into alkali bentonites by alkali salts, were insufficient.

13049. ENDELL, JOACHIM. **The study of the fine structure of clays by means of the electron microscope.** *Keram. Rundschau* 49, 23-6(1941).—*C.A.* 35, 4559[1].

Bentonite consisting of well-developed plates was more suitable for film prepn. than that consisting of intergrown, irregular, scaly masses.

13050. HUMBERT, R.P. AND SHAW, BYRON. **Studies of clay particles with the electron microscope. I. Shapes of clay particles.** *Soil Sci.* 52, 481-7(1941).—*C.A.* 36, 2660[9].

Photographs showed the plate-shaped nature of clay particles. The crystallinity of kaolinite was many times better developed than that of montmorillonite.

13051. JACKSON, M.L. AND HELLMAN, N.N. **X-ray diffraction procedure for positive differentiation of montmorillonite from hydrous mica.** *Soil Sci. Soc. Am. Proc.* 6, 133-45(1941).—*C.A.* 37, 490[9].

A complete dispersion of the clay was based on Na saturation and digestion in dilute Na_2CO_3 solution, mechanical subdivision of the clay at 0.2 μ particle-diameter, suspension of the clay in 0.3 *N* Na acetate buffer adjusted to pH 3.5 with HCl and boiling for 5 minutes, saturation with Ca and washing free of excess salt, and dispersion in benzene followed by drying at 35°C. This preparation resulted in a 14-15 A. spacing for montmorillonite and a spacing of 12 A. for hydrous mica. Montmorillonite clays gave smaller than 15 A. (001) spacings when dried from water or benzene while saturated with H, Li, Na, Be, or K.

13052. Shaw, B.T. and Humbert, R.P. **Electron micrographs of clay minerals.** *Soil Sci. Soc. Am. Proc.* 6, 146-9(1941).—*C.A.* 37, 490[8].
Characteristic electron micrographs of several clay minerals were reproduced. The montmorillonites showed structures ranging from a fluffy amorphous-appearing material to well-defined, extremely thin plates. Nontronite had flat, frayed fibers; kaolinite and dickite both had hexagonal plate-shaped crystals and halloysite had long split rods. Dickite crystals were much thicker than most kaolinitic crystals.

13053. Biscoe, J. and Warren, B.E. **X-ray study of carbon black.** *J. Applied Phys.* 13, 364-71 (1942).—*C.A.* 36, 4746[9].
The diffraction patterns were made in evacuated cameras, and consisted of (001) and two-dimensional reflections (*hk*). The dimensions within a layer were the same as in graphite, but the layer sepn. was somewhat greater. Heat-treatment increased the size of parallel-layer groups. Small-angle scattering studies indicated the existence of clusters a few hundred A. in size.

13054. Dankov, P.D. **The structure and the mechanism of formation of oxide films on aluminum.** *J. Tech. Phys. (U.S.S.R.)* 12, 251-72(1942).—*C.A.* 37, 5296[5].
X-ray diagrams and photomicrographs were reproduced.

13055. Glocker, R. and Hendus, H. **The atomic arrangement in amorphous solids.** *Z. Electrochem.* 48, 327-31(1942).—*C.A.* 37, 5633[9].
Diffraction diagrams of explosive Sb and glassy Se were detd. with a vacuum camera with monochromatized Cu Kα radiation. Radial distribution analyses indicated neighbors as follows: for Se: 2 at 2.37 A., 8 at 3.67 A. and 8 at 4.72 A.; for Sb: 4 at 2.87 A., 2 at 3.51 A. and 12 at 4.18 A. These liquidlike states were compared and contrasted with glass, benzene and carbon black.

13056. Hellman, N.N.; Aldrich, D.G., and Jackson, M.L. **Further note on an x-ray diffraction procedure for the positive differentiation of montmorillonite from hydrous mica.** *Soil Sci. Soc. Am. Proc.* 7, 194-200(1942).—*C.A.* 37, 6075[2].
A modification of the x-ray diffraction procedure for differentiating montmorillonite from hydrous mica was proposed. The fine clay was satd. with Ca, suspended in a benzene-ethanol-water mixt., hydrated to 50% of the wt of clay by the expulsion of water from the suspension medium by addn. of benzene, freed of excess liquid, dried at 30°C and 65% relative humidity, and x-rayed while exposed to an atm. of 92% relative humidity. This procedure resulted in a 16 A. - (001) line of very high intensity for montmorillonite and a 13 A. - (001) line of moderate intensity for hydrous mica.

13057. Humbert, R.P. **Particle shape and the behavior of clay as revealed by the electron microscope.** *Bull. Am. Ceram. Soc.* 21, 260-3 (1942).—*C.A.* 37, 2149[7].
Electron photomicrographs were shown of montmorillonite, nontronite, illite, beidellite, hectorite, kaolinite, dickite, halloysite and of 3 com. clays, Sciotoville fireclay, Mayfield, Ky., ball clay and attapulgite (Attapulgus, Ga., clay). Montmorillonites showed structures ranging from fluffy, amorphous-appearing material to well-defined thin plates.

13058. Kodama, Shinjiro and Tahara, Hidekazu. **X-ray investigation of iron catalyst used in the synthesis of gasoline. I. Preliminary report.** *J. Soc. Chem. Ind. Japan* 45, 1260-2 (1942).—*C.A.* 42, 6082*e*.
A freshly prepd. catalyst for the hydrogenation of CO (Fe 100, Cu 24, Mn 2, kieselguhr 125, and K_2CO_3 2 parts) was amorphous. Heating at 700°C for 6 hrs destroyed the catalytic power and produced α-Fe_2O_3. Reduction in H_2 at 450°C also destroyed the catalytic power, and produced α-Fe. After use in the synthesis of gasoline at 255°C for 2 hours the catalyst had a spinel structure with lattice const. 8.4 A.

13059. Kratky, O.; Sekora, A., and Treer, R. **Diffuse scattering of Röntgen rays by colloidal systems at small angles.** *Z. Elektrochem.* 48, 587-601(1942).—*C.A.* 37, 6546[5].
The micelle thickness could be calcd. indirectly from the diffuse scattering. The intensity was connected with the difference between the space electron density of the colloidal particles and that of the interstitial medium. With equal electron densities, the scattering disappeared just as in optics the particle was no longer visible when immersed in a medium of the same *n*. This was applied to cellulose hydrates and to alkali celluloses.

13060. Mahl, H. **Thermally produced oxide films on aluminum.** *Kolloid-Z.* 100, 219-28(1942).—*C.A.* 37, 3648[9].
Oxide films, formed on Al foil by ignition in air at 500-600°C, were investigated by electron interference and the electron microscope. They consisted of scaly crystallites of γ-Al oxide with the plane of greatest extent of the oxide crystallites approx. parallel to the surface. Oxide films produced by sweeping Al foil over a Bunsen flame were not platelets but very fine-grained without marked fibrous structure.

13061. Schwab, Georg-Maria. **Crystal orientation in tarnish layers.** *Z. physik. Chem.* B51, 254-64(1942).—*C.A.* 36, 6859[2].
The layers arising on Ag, Cu and Pb as the result of different tarnishing reactions were investigated. In some cases regular lattice orientations with respect to crystallographic directions of the ground material were observed. The conditions for such orientations were an increase in the mol. vol. and the coincidence of certain distances of the two lattices within less than 6%.

13062. Shaw, B.T. **The nature of colloidal clay as revealed by the electron microscope.** *J. Phys. Chem.* 46, 1032-43(1942).—*C.A.* 37, 1638[4].
Montmorillonite fractions less than 50 mμ (equiv. spherical diam.) were probably composed

largely of crystals about 9 A. thick. Fractions contg. particles from 200 to 50 mμ contained aggregates of crystals as well as individual crystals. Fractions contg. particles greater than 200 mμ contained principally aggregates. By wet-grinding kaolinite for 144 hrs the exchange capacity was raised from 3.8 to 16.6 milliequiv. per liter. By dry-grinding for 144 hrs the exchange capacity of the kaolinite was increased to 49.5 milliequiv. per liter. Under some conditions the unit plates of montmorillonite may build up into packages showing orientation in the *a* and *b* directions, whereas under other conditions there was no orientation.

13063. UEDA, RYUZÔ AND TAKAGI, SACHIO. **Diffraction of cathode rays by a unimolecular layer of stearic acid.** *Science* (Japan) 12, 217(1942). —*C.A.* 45, 9984*c*.

A unimol. layer of stearic acid was prepd. on the surface of distd. H_2O, and was transferred to the cleavage surface of molybdenite by the method of Langmuir and Blodgett. A clear diffraction pattern was obtained for it by cathode rays. It was found that stearic acid belonged to the rhombic system, having $a = 7.30$ and $b = 4.98$.

13064. EITEL, W. **The electron microscope and its application to ceramic problems.** *Ber. deut. keram. Ges.* 24, 37-53(1943).—*C.A.* 38, 461^9.

Kaolin was characterized by individual crystals having hexagonal outlines. Montmorillonite had a strong tendency to form finely flaked, leafy aggregates, which appeared as a cloud in the electron microscope. The absorption of electrons was increased by exchanging the lighter cations of the montmorillonite for heavier ones. The electron-diffraction diagrams of the above clay minerals corresponded with the x-ray diagrams.

13065. ENDELL, K. AND ARDENNE, M. V. **Sintering and melting in ceramic materials, glass mixtures, slag and coal ashes heated in an electron microscope.** *Kolloid-Z.* 104, 223-31(1943). —*C.A.* 38, 1410^6.

The successive changes in powd. materials when heated to their m. p. in a suitable electron microscope were illustrated.

13066. GEILING, S. AND GLOCKER, R. **Atomic arrangement in aluminum hydroxide gel.** *Z. Elektrochem.* 49, 269-73(1943).—*C.A.* 38, 1161^2.

The α-gel was pptd. at low temp. to avoid aging effects, whereas the β-gel was prepd. by heating the former for several hrs under water at 70°C. The α-gel aged on standing with a gradual transition to β-gel, though the transformation was incomplete in 7 weeks. It was concluded that the α-gel did not have a space lattice structure. The β-gel showed some of the interferences characteristic of boehmite.

13067. HOFMANN, ULRICH. **The structure and technical properties of carbons.** *Wien. Chem.-Ztg.* 46, 97-106(1943).—*C.A.* 38, 2868^1.

Graphite, cokes (retort graphite), activated carbons and lampblacks were considered. From the broadening of Debye rings av. crystal sizes were: graphite, diam. 1000 A., height perpendicular to planes 400 A.; coke, diam. 20-60 A., height 16-45 A.; active carbon, diam. 18-20 A., height 8-10 A.; lampblack, diam. 25-200 A., height 15-60 A. The last 3 differed among themselves chiefly in secondary structure. Adsorption of methylene blue showed the active surface for cokes (1.2 to 2.5 m^2/g) to be only 1/200 to 1/1000 of the surface calcd. from crystal size. The active surface (470-550 m^2/g) of active carbon was half the calcd. surface. Lampblacks had an active surface of 7-63 m^2/g.

13068. KAMOKAWA, HIROSHI. **Study of the polished surface of glass by electron diffraction.** *J. Phys.-Math. Soc. Japan* 17, 396-415(1943).—*C.A.* 42, 14*a*.

The surface of quartz glass polished with rouge had smaller rough places than the polished surface of metals, as in the case of quartz. The particles of rouge were observed with an electron microscope, and the effect of their size and form on the polished surface was studied. The surface structure of glass undergoing chem. change was also observed.

13069. LAUBENGAYER, A.W. AND WEISZ, R.S. **A hydrothermal study of equilibria in the system alumina-water.** *J. Am. Chem. Soc.* 65, 247-50 (1943).—*C.A.* 37, 1644^1.

The data indicated that corundum was the stable phase above 450 ± 5°C; γ-alumina was metastable throughout the range investigated; diaspore was stable below 450 ± 5°C, and the lower limit for its stability seemed to be near 280°C; boehmite apparently was stable between 155 and 280°C; gibbsite was unstable above 155°C. Bayerite was unstable above 155°C, and the indications were that it was less stable than gibbsite below this temp.

13070. LINKE, F. **Condensation nuclei made visible in the electron microscope.** *Naturwissenschaften* 31, 230-1(1943).—*C.A.* 38, 9^9.

Condensation nuclei were pptd. from air on a microscope slide; electron-micrograms were given. Some of the nuclei were amorphous, some cryst., av. size 25-100 mμ.

13071. RAGOSS, A.; HOFFMANN, U., AND HOLST, R. **Graphite formation (black-leading) of Thermax carbon black.** *Kolloid-Z.* 105, 118-24(1943).—*C.A.* 38, 4849^4.

The graphite formation of Thermax C black (from natural gas) by step-wise heating from 1000° to 3000°C was followed by means of an electron microscope which showed the growth of graphite crystals. The adsorption capacity for methylene blue remained const. during graphite formation; the particles had as strong adsorptive power when they were composed of tens of thousands of small crystals with numerous edges and corners as when they were built up of the flat faces of a few larger crystals.

13072. SHIRAI, SHUNJI. **Structure of thin nickel and gold films.** *Proc. Phys. Math. Soc. Japan* 25, 169-72(1943).—*C.A.* 41, 6101*b*.

The structure of thin Ni and Au prepd. by evapn. *in vacuo* on a heat-treated rock-salt cleavage surface was investigated by cathode-ray diffraction.

13073. TAKEUCHI, TSUNEHIKO. **Mineralogical studies of bauxite. I. Properties of bauxites from various localities. II. X-ray diffraction of bauxite powder.** *Bull. Research Inst. Mineral Dressing Metall.* 2, 3-17, 18-28(1943).—*C.A.* 45, 507*b*.

Bauxite from Haiphong (French Indo-China) was mainly diaspore ($HAlO_2$); that from Montpellier (France), boehmite [AlO(OH)]; those from Bintan (Dutch East Indies), Palau (Caroline Islands), South America and Malaya, gibbsite [$Al(OH)_3$]; that from Greece, a mixt. of diaspore and gibbsite; those from Yugoslavia and India, a mixt. of gibbsite and boehmite.

13074. TANIDA, SHIGEO. **Mixed catalysts. II. Structure analysis of nickel-molybdenum and nickel-tungsten catalysts by means of x-rays.** *Bull. Chem. Soc. Japan* 18, 36-44(1943).—*C.A.* 41, 4368*ef*.

X-ray photographs of binary catalysts, Ni-Mo and Ni-W, which had various ratios of compn. were taken. In the case of Ni-Mo system, the diffraction lines shifted with increasing addn. of Mo, and the lattice const. was enlarged. The limit of soly, of the solid soln. was about 100 Ni-15 Mo, which had proved to have the highest catalytic property. In the case of Ni-W system, change of the lattice const. was not observed.

13075. TOMITA, AKIRA. **Zinc catalyst. I. The methanol-decomposing ability of the zinc catalyst prepared from zinc complex salt.** *J. Chem. Soc. Japan* 64, 423-30(1943).—*C.A.* 41, 3353*h*.

The MeOH - decompg. activity of Zn catalyst prepd. from complex compds. was great compared with that of catalyst prepd. by the usual pptn. method. From the x-ray patterns of the catalysts, it was presumed that the crystal was incomplete and that there were many atoms combined in unsatd. state.

13076. TOVBORG-JENSEN, AKSEL. **Determination of particle size by x-ray powder diffraction method.** *Kgl. Danske Videnskab. Selskab., Math.-fys. Medd.* 20, No. 8, 9 pp.(1943).—*C.A.* 38, 4172^5.

If B' was the width of an *hkl* reflection of the substance whose particle size was desired and B the width of the same line in a normal diagram, the particle thickness, t, was given by the formula $b = k\lambda/(t \cos \theta)$, where $b = (B'^2 - B^2)^{1/2}$.

13077. VENTURELLO, GIOVANNI. **Aluminum hydroxide gels.** *Atti reale accad. sci. Torino, Classe sci. fis., mat. nat.* 79, (1943-44).—*C.A.* 41, 4995*d*.

The gel of $Al(OH)_3$ obtained by pptn. (α-gel) appeared amorphous on x-ray observation; by aging or by heating at 70°C it was transformed into the β-gel, which did not show a true cryst. structure, but may be considered as a product gradually crystg., similar to boehmite.

13078. ALDRICH, D.G.; HELLMAN, N.N., AND JACKSON, M.L. **Hydration control of montmorillonite as required for its identification and estimation by x-ray diffraction methods.** *Soil Sci.* 57, 215-31(1944).—*C.A.* 38, 4535^1.

Clay particles less than 0.2 μ in diam., conditioned and satd. with Ca, were suspended in a ternary soln. of benzene, ethanol and water, the compn. of which was such as to provide true soln. but near-satn. with respect to water. Benzene was added to the suspension; this resulted in setting free a water-rich 2nd phase in finely divided form throughout the suspension so that it was sorbed uniformly by all of the clay. Most of the supernatant liquid was decanted and the clay dried under controlled conditions.

13079. BÉNARD, JACQUES. **New x-ray method of studying oxide layers.** *Bull soc. chim.* 11, 327-31(1944).—*C.A.* 40, 1715^2.

The rotating-film method, employing a diffraction standard, permitted precise measurement of the parameters in the small surface elements, using radiation that penetrated only slightly. The Kα line of Co was used, with powd. Ag as the diffraction standard, in expts. with FeO. The layer of FeO formed by heating Fe in an oxidizing atm. at 900°C showed a gradual change in the Fe content, which formed a satd. solid soln. at the underlying metal surface, and decreased toward the outer surface.

13080. BÉNARD, JACQUES; CHAUDRON, G., AND TALBOT, J. **X-ray study of splitting of a single crystal of iron by hydrogen absorption.** *Métaux, corrosion, usure* 19, No. 11-12, 106(1944).—*C.A.* 45, 3678*f*.

Single crystals of Fe were reduced to a large no. of single crystals after a long period of electrolytic charging with H_2. The effect was shown by Laue and Debye-Scherrer diagrams, the former progressively disappearing and the latter becoming more pronounced as charging proceeded.

13081. BLAYDEN, H.E.; GIBSON, J., AND RILEY, H.L. **An x-ray study of the structure of coals, cokes and chars.** *Proc. Conf. Ultra-fine Structure of Coals and Cokes, Brit. Coal Utilisation Research Assoc.* 1944, 176-231.—*C.A.* 39, 1269^6.

The crystallite dimensions in 2 planes were reported for samples including cellulose, lignin, glycine, peat, dopplerite, brown coal, lignite, poorly coking and strongly coking bituminous coal, anthracite, natural coke ("cinder coal"), fusain and vitrain from bituminous coal, and chars and cokes of these at various temps. Generally similar structure was shown by all carbonized and coalified samples, including the exts. of coal. Both carbonization and the natural process of coalification were accompanied by progressive aromatization and variation in crystallite aggregation in turbostratic arrangement. The x-ray results favored the low-temp. theory of coal origin, probably less than 200°C.

13082. ENDELL, JOACHIM. **Study of clays and diatomaceous earths by x-rays and the electron microscope.** *Ber. deut. keram. Ges.* 25, 113-26 (1944).—*C.A.* 44, 5068*e*.

13083. GIBSON, J.; RILEY, H.L., AND TAYLOR, J. **Filamentous carbon.** *Nature* 154, 544(1944).—*C.A.* 39, 852^2.

Filamentous carbon was prepd. by cracking CH_4, dild. with N_2, H_2, and CO, on an Fe surface at 1000°C. X-ray analysis showed it to be amorphous, with the *c* axis perpendicular to the fiber axis.

13084. HARIHARAN, P.S. **Intensity of x-ray reflection by diamond.** *Proc. Indian Acad. Sci.* 19A, 261-4(1944).—*C.A.* 39, 449^8.

In blue-fluorescing diamonds, the intensity of the (111) reflection increased with the intensity of the fluorescence. The intensity of the same reflection was greater in yellow-fluorescing diamonds than in blue-fluorescing ones. In yellow-fluorescing diamonds, the intensity decreased with increasing fluorescence.

13085. HEIDENREICH, R.D. AND MATHESON, L.A. **Electron-microscope determination of surface elevations and orientations.** *J. Applied Phys.* 15, 423-35(1944).—*C.A.* 38, 3543^5.

The stereoscopic method was analyzed. The parallax equation of aerial photography was employed in the form $f = (\mathrm{cosec}\ \sigma/2M) \times 10^3$ microns/mm, where σ was the stereo angle and M the total magnification. Parallax measurements were multiplied by the conversion factor f to convert them to elevations, which could be detd. to within 10% in the range from 0.1 to 2 μ, based on expts. with cubic etch figures of Al.

13086. KONIG, HANS. **Electron diffraction of copper-zinc alloys.** *Reischsber, Physik. (Beihefte Physik. Z.)* 1, 7-10(1944)(Pub. 1945). —*C.A.* 41, 6462*d*.

Cu and Zn evapd. in high vacuum onto collodion diffused at room temp. to form stable alloys. Diffraction patterns of the whole range of alloys ($\eta \rightarrow \epsilon \rightarrow \gamma \rightarrow \beta \rightarrow \alpha$ brass) were observed. Diffusion was retarded by the pressure of an oxide film on the Cu. ϵ-Brass showed a hitherto unknown lattice parameter.

13087. MRGUDICH, J.N. AND CLOCK, R.C. **X-ray and electron-microscope evaluation of carbon blacks for dry cells.** *Trans. Electrochem. Soc.* 86, 13 pp. (preprint)(1944).—*C.A.* 39, 27^9.

A black must simultaneously satisfy 3 conditions: (1) the ultimate particles of the black should be adequately conductive, (2) surface forces detg. black dispersibility should be nicely balanced between the 2 extremes of clumping and complete isolation of the particles, and (3) the particle size should not be much in excess of 38 mμ.

13088. NEUHAUS, A. AND NOLL, W. **Partial isomorphous systems. VIII. Oriented growth of organic substances on typical metals.** *Naturwissenschaften* 32, 76-7(1944).—*C.A.* 42, 4017*h*.

Bromanil, $C_6O_2Br_4$, formed deep yellow leaflets and tablets on the (100) face of Ag; a 8.62, b 6.22, c 17.94 A., β102°; $z = 4$. The (001) plane of bromanil was parallel to (100) of Ag, and the b-axis was parallel to the two (100) directions of the Ag crystal. Bromanil, like chloranil, grew very well on (100) of NaCl. Good oriented growth of $C_6Cl_5NH_2$ and C_6Br_5OH (but not of C_6Cl_5OH) took place on (100) of Ag.

13089. PETITPAS, THÉRÈSE; CHEYLAN, ÉTIENNE, AND MATHIEU, MARCEL. **Structure of catalytically active solid phase. II. Structure of hopcalite catalysts for oxidation of carbon monoxide.** *Mém. services chim. état (Paris)* 31, 323-31 (1944).—*C.A.* 40, 5986^2.

Active hopcalite preserved the structure of $MnCO_3$ (rhomobohedral rhodocrosite analogous to calcite). During thermal treatment to produce an active catalyst, the (111) line in the x-ray spectrum disappeared. On further heating, activity was destroyed and the (100) line disappeared. On still further heating the structure changed to that of Mn_2O_3. The structure of pyrolusite (MnO_2) was never observed.

13090. RILEY, D.P. **The use of x-ray methods in the study of amorphous materials.** *Brit. Coal Utilisation Research Assoc. Bull.* 8, 219-22 (1944).—*C.A.* 38, 6191^9.

13091. WINKLER, HELMUT G.F. **The crystal structure of montmorillonite.** *Z. Krist.* 105, 291-303(1944).—*C.A.* 39, 5211^9.

A new structure was proposed for montmorillonite in which all fixed lines of the powder photographs were explained as interferences from single layer packets. Such packets extended indefinitely in the a and b directions, but were limited to a single identity period in the c direction = 6.49 A. (a = 5.16, b = 8.94 A., β = 100°). The 001 and hkl interferences did not change with the swelling. The variable interference, 9.5-20 A., represented the distance between packets varying with the water content.

13092. AKAMATSU, HIDEO. **Structural model of amorphous carbon.** *J. Chem. Soc. Japan* 66, 7-8 (1945).—*C.A.* 42, 7127*e*.

The x-ray diffraction patterns of violanthrone, isoviolanthrone, pyranthrone, and indanthrene brilliant green 4G were investigated. The patterns resembled very much that of carbon black. These dyes could be considered to present a structural model of amorphous carbon.

13093. FEITKNECHT, W. **Investigation of the structure of colloidal materials by x-rays and the electron microscope.** *Vierteljahrsschr. naturforsch Ges. Zurich* 90, 161-81(1945).—*C.A.* 40, 3324^5.

The detns. of crystal structure consts. and particle sizes by conventional x-ray and electron-diffraction methods were reviewed. As_2S_3 and colloidal Au were cited as examples of spherical colloids, and V_2O_5 was cited as a linear colloid, and electron micrographs were shown for the last two.

13094. JELLINEK, M.H. AND FANKUCHEN, I. **λ-ray diffraction examination of γ-Al_2O_3.** *Ind. Eng. Chem.* 37, 158-63(1945).—*C.A.* 39, 1341^7.

The behavior of γ-Al_2O_3 when heated at various temps. for different lengths of time was studied by large-angle Bragg reflection (crystallite-size changes) and small-angle scattering (particle-size changes). The no. of Bragg reflection lines increased on heating, and the crystallite size increased too, along with the perfection of the crystal structure. Crystallite diams. were given as follows (in A.): unheated, 45; 1600°F for one hr, 55; 1472°F for 6 hrs, 59; 1472°F for 48 hrs, 67; 1600°F for 6 hrs, 62. In the last case lines of α-Al_2O_3 began to appear.

13095. KAMEYAMA, NAOTO. **Observation of cuprous oxide on the surface of a commutator by electronic diffraction.** *J. Soc. Chem. Ind. Japan* 48, 62-3(1945).—*C.A.* 42, 6199*c*.

An electron diffraction study showed that a layer of Cu$_2$O existed on the surface of the Cu.

13096. Ladd, W.A. and Wiegand, W.B. **Electron-microscope studies of colloidal carbon reticulate chain structure.** *Rubber Age* (N.Y.) 57, 299-307 (1945).—*C.A.* 39, 3686^7.

Before being subjected to shearing forces, all carbon blacks had reticulate chain structures, with lampblack and acetylene black having the most highly developed structures. Thermal carbon blacks were characterized by a distinction rod linkage structure, whereby the particles were fused tightly together. These rods were not radial, and, when broken, frequently showed skewed fractures. All other carbon blacks in their "loose" state had structures in which their ultimate spheroidal particles were closely connected. When carbon blacks were manipulated energetically, as by mulling in oil, Coblac treatment, or milling in rubber, the changes in their reticulate chain structures differed greatly, depending on the type of carbon black.

13097. Shekhter, A.; Roginskiĭ, S., and Isaev, B. **Electron-microscopical investigation of catalyst. I. Asbestos as carrier.** *Acta Physicochim. U.R.S.S.* 20, 217-26 (1945).—*C.A.* 40, 683^8.

Metallic and oxide catalysts, deposited on asbestos and used in oxidation and dehydrogenation reactions, were examd. with an R.C.A. type-B electron microscope. Heating caused a disintegration of fibers starting at 500°C and completed at 1250°C. Anthophyllite-asbestos fibers did not begin to deteriorate under 1250°C. The catalysts adhered to the fiber as isolated, nonhomogeneous crystalline grains.

13098. Turkevich, John. **Electron microscopy of catalysts.** *J. Chem. Phys.* 13, 235-9 (1945). —*C.A.* 39, 4202^3.

Electron-microscope photographs of Pt, platinized asbestos, Pt on activated charcoal, Alorco activated alumina, active silica gel, alumina silicate, zinc oxide, and nickel-thoria (supported on kieselguhr) catalysts were discussed briefly.

13099. Bénard, Jacques and Odile Coquelle. **Kinetic study of the formation of oxides on iron surfaces at high temperatures.** *Compt. rend.* 222, 884-5 (1946).—*C.A.* 40, 5985^2.

The rate of development of Fe$_2$O$_3$ layer on fresh Fe surface was linear at 900°, 950°, and 1000°C as measured micrographically by the thickness of the layer formed. The rate for Fe$_3$O$_4$ was linear at 700°, 800°, and 900°C, but diminished as time progressed at 950°C. The rate of production of FeO was parabolic at 650°, 700°, 800°, 900°, and 950°C. Two factors were involved - the diffusion of reactants across the oxide layer, and the rate of interaction of the reactants.

13100. Birks, L.S. and Friedman, H. **Particle-size determination from x-ray line broadening.** *J. Applied Phys.* 17, 687-92 (1946).—*C.A.* 40, 6934^1.

By controlled heating of MgCO$_3$ at 400° to 1000°C for 2 to 4 hrs, MgO particles ranging in size from 50 to 1000 A. were prepd. Mech. mixts. of 2 different sizes were examd. by the x-ray method, but the particle sizes could not be detd. unless the 2 max. of the distribution curve were completely resolved.

13101. Dankov, P.D. and Ignatov, D.V. **Structure of anodic films formed on alumium in oxygen gas discharge.** *Compt. rend. acad. sci. U.R.S.S.* 54, 235-8 (1946)(in English).—*C.A.* 41, 5403*g*.

The film formed on Al by anodic oxidation in an O$_2$ discharge tube had the same electron-diffraction pattern as that obtained from Al that had been exposed to the air for several months. This indicated that the same compd. (Al$_2$O$_3$) was formed in each case.

13102. Erchak, Michael, Jr.; Fankuchen, I., and Ward, Roland. **Reaction between ferric oxide and barium carbonate in the solid phase. Identification of phases by x-ray diffraction.** *J. Am. Chem. Soc.* 68, 2085-93 (1946).—*C.A.* 41, 23*f*.

The reaction of BaCO$_3$ with Fe$_2$O$_3$ in the presence of O$_2$ was studied by x-ray diffraction.

13103. Gulbransen, Earl A. **New developments in the study of surface chemistry.** *Metal Progress* 49, 553-9(1946).—*C.A.* 40, 2371^6.

Oxidation of Fe, Al, Mo, Mg, and Cu was studied by electron diffraction of thin films of the metals produced *in vacuo* after controlled oxidation in a closed container. Velocities of reaction were detd. with a vacuum microbalance.

13104. Gulbransen, Earl A. and Hickman, J.W. **An electron-diffraction study of oxide films formed on iron, cobalt, nickel, chromium, and copper at high temperatures.** *Metals Technol.* 13, No. 7; *Am. Inst. Mining Met. Engrs., Inst. metals Div., Tech. Pub.* No. 2068, 26 pp (1946).—*C.A.* 41, 358*f*.

Vacuum-formed films of Fe at elevated temps. and the effect of surface prepn. were studied. The oxidations of Co, Ni, Cr, and Cu were studied over a wide temp. range and for times up to 1 hr. The oxidation of Co indicated one lattice transformation between Co$_3$O$_4$ and CoO at 400° to 600°C. No lattice transitions occurred in the oxides formed on Ni, Cr, and Cu. Crystal growth and orientation effects were noticed, which indicated phys. changes in the surface oxides of thin metals.

13105. Hass, G. **Growth and structure of thin oxide layers on aluminum.** *Optik* 1, 134-43 (1946).—*C.A.* 41, 5770*f*.

An instantaneous film of 15-20 A. thickness was formed on exposing Al to air. Subsequent growth was slow and ceased after 1 month. The films were 45 A. thick on plane, mirrorlike surfaces and 90 A. on rough surfaces. The oxide layer had a glasslike structure. The oxidation rate of Al in contact with air was const. to 400°C, rose slowly to 500°C, and rapidly thereafter. Oxide layers that remained in contact with the Al crystallized at about 500°C, sepd. layers at 680°C, formed Al$_2$O$_3$ with a space lattice const. of a = 790 A.

13106. Hofer, L.J.E.; Peebles, W.C., and Dieter, W.E. **X-ray diffraction and magnetic studies of unreduced ferric oxide Fischer-Tropsch catalysts.** *J. Am. Chem. Soc.* 68, 1953-6 (1946).—*C.A.* 41, 644*i*.

The magnetic susceptibility of active raw Fe_2O_3 catalysts was considerably greater than that of any Fe_2O_3 or $Fe_2O_3.H_2O$ that would be identified in the diffraction pattern of the catalysts. The magnetic susceptibility of those catalysts contg. β-$Fe_2O_3.H_2O$ was very much lower than that of the active catalysts and did not greatly exceed that of β-$Fe_2O_3.H_2O$ itself. Several suggestions were proposed to account for the deactivation of the catalyst.

13107. Jellinek, M.H.; Solomon, Ernest, and Fankuchen, I. **Measurement and analysis of small-angle x-ray scattering.** *Ind. Eng. Chem. Anal. Ed.* 18, 172-5 (1946).—*C.A.* 40, 3052^1.

A simple method for the graphical analysis of data for detn. of particle-size distribution was illustrated with samples of carbon black and γ-Al_2O_3. Surface areas so calcd. compared favorably with areas evaluated from N_2 adsorption.

13108. Ruess, G.L. and Ruston, W.R. **The active surface of the carbon crystal.** *Fuel* 25, No. 6, 156-9 (1946).—*C.A.* 41, 1409*g*.

The carbon black obtained by thermal decompn. of graphite-oxide gave broadened graphite interferences, and the detn. of crystallite-size by means of x-rays and electron micrographs showed the crystallites to be of pronounced laminar shape. Difference in activity of carbons may possibly be due to slight differences between the interatomic distances within the planes.

13109. Alais, F.; Fouchécour, P. de., and Reis, T. **Preliminary note on electron microscope studies of catalysts, bleaching clays, bentonites, and schists.** *Rev. inst. Franc petrole* 2, 337-40 (1947).—*C.A.* 42, 4434*i*.

Bentonite was composed of flat particles. A montmorillonite and a German activated clay had similar cryst. structures which were confirmed by x-ray analysis. Tungstic acid was composed of long needles with extended surface. Fresh catalysts had much greater dispersion, ie., greater surface, than used ones.

13110. Aldred, F.C. and Happey, F. **Activation of copper by oxidation and reduction.** *Nature* 160, 267-8(1947).—*C.A.* 42, 4435*e*.

Preliminary x-ray data on cryst. changes produced in metallic and oxide films on Cu during activation showed that the outer surface of the Cu was oxidized to Cu_2O, which increased the vol. occupied by 4 Cu atoms. Further oxidation of CuO caused an addnl. slight increase in vol. Reduction of H_2 broke down the oxide crystals without extensive migration of metallic atoms, yielding a spongy matrix. With CO, the heat involved was not rapidly dissipated so that recrystn. occurred and the mass became less porous.

13111. Anderson, Robert B.; McCartney, James T.; Hall, W. Keith, and Hofer, L.J.E. **Kieselguhrs. Suitability as carriers in catalysts.** *Ind. Eng. Chem.* 39, 1618-28 (1947).—*C.A.* 42, 1031*e*.

Electron photomicrographs, x-ray diffraction patterns, chem. analyses, surface areas, bulk d., mercury d., and He d. were presented for natural, calcined, and fluxcalcined kieselguhrs. Diffraction patterns of natural kieselguhr indicated that it was hydrous amorphous silica. Faint lines due to quartz were found. Natural kieselguhrs showed a specific surface area in the range, 15-37 m^2/g, while calcined samples showed an area 2 to 6 m^2/g. The isotherms were type II with the natural kieselguhrs showing hysteresis at a relative pressure of 0.4; this indicated pores with a diam. of 15 to 100 A., in agreement with the photomicrographic evidence and in line with recent theory on the cause of hysteresis in adsorption curves.

13112. Brummage, K.G. **An electron-diffraction study of the structure of thin films of normal paraffins.** *Proc. Roy. Soc. (London)* A188 414-26 (1947).—*C.A.* 41, 3949*a*.

Thin films of $C_{24}H_{50}$, $C_{30}H_{62}$, and $C_{34}H_{70}$ were examd. when deposited on stainless steel, Cu, or collodion. Both the reflection and the transmission techniques were employed. A thin film of a normal paraffin upon a metal consisted of a continuous and evenly spread layer, in which the mol. axes were normal to the substrate surface. The film bridged over valleys and pits upon the surface.

13113. Brummage, K.G. **An electron-diffraction study of the heating of straight-chain organic films and its application to lubrication.** *Proc. Roy. Soc. (London)* 191A, 243-52 (1947).—*C.A.* 42, 5216*d*.

Thin films of normal paraffins, fatty acids, and esters were examd. by electron diffraction during heating upon a variety of metal surfaces. In all cases the films lost their orderly condensed structure at a comparatively low temp., leaving expanded films of individual mols. Evidence was obtained of the formation of metallic soaps when fatty acid films were deposited upon reactive surfaces such as Cu, Cd, and mild steel. Base metals used were Al, Cd, Cu, Ni, Ag, mild steel, and stainless steel.

13114. Brusset, Henry. **Carbonization of cellulose.** *Compt. rend.* 224, 1356-8 (1947).—*C.A.* 41, 6044*f*.

Powder and fiber diagrams, as well as the central diffusion method, were used to study the solid state of bleached cotton in comparison with cotton heated to 185°, 242°, 257°, 284°, 314°, 340°, 430°, 465°, and 600°C. Low-angle diffraction could not be observed for the 1st and 3rd of these samples, whereas the 5th showed slight diffraction, and the others gave an intense, sharply defined diffraction. The cellulosic structure was retained up to about 300°C in spite of an important modification of the material. An amorphous structure, appearing at about 300°C, persisted throughout heating to higher temps.

13115. Chakravarty, K.M. and Sen, Ranjit. **X-ray diffraction studies of a nickel-thoria-kieselguhr catalyst for Fischer-Tropsch synthesis.** *Nature* 160, 907-8(1947).—*C.A.* 43, 2853*d*.

Powder diffraction data were tabulated for kieselguhr and for a prepd. 100:18:100 Ni-thoria-kieselguhr catalyst. The kieselguhr was partly amorphous with cryst. accessories and the prepd. catalyst consisted of Ni and Fe_2O_3 (from the kieselguhr).

13116. Enoksson, Bertil and Wetterholm, Allan. **An examination of the sulfur-binding capacity**

of charcoal by means of x-ray and electron diffraction. *Acta. Chem. Scand.* 1, 889-92 (1947)(in English).—*C.A.* 42, 5737*i*.

X-ray and electron diffraction studies were made on pure charcoal, mixts. of charcoal and S, and on the charcoal-S "compd." obtained by extn. with either aniline or CS_2, which contained 13% S. Electron photomicrographs of Charcoal-S "compd." at magnifications of 1200 or 20,000 were no different than those of charcoal; this indicated that the particles retained their form and size after S absorption. X-ray and electron diffraction diagrams of charcoal-S "compd." were distinctly different from those of either charcoal or S.

13117. GIBSON, J. AND RIBLEY, H.L. **The x-ray scattering power of microcrystalline carbons.** *Proc. Intern. Congr. Pure and Applied Chem.* 11, 131-4(1947).—*C.A.* 44, 5176*b*.

Specimens prepd. by mixing crushed dried carbon with 0.2 its wt of finely divided Al powder were moistened with gum arabic and extruded as cylinders 0.5 mm in diam. Examn. with Co Kα radiation reflected from pentaerythritol gave pictures that could be measured with the microphotometer. After elimination of background, intensities of 002 lines from carbon and 111 lines from Al were compared. Little or no increase in scattering power occurred on heating chars from 1000° to 2350°C.

13118. GORBUNOV, N.I. AND TSYURUPA, I.G. **X-ray determination of montmorillonite, kaolinite, quartz, and gypsum with mixture of amorphous silicic acid.** *Pedology* (U.S.S.R.) 1947, 555-67.—*C.A.* 42, 3635*e*.

Quartz, gypsum, and kaolinite gave clear x-ray diffraction patterns and montmorillonite less-clear pictures. Kaolinite and montmorillonite gave interference lines when these comprised 10% of the mixt. with silicic acid. Smaller quantities could be used if the exposure time was increased.

13119. HAST, NILS. **Structure of clay.** *Nature* 159, 354-7 (1947).—*C.A.* 41, 5272*b*.

A soln. of cellulose nitrate in amyl acetate was allowed to evap. on a clay surface. The resulting film of cellulose nitrate was peeled off with an adhering layer of clay particles and introduced into a vacuum where it was coated with a layer of vaporized Be or Al 25-50 A. thick. The cellulose nitrate was then dissolved with amyl acetate. The resulting film was studied with the aid of the electron microscope. Photographs of bentonite showed that it was built up to small, plane crystals, apparently round plates about 120 A. in diam. and 10 A. thick.

13120. HOFER, L.J.E. AND PEEBLES, W.C. **Preparation and x-ray diffraction studies of a new cobalt carbide.** *J. Am. Chem. Soc.* 69, 893-9 (1947).—*C.A.* 41, 4363*g*.

The carburization of Co by CO was studied at various temps., and the reaction of H_2 with, and x-ray analyses of, the resulting products. The results indicated that the easily hydrogenated carbon produced by the action of CO on finely divided Co metal was combined with Co to form a new cryst. species, Co_2C, whose structure was distinct from either α- or β-cobalt.

13121. KAHLER, F. **Electron-microscope investigation of sintered magnesium oxide.** *Radex-Rundschau* 1947, No. 3, 50-5.—*C.A.* 43, 3986*f*.

Samples prepd. from natural $MgCO_3$ (contg. 1.54% Fe_2O_3) were examd. after firing at 400°-1000°C. CO_2 was released practically completely at 500°C. Microscopically fine MgO particles were formed, which were pseudomorphs of the $MgCO_3$ matrix. The crystals grew by recrystn. to a size of 5 μ. The secondary crystals had high porosity. The first indications of sintering with considerable reduction in porosity were observed at 900°C. Considerable sintering occurred at 1000°C.

13122. LEGRAND, CH. **Study of surface structures by means of x-rays.** *J. recherches centr. natl. recherche sci.* 1947, 147-51; *Compt. rend.* 225, 731-3 (1947).—*C.A.* 42, 5295*d*.

The thickness of cryst. material depended on the angle of incidence. From theoretical consideration the thickness was of the order of 10 μ for $\alpha = 60°$, 7μ for 30°, and 1.4 μ for 3°. At 30° incidence, no difference could be observed between samples of stainless steel that were (a) ground, (b) polished with corundum, (c) polished with chrome green. At 3° the lines were widened increasingly as the polish was made finer.

13123. OBORIN, V.I. **Elementary structure of alumina catalyst.** *Neftyanoe Khoz.* 25, No. 11, 50-4(1947).—*C.A.* 42, 5750*d*.

The catalytic action was exerted by γ-alumina presumably because two Al atoms on adjacent mols. formed a doublet wherein the distance between the centers of the atoms was 2.56 A., which was close to the distance between a C atom and every other C atom in the chain. Regular orientation of the alumina mols. in space, corresponding to the elementary cryst. lattice, provided a relatively large no. of doublets and therefore a large degree of activity. Silica as a carrier supplied a large surface for the crystn. of alumina.

13124. RAETHER, HEINZ. **The surface structure of solids.** *Naturforsch. u. Med. Deutschland 1939-1946* 8, No. 1, 109-18(1947).—*C.A.* 44, 8722*f*.

Electron-diffraction expts. and photographs made with the aid of the electron microscope indicated that cold working always reduced the grain size and that it did not produce an amorphous surface but rather a very finely cryst. surface. Results of studies of the properties of deformed surface films, especially their recrystn. and oxidation, were reported. The structures of electrolytically polished metal surfaces and tempered alkali halide surfaces were discussed.

13125. SCHWAB, GEORG-MARIA. **Crystallite orientation in coating films. IV. Oriented coating films on thallous halides.** *Trans. Faraday Soc.* 43, 724-33 (1947).—*C.A.* 42, 5294*f*.

The TlCl, monocrystals, films of TlBr grew in an isomorphously orientated arrangement, forming intermediate mixed crystals; TlI did not do so, and AgCl was orientated. On TlBr, an isomorphous orientated mixed crystal was formed; AgBr was orientated too. On (110) of TlBr, the (110) of AgBr built up, the crystallographic axes within these planes being perpendicular to each other. This orientation of a NaCl-lattice on a CsCl-lattice was energetically much more favored than the (100) on (100).

13126. SHULL, C.G. AND ROESS, L.C. **X-ray scattering at small angles by finely divided solids. I. General approximate theory and applications. II. Exact theory for random distributions of spheroidal particles.** *J. Applied Phys.* 18, 295-313 (1947).—*C.A.* 41, 2991*c*.

Scattering data, mass-distribution curves, and av. particle sizes were shown for amorphous silica gels, and cryst. Al_2O_3, NiO, Fe_2O_3, and $Al_2O_3.MoO_3$. These data correlated well with those from measurements of line broadening and specific surface. Scattering curves were presented for shapes ranging from flat disks through spheres to long thin rods having Maxwellian and rectangular distributions of particle mass. Addnl. evidence from independent investigations of such quantities as particle shape and sample specific surface was required.

13127. URAZOV, G.G.; KEFELY, L.M., AND LEL'CHUK, S.L. **Structure of skeleton catalysts and their production.** *Compt. rend. acad. sci. U.R.S.S.* 55, 509-11(1947) (in English).—*C.A.* 41, 7063*a*.

X-ray data showed that the Cu atoms not removed were regrouped into the cubic lattice; the recrystn. was incomplete and resulted in a porous structure contg. ducts of varying magnitude; the Cu was more active. The same was true for the Ni-Al alloy. The small crystals of $CuAl_2$ and Ni_2Al_3 remaining were dispersed into many very fine crystals as a result of the alkali treatment.

13128. URAZOV, G.G.; KEFELY, L.M., AND LEL'CHUK, S.L. **The structure of the nickel skeleton catalyst.** *Compt. rend. acad. sci. U.R.S.S.* 55, 735-8 (1947) (in English).—*C.A.* 41, 6800*h*.

X-ray diffraction patterns of alkali-treated Ni_2Al_3 single crystals showed that the Ni skeleton catalyst was a skeleton structure of Ni_2Al_3, left after Al was removed by alk. treatment, in which minute particles of Ni were imbedded. The size of the Ni particles, estd. from x-ray diffraction patterns obtained without rotation, were between 10^{-6} and 10^{-7} cm. During the oxidation reaction at the surface of the Ni catalyst, the latter was not oxidized; it was the adsorbed H that was removed.

13129. ALEXANIAN, C.L. **X-ray examination of decolorizing, adsorbing, and catalyzing agents.** *Rév. inst. franc. petrole* 3, 104-10 (1948).—*C.A.* 43, 840*i*.

The powder method yielded characteristic x-ray diffraction patterns for kaolinites, montmorillonites, and aluminosilicate catalysts used in the oil industry. It may, therefore, be used to control production and as a means of identification.

13130. ARNELL, J.C. AND BARSS, W.M. **A comparison of the x-ray-diffraction and nitrogen adsorption surface areas of carbon blacks and charcoals.** *Can. J. Research* 26A, 236-42(1948).—*C.A.* 42, 8576*a*.

The surface areas, as detd. from x-ray diffraction and low-temp. N_2-adsorption data, were compared for a no. of carbon blacks and charcoals. Comparative data were also obtained on samples of charcoal at various stages of activation and after calcination. From the broad x-ray diffraction bands, the crystallite dimensions of the ultimate particles could be estd. Samples examd. had specific surfaces of about 2500-3000 m^2 per ml.

13131. BERESTNEVA, Z. YA.; KORETSKAYA, T.A., AND KARGIN, V.A. **Structure of vanadium pentoxide sols.** *Doklady Akad. Nauk S.S.S.R.* 59, 1121-4 (1948).—*C.A.* 42, 7132*g*.

Electron-microscope pictures of V_2O_5 sols showed, under a magnification of 15000-18000, initial presence of sep. particles and small aggregates, growing linearly into long threads, without or with only very little branching. It contradicted any representation of a homogeneity of the surface of the particles.

13132. BHATTACHARJEE, S.B. **X-ray study of crystallization of amorphous silica.** *Science and Culture* 13, 469 (1948).—*C.A.* 42, 8570*h*.

The mean band-spacing of amorphous silica gradually increased with the period of heating of the sample at high temps., e.g. 650°C, and finally sharp rings appeared, showing complete crystn. The most intense ring corresponded approx. with the position of the amorphous band. The increase in the lattice const. after 48 hrs of heating at 550°C was found to be 7.4%.

13133. BRUSSET, HENRY. **Microporosity of carbon catalysts.** *Compt. rend.* 227, 843-5 (1948).—*C.A.* 43, 2080*c*.

Carbon blacks suitable for catalytic desulfurization of fuel gases were studied by low-angle x-ray diffraction. A plot of log I vs. θ^2 (I = intensity of the ray diffracted at the angle θ) gave a characteristic curve for the best catalysts. A good catalyst had very few pores less than 60 A. in diam.

13134. BURNHAM, JOHN AND ROBINSON, PRESTON. **Properties of insulating alumina films.** *Natl. Research Council, Div. Eng. and Ind. Research, Ann. Rept. Conf. on Elec. Insulation* 1948, 68-71 (1949).—*C.A.* 43, 5250*h*.

High-purity Al electrodes were subjected to high voltages in boric, citric, and tartaric acids to form pure Al_2O_3 films which were examd. by the electron microscope, by x-rays, and for their elec. properties. Nonporous, plate-like oxide microcrystals with hexagonal symmetry and about 100 A. wide were obtained whose boundaries coincided with that of the original Al crystal grains. Their x-ray diffraction lines agreed closely with those of γ-Al_2O_3.

13135. CHRIST, C.L.; BURTON, C.J., AND BOTTY, M.C. **Use of x-ray and electron diffraction as methods of analysis in biochemical chromatography.** *Science* 108, 91-2(1948).—*C.A.* 42, 7360*e*.

A method was described for the identification of minute amts. of amino acids in mixts. After sepn. by paper partition chromatography, the portion of the paper contg. the desired compd. was leached out. The ext., contg. approx. 200γ of the amino acid, was dropped on a glass slide, and water was removed under vacuum. Examn. of specimens by electron diffraction gave inconsistent results, but reproducible diffraction patterns were obtained from less than 50γ of a no. of amino acids by using x-ray analysis.

13136. Doxey, G.O. **Electron diffraction for film and surface studies.** *Electronics* 21, No. 6, 12-14(1948).—*C.A.* 42, 4461*b*.
Cryst. structures of thin films were detd. by diffraction patterns produced when electrons were directed through the material (catalysts, lubricants, surface deposits, pigments, dyes, and many phases of metallurgy). Surfaces of materials were studied by patterns of reflected electrons.

13137. Elleman, A.J. and Wilman, H. **The structure and growth of lead sulfide deposits on rock salt substrates.** *Proc. Phys. Soc.* 61, 164-73(1948).—*C.A.* 43, 3685*g*.
PbS deposits condensed *in vacuo* on various crystallographic rock salt faces were investigated by electron diffraction. The deposited atoms took up the position of least potential energy relative to the substrate as far as was permitted. About a third of the deposits on the (001) NaCl face showed strongly twinned structures. The deposited crystals tended to develop definite external faces.

13138. Ellis, S.G. **Electron microscopy. I. Techniques.** *Petroleum Refiner* 27, No.8, 410-15 (1948).—*C.A.* 43, 31*i*.
An outline of the techniques used in electron microscopy was accompanied by illustrative sketches. When operated properly, the electron microscope gave magnifications of 20,000 X; micrographs, which may be usefully enlarged to 200,000 X, measured particle size down to 100 A. with less than 5% error.

13139. Ellis, S.G. **Electron microscopy. II. Oil-industry uses.** *Petroleum Refiner* 27, No. 9, 487-91(1948).—*C.A.* 43, 32*d*.
The application of the electron microscope to the study of greases, asphaltic substances, and catalysts was discussed, and reproductions of electron micrographs were presented. The use of the electron microscope for electron-diffraction studies was compared with x-ray diffraction. Max. resolving power was obtained in the study of dense particles, but supplementary methods were necessary to improve contract in less-dense specimens.

13140. Georgiadis, Constantin. **Graphitization of coals.** *Compt. rend. congr. ind. gaz Paris* (Assoc. tech. ind. gaz France) 65, 389-97(1948). —*C.A.* 46, 5293*i*.
The amt. of graphite formed was detd. by x-ray analysis, following acid treatment of the coke, and by measurement of the elec. cond. Graphite formation was negligible after 6 hrs of heating at 750°C, but was appreciable at 950° and 1050°C. Graphite formation was higher for coals contg. more volatile matter and varied inversely with the swelling index.

13141. Grenall, Alexander. **Montmorillonite cracking catalyst; x-ray diffraction.** *Ind. Eng. Chem.* 40, 2148-51 (1948).—*C.A.* 43, 1554*d*.
With the thermal destruction of montmorillonite clay at about 1560°F, the cracking activity with regard to gasoline production disappeared. Catalyst activity decreased on heating the catalyst in an atm. of steam. The diffraction pattern was unchanged by this treatment at 1100°F, but at 1400°F in 100% steam atm. decrease in pattern intensity occurred.

13142. Gulbransen, E.A. **Application of electron-diffraction techniques to the study of corrosion processes.** *Corrosion* 4, 445-55 (1948).—*C.A.* 42, 7694*b*.
The electron-diffraction method was used for studying the dry oxidation films on Fe, Ni, and Cr.

13143. Harris, Louis; Jeffries, David, and Siegel, Benjamin M. **An electron-microscope study of gold smoke deposits.** *J. Applied Phys.* 19, 791-4 (1948).—*C.A.* 42, 7615*b*.
Smokes were produced by evapg. Au from a hot W filament in a partial atm. of N_2 and the samples were collected on thin collodion films. The size of the unit colloidal Au particles varied with the pressure of the atm. and the rate of evapn. The manner of aggregation of the particles was independent of the N_2 pressure and rate of evapn. over a relatively wide range. The aggregations, however, changed markedly when a small amt. of O_2 was present during the evapn.

13144. Hass, Georg. **The formation and the structure of silicon layers formed by vaporization, and their behavior at high temperatures.** *Z. anorg. Chem.* 257, 166-72 (1948).—*C.A.* 43, 6028*g*.
Electron-diffraction patterns and electron micrographs were given for Si films deposited on NaCl or Al_2O_3 supports. Diffraction patterns of films deposited under 600°C showed only 3 diffuse rings. If these were heated at about 700°C, or if the deposit was made above 600°C, the patterns showed the characteristic sharp Si ring and the undesirable 222 reflection. Oxidation of Si in air at 700°C was slight.

13145. Hoerni, J. and Weigle, J. **Diffraction of electrons by graphite.** *Helv. Phys. Acta* 21, 215-16 (1948).—*C.A.* 42, 8565*g*.
Measurements were made with single crystals of 500-1000 A. thickness and about 0.05 min. sides. The Fourier coeff. of the internal potential of the crystal for the (100) plane was 1.7 v. and was const. over the range of crystal thicknesses studied. For the (110) plane, it was 3.2 v. and did not vary between electron potentials of 20-50 kv.

13146. Jack, K.H. **Binary and ternary interstitial alloys. I. The iron-nitrogen system: the structures of Fe_4N and Fe_2N.** *Proc. Roy. Soc. (London)* 195, 34-40 (1948).
The ζ-iron nitride phase (Fe_2N) was prepd. by passing NH_3 over Fe at temp. not exceeding 450°C and under such conditions that the partial pres. of H_2 was negligible. The positions of the N atoms in γ' (Fe_4N) and in ζ were detd.

13147. Jack, K.H. **Binary and ternary interstitial alloys. II. The iron-carbon-nitrogen system.** *Proc. Roy. Soc. (London)* 195, 41-55 (1948)
Chem. and X-ray investigation of the reaction of CO with Fe nitrides and of the reaction of NH_3 with Fe carbides disclosed the existence of Fe carbonitrides—a series of new ternary interstitial alloys contg. Fe, C and N. Prolonged reaction of CO with Fe nitrides resulted in complete elimina-

tion of N. Below 500°C the product was a carbide of Fe, the narrow compn. range of which included $Fe_{20}C_9$. Above 500°C the product of the same reaction was cementite.

13148. KONIG, HANS. **The role of carbon in electron-microscope pictures.** *Naturwissenchaften* 35, 261-5(1948).—*C.A.* 44, 2843*b*.

The behavior of carbon particles (soot) was studied under the electron microscope; their tendency to increase in size owing to decompn. of hydrocarbons from the packing material and the formation of carbon envelopes around other prepns. under the influence of electron bombardent were discussed.

13149. MÜHLETHALER, K. **Electron microscope studies of the fine structure of gels.** *Makromol. Chem.* 2, 143-71(1948).—*C.A.* 45, 4528*h*.

Electron photomicrographs of V_2O_5 gels, prepd. from NH_4VO_3 and HCl, showed a random reticulation of fibrils which averaged 1-2 μ in length and 0.02 μ in diam. Electron diffraction patterns showed that these fibrils were cryst.

13150. PETRYANOV, I. AND ROZENBLYUM, N. **Contact angles of small drops.** *Doklady Akad. Nauk S.S.S.R.* 61, 661-4(1948).—*C.A.* 43, 17*f*.

Thin asbestos fibers were photographed under the electron microscope, under a magnification of 17,000 and subsequent enlargement of 1.7, and the same fibers re-photographed after wetting with a liquid until a string of droplets was formed along the fiber. At const. fiber diam. d, 0.13 and 0.05 μ, with Ti hydroxychloride as liquid. The stable liquid sheath between the drops had a thickness of the order of $0.5\text{-}1.6 \times 10^{-6}$ cm for Ti hydroxychloride and of $2.0\text{-}4.0 \times 10^{-6}$ cm for the vacuum oil. The initial liquid sheath, prior to the formation of the droplets, had a thickness of $1.0\text{-}2.0 \times 10^{-6}$ cm for Ti-hydroxychloride on asbestos fibers of 0.1μ.

13151. PINSKER, Z.G.; LAPIDUS, E.L., AND TATARINOVA, L.I. **Electronographic study of the structure of kaolinite.** *Zhur. Fiz. Khim.* 22, 1017-26 (1948).—*C.A.* 43, 481*i*.

Aq. suspensions of kaolin minerals on evapn. on a celluloid film left crystal flakes parallel to the support. With *nacrite* these flakes were oriented also in their plane, and a point pattern was obtained from which the translation group Γ_m^b and the spacings $a = 5.14$, $b = 8.90$ A. were detd.; the angle between a and b was 90 ± 0.36°. Kaolinite flakes had no preferred orientation around the normal to the support.

13152. RILEY, H.L. **Macromolecular structure of bituminous coal.** *Bull. soc. chim. belges* 57, 400-15(1948) (in English).—*C.A.* 43, 8638*i*.

Bright bituminous coals showed a max. at about 550°C in their c dimension curves, the magnitude of which appeared to be related to the coking power of the coal. The more sol. part of the coal (γ-fraction) was responsible for this max. Anthracites showed no tendency to give max. at 550°C in the c dimension. The a dimension increased slowly from 19 A. (55% C) to 22 A. (92% C), then rose rapidly to about 30 A. at 95% C.

13153. RUBINSHTEIN, A.M. **X-ray study of the effect of the lattice parameters and of the dimensions of the primary crystals on the activity and the selectivity of catalysts.** *Problemy Kinetiki i Kataliza* 5, 11-24 (1948).—*C.A.* 46, 10822*i*.

Ten MgO catalysts with primary crystallite size (detd. by x-ray diffraction) varying from 21.9 to 63.0 A., and lattice consts. varying from 4.16 to 4.24 A. (tabular value 4.20 A.) were tested in the dehydrogenation-dehydration of BuOH. Activity isotherms at 400° and at 460°C at const. lattice parameter showed a max. of activity (a) at a dispersity of the order of 25-30 A., particularly in dehydrogenation. With increasing temp. differences of a of prepns. deviating from the optimum dispersity diminished. Prepns. with a less-deformed lattice were somewhat more subject to the effect of the dispersity than are prepns. with a compressed lattice. With increasing lattice parameter, a in dehydrogenation decreased and in dehydration increased.

13154. SCHRÖDER, WILHELM. **Investigation of the thermal behavior of beryllium hydroxide by Otto Hahn's emanation method, x-rays, and the electron microscope.** *Z. Elektrochem.* 52, 140-4 (1948).—*C.A.* 43, 5300*b*.

The dehydration of metastable crystd. $Be(OH)_2$, as well as the change of the resulting BeO to increasingly inactive products, was studied directly during ignition, and also after cooling to room temp. The results were compared with x-ray detn. of the av. size of the primary particles, and with investigations by means of the electron microscope. Pseudomorphic forms like $Be(OH)_2$ remained up to about 1000°C.

13155. SHIMOMURA, YASUMITSU AND NISHIYAMA, ZENJI. **The crystal structure of nickel oxide.** *Mem. Inst. Sci. Ind. Research Osaka Univ.* 6, 30-4 (1948).—*C.A.* 45, 7404*i*.

When $Ni(NO_3)_2$ was heated in air at 1350°C for 1 hr, NiO with a rhombohedral structure was formed, as detd. by x-ray diffraction. The oxide belonged to the space group D_{3d}^1, the lattice consts. being $a = 4.16768$ and $\alpha = 90°\ 3.8'$. Oxidation of a Ni foil under conditions where the oxide remained on the surface yielded NiO with the characteristic NaCl-type structure. When the oxide film broke away from the substrate or when the foil was completely consumed by oxidation, the rhombohedral structure was observed.

13156. SODA, NORIMUNE AND MIYAGAWA, YUKIO. **The mechanical transition temperatures. (Fundamental studies of the combination of bearing metals.)** *Rept. Inst. Sci. and Technol. Univ. Tokyo* 2, 23-30(1948).—*C.A.* 45, 6373*d*.

Sliding friction was measured for the pairs of Cu-Cu, Ni-Ni, Cu-Ni, and soft iron-soft iron lubricated with normal aliphatic acids of C_4-C_{16}. The mech. transition temp. for soft iron pair were the highest and fairly coincident with the transition temps. observed by electron diffraction. Those for Cu-Cu pair were the lowest and coincident with the m.ps. of the lubricant oils in bulk.

13157. TERMINASOV, YU. S. AND BELETSKII, M.S. **X-ray investigation of the structure of the nickel-skeleton catalyst.** *Doklady Akad. Nauk S.S.S.R.* 63, 411-13(1948).—*C.A.* 44, 9784*f*.

The catalyst obtained after leaching out the Ni_2Al_3 with alkali and subsequent self-ignition of the Ni residue consisted of a mixt. of cubic Ni (lattice const. $a = 3.52$ A.) and NiO ($a = 4.15$ A.). If, after the leaching, the catalyst was stored under H_2O to prevent oxidation, x-ray patterns revealed hexagonal Ni, with $a = 2.56$, $c = 4.16$ A. The grain size of the hexagonal Ni in the skeleton catalyst was of the order of 10^{-5} - 10^{-6} cm.

13158. YAMAGUCHI, SHIGETO AND TSUTSUMI, SHIGERU. **Mechanism of the polymerization of butylene by silica-alumina catalysts.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 69, 6-7(1948).—*C.A.* 46, 8488*c*.

The catalysts of various percentages of Al_2O_3 and SiO_2, effective for the polymerization of butylene, were subjected to electron-diffraction study. The catalysts were a mixt. of Al_2O_3 of hydrargillite form and SiO_2 of β-christobalite with grain size of the order of 100 A.

13159. ZHDANOV, G.S.; KOTOV, V.P., AND LYUBARSKII, G.D. **X-ray analysis of aluminum hydroxide catalysts.** *Problemy Kinetiki i Kataliza* 5, 25-35(1948).—*C.A.* 46, 10822*f*.

The 5 samples studied, dried at 120°C proved to be either bayerite, or mixts. of bayerite with böhmite. On heating, from 210°C up, γ-Al_2O_3 was formed. This phase was present pure in samples heated to 400°-600°C; its dispersity fell with the rise of the temp. A tentative scheme of the phase compn. as a function of the anneal temp., and a diagram relating the Al_2O_3 concn. of the soln. and the pptn. temp. were given. The pptn. from more concd. solns. at higher temps. gave bayerite; the amt. of böhmite increased with decreasing concn. and decreasing temp., and at the same time the dispersity of the ppt. increased.

13160. BERESTNEVA, Z. YA.; KORETSKAYA, T.A., AND KARGIN, V.A. **Electron-microscope study of silica sols.** *Kolloid Zhur.* 11, 369-70(1949).—*C.A.* 44, 2823*i*.

Drops of silica sols evapd. on org. films and then coated with Cr showed structures of 2 types: (1) particles of 0.01-0.1 μ presumably originating from the colloidal silica, and (2) cracked structureless films presumably originating from the molecularly dissolved silica.

13161. BERRY, CHESTER R. **Structure of thin films of silver and silver iodide on silver bromide substrates.** *Acta Cryst.* 2, 393-7(1949).—*C.A.* 44, 3323*i*.

Ag films were prepd. by evapn.; AgI was formed by reaction of the AgBr with dil. soln. of KI and a cyanine-iodide sensitizing dye. The various orientations and structures of these deposits could be accounted for by assuming that the coating layers were built up by a disordered stacking of close-packed layers on minute octahedral faces of the substrate.

13162. BEYERSDORFER, K. **Electron-microscopical examination of surfaces of ruby glasses.** *Optik* 5, 557-63(1949).—*C.A.* 44, 4213*a*.

The ruby glasses contained Cu and Au as the coloring agents and fresh fracture surfaces were prepd. by knocking off splinter. The surfaces were shadowed with Au or Pt at 20°-30°C. The thickness of the metallic layer was between 10 and 50 A. The double-layer replica was lossened with 0.5% HF, washed with water, dried, and then examd. with the electron microscope. Pt showed the finer grain. Nine electron micrographs were given of replicas of unetched and etched (with 20% HF) fracture surfaces of ruby glasses showing crystallites of Au or Cu in the glass.

13163. BIBERMAN, L.M.; VTOROV, E.N.; KOVNER, I.A.; SUSHKIN, N.G., AND YAVORSKIĬ, B.M. **Scattering of electrons in thin layers.** *Doklady Akad. Nauk S.S.S.R.* 69, 519-20(1949).—*C.A.* 45, 9362*f*.

Small-angle scattering of electrons was observed in a suitably adapted electron microscope. For a Cr film of 4.9×10^{-6} g/cm² on collodion, data for the scattering as a function of angle were given by curves for 30, 60, and 80 kv., resp.

13164. BRUSSET, HENRY. **Study of the activation of carbon by low-angle x-ray scattering.** *Bull. soc. chim. France* 1949, 323-7.—*C.A.* 43, 6396*e*.

Several differently activated carbons from wood and lignite were studied, and the results compared with various measures of adsorptive capacity. The x-ray method was sensitive and complements other methods.

13165. BUĬNOV, N.N.; DEMENEV, N.V.; SHUR, A.S., AND FEDOROVA, G.G. **Electron-microscopic study of the structure of platinum films produced on the surface of aqueous solutions of salts of the metal by reduction with gases.** *Doklady Akad. Nauk S.S.S.R.* 66, 223-6 (1949).—*C.A.* 43, 6038*h*.

In the initial stages of the reduction of a K_2PtCl_6 soln. by H_2, the film consisted of single crystallites of 50 A. or more. Further prolonged reduction produced thicker films, exceedingly porous and consisting of aggregates of different sizes. These aggregates were formed by way of oriented coagulation of the original single crystallites. The metal film was formed not only at the surface, but throughout the superficial layer of the soln.

13166. COMER, JOSEPH J. AND HAMM, F.A. **Modified silica-replica technique.** *Anal. Chem.* 21, 418-19(1949).—*C.A.* 43,4557*b*.

A colloidal silica dispersion was used to prep. silica replicas for electron microscopy. Two methods were discussed: (1) silica flakes, obtained by evapn. of the dispersion, were packed in a W basket which was used as the filament in a conventional replica app., (2) the W basket was dipped 4 times in the dispersion, dried between dips, and similarly used as a filament. The method using flakes was preferred as less-frequent renewals of the filament coating were necessary.

13167. ECHEISTOVA, A.I. AND SHEKHTER, A.B. **Electron-microscopic study of structural changes of highly dispersed solids on heating.** *Izvest. Akad. Nauk. S.S.S.R.*, *Otdel Khim. Nauk.* 1949, 13-17.—*C.A.* 43, 4923*b*.

Smoke films of ZnO, MgO, Ag, and Au, showing a loose needle-network structure, stable at ordinary temp., became increasingly compact and contracted on heating. These changes were noticeable at about 0.3-0.45 of the abs. temp. of melting.

With ZnO, the change was complete in 2 min. at 900°C, but required 15 hrs at 400°C.

13168. ECHEISTOVA, A.I. AND SHEKHTER, A.B. **Changes produced in solids by the impact of electrons in the electron microscope.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* **1949**, 238-41.—*C.A.* 44, 9792*g*.

Smoke particles observed in the electron microscope showed a peculiar phenomenon of "thickening" as if a sheath of some foreign matter were growing around the contours of the particles. This thickening was due directly to the prolonged electron bombardment, as it did not take place on areas screened against the electrons. The sheath disappeared completely on heating in air at 600°C. Treatment of MgO smoke films with C_6H_6 at 770°C gave rise to the same thickening effect, also disappearing on oxidation at 600°C. The source of the carbonaceous sheath could be formed only by cracking of org. matter adsorbed on the surface of the particles.

13169. EISENSTEIN, A. **Some properties of the barium orthosilicate-oxide cathode interface.** *J. Applied Phys.* **20**, 776-90 (1949).—*C.A.* 43, 8856*g*.

Oxide cathodes prepd. on a Si-Ni alloy base metal had an interface of Ba_2SiO_4. The thickness of this layer was measured by means of an x-ray method and found to increase with the life of the cathode and to be of the order of 10^{-3} cm. Measurements of the effective, specific elec. cond. were made and compared with the cond. of the coating, (Ba,Sr)O. The interface layer influenced the thermionic emission characteristics of the cathode owing an interface voltage developed by the flow of emission current.

13170. FRICKE, R. **Primary, secondary, and actual structure of solid substances.** *Trans. Chalmers Univ. Technol., Gothenburg No.* **82**, 17pp. (1949).—*C.A.* 44, 3324*g*.

Thermodynamic and x-ray data were correlated for a few compds. and metals of close-packed hexagonal, body-centered cubic, and face-centered cubic lattice type to show that a new field in chemistry may exist in studying the actual structure of materials. The differences in chem. and phys. properties with the planes of the lattices might eventually be used to predict specific surface adsorption and related phenomena.

13171. FRISBY, HENRI. **Study of anodic oxidation of copper by electron diffraction.** *Compt. rend.* **228**, 1291-2 (1949).—*C.A.* 44, 53*d*.

Electrolysis of 0.1 *N* soda soln. with Cu electrodes resulted in a non-adherent CuO film, whereas heating Cu in an air stream at temp. below 175°C yielded strongly adhering Cu_2O. The latter and Cu were face-centered cubic, whereas CuO was monoclinic. In the formation of Cu_2O the orientation of the Cu surface atoms was maintained but not with CuO.

13172. FUJIKI, YOSHIBUMI. **Molecular arrangement of some organic films.** *Mem. Coll. Sci., Univ. Kyoto, Ser. A*, **25**, 119-25(1949).—*C.A.* 47, 18*f*.

Films of fine paraffin waxes(m. 44° to 74°C) were prepd. on Cu foils and plates and examd. by electron diffraction by reflection and by transmission while being heated in a small elec. furnace. The pattern obtained by transmission corresponded to a single crystal of the orthorhombic system and transformed to hexagonal as the temp. rose. This form was maintained to a certain definite temp. higher than the m.p., and there appeared a blurred ring whose Bragg spacing was 4.6 A.

13173. GONZALEZ, F. GARCIA AND VIVALDI, J.L. MARTIN. **Characterization and properties of a sample of bentonite from Almeria.** *Anales edafol. y fisiol. vegetal* **8**, 567-82 (1949).—*C.A.* 44, 5274*i*.

Bentonite from Sierra de Nijar (Almeria) was a member of the isomorphous montmorillonite-beidellite series, and it had a very fine grain and few impurities. Electron-microscopic observation disclosed the existence of fibrous particles.

13174. HANSMANN, GÜNTER AND PIETSCH, HELMUT. **Electron-microscope picture of surfaces of filter membranes.** *Naturwissenschaften* **36**, 250-1 (1949).—*C.A.* 44, 5679*h*.

Zsigmondy collodion filter membranes in the dried form showed a net structure on the surface; electron microscopy showed that the pore size inside each net cell varied from 0.15 to 1 μ and at the cell boundaries from 0.04 to 0.05 μ. The specimen was prepd. by evapg. tungsten oxide onto the surface combined with SiO_2.

13175. HOERNI, JEAN. **Diffraction of electrons in graphite.** *Nature* **164**, 1045-6(1949).—*C.A.* 44, 3326*g*.

Electron diffraction patterns of single crystals of graphite were obtained for crystals of *ababab* layers, *abababcbcbc* layers, and *abababcabcabc* layers. The structure factors for the first two crystals were the same for most spots, but crystals of the third form showed the presence of supplementary spots.

13176. HONJO, GORO. **Electron-diffraction studies on oxide films formed on metals and alloys.** *J. Phys. Soc. Japan* **4**, 330-3(1949).—*C.A.* 44, 5300*g*.

Specimens of Cu metal were polished, placed in a vacuum, and heated to the desired temp.; air at the desired pressure was admitted to the chamber. The specimen was then cooled rapidly and the oxide layer was studied by electron diffraction. CuO was formed at higher pressures (above 10 mm Hg) and intermediate temps.; Cu + Cu_2O appeared at high temps. (above 700°C) and low pressures (below 10^{-2} cm Hg); and Cu_2O was formed over the remaining regions.

13177. HUBER, K. AND ZBINDEN, H. **The aging of vanadium pentoxide sols.** *Z. anorg. Chem.* **258**, 188-97(1949).—*C.A.* 45, 22*d*.

The aging of V_2O_5 sols was observed with the aid of the electron microscope. A noticeable increase in particle size occurred at 40°C in 2-8 days, but there was little change at room temp. over 14-23 months. The aging was hastened by the presence of electrolytes, increasing in the lyotropic series Li^+, Na^+, NH_4^+, K^+. It consisted more of a coagulation than a crystn.

13178. JELLINEK, M.H. AND FANKUCHEN I. **X-ray examination of pure alumina gel.** *Ind. Eng. Chem.* **41**, 2259-65(1949).—*C.A.* 44, 1301*f*.

The tendency of low-temp. γ-Al_2O_3 to convert to stable α-Al_2O_3 with heat was measured by x-ray diffraction; the corresponding steady increase in crystallite and particle radius was measured by line width and small-angle scattering. The original Al_2O_3, contg. 30.25% volatile (mostly water), was essentially bayerite and gibbsite with traces of boehmite. This was heated several hundred hrs at 1470°, 1560° and 1650°F and a few hrs at temps. up to 1920°F. The first detectable trace of α-Al_2O_3 appeared after nearly 900 hrs at temps. up to 1650°F plus 2 hrs at 1880°F.

13179. Karšulin, M.; Tomić, A., and Lahodny, A. **Investigations on bauxite.** *Rad. Acad. Sci. Zagreb* 276, 125-38(1949).—*C.A.* 46, 9231*g*.

A method was described for the detn. of the content of boehmite ($Al_2O_3.H_2O$) and kaolinite in bauxite by means of a differential thermal analysis. The maximums shifted slightly for different samples depending on differences in crystal lattice. From the height of the max. and a chem. analysis of the sample the content in boehmite and kaolinite was calcd. The results were confirmed by Debye-Scherrer analyses.

13180. Kochanovská, A. **X-rays in investigation of bentonites.** *Instruments and Measurements Conf., Stockholm, Trans.* 1949, 71-6(Pub. 1950) (in English).—*C.A.* 45, 7760*i*.

Samples of bentonites from various localities were investigated as to the fine structure of their chief part, montmorillonite, and as to impurities. The main differences in the fine structure of montmorillonite were: in the appearance of "forbidden lines"; in differences of relative intensities of certain reflections, especially of the reflection (001), and in differences in the values of parameter *c* (measured under the same conditions of moisture).

13181. Mathieu-Sicaud, Agnes and Levavasseur, Gustave. **Ultrasonic dispersion of clay suspensions - interpretation of the results with an electron microscope.** *Compt. rend.* 228, 393-5(1949).—*C.A.* 43, 4538*b*.

The effects of the frequency of ultrasonic waves on the dispersion of kaolinite and montmorillonite suspensions in water were studied by nephelometer and electron microscope. The dispersion varied with the frequency, reaching a max. at 960 kc for kaolinite and at 320 kc for kaolinite and at 320 kc for montmorillonite. The mean particle size was 1000 A. in the former case and 1700 A. in the latter. Each frequency corresponded to a certain mean particle size.

13182. McMurdie, H.F. **Microstructure of bone char.** *Proc. Tech. Session Bone Char* 1949, 263-70.—*C.A.* 43, 8649*h*.

Marked differences in appearance were shown by low power photo-micrography for bone chars of different origins and history. Electron microscope pictures showed the change in the form of the carbonaceous residues from new and spent chars. X-ray diffraction showed the relation of the patterns to the mineral fluorapatite. The av. particle sizes of the apatite grain were obtained from a measurement of the breadth of the peaks obtained on the x-ray recording spectrometer. These were found to increase from about 200 A. for new char to 400 A. for char after service.

13183. Nakahira, Mitsuoki. **Powder röntgenograms of montmorillonite.** *Repts. Sci. Research Inst.* (Tokyo) 25, 136-9(1949).—*C.A.* 45, 2373*g*.

In the röntgenograms the intensity of the refraction lines around 12-15, 5, and 3 A. was found to be indicative of the water content, compn., and exchangeable bases. In a thoroughly dried sample the lines were strong near 12, but weak near 5.9 A. and in an air-dried sample strong near 14.8-15.8, but medium to weak near 4.9-5.2 A.

13184. Pernoux, Émile. **Electron microscope examination of kieselguhr.** *Compt. rend.* 228, 1646-7 (1949).—*C.A.* 43, 8831*a*.

Untreated kieselguhr (Filter-Cel) contained regular and well-defined pores of about 0.5 μ diam. On acid treatment, the smaller of these pores became filled with silicic acid gel and the larger ones were visibly obstructed. On treatment of the acid-treated sample with Na_2CO_3 soln., the gel was removed, and the pores were enlarged as compared with the original sample, whereas Na_2CO_3 treatment of the original sample had little effect.

13185. Pongratz, A. **Sintering phenomena on vanadium catalysts and their detection by electron-optical exposures.** *Mitt. chem. Forsch.-Inst. Ind. österr.* 3, 41-4(1949).—*C.A.* 43, 7803*a*.

If gas phase oxidations were performed at 300°-450°C, recrystns. took place that reduced the activity of vanadium catalysts considerably. Prepns. of V_2O_5 and $TiO(VO_3)_2$ were investigated by the electron microscope and the latter was found far superior because it scarcely sintered at higher temp., whereas V_2O_5 sintered to a very great extent.

13186. Raether, Heinz. **Detection of surface films by means of electron interferences.** *Z. Naturforsch.* 4a, 582-7 (1949).—*C.A.* 44, 4302*d*.

Theoretical considerations indicated that cryst. surface films of 5 to 10 A. thickness should be recognizable on smooth surfaces but not on rough ones. Applications to samples of Zn and Al were given. Electrolytically polished Al surfaces became covered with an oxide layer so thin (30-60 A.) that interferences were noticeable even after a month of exposure to the atm.

13187. Roginskiĭ, S.Z.; Shekhter, A.B.; Echeistova, A.I.; Kavtaradze, N.N., and Kushnerev, M. Ya. **Electron-microscope observation of the mechanism of dehydration of crystallohydrates.** *Doklady Akad. Nauk S.S.S.R.* 68, 879-80(1949).—*C.A.* 44, 896*c*.

Crystals of $Na_2SO_4.10H_2O$, which lost their H_2O of crystn. very rapidly on evacuation at room temp., showed no change in shape at the beginning of the examn. under an electron microscope, although dehydration was already complete. Changes, in the form of increasing cavities and hollows, did appear, however, on continued irradiation by electrons, resulting, on prolonged irradiation, in a skeleton-like structure. Similar phenomena were observed with initially hydrated $MgSO_4$, $Sr(IO_3)_2$, and $CaSO_4$ crystals.

13188. ROGINSKIĬ, S.Z.; TRET'YAKOV, I.I., AND SHEKHTER, A.B. **Electron-microscopic study of the surface of working catalysts. I. Application of the method of shadow replicas to studying variation of catalysts as result of the catalytic reaction.** *Zhur. Fiz. Khim.* 23, 50-6 (1949).—*C.A.* 43, 4087*a*.

The roughening of a Pd plate by combustion of H_2 on it for 132 hrs at 175° was shown by electron microscopy with use of collodion replicas on which a Cr wedge was later evapd. The difficulties of electron microscopy due to the smallness of the field of vision could be overcome by statistical methods.

13189. SANDERS, J.V. **Electron diffraction observations of an adsorbed ester.** *Research (London)* 2, 586-7(1949).—*C.A.* 44, 3766*f*.

The orientation of monolayers of Et stearate absorbed on metal surfaces was examd. by electron diffraction. On Pt no orientation was found above the m.p. of the ester in bulk (34°C). On reactive metals, as Cd and Zn, the diffraction pattern of the monolayer showed no change until the temp. was raised well above the m.p. of stearic acid. Me stearate behaved in similar manner. Such results supported the view that the acid was present and preferentially adsorbed on the metal surface.

13190. SPINK, J.A. **Structure of molecular films of stearic acid on copper.** *Nature* 163, 441 (1949).—*C.A.* 43, 7769*f*.

Electron-diffraction patterns of uni- and multi-mol. layers of stearic acid on Cu were obtained that showed the existence of crystallites of a metal soap on the Cu surface. The patterns indicated that the Cu stearate crystals were oriented with their (001) planes parallel to the metal surface.

13191. TRAMBOUZE, YVES. **X-ray diffraction study of Fischer catalysts.** *Compt. rend.* 228, 1432-3 (1949).—*C.A.* 43, 7313*c*.

The presence in the dried material of a Ni hydroaluminate was confirmed. When the material was heated in N_2 at 450°C for 24 hrs, lines of a Ni hydrosilicate also appeared.

13192. TURKEVICH, JOHN AND HILLIER, JAMES. **Electron microscopy of colloidal systems.** *Anal. Chem.* 21, 475-85 (1949).—*C.A.* 43, 6040*g*.

The morphology of colloidal particles as viewed by the electron microscope was presented. These included polystyrene latex, $Al(OH)_3$, Au, $Fe(OH)_3$, V_2O_5, chrysotile, calcium grease, carbon black, and WO_3 as examples.

13193. UNMACK, AUGUSTA. **X-ray investigation of commercial preparations of aluminum hydroxide and oxide.** *Kemisk* 1949, No. 1, 11 pp.—*C.A.* 44, 10271*h*.

Com. prepns. of $Al(OH)_3$ contained gibbsite, bayerite, and amorphous material, of which only the latter dissolved readily in dil. acid. Com. prepns. of Al_2O_3 contained both α- and γ-Al_2O_3, of which only the γ-modification was suitable for use in chromatography. The effect of heating to high temps. appeared to depend not on the cryst. form of the original material, but on the amt. and nature of the impurities present.

13194. YAMAGUCHI, SHIGETO AND MATSUMOTO, KO. **Electron microscopic and electron-refractive study of a corroded metallic surface (crystalline state of an iron surface corroded by hydrogen).** *Repts. Sci. Research Inst.* (Japan) 25, 60-4(1949).—*C.A.* 45, 3315*c*.

The surface of an Fe bell jar used as the cover of a H_2 generator continuously for 15 years was sepd. into a film applied to the surface of stainless steel and examd. under an electron microscope and electron beams. Around the cryst. angles were a reservoir of H_2 (Fe as a catalyst for hydrogenation seemed to be activated in this region). For the no. of bubbles counted per unit area the amt. of gas contained in the metal could be estd.

13195. YOSHIOKA, HIDE. **A study on corrosion of iron by electron diffraction.** *J. Phys. Soc. Japan* 4, 270-5(1949).—*C.A.* 44, 5300*e*.

The green rust of iron was studied and identified with a series of sharp rings in the electron-diffraction pattern. This compd. was found to be unstable in the presence of O_2, converting it to γ-$Fe_2O_3.H_2O$ in a few hrs. The oxidation of $Fe(OH)_2$, the primary corrosion product of Fe, was explained as follows: (1) under rapid oxidation conditions, $Fe(OH)_2 \rightarrow \alpha$-$Fe_2O_3.H_2O$, (2) in O_2-deficient cases, $Fe(OH)_2 \rightarrow$ green rust, (3) under slow oxidation conditions, green rust $\rightarrow \gamma$-$Fe_2O_3.H_2O$, and (4) under very slow oxidation conditions, green rust $\rightarrow Fe_3O_4$.

13196. ZVYAGIN, B.B. AND PINSKER, Z.G. **Electronographic determination of the structure of montmorillonite.** *Doklady Akad. Nauk S.S.S.R.* 68, 65-7 (1949).—*C.A.* 44, 3848*a*.

The high vacuum in which the electron diffraction was observed eliminated the excess water content of ordinary montmorillonite to such a degree that the compn. was practically $Al_2(Si_4O_{10})(OH)_2$, with characteristic replacements of Al^{3+} ions by Fe, Mg, and of Si^{4+} by Al^{3+}. The agreement of the results with the detn. of the structure by x-ray diffraction was complete.

13197. ZVYAGIN, B.B. AND PINSKER, Z.G. **Electronographic determination of the elementary cells of pyrophyllite and talc, and their structural relations to montmorillonite.** *Doklady Akad. Nauk S.S.S.R.* 68, 505-8(1949).—*C.A.* 45, 7476*h*.

From the discussions of the intensities of (*hkl*) reflexes on inclined electron-diffraction diagrams it was concluded that the facts were satisfactorily described by a monolayer structure in montmorillonite, and by a double-layer structure of two types, for pyrophyllite. The hexagonal network of pyrophyllite was accurately projected on the basis of the reciprocal lattice.

13198. AMES, J.; COTTRELL, T.L., AND SAMPSON, AVIS M.D. **An electron-microscope study of crystal surfaces.** *Trans. Faraday Soc.* 46, 938-41(1950).—*C.A.* 45, 4515*e*.

A method of prepg. inorg. crystal surface replicas was described. Step or layer-like irregularities were observed on the faces of a no. of crystals. When crystals were grown from solns. contg. habit modificants, the layers became thicker and more numerous. Secondary surface phenomena included oriented ripples and ridges. In many of the micrographs, considerable departures from the generally accepted principles of crystal symmetry could be seen.

13199. BEECK, OTTO AND RITCHIE, A.W. **The effect of crystal parameter on hydrogenation and dehydrogenation.** *Discussions Faraday Soc.* **1950**, No. 8, 159-66.—*C.A.* 45, 9987*f*.
Measurement of the surface of oriented and unoriented evapd. porous Ni films were made by the B.E.T. method using Ne, Kr, CH_4, and C_4H_{10}. The detn. of the no. of crystallographic sites through the adsorption of H_2 at liquid-N_2 temp. showed that (110)-oriented Ni films also exposed (110) planes to the gas phase. The rates of hydrogenation of benzene over oriented and unoriented Ni and Fe films were slow and about the same, and proceeded through the adsorbed state of benzene without influence by the crystal geometry of the substrate.

13200. BELETSKIĬ, M.S. **Structure of the oxide film formed on the surface of aluminum.** *Doklady Akad. Nauk S.S.S.R.* 75, 551-3(1950).—*C.A.* 45, 3275*h*.
X-ray and electron-diffraction examn. of a "medicinal alumina powder" failed to show any lines, possibly owing to the high dispersity or to an amorphous condition of the surface layer of Al_2O_3. On prolonged hydration at 10°-12°C, the powder became lighter in color, gray, and then, after 10 days, gray-yellow. By x-ray pattern, at this stage, the prepn. became boehmite, $Al_2O_3.H_2O$.

13201. BERESTNEVA, Z. YA.; KORETSKAYA, G.A., AND KARGIN, V.A. **Electron-microscope study of titania sols and the mechanism of formation of colloidal particles.** *Kolloid. Zhur.* 12, 338-41 (1950).—*C.A.* 45, 928*d*.
Sols obtained by mixing $TiCl_4$ with cold H_2O contained originally amorphous spheres (e.g. 0.2 μ) which then crystallized within some hrs. When $TiCl_4$ was mixed with hot water, cryst. particles formed at once. A new electronographic study showed that the spacings of rutile were: *a* 4.58, *c* 2.95 A.; anatase *a* 3.73, *c* 9.37; brookite *a* 9.20, *b* 5.44, *c* 5.14.

13202. BEUGOU, P. AND CONJEAUD, P. **Determination of the ash content of coals by x-rays.** *Rév. ind. minérale* 31, 164-81 (1950).—*C.A.* 45, 4021*e*.
The laws of absorption of x-rays in coal were given. App. for producing and using x-rays in irradiating specimens, and the prepn. of specimens were described. Arrangements for testing were developed. The accuracy was about 0.5%.

13203. BEYERSDORFER, K. **The structure of graphite oxide carbon black.** *Optik* 7, *Sonderheft* 2, 192-8(1950).—*C.A.* 45, 6000*c*.
In oxidation of graphite the O_2 entered between layers of C atoms, the graphite lattice being largely retained. On decompn. at 250-300°C very finely divided carbon remained. An electron diffraction diagram showed 6 intensity maxima, as expected in this structure. Size of crystallites was estd. to be 1000 to 2000 A. and thickness of foliations under 100 A.

13204. BIANCHI, GIUSEPPE. **Structure of cathodic platinum black deposits.** *Ann. chim.* (Rome) 40, 222-33 (1950).—*C.A.* 45, 7854*g*.
The appearance and structure of cathodic Pt black deposits were markedly affected by the concn. in the plating soln., of small amounts of heavy metals, particularly Pb, Hg, Cd, and Tl as well as by the c.d. and temp. X-ray studies of these deposits were made.

13205. BOETTCHER, A. **Oxidation of sputtered aluminum-magnesium and aluminum-silver alloys in a vacuum. II.** *Z. angew. Physik.* 2, 249-51 (1950).—*C.A.* 46, 9922*c*.
Al-Mg alloys, sputtered in a vacuum of 10^{-4} mm. Hg; were prepd. uniformly by subsequent heating to 265°C; this caused uniform diffusion. Electron-diffraction expts. showed that oxidation did not take place at temps. below 360°C. Al-Ag alloys could be prepd. by sputtering and subsequent tempering at 380°C.

13206. BOSWELL, F.W.C. **Standard substance for precise electron-diffraction measurements.** *Phys. Rev.* **80**, 91-2(1950).—*C.A.* 45, 436*d*.
Au and ZnO were unsatisfactory standards for precision measurements. Vacuum-evapd. TlCl, about 300 A. thick, deposited on Formvar or collodion, was satisfactory; no change was detected in a specimen left exposed to the air for weeks. MgO smoke was useful as a secondary standard.

13207. BRUSSET, HENRY. **Porosity of carbon powder.** *J. chim. phys.* 47, 583-5(1950).—*C.A.* 44, 10453*i*.
Active carbons were studied by low-angle x-ray diffraction. The activation of carbon and the catalysis of H_2S oxidation by active carbons were discussed.

13208. BRUSSET, HENRY AND KIKINDAI, TIVADAR. **Central diffusion of x-rays produced by some mineral colloids.** *Compt. rend.* 231, 858-60 (1950).—*C.A.* 45, 2744*g*.
A plot of log I vs. ϵ^2 for small angles (I = intensity, ϵ = scattering angle) was often a straight line from the slope of which an estimate of particle size could be obtained. ZnO, $Zn(OH)_2$ gel, CuS, Se, MgO, Al_2O_3, colloidal Ag, As_2S_5, and $BaSO_4$ were studied.

13209. CAMERON, H.K. **The x-ray study of carbon.** *Coke and Gas* **1950**, 21-5.—*C.A.* 44, 3239*i*.
Investigations into the graphitization of various forms of carbon at high temps. were reviewed with x-ray and electron microscope pictures.

13210. COURTEL, ROBERT. **Oxidation characteristics of metallic alloys ground at different speeds in rarified atmosphere.** *Rev. mét.* 47, 700-3 (1950).—*C.A.* 45, 519*b*.
Specimens of monocryst. Co and of C 0.06, Si 0.57, Mn 0.44, Ni 79.73, and Cr 19.44% were ground with a wheel under a vacuum or in air at 8 cm of Hg pressure while their surface was examd. by electron diffraction in the direction perpendicular to the grinding wheel. With Co ground in vacuum, the original hexagonal structure of the surface changes to cubic at 14 m/sec peripheral speed remaining hexagonal at lower velocities. The 80 Ni-20 Cr alloy ground in dry air showed the presence of velocity levels sepg. regions at which no oxides were formed from those where the examn. showed only oxide lines in the absence of any metallic rays.

13211. DEMENEV, N.V.; BUĬNOV, N.N., AND MILYUTINA, M.I. **Electron-microscopic study of the structure of palladium films produced on the surface of aqueous solutions of metal salts by the action of reducing gases.** *Doklady Akad. Nauk S.S.S.R.* 73, 751-4(1950).—*C.A.* 45, 926*i*.

Pd films produced by H_2 on the surface of solns. of $PdCl_2$ were highly porous and consist of crystallites ranging from 25 to 90 A., with a max. around 50 A. Thick films obtained by rapid reduction showed a high proportion of aggregates, evidently formed around single coarse particles acting as coagulation centers. Slow reduction produced aggregates of seemingly triangular shape which, on stereoscopic examn. were seen to be hollow cones with the generatrix lying in the plane of the film.

13212. ENDTER, FRIEDRICH. **Structure of technical lampblack.** *Z. anorg. u. allgem. Chem.* 263, 191-9(1950).—*C.A.* 46, 7392*f*.

Hexagonal lampblack particles observed with an electron microscope were not compatible with the conception that the borders of the particles should be random. The anomaly was explained by assuming the structure to consist of primary and secondary particles.

13213. EPSTEIN, H.T. **The structure of monolayers and multilayers of polar hydrocarbon molecules on solid substrates.** *J. Phys. & Coll. Chem.* 54, 1053-69 (1950).—*C.A.* 45, 419*e*.

Monolayers and multilayers of stearic acid and other fatty acids were prepd. on glass microscope slides, shadow cast, and examd. by electron microscopy. The mols. in monolayers were grouped into clusters (micelles) of characteristic diam. and tilt angle, both of which varied inversely with the length of the mol. Electron micrographs were also obtained of skeletonized films prepd. by dissolving out the stearic acid from mixed films of stearic acid and Ba stearate.

13214. FRANCOIS, JEANNINE. **Influence of temperature on the particle size of nickel oxide.** *Compt. rend.* 230, 1282-4(1950).—*C.A.* 44, 10453*h*.

Ni oxide, prepd. by heating $NiCO_3$ at various temps., was examd. by small-angle x-ray diffraction. The sample prepd. at 400 °C was homodispersed with a particle radius of 27 A. Between 400° and 425 °C, sintering occurred to give a heterodispersed system with a trend to larger particle size.

13215. FRANKLIN, ROSALIND E. **Influence of the bonding electrons in the scattering of x-rays by carbon.** *Nature* 165, 71-2(1950).—*C.A.* 44, 4776*f*.

During an investigation of the scattering of x-rays by various carbons, an anomalously high intensity of the (10) band was always observed. This was attributed to the configuration of the valency electrons in graphite or in carbons contg. incipient graphitic layers.

13216. FRANKLIN, ROSALIND E. **The interpretation of diffuse x-ray diagrams of carbon.** *Acta cryst.* 3, 107-21(1950).—*C.A.* 44, 7141*i*.

A detailed study was made of carbon obtained by pyrolysis of polyvinylidene chloride at 1000 °C. Results of the radial distribution method agreed with those from comparison of observed and calcd. intensity curves. Of the sample, 65% was in perfect graphitic layers of av. diam. 16 A. and the rest was disordered. About 55% of the layers were in parallel pairs 3.7 A. apart. The mean interparticle distance was 26 A.

13217. FRANKLIN, ROSALIND E. **The structure of carbon.** *J. chim. phys.* 47, 573-5(1950).—*C.A.* 44, 11066*d*.

Results of an x-ray study of some carbons formed by pyrolysis of various org. materials were described. From 10 to 45% of the carbon in any sample was highly disordered, the remainder being in graphite-like layers from 13 to 22 A. in diam. The interlayer spacing was 3.7 A. when a group of two layers occurred, decreasing when more layers were present in a group to a limit of 3.44 A.

13218. GARNER, F.H.; NUTT, C.W., AND MOHTADI, M.F. **Detergency of carbon black in hydrocarbon solutions. II. The effect of dispersion medium on the particle-size distribution of carbon black.** *J. Inst. Petroleum* 36, 292-4(1950).—*C.A.* 44, 7520*g*.

An electron micrograph study of the particle-size distribution of carbon black dispersed in toluene solns. of various additives showed a correlation between the particle size and the dispersive power of the medium as measured by a standard settling-rate test. The additives studied in toluene were: (a) 1.0% dibromolinoleic acid; (b) 1.0% naphtenic acid; (c) 0.47% Ca naphthenate; and (d) 1.0% com. additive, P.64.

13219. GEROULD, CHARLES H. **The use of latex spheres as size standards in electron microscopy.** *J. Applied Phys.* 21, 183-4(1950).—*C.A.* 44, 7140*d*.

Precautions were recommended in the handling of latex 580G, lot 3584. Increases in diam. of latex spheres as a result of shadowing, greater than those due to the thickness of metal film, were reported.

13220. GLEMSER, O. AND LUTZ, G. **Decomposition of molybdenum trioxide in the electron microscope and the appearance of lower oxides.** *Kolloid-Z.* 119, 99-102(1950).—*C.A.* 45, 3708*b*.

The decompn. of MoO_3 crystals into crystallites of lower oxides (Mo_4O_{11}, Mo_8O_{23}, Mo_9O_{26}, and probably MoO_2) was illustrated by 10 photographs.

13221. GUINIER, A. **Study of catalysts by scattering of x-rays at small angles.** *Discussions Faraday Soc.* 1950, No. 8, 344-7.—*C.A.* 45, 9991*e*.

Scattering measurements alone did not provide precise information about the size and shape of an irregular array of particles of a powder catalyst. However, in simple cases, or when the measurements were supplemented by information obtained by other methods, e.g. electron microscopy, the quant. use of x-ray data was possible.

13222. GULBRANSEN, EARL A. AND RUKA, ROSWELL. **Kinetics of solid-phase reactions in oxide films on iron; the reversible transformation at or near 570°C.** *J. Metals* 188, *Trans.* 1500-8(1950).—*C.A.* 45, 426*d*.

The forward and reverse reactions, $Fe_3O_4 + Fe \rightleftarrows 4FeO$, were studied by electron-diffraction methods. In thin films the forward reaction occurred at temps. 170°C below the equil. value. The mechanism of the forward reaction was governed by the diffusion of Fe. Studies on the reverse reaction indicated that a process of nucleation and growth was rate controlling.

13223. HACKERMAN, NORMAN AND ANTES, LELAND L. **Contact potentials of evaporated iron films in air and in nitrogen at low pressure.** *Science* 112, 471(1950).—*C.A.* 45, 1886*i*.

The potential of an Fe film against a Pt reference plate was independent of time and pressure in pure N_2, but increased by several tenths of a volt in the presence of 0.01 to 10μ of air. The change in potential was related to sorption of O_2 on the surface layer rather than gross penetration. Rate of O_2 adsorption was more rapid than desorption judging from the behavior of potential as a function of time and pressure. Electron diffraction studies showed that an oxide pattern was noticeable on the surface of an Fe film 1.5 min. after contact with air while on a Ni film 27 min. was required.

13224. HENSLEY, EUGENE B. AND AFFLECK, JOHN H. **The barium oxide on tungsten cathode interface.** *J. Applied Phys.* 21, 938-9(1950).—*C.A.* 44, 10485*b*.

An interface compd. formed by the reaction of an oxide coating with the metal was identified by x-ray diffraction as principally barium tungstite, $BaWO_3$, when the coating was pure BaO. The corresponding tungstites were found when SrO or the solid soln. (BaSr)O was used for coating.

13225. HERGLOTZ, H. AND LISSNER, A. **Raney metals as desulfurization catalysts. II.** *Z. anorg. Chem.* 261, 237-47(1950).—*C.A.* 44, 10474*b*.

An x-ray investigation was made of Cu and Co metal formed by the Raney process and of several Cu and Co catalysts. The grain size of Co was less than 10^{-4} cm. During desulfurization on Co catalysts, Co sulfides were formed with greater or less S than suggested by the stoichiometric formula CoS.

13226. HOFER, L.J.E.; COHN, E.M., AND PEEBLES, W.C. **Isothermal decomposition of nickel carbide.** *J. Phys. & Colloid Chem.* 54, 1161-9 (1950).—*C.A.* 45, 1850*d*.

The thermal stability of Ni_3C was studied magnetically and by x-ray diffraction between 320° and 355°C. During an induction period, which preceded the decompn., there was no detectable structural change in the carbide. Ni and free C were formed on decompn. Empirical activation energies for the induction period and the decompn. process were calcd.

13227. HOFER, L.J.E.; PEEBLES, W.C., AND BEAN, E.H. **X-ray diffraction studies of the action of carbon monoxide on cobalt-thoria-kieselguhr catalysts. II.** *J. Am. Chem. Soc.* 72, 2698-2701(1950).—*C.A.* 44, 9223*g*.

Reduced Co-thoria-kieselguhr catalysts produced increasing amts. of free carbon and decreasing amts. of Co carbide on carburization with CO at increasing temps. in the range 243° to 298°C. At the high temps., the max. amt. of carbide was formed within the first 5 hrs of carburization. Free carbon tended to make the catalyst inaccessible to further carbide formation.

13228. HOFMANN, U. AND OHLERICH, G. **The surface chemistry of carbon.** *Angew. Chem.* 62, 16-21 (1950).—*C.A.* 44, 3778*h*.

Surface compds. of carbon with O_2, S, and N_2 were prepd. and identified. Active centers, apparently, were not involved in the HBr catalysis, and it was concluded that the hexagonal network of the C atoms of the exposed base surfaces (in contrast to the prismatic surfaces) was responsible for the properties exhibited by the carbon. The catalytic production of 100 C atoms in the surface amounted to about 20 mols. of HBr per hr at 150°C.

13229. HOSEMANN, R. **X-ray diffraction in colloidal systems-relation among packing density, poly-dispersity, and pure particle scattering.** *Kolloid-Z.* 118, 116(1950).—*C.A.* 45, 21*i*.

13230. IMELIK, BORIS. **Study of the alteration of the fine structure of silica gel by the small-angle scattering of x-rays.** *Bull. soc. chim. France* 1950, 1232-4.—*C.A.* 45, 5489*a*.

Alteration of the fine structure of silica gel during adsorption and the swelling of the particles was shown to be possible by using the diffraction of x-rays at small angles. The resulting x-ray pattern had a ring whose mean radius was 29.2 A. for the gel itself. After satn. with a soln. of I_2 in CCl_4 it was 29.2 A.; after desorption of I_2 and CCl_4 it was 32.5 A.; and after prolonged desorption at 37°C it was 29.0 A. When the gel satd. with CCl_4 alone, the resulting ring gave a radius of 35.8 A.; desorbed of CCl_4 it was 34.5 A.; and after prolonged desorption at 37°C, it became 30.0 A.

13231. INOUE, KATSUYA. **Structure of humic acids. An x-ray diffraction study.** *Bull Chem. Soc. Japan* 23, 132-4(1950)(in English).—*C.A.* 45,7335*d*.

Humic acid was defined as the chocolate-colored substance which was produced by an extn. of coal with 1% NaOH up to 90°C and pptd. by the addn. of an excess of mineral acid. Fifteen samples were studied. The following data summarized the results for 14 samples: lattice parameter a = 2.11—2.40 A., c/2 = 3.44—3.85 A., crystallite dimension a = 7.0—14.3 A., c = 8.8—21.0 A. All parameters were consistent with the so-called "amorphous carbon" lattice.

13232. KANTZER, M. AND MEZARD, M. **Silica gel photographed by the electron microscope.** *Bull. soc. franc. céram.* 1950, No. 6, 37-40.—*C.A.* 46, 5402*f*.

Specimens of silica gel were prepd. by pulverizing the dry material above the screen and letting the very fine dust settle on it. The results were similar to those obtained by evapg. the suspending medium of a suspension. X-ray spectra were presented for each material photographed. After the silica gel was heated to 1280°C cristobalite was present, with no trace of quartz.

13233. KASATOCHKIN, V.I.; KUKHARENKO, T.A.; ZOLOTAREVSKAYA, E.YU., AND RAZUMOVA, L.L. **X-**

ray study of humic acids of coal. *Doklady Akad. Nauk S.S.S.R.* 74, 775-8(1950).—*C.A.* 46, 1227*h*.

Humic acids were aromatic hydroxy carboxylic acids of high mol. wt. Changes in mol. structure during the gradual coalification were studied by x-ray examn. of peats and soft coals of different localities, and artificially oxidized coal (with ratios C:H from 13.2 to 26.8). The interferences were increasingly distinct and sharper with advancing degree of coalification and mol. rearrangement. With progressive coalification, the ordered lattice of the aromatic nuclei of the humic acid increased; the disordered part appeared peripheral owing to the groups of the mols. The changes of the ratio C:H as an indicator for increasing condensation of aromatic nuclei paralleled these diffraction phenomena.

13234. Krause, A.; Kotkowski, St., and Karolewicz, St. **Influence of the structure on catalytic activity.** *Przemysl Chem.* 6(29), 25-32(1950).—*C.A.* 45, 10021*f*.

A mixt. of $Fe(OH)_3$ and $Cu(OH)_2$ was pptd. and the ratio of Fe:Cu was 1:0.5 in one case and 1:1 in another. The mixts. were heated slowly from 25° to 900°C and samples were taken at 50° intervals. The catalytic activity was measured by the peroxidative oxidation of formic acid with H_2O_2 at 37°C; it decreased with increased temp. X-ray diagrams of the samples heated above 400°C showed the formation of the spinel structure of cupric ferrite. The spinel structure was formed through different transitory phases which had a radical structure characteristic of the deformed space lattice at 400°C.

13235. Kwiecinski, Alfred. **Crystal lattices of the element carbon.** *Przeglad Górniczy* 6, No. 11, 587-95(1950).—*C.A.* 45, 4991*g*.

Atoms linked covalently were in point contact with each other on one side. When the bond energy between two atoms was less than max., they were slightly spaced from each other or tilted or rotated with respect to each other in the model. The lattices of graphite and diamond were described in detail. The latter was characterized by max. compactness, the atoms being at the corners of a pentagonal dodecahedron.

13236. Likhtman, V.I. **Sintering of metallic powders.** *Doklady Akad. Nauk S.S.S.R.* 71, 323-5 (1950).—*C.A.* 44, 5773*b*.

Micrography of a powder of oxidized electrolytic Cu, pressed at 300°C under graphite, showed tiny bridges of metal connecting grains where the metal was not brought into immediate contact by the compression. At 400°C, the bridges were broader with recrystn. beginning to appear within the grains. The highly mobile atoms migrated preferably to points where the metal grains were closest to each other. Evapn. of metal was demonstrated to take place at highly active points at as low as 300-400°C, and its condensation at less active points may also play a role in the formation of the bridges.

13237. Longuet-Escard, J. **Fixation of hydroxides on montmorillonite.** *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* 3, 40-4; 4, 65-6(1950) (in French).—*C.A.* 46, 8791*h*.

X-ray studies were made on complexes of the chlorite type, e.g., montmorillonite $Ni(OH)_2$, montmorillonite-$Al(OH)_3$, and especially mixed montmorillonite-Ni and Al hydroxides. Compds. analogous to natural chlorite can be prepd. The tendency which anions, e.g., OH, had to penetrate even in the very dild. centers, between the layers of montmorillonite (as do cations) was shown.

13238. Lukesh, Joseph S. **The symmetry of graphite.** *Phys. Rev.* 80, 226-9(1950); *Am. Mineral.* 35, 125 (1950).—*C.A.* 45, 414*a*.

X-ray diffraction evidence indicated that the symmetry of graphite was no higher than twofold. Twin observations and the occurrence of satellite reflections was observed, both of which were incompatible with sixfold symmetry. Both phenomena strongly suggested that the classical concept of equiv. C-C bonds must be discarded in favor of one involving unequal bond lengths and bond angles.

13239. Mac Ewan, Douglas M.C. and Amoros, Jose Luis. **Röntgenographic investigation of clays.** *Anales edafol. y fisiol. vegetal* (Madrid) 9, 363-79(1950).—*C.A.* 45, 6330*h*.

The prepn. of samples by centrifugation, mounting of samples for analysis, and fundamental characteristics of the cameras used for small-angle reflections were discussed. Tables of spacings and intensities of powder diagrams were given for the minerals most frequently found in clays.

13240. Mathieu-Sicaud, Agnès. **Applications of the electron microscope to the study of dispersions. II.** *Mém. services chim. état* 35, No. 4, 33-78 (1950).—*C.A.* 46, 2878*d*.

The following ultrasonic frequencies for max. dispersion of $BaSO_4$ suspensions of varying size and inertia of particle were given: 1,320, 1,920 and 3,400 A.; 960, 720, and 576 kc, resp.; for suspensions of alumina in water: 3,800 and 11,300 A.; 240 and 960 kc, resp.

13241. McCartney, James T.; Seligman, Bernard; Hall, W. Keith, and Anderson, Robert B. **An electron-microscopic study of metal oxides and metal oxide catalysts.** *J. Phys. & Colloid Chem.* 54, 505-19(1950).—*C.A.* 44, 5691*f*.

Changes in structure were studied on reduction of Fe_2O_3 gel, hydrous NiO, CuO powder, Ag_2O powder, CoO powder, Co basic carbonate, Co-ThO_2-MgO (100:6:12) catalyst, Co-kieselguhr (100:200) catalyst, Co-ThO_2-MgO-kieselguhr (100:6:12:200) catalyst, and Fe_2O_3 catalyst (Fe:Cu:K_2CO_3, 100:10:0.5). Wt losses and comparisons of electron micrographs and B.E.T. surface areas were detd. Pptd. oxides and catalysts always showed decrease in surface area on reduction and a sizable portion of this decrease occurred in reduction rather than by sintering. Decrease in sintering on reduction of Co basic carbonate was effected by the addn. of promoters and kieselguhr, the order of increasing effectiveness being kieselguhr < ThO_2, MgO < ThO_2 plus MgO.

13242. McLauchlan, T.A.; Sennett, R.S., and Scott, G.D. **Continuous observations with the electron microscope on the formation of evaporated films of silver, gold, and tin.** *Can. J. Research* 28A, 530-4(1950).—*C.A.* 45, 2737*h*.

The growth of films of Au, Ag, and Sn was observed continuously by the use of a special specimen holder for the evapn. of metals within an RCA-EMU electron microscope. The micrographs confirmed the migration of metal atoms leading to the formation of nuclei, growth and merger of aggregates, and the effect of surface tension. The recrystn. of NaCl after exposure of an evapd. film to air was illustrated.

13243. Mering, Jacques. **The reflections of x-rays by interstratified clay minerals.** *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* 3, 21-6(1950)(in French).—*C.A.* 46, 8792*h*.

An exact interpretation required calcg. 3 long approaches, taking into account all the parameters: thickness and structure of the layers, their relative abundance, and their degree of disorder. These calcns. could be made in advance for a sufficient no. of sequence types, permitting an interpolation.

13244. Mering, J.; Mathieu-Sicaud, A., and Perrin-Bonnet, I. **Electron-microscope study of montmorillonite saturated with different cations.** *Trans. 4th Intern. Congr. Soil Sci., Amsterdam* 3, 29-32, 173; 4, 60(1950)(in French).—*C.A.* 47, 805*i*.

An electron-microscope study of the evapn. of a suspension did not directly indicate the state of the suspension. Interaction of 3 types could take place: (1) between paraticles and the liquid surface, (2) between particles and the membrane support (Formvar), and (3) among the particles. In Na-montmorillonite the 3rd type predominated. In H-montmorillonite the 3rd type was weak, and the 2nd type predominated.

13245. Michel, Andre; Bernier, Roger, and LeClerc, Georges. **Thermomagnetic study of Fischer catalyst containing nickel.** *J. chim. phys.* 47, 269-73(1950).—*C.A.* 44, 7638*i*.

There existed an intimate relation between the catalytic activity of Ni and the crystal size. The most active catalysts possessed a certain type of magnetization-temp. curve that was correlated by means of x-rays with the crystal size. Under certain conditions of catalysis the Ni catalyst was transformed into a paramagnetic hexagonal carbide of Ni.

13246. Miwa, Mitsuo; Mamiya, Shoichi; Igarashi, Tatsuo, and Onai, Yoshio. **Structure of amorphous carbon.** *J. Phys. Soc. Japan* 5, 81-3 (1950).—*C.A.* 45, 4911*i*.

Graphite, CO (reduced by Fe at 500°C), CO (reduced at 350°-400°C), retort carbon, coke, C_2H_2 decompd. at 800°C, and C_6H_6 soot were examd. by means of x-ray diffraction. As the particle size of amorphous C decreased, the higher-order reflection by the (001) plane faded away rapidly.

13247. Pechkovskaya, K.; Pupko, S., and Dogadkin, B. **Structure and properties of loaded rubber mixtures. IV. An electron-microscope study of various carbon blacks and their mixtures with sodium-butadiene rubber.** *Kolloid. Zhur.* 12, 367-9(1950).—*C.A.* 45, 890*i*.

Carbon black suspensions in H_2O, EtOH, or toluene were dispersed by supersonic vibrations and observed in an electron microscope. Sections of loaded rubber were coated with collodion, which then was shaded with Cr, or with Me methacrylate, which in turn was coated with silica. Channel carbon blacks formed chains whose particles range from 260 to 400 A.; finer carbon black samples proved to be better as fillers.

13248. Picon, Marius and Flahaut, Jean. **Association of carbon and manganese sulfide.** *Compt. rend.* 230, 2192-3(1950).—*C.A.* 44, 10441*g*.

When the azeotrope of carbon and MnS obtained by vaporization in vacuum above 1400°C was condensed, the phys. and chem. properties of the product showed that it was not a simple mixt. The d. at 0°C was 3.55 compared to 3.68 for the mixt. X-ray study and soly. in fuming HNO_3 and Brodie mixt. indicated that the carbon was actually amorphous.

13249. Radushkevich, L.V. and Luk'yanovich, V.M. **The structure of sorbents determined by means of the electron microscope.** *Zhur. Fiz. Khim.* 24, 21-42(1950).—*C.A.* 44, 4747*a*.

The sorbents were deposited on films from suspensions (suitable for Al_2O_3 and SiO_2) or from dust or rubbed in a film-forming material. Over 1000 specimens of active carbon were studied. Com. specimens all gave similar pictures, but different spots of a specimen had different structures. The dimensions of the visible pores in sugar charcoal increased when the total pore vol. was increased by longer heating. SiO_2 gels (12 specimens) were studied.

13250. Rao, M.R.A. **Electron microscopic studies on aqueous sols.** *Proc. Phys. Soc.* (London) 63B, 980-1(1950).—*C.A.* 45, 4526*i*.

Electron micrographs were shown for aq. sols contg. the following colloidal suspensions: graphite, stearic acid, V_2O_5, and S. The colloidal graphite was laminated and the thickness of the lamina was a small fraction of the av. diam. The particles of stearic acid seemed to have all kinds of shapes. Large particles of the freshly prepd. V_2O_5 spontaneously disintegrated on keeping. A micrograph of colloidal S showed particles more or less spherical and very much smaller in diam. Colloidal S did not indicate any change in the degree of depolarization with orientation of the particles.

13251. Sabatier, Germain. **Crystallization, by heating, of the mixed gels of silica and magnesia.** *Compt. rend.* 230, 1962-4(1950).—*C.A.* 44, 8739*b*.

Temps. and relative heats of crystn. for mixts. of varying compns. were detd. from the positions and lengths of the horizontal stretches in time-temp. curves (cooling curves). X-ray diffraction analysis of the cryst. phases showed that only those already known, from the study of fused MgO-SiO_2 systems, occurred.

13252. Schaeffer, W.D.; Polley, M.H., and Smith, W.R. **Nature of carbon black surfaces as revealed by adsorption studies.** *J. Phys. & Colloid Chem.* 54, 227-39(1950).—*C.A.* 44, 6700*c*.

The interaction between fully reinforcing black, Spheron 6, and decane and dihydromyrcene at 100°C were given. Particle sizes were obtained by means of an RCA-EMU electron microscope and B.E.T. surface areas from low-temp. N_2 adsorption isotherms, by assuming 16.2 A.^{2} as the cross-sectional area of N_2. The initial heat of adsorption of dihydromyrcene was about 20 kcal/mole higher than that of the satd. hydrocarbons, although the heats of liquefaction were very similar. The difference in the heats disappeared when the black was devolatilized at 975°C in vacuo over a 3-5 hr period.

13253. SCHWAB, GEORG-MARIA. **Compact-dispersed silver.** *J. Phys. & Colloid Chem.* 54, 576-80 (1950).—*C.A.* 44, 5679*f*.

Pore size and particle size of compact-dispersed Ag contg. 5.4 at. % of Ag were calcd. from the velocity of decompn. of HCOOH vapor, from the sp flow penetration for H_2O, and from x-ray diffraction lines. The 3 methods agreed with values from 1 to 2×10^{-4} cm. The mechanism of reduction of Ag halide by Zn was an electrolytic one. The Zn and the Ag front formed a short-circuited element. The Ag was pseudomorphic after the AgCl. The lattice orientation of compact-dispersed Ag prepd. from single AgCl crystals showed no relation to the original crystal.

13254. SENNETT, R.S. AND SCOTT, G.D. **The structure of evaporated metal films and their optical properties.** *J. Optical Soc. Am.* 40, 203-11(1950).—*C.A.* 44, 6224*d*.

The structures of evapd. films of Ag, Au, Cu, Al, Sb, Ni, Pd, and Cr in thickness from 30 to 500 A. were observed in the electron microscope and correlated with their optical properties. The stable form of films thinner than a characteristic thickness was found to be aggregated. The rate of formation affected the structure and the optical properties; slow rates in general gave more aggregated structure and increased light absorption.

13255. SERSALE, RICCARDO. **Thermal activation of bauxite.** *Ricerca sci.* 20, 1685-98(1950).—*C.A.* 45, 5340*d*.

Two samples of bauxite $Al_2O_3.H_2O$ differing in Fe content were studied at 480° and 900°C by using x-ray analysis, thermodilatometry and thermodensitometry. At the lower temp. H_2O was lost and the higher the γ Al_2O_3 became α Al_2O_3. The dehydration was accompanied by a sudden and marked permanent expansion.

13256. SHEKHTER, A.B.; ECHEISTOVA, A.I., AND TRET'YAKOV, I.I. **Crawling of silver atoms along the surface of zinc oxide crystals.** *Zhur. Fiz. Khim.* 24, 202-6(1950).—*C.A.* 44, 6224*g*.

Ag vapor was condensed on ZnO needles. Viewed in an electron microscope, Ag formed blobs of 200-1000 A. strung along the needles. The dimensions of these blobs did not change at room temp. or 150°C, but heating to 220-300°C in air reduced the no. of the blobs and increased their diam. and mutual distance. This proved that Ag atoms could migrate along the ZnO surface.

13257. SHEKHTER, A.B.; ECHEISTOVA, A.I., AND TRET'YAKOV, I.I. **Creep of atoms of gold and of palladium on the surface of crystals of zinc oxide.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* 1950, 465-8.—*C.A.* 45, 3216*c*.

Electron-microscopic examn. of evapd. films of Au, of an estd. thickness of ~ 25 at. layers, on ZnO showed (X60,000 magnification) individual crystallites of Au on needles of ZnO. Prolonged heating up to 320°C produced no change, but from 320° to 340°C there was progressive coarsening of the Au crystallites, due to disappearance of the smaller ones, and a progressive increase of the distance between crystallites. Pd films on ZnO, viewed under a magnification of X40,000, showed no sep. crystallites. Electron diffraction patterns could not be obtained from films on ZnO, but on collodion evapd. films of Ag gave the characteristic lines of the Ag lattice even with amts. corresponding to about 1 at. layer.

13258. STOL'NIKOV, V.V. **Electron-microscope investigation of the hydration of cement.** *Doklady Akad. Nauk S.S.S.R.* 71, 339-41(1950).—*C.A.* 44, 6095*g*.

In the early stages of the hydration the surface of the grain was covered with bristles, probably hydration products of tricalcium silicate and tricalcium aluminate. On the presence of 0.3% of Na soap of abietic resin as surface-active addn. agent, the bristles were distinctly smaller and finer. The effect of the soap consisted in an increase of the dispersity of the new formations.

13259. TAZAKI, HIDEO AND MIYANO, KAZUYOSHI. **X-ray examination of clay minerals.** *J. Sci. Hiroshima Univ.* Ser. A, 14, 151-4(1950).—*C.A.* 46, 8512*b*.

Pure clay minerals (32 samples) were examd. by the powder method of x-rays and the lines due to kaolinite, to montmorillonite to talc, to pyrophyllite, and to muscovite were detd.

13260. TERTIAN, ROBERT. **The constitution and crystal structure of activated alumina.** *Compt. rend.* 230, 1677-9(1950).—*C.A.* 44, 10434*e*.

The structure of γ-Al_2O_3 obtained by calcining a monocrystal of the hydrate at temps up to 1100°C was found to consist of 2 forms. One form, which was most common in well-crystd. γ-Al_2O_3, had the same arrangement as corundum, but the Al atoms were inscribed in a cubic face-centered network of O. The lattice unit was hexagonal with parameters a = 8.40 A., c = 13.65 A. It contained 18 mols. Al_2O_3, and the calcd. d. was 3.66, agreeing with the measured max. 3.65.

13261. TURKEVICH, JOHN; HUBBELL, HARRY H., AND HILLIER, JAMES. **Electron microscopy and small angle x-ray scattering.** *Discussions Faraday Soc.* 1950, No. 8, 348.

Applications were cited in the use of the electron microscope for the study of catalyst preparation and sintering. Correlations were presented of particle size determinations by the electron microscope with those obtained from the low angle scattering of X-rays.

13262. ZEHENDER, E. **The electron-microscopic investigation of the structure of films of zinc and cadmium formed by condensation of vapors.** *Optik* 7, *Sonderheft* 2, 200-7(1950).—*C.A.* 45, 5995*i*.

Ag was used as the contaminant or seeding layer. With Ag in amt. corresponding to a film 10^{-2} monatomic in thickness, Zn formed a bright surface with crystals about 30 mμ in size. The film had 80% of the elec. cond. of massive Ag.

With one-tenth as much Ag, the film of Zn was bluish and was composed of crystals about 100 mμ in size. With no Ag present the film was gray and crystals were about 200 mμ in size. Results with Cd were similar to those with Zn, but the crystals of the former were larger.

13263. ABE, RYUJI. **Study on corrosion-process of iron by electron diffraction.** *J. Phys. Soc. Japan* 6, 345-50(1951)(in English).—*C.A.* 47, 952*f*.

The anodic corrosion products of Fe in 0.1% aq. NaCl soln. were studied by electron diffraction. The primary product was $Fe(OH)_2$. Under the usual conditions this was oxidized partly to γ-$Fe_2O_3.H_2O$, which combined with the remaining $Fe(OH)_2$ to form a green rust $2FeO.Fe_2O_3.H_2O$. This green rust was then oxidized to a final product of γ-$Fe_2O_3.H_2O$ if the pH of the soln. was less than 2, α-Fe_2O_3 if pH was 4 or 5, and Fe_3O_4 if pH was greater than 11.

13264. BAGNO, ODETTE; LONGUET-ESCARD, JACQUELINE, AND MATHIEU-SICAUD, AGNÉS. **Electron microscopy of nickel hydroxide sols.** *Compt. rend.* 232, 1350-2(1951).—*C.A.* 46, 2878*b*.

Electron photomicrographs showed that a flocculent ppt. of $Ni(OH)_2$ was completely peptized in 48 hrs at 20°C, to particles of diam. 50 A. After 5 days aging the diam. had increased to 150 A. A ppt. peptized at 40° to 80°C showed both large and small particles.

13265. BAGNO, ODETTE; LONGUET-ESCARD, JACQUELINE, AND MATHIEU-SICAUD, AGNÈS. **Study of nickel hydroxide sols by the electron microscope.** *Mém. services chim. état.* (Paris) 36, No. 1, 81-3(1951).—*C.A.* 47, 380*e*.

The patterns formed during the peptization and flocculation of $Ni(OH)_2$ at ordinary and elevated temp. were shown. The diam. of the monodispersed particles was about 150 A., and the aged hexagon-shaped particles (aligned on the 00*l* face) were about 1000 A. in diam.

13266. BLOIS, MARSDEN S. JR. **Approach to the microscopy of molecules.** *Science* 114, 175-7 (1951).—*C.A.* 46, 2369*b*.

Electron micrographs of very thin evapd. metallic deposits showed that under certain conditions the discontinuous distribution of particles was subject to strong orienting effects. A 10-A. deposit of Ag on collodion showed an elementary structural unit circular in form, with a tendency for the structural units to link up and form a linear beadlike pattern. Au and Ag films 10-20 A. thick were deposited by evapn. on nitrocellulose films; in all cases the lengths of the linear metallic deposits were shorter than the actual mol. lengths, but increased as the polymer length of the substrate increased.

13267. BOETTCHER, A. **Electron-microscopic studies of fillers dispersed in rubber.** *Kautschuck u. Gummi* 4, 123-8(1951).—*C.A.* 45, 5962*e*.

The dispersion of different types of carbon black, Ca silicate, and $MgCO_3$ in natural rubber vulcanizates was studied. The fillers were examd. after soln. of the rubber. Nineteen electron micrographs were shown. These techniques made it possible to identify different fillers, to det. their state of dispersion, and to follow changes in their structure as a result of processing and vulcanizing.

13268. BOUILLON, F. **Dry oxidation of copper and its alloys. I. Influence of temperature on the isochronal oxidation of pure copper.** *Bull. soc. chim. Belges* 60, 337-56(1951).—*C.A.* 46, 4452*e*.

Electropolished samples of Cu were oxidized in dry O_2 for 1 day at atm. pressure and temps. ranging from 100° to 900°C. The direct oxidation of Cu below 224°C always led to Cu_2O. At temps. above 224°C Cu_2O was in turn oxidized to CuO. Above 317°C the rate of oxidation was so great that Cu_2O could no longer be detected in the films. The first layers of Cu_2O had a strong (111) orientation which disappeared as soon as the film thickness reached about 700 A. CuO behaved in a very different manner.

13269. BRENET, JEAN AND BRIOT, ANNE MARIE. **Study of the evolution of depolarizing and catalytic activity of manganese oxides.** *Compt. rend.* 232, 2021-3(1951).—*C.A.* 45, 8335*h*.

From detns. of electrochem. potential and depolarizing activity there was a sharp discontinuity at about 150°C. After thermal activation, x-ray diagrams showed a phase other than *pyrolusite*.

13270. BRINDLEY, G.W. **The interpretation of broadened x-ray reflections with special reference to clay minerals.** *Discussions Faraday Soc.* No. 11, 75-82(1951).—*C.A.* 46, 8577*d*.

Clay minerals showed broadening of x-ray reflections as a consequence of lattice mistakes and small crystal size. The 3-dimensional character of diffraction was an added complication. The smallest crystals in the clay-mineral series were halloysite and montmorillonite, both of which were 0.01-0.2 μ in size.

13271. BROMBERG, A.V.; LUK'YANOVICH, V.M.; NEMTSOVA, V.V.; RADUSHKEVICH, L.V., AND CHMUTOV, K.V. **Electron-microscopic investigation of mutual coagulation of hydrophobic sols.** *Doklady Akad. Nauk S.S.S.R.* 79, 281-2(1951).—*C.A.* 46, 23*a*.

When neg. hydrosols of V_2O_5 were mixed with positively charged hydrosols of Au (pos. by addn. of $Th(NO_3)_4$), dialyzed $Fe(OH)_3$, or AgI (pos. by excess of $AgNO_3$), particles of the pos. sol were seen to adhere to the threads or rods of V_2O_5. Distribution of the pos. particles along the threads was uniform.

13272. BROMBERG, A.V.; LUK'YANOVICH, V.M.; NEMTSOVA, V.V.; RADUSHKEVICH, L.V., AND CHMUTOV, K.V. **Electron-microscopic study of fine structure by means of development.** *Doklady Akad. Nauk S.S.S.R.* 79, 827-30(1951).—*C.A.* 46, 1842*b*.

The surface properties were different in the middle and at the end of the rod-shaped particles of a V_2O_5 sol. With a 15-day-old dil. V_2O_5 hydrosol, one single Ag crystal formed on each rod. In the group of the shortest V_2O_5 particles, 0-0.2 μ, (which comprised 43% of all particles) the Ag crystallite was found to be located at the end of the V_2O_5 rod in more than 90% of all cases. In the groups of the longer particles, 0.2-1.6 μ, the Ag crystallite was at the end of the rod in 40-50% of all cases; in the remaining cases, it was found mostly no farther than 0.2 μ from the end.

13273. Brú, L. and Gharpurey, M.K. **Epitaxial crystal growth of silver on rock-salt (110) and (111) faces.** *Proc. Phys. Soc.* (London) 64A, 283-6(1951).—*C.A.* 45, 8315*b*.

It was found by electron diffraction that Ag grew in parallel orientation on (110) and (111) faces of rock-salt and that the Ag crystals were twinned repeatedly on their {111} faces. A new example of rotational slip was noted in which Ag crystals slipped rotationally on their {110} planes. Ag was deposited from a Ag filament on freshly etched (110) and (111) faces of rock-salt kept at 75-200°C.

13274. Cowley, J.M.; Rees, A.L.G., and Spink, J.A. **The morphology of zinc oxide smoke particles.** *Proc. Phys. Soc.* (London) 64B, 638-44(1951).—*C.A.* 46, 9932*c*.

Single-crystal electron diffraction patterns with doubled spots obtained from ZnO smoke particles originated from pairs of thin sheets joining together the members of a group of 4 spines. The plane of each sheet was parallel to a (1010)-type lattice plane. When 2 or 3 sheets were formed with a group of spines in ZnO smoke, they often grew so that the crystal lattice in all sheets was continuous with that of one of the spines.

13275. Dragsdorf, R.D.; Kissinger, H.E., and Perkins, A.T. **An x-ray study of the decomposition of kaolinite.** *Soil Sci.* 71, 439-48(1951).—*C.A.* 46, 2217*h*.

Intensive ball-milling of kaolinite resulted in the formation of a mineral, distinct from, but structurally related to the original kaolinite. The initial grinding produced disorders in the stacking of component layers. After further grinding randomness of a second type was found. The lines observed corresponded to spacing calcd. on the basis of a monoclinic cell.

13276. Fischer, Robert B. **Precipitation of barium sulfate. Investigation by electron microscopy.** *Anal. Chem.* 23, 1667-71(1951).—*C.A.* 46, 1389*c*.

During aging of $BaSO_4$ the crystals in contact with the mother liquid showed no significant change in crystal size nor in apparent degree of perfection unless the particle size at the start of the aging was well under 1 micron, in which case Ostwald ripening occurred. Sometimes slight agglomeration took place. Copptn. involved the formation of surface protuberances upon $BaSO_4$ crystals formed very slowly by a process of diffusion mixing of reagent solns.

13277. Franklin, Rosalind E. **Crystallite growth in graphitizing and nongraphitizing carbons.** *Proc. Roy. Soc.* (London) A209, 196-218(1951).—*C.A.* 46, 7391*i*.

An investigation of the structure of carbons of different origin treated at temps. between 1000° and 3000°C showed that the graphitizing and nongraphitizing carbons form 2 distinct and well-defined classes. Carbons were obtained from polyvinylidene chloride (Saran), sugar charcoal, hexachlorobenzene, coal of 82.4% C (Northumberland), coal of 83.1% carbon (Yorkshire), polyvinyl chloride, petroleum coke, pitch coke and Welsh coking coal. The nongraphitizing carbons were formed, in general, from substances contg. little H or much O. On heating such substances there developed, at low temps., a strong system of cross-linking which immobilized the structure and united the crystallites in a rigid mass. The resulting carbons were hard, and their fine-structure porosity large and preserved at high temps.

13278. Fricke, Robert and Eberspächer, Otto. **Small- and wide-angle x-ray scattering by γ-Al_2O_3.** *Z. anorg. u. allgem. Chem.* 265, 21-40 (1951).—*C.A.* 46, 7840*d*.

Boehmite, prepd. from pure activated Al, consisted of filiform structural units (av. primary particle size = approx. 90A.) which were interwoven to spongy agglomerates. The γ-Al_2O_3 formed by dehydration at 400°-1000°C had a corpuscular network. Bayerite, under the electron microscope, appeared as a cryst. powder with an av. secondary particle size of about 1000A., but the primary particle size was approx. one order of magnitude lower. The primary particle size increased with increasing dehydration temp. Bayerite prepns. produced only small-angle x-ray scattering.

13279. Gorbunov, N.I. and Tsyurupa, I.G. **Optimal conditions for x-ray studies of particle sizes separated from soils and clays.** *Doklady Akad. Nauk U.S.S.R.* 77, 717-20(1951).—*C.A.* 46, 1683*f*.

Particles <1 μ were most suited. For special purposes this fraction was divided into two: 1-0.2 μ and <0.2 μ. The finer fraction was used for x-ray and electronic methods of analyses. The thermal analysis method of this fraction was not practical since it required 2.5 g of the material. In the montmorillonitic clays (askangel, humbrin, bentonite) the quantity of the fraction <0.2 μ was not higher than 52%. In kaolinitic clays this particle-size fraction was 5.5%. The <1 μ fraction in montmorillonitic clays was 96% and in kaolinitic clays and some clay soils up to 65%. The proportion of the different particle-size fractions as deciphered by x-ray analyses was given on clays and some zonal soils.

13280. Gulbransen, Earl A. and Ruka, Roswell. **Kinetics and mechanism of solid phase reactions --in oxide films on pure iron.** *Ind. Eng. Chem.* 43, 697-703(1951).—*C.A.* 45, 4121*a*.

The formation of multiple oxides in the oxidation of pure Fe was studied using the high-temp. electron diffraction method in the temp. range of 570° to 700°C. Although α-Fe_2O_3, Fe_3O_4, and FeO (wüstite) existed in sep. layers during oxidation, the higher oxides were converted to FeO by the solid-phase reaction with Fe when O_2 was removed.

13281. Heystek, H. **Attapulgite occurrence in the northern Transvaal.** *S. African J. Sci.* 47, 287(1951).—*C.A.* 46, 5489*b*.

A clay occurring at Turfbult in the Springbok Flats (Transvaal), assocd. with a large amt. of calcite, was identified as an attapulgite by chem. analysis, x-ray diffraction, differential thermal analysis, and electron microscopy. The distinguishing features of attapulgite and its uses were enumerated.

13282. ISHIGURO, MASAKAZU. **The adsorption of diatomic molecules on surfaces of molten metals.** *Mem. Inst. Sci. and Ind. Research, Osaka Univ.* 8, 78-82(1951).—*C.A.* 46, 2372*g*.

The silhouette of a molten drop in H_2 and O_2 was detd. from x-ray shadowgraphs. The surface tension was calcd. from the shape of the drop. Surface tensions of molten Sn, Bi, and Pb were given in graphic form for 0-30 mm pressure of H_2 and 0-7 mm pressure of O_2.

13283. KADOTA, NORIAKI AND IKEDA, SADAAKI. **X-ray diffraction study on the structure of the nickel-copper coprecipitation catalysts.** *J. Am. Chem. Soc.* 73, 4475-6(1951).—*C.A.* 46, 6916*f*.

A plot of lattice distance *vs.* at. fraction in Cu and Ni gave an S-shaped curve. The rate const. from the initial structure of 3.547 A. lattice distance to the final structure of 3.577 A. lattice distance was larger than the rate from the structure of 3.580 spacing. A nonequil. state of the alloy phase was formed on the catalyst surface, which remained unstable on the surface to an extent depending on the compn. of the catalyst.

13284. KASATOCHKIN, V.I. AND LUKIN, B.V. **X-ray analysis of the molecular structure of resins. X-ray diffraction of amorphous rubber.** *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.*, 15, 209-17 (1951).—*C.A.* 45, 9907*c*.

The amt. of disordered (gaseous) chain constituents could be obtained by relative measurements of the intensities of the ring and the background in diffraction pictures taken at small angles. Fatigue of natural rubber decreased the amt. of cryst. phase; fatigue of Na-butadiene rubber increased the intensity of the ring. Addn. of a filler (gas carbon black) to the vulcanization mixt. shortened considerably the time for crystn., even at very small concns. of S.

13285. KAWAKAMI, MUTSUMI AND OGASAWARA, NAOYUKI. **Behaviors of thin barium films on molybdenum wires. Observations by the electron microscope.** *Ôyô Butsuri* (J. Applied Phys.) 20, 63-8(1951).—*C.A.* 46, 5922*f*.

Electron-microscopic observations were reported of Ba films on Mo wire in relation to the activation effect of Ba vapor from a getter on Mo filaments in vacuum tubes. There were 2 kinds of images of the activated filament.

13286. KITAZAKI, UMEKA, **Variation in coal properties. II. X-ray diffraction patterns of coking coal and the mechanism of coking.** *Misc. Repts. Research Inst. Nat. Resources* (Japan) No. 22, 42-54(1951).—*C.A.* 47, 1354*h*.

Various grades of coking coals had a plane of hexagonal C linkage well developed and piled up along the *c* axis (irregularly along the *a* and *b* axes), the development being higher with greater degrees of coking. During coking, the 2-dimensional C lattice seemed freed of loose C bonds around it, generating hydrocarbon gas to be dissipated by evapn. and subsequently transformed to the 3-dimensional graphite structure.

13287. KNAPP, D.R. AND MITRA, R.P. **Electron diffraction by clay minerals with a fibrous or rod-like habit.** *Nature* 168, 380-1(1951).—*C.A.* 46, 7871*a*.

An electron-diffraction study of kaolinite, hallosite, attapulgite and argilla esmectica verde was made.

13288. KÖNIG, H. AND HELWIG, G. **Thin layers formed from hydrocarbons by electron or ion bombardment.** *Z. Physik* 129, 491-503(1951).—*C.A.* 45, 7427*b*.

A glow discharge was passed through C_6H_6 vapor and the films collected on quartz plates. Their d. was 1.4 g/ml. and their sp elec. cond. was 10^{-9}/ohm-cm for layers 0.5 to 0.8 μ thick. When these films were heated in a vacuum they gradually turned black, their elec. cond. increased greatly, and their electron-diffraction patterns looked like those obtained with carbonized org. objects.

13289. LAIRD, A.D.K. AND PUTNAM, J.A. **Fluid saturation in porous media by x-ray technique.** *Trans. Am. Inst. Mining Met. Engrs.* 192, *Tech. Pub.* No. 3169 (in *J. Petroleum Technol.* 3, No. 10., 275-84)(1951).—*C.A.* 46, 1741*b*.

The approx. theory of x-radiation was used to predict the strength of x-ray beams emerging from cores of porous materials contg. various combinations of fluids. Making use of the fact that absorption of x-rays was independent of the order in which various materials were traversed, a method was developed for calibrating the x-ray emergent beam strengths in terms of fluid satn. of the core.

13290. LECUIR-CHAUMETON, LUCIENNE; BILDÉ, HENRY, AND DEVAUX, JEAN. **Application of electron diffraction to the study of reactions between two surfaces in contact.** *Compt. rend.* 232, 1556-8(1951).—*C.A.* 45, 8332*g*.

Electron diffraction by reflection was used to study the reaction between Al_2O_3 and NiO and between Mo metal and glass. Conglomerates of Al_2O_3 and NiO were mixed and heated at 1400°C for 2 hrs. A blue coating that formed on the Al_2O_3 pellets gave the diffraction pattern of spinel, Al_2O_4Ni.

13291. LONGUET-ESCARD, JACQUELINE AND BAGNO, ODETTE. **The formation of nickel hydroxide sols.** *Mém. services chim. état* (Paris) 36, No. 1, 77-9(1951).—*C.A.* 47, 380*d*.

The appearance of abnormal lines (along 00*l*) in the Debye-Scherrer patterns of $Ni(OH)_2$ sols was ascribed to an increase in the size of the micelles upon aging.

13292. LUCAS, L.N.D. **The structure of thin layers of zinc oxide grown on a zinc single crystal.** *Proc. Phys. Soc.* (London) 64A, 943-5(1951).—*C.A.* 46, 10761*h*.

Growth of ZnO was produced on cleavage planes of single crystals of Zn, and the result was studied by electron diffraction. The expt. showed that an extremely thin ZnO layer was grown, no more than 10 mol. layers thick.

13293. MAMIYA, SHOICHI. **Nature of metal black.** *Science of Light* (Japan) 1, No. 1, 42-5(1951).—*C.A.* 47, 4777*c*.

X-ray examn. showed that Ni, Zn, Ag, Sn, Pb, and Bi blacks evapd. in air at low pressure were aggregates of minute crystallites of the corresponding metals; the crystallites became smaller with increase of pressure. With Zn, a sooty substance was obtained even in an atm. of N_2, H_2, or NO if the pressure of the gas was properly chosen. No definite evidence of intrusion of occluded gas into the crystal lattice was found in the x-ray examn.

13294. Mathieu-Sicaud, A.; Mering, J., and Perrin-Bonnet, I. **Electron-microscope study of montmorillonite and hectorite saturated with different cations.** *Bull. soc. franç. minéral.* 74, 439-56(1951).—*C.A.* 46, 4883*a*.

Suspensions of montmorillonite and hectorite well dispersed and satd. with H_2, Na, and Ca cations were mounted on Formvar films and observed with an electron microscope. Montmorillonite satd. with Na was easily dispersed. The reversible transformation montmorillonite H-montmorillonite Na was easily obtained, whereas the transformation from hectorite Na-hectorite H was not reversible. Measurements of montmorillonite single crystals showed the hexagons to be approx. 300 A. in size, in agreement with x-ray data.

13295. McCartney, J.T. and Anderson, R.B. **Electron-microscopic replica studies of porosity in fused iron catalysts.** *J. Applied Phys.* 22, 1441-3(1951).—*C.A.* 46, 4339*e*.

The prepn. of various replicas of a fused iron catalyst was described. Micrographs of these replicas showed comparable fine structures that were attributed to the pores developed in the catalyst. on reduction.

13296. Menter, J.W. **A study of boundary lubricant films by electron diffraction.** *Phys. of Lubrication, Brit. J. Applied Phys.*, Suppl. 1, 52-4(1951).—*C.A.* 45, 4915*b*.

Exptl. work reported on the orientation and structure of thin films of long-chain hydrocarbon compds. on metal surfaces and the effect of temp. indicated that good boundary lubrication occurred only when there was a closely packed solid film of oriented mols. on the surface.

13297. Menter, J.W. and Tabor, D. **Orientation of fatty acid and soap films on metal surfaces.** *Proc. Roy. Soc.* (London) A204, 514-24(1951).—*C.A.* 46, 4875*f*.

The orientation and structure of films of lauric, myristic, palmitic, stearic, and octacosanoic acids and certain of their heavy metal soaps on surfaces of Pt, Ag, Cu, Cd, Zn, and mild steel were studied by electron diffraction. Films were applied by retraction of molten drops and by rubbing at room temp. For all films there was a characteristic temp. at which disorientation occurred. For acids on nonreactive metals the transition occurred near the m.p. On reactive metals, Zn and Cd, disorientation occurred near the softening point of the corresponding soap, suggesting soap formation.

13298. Milligan, W.O. **Recent x-ray diffraction studies on the hydrous oxides and hydroxides.** *J. Phys. & Colloid Chem.* 55, 497-507(1951).—*C.A.* 45, 6001*a*.

Work done on hydrous oxides and hydroxides since 1942 was reviewed. The discussion was limited primarily to x-ray and electron-diffraction studies on single oxides such as CuO, alumina, chromia, and the trivalent oxides of In, Sc, and the rare earths, and dual or multiple oxide systems such as $NiO\text{-}Al_2O_3$, $BeO\text{-}In_2O_3$, $Cr_2O_3\text{-}Fe_2O_3$, $Cr_2O_3\text{-}ZrO_2$, $NiO\text{-}Cr_2O_3$, and $NiO\text{-}Cr_2O_3\text{-}ZrO_2$.

13299. Mosesman, M.A. **In situ x-ray diffraction studies of heterogeneous reactions.** *J. Am. Chem. Soc.* 73, 5635-9(1951).—*C.A.* 46, 2384*a*.

The construction of the app. permitted operation at pressures up to 11 atm. and temps. up to 650°C at flow rates as low as 1.0 ml/hr. X-ray diffraction data were obtained in the application of this app. to the detn. of the stable oxidation states of Fe in an NH_3 synthesis catalyst and of MoO_3 in bulk and Al_2O_3-supported MoO_3 in reducing and oxidizing atm.

13300. Nahin, P.G.; Merrill, W.C.; Grenall, A., and Crog, R.S. **Mineralogical studies of California oil-bearing formations. I. Identification of clays.** *Trans. Am. Inst. Mining Met. Engrs.* 192, *Tech. Pub.* No. 3059 (in *J. Petroleum Technol.* 3, 151-8)(1951).—*C.A.* 45, 7924*h*.

X-ray diffraction, electron microscopy, thin-section petrography, infrared spectroscopy, and cation exchange analysis methods were described. A group of the more important clay minerals was assembled and characterized by these methods for use as standards in core analysis. Although no one method of analysis was diagnostic for all of the clay minerals, the infrared technique showed considerable promise.

13301. Newkirk, J.B.; Smoluchowski, R.; Geisler, A.H., and Martin, D.L. **Diffuse scattering by an ordering alloy.** *Acta Cryst.* 4, 507-12(1951) (in English).—*C.A.* 47, 938*d*.

Diffuse x-ray diffractions produced by a partially ordered crystal of Co-Pt alloy of about 50 at. % compn. were investigated. They were explained by assuming the presence of thin platelets of the ordered tetragonal phase on {110} planes of the disordered cubic.

13302. Nowotny, H. and Funk, R. **The system: $Al_2O_3\text{-}Fe_2O_3\text{-}SiO_2$.** *Radex Rundschau* 1951, 334-40. —*C.A.* 46, 5946*i*.

The binary systems $Al_2O_3\text{-}Fe_2O_3$ and $Fe_2O_3\text{-}SiO_2$ were investigated by means of x-rays. In the 1st case a formation of mixed crystals was observed on both ends of the system whose homogeneity limit was ascertained at 1000° or about 1700°C. In the 2nd case the 2 oxides continued to exist unchanged side by side. The ternary system of $Al_2O_3\text{-}Fe_2O_3\text{-}SiO_2$ was detd. by the phases appearing in the adjacent systems. The measured Curie points of the ferromagnetic test-pieces, whose compns. were partly within the binary systems of $Al_2O_3\text{-}Fe_2O_3$ and $Fe_2O_3\text{-}SiO_2$, and partly within the ternary system, confirmed the structure established by x-rays.

13303. Okada, Kenichi and Ishigaki, Kishiro. **Electron diffraction studies on the surface treatment of zinc.** *J. Chem. Soc. Japan*, Ind. Chem. Sect. 54, 619-20(1951).—*C.A.* 47, 6849*b*.

After subjecting the surface of Zn to various treatments, the structure was studied by means of electron diffraction. $Zn(OH)_2$ was formed at once as soon as the Zn surface touched water. By washing with acidic Al or Cr alum solns., the corresponding $Al_2O_3.H_2O$ or $Cr_2O_3.H_2O$ was formed on the surface.

13304. PISARENKO, A.P.; SHEKHTER, A.B., AND ECHEISTOVA, A.I. **Electron-microscopic investigation of rubber structures.** *Doklady Akad. Nauk S.S.S.R.* 76, 423-5(1951).—*C.A.* 46, 1789*g*.

Films 200-800 A. thick of Na-butadiene rubber prepd. by evapn. of a toluene soln., showed characteristic ridges, oriented at different angles and occasionally forming closed cells. With a carbon black filter, and without a surface-active agent, the distribution of carbon black was highly heterogeneous; 0.1% of stearic acid, benzidine, or diphenylguanidine did not change this picture.

13305. RICHTER, H. AND FÜRST, O. **Amorphous germanium.** *Z. Naturforsch.* **6a**, 38-46(1951).—*C.A.* 46, 8925*h*.

Amorphous Ge was studied by x-ray and electron-diffraction techniques. For x-ray studies 15-20 layers, obtained by evapn. on NaCl and soln. of the NaCl, were superposed to obtain a thickness of 10^{-3} cm. Correction factors for the absorption of such layers of finite thickness were given. Results of Fourier analysis of the scattering curves indicated a noncryst. state of the Ge layers.

13306. ROBERTSON, H.S. **The microstructure of clay minerals.** *Tonind.-Ztg.* 75, 2-6(1951).—*C.A.* 45, 3768*i*.

The electron microscope structures of clay minerals and the mol. arrangement were discussed, touching on the properties caused by elec. charges. Cation exchange, adsorption, bentonite-like behavior, compressive strength, plasticity, and property of "balling" were included.

13307. RUBINSHTEIN, A.M. AND KULIKOV, S.G. **Structure and properties of titanium dioxide catalysts and their polymorphism.** *Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* 1951, 133-9.—*C.A.* 45, 6031*d*.

Anatase-TiO_2 was prepd. by pptn. from $TiCl_4$ with NH_4OH, and 3 series of catalysts were prepd. by (a) 5 hrs heating at 400°, 500°, 600°, 700°, 800°C; (b) heating to 600° for 5, 10, 25, 50, 100 hrs; (c) mixing ready-made anatase and rutile in the proportions (% anatase, rutile) 100,0; 90,10; 75,25; 50,50; 25,75; 10,90; 0,100. All prepns. were examd. by x-rays.

13308. SCHOFIELD, F. **Preparing paste and powder specimens for the electron microscope.** *Brit. J. Applied Phys.* 2, 18-19(1951).—*C.A.* 45, 4097*i*.

Paste and powders were prepd. for electron-microscope examn. by a method which avoided aggregation of the solid particles by dispersing in in a liquid medium of 50% alc. and 0.02% gelatin. The sample was dild. 1000:1. As an alternative, a medium viscosity grade of ethylcellulose in isopropyl alc. could also be used.

13309. SHEKHTER, A.B.; KUSHNEREV, M. YA., AND MOSHKOVSKII, YU. SH. **Catalytic activity and structure of active zinc oxide. III. Influence of the method of preparation of zinc oxide catalysts on their x-ray structure.** *Izvest Akad. Nauk S.S.S.R., Otdel. Khim. Nauk* **1951**, 388-94.—*C.A.* 45, 10021*h*.

A no. of samples of ZnO catalysts were prepd. by decompn. of $ZnCO_3$ at 350°C *in vacuo*, and oxidation of Zn vapor in the elec. arc, with both series subsequently heated *in vacuo* 2 hrs at a definite temp. between 500° and 1000°C. By Debye x-ray line widths, crude (i.e. not heat-treated) prepns. from $ZnCO_3$ had finer crystals (mean dimension m = 36 A.) than oxidized Zn vapor (m = 56 A.). Heating to 500°, 700°, 800°, and 1000°C produced in the first series an increase of m (47, 62, 63, and 77 A.), but practically no change in the second series.

13310. SHEKHTER, A.B. AND ZHABROVA, G.M. **Catalytic properties and structure of active zinc oxide. IV. Influence of the method of preparation on the electron-microscopic structure of zinc oxide.** *Izvest. Akad. Nauk, Otdel. Khim. Nauk* **1951**, 500-4.—*C.A.* 46, 3839*e*.

Electron microscopy revealed deep secondary-structure differences between ZnO prepns. obtained by pyrolytic decompn. of different Zn salts (nitrate, carbonate, formate, oxalate, acetate, hydroxide). ZnO from $Zn(NO_3)_2$ at 350 and 600°C was the coarsest and least porous, whereas ZnO from $ZnCO_3$ had the highest dispersity and finest porosity; the other salts occupied positions intermediate between these 2 extremes. Samples of ZnO obtained by decompn. of the salts at 200-300° and subsequently heated to 600° did not differ in structure from ZnO prepd. by decompn. at 600°. Data of surface areas (in m^2/g) of different prepns. of ZnO were given.

13311. STROHMAIER, KARL. **A simple process for the preparation of transparent films of aluminum oxide of large area and thickness between 50 and 300 mμ.** *Z. Naturforsch.* **6a**, 508-9(1951).—*C.A.* 47, 6280*g*.

A 10-15 μ thick Al foil was polished, and its edges were oxidized electrolytically at 160 v. and 0.3 amp. with Al or C cathode for 2-3 min. The flat area was then oxidized electrolytically in 3% NH_4 citrate to the desired thickness. The Al was dissolved in fuming HCl with a few crystals of $CuCl_2$. These Al_2O_3 films were more stable toward heat and chem. attack than collodion films.

13312. SUITO, EIJI AND UEDA, NATSU. **Electron microscopy and diffraction of triangular particles of gold sol.** *Science* (Japan) 21, 598-9(1951).—*C.A.* 46, 1862*a*.

The sol was prepd. by the reduction of aq. $AuCl_3$ soln. by H_2O_2 at 80°C after adding HCl to give a pH of 2.3. The electron-microscopic photograph showed the existence of particles as large as 1 to 3 μ, which were triangles, hexagons, or intermediates of these, or twins. The photographs of these thin plates showed striped patterns. All of the Au particles grew along the (111) plane.

13313. TAKAGI, RIITSU. **Electron-microscope and diffraction studies of chromic oxides.** *J. Phys. Soc. Japan* 6, 350-1(1951)(in English).—*C.A.* 47, 938*f*.

Cr_2O_3 obtained by the calcination of the following substances was studied: (1) CrO_3 at 600°

and 1300°C, (2) a mixt. of CrO_3 and C_2H_5OH at 1100°C, (3) a mixt. of $Na_2Cr_2O_7.2H_2O$ and S at 1100°C. Cr_2O_3 obtained from (1) was granular and of irregular shape, the size of the particle increasing with the temp. of calcination. Cr_2O_3 obtained from (2) and (3) was platelike, often showing hexagonal shape.

13314. Tazaki, Hideo and Kuwabara, Shigeya. **A study of oxide films formed on copper-magnesium alloys by electron diffraction.** *J. Sci. Hiroshima Univ.*, Ser. A, 15, 67-70(1951).—*C.A.* 47, 5337*h*.

Samples contg. 1, 3, 5, and 10% Mg were studied. At pressures of air from 10^{-2} mm to 100 mm, Cu_2O only was detected over a temp. range of 0° to 250°C. At the higher gas pressures and at temps. over 250°C, CuO was also detected. MgO was detected only at temps. exceeding 350°C and air pressures exceeding 0.1 mm. Abrasion of the MgO film on the surface of the specimen yielded Cu_2O diffraction rings upon subsequent examn.

13315. Trillat, Jean Jacques and Oketani, Shiguéo. **Electron-diffraction study of the cementation of iron. II. Action of a mixture of carbon monoxide and hydrogen.** *Compt. rend.* 232, 1116-18(1951).—*C.A.* 45, 5086*c*.

Cementation of thin films of Fe in the presence of pure CO produced only Fe_3C and Fe_3O_4. When a mixt. of equal vols. of CO and H_2 was used, no indications of an iron oxide were found. At 350°C, the presence of α-Fe, a little Fe_3C, and a new phase, Fe_2C, were detected. At 400°C only α-Fe and Fe_3C were observed.

13316. Turkevich, John and Hubbell, Harry H. **Low-angle x-ray diffraction of colloidal gold and carbon black.** *J. Am. Chem. Soc.* 73, 1-7(1951).—*C.A.* 45, 6045*g*.

An app. for the detn. of low-angle x-ray scattering of particles of colloid size was described and applied to the detn. of the particle size of monodisperse colloidal Au and of carbon black. The values of the particle size so obtained agreed satisfactorily with measurements using the electron microscope. The wave-length dependence of the x-ray scattering was also detd. and found to agree with theoretical predictions.

13317. Turkevich, John; Stevenson, Peter C., and Hillier, James. **The nucleation and growth processes in the synthesis of colloidal gold.** *Discussions Faraday Soc.* No. 11, 55-75(1951).—*C.A.* 46, 8932*f*.

Au sols prepd. by the following methods were examd. by electron microscopy: by the elec.-arc method, by reaction of K chloroaurate with white P, $KMnO_4$, H_2NOH, or tannin, by bubbling CO or C_2H_2 through an aq. soln. of chloroauric acid, by boiling chloroauric acid solns. with $(COOH)_2$ or citric acid, or by adding 1% aq. Na citrate soln. with good mech. stirring to a hot chloroauric acid soln. The growth of the nuclei occurred exponentially, the rate of change of diam. with time being proportional to diam. The size-distribution curves of Au sols were controlled by the amt. of Au, the nucleation process, and the exponential growth process.

13318. Voorthuijsen, J.J.B. van Eijk van and Franzen, P. **Structure and properties of compounds formed during the preparation of nickel-on-silica catalysts.** *Rec. trav. chim.* 70, 793-812(1951)(in English).—*C.A.* 46, 8490*g*.

The system $NiO-SiO_2-H_2O$ was studied. The formation of Ni hydrosilicate ions under various conditions was studied by x-ray and thermal methods. Hydrothermal treatment improved the crystallinity. The reducibility with H_2 was measured as a function of temp. It varied with SiO_2 content and with degree of perfection of the hydrosilicate structure. Usually Ni in the cubic form was obtained; however, there were indications that in the case of hydrothermally treated Ni montmorillonite and Ni antigorite gels, part of the reduced Ni atoms remained in the places they occupied as ions in the hydrosilicate structure.

13319. Wadsley, A.D. and Walkley, A. **Structure and reactivity of the oxides of manganese.** *Rev. Pure Applied Chem.* (Australia) 1, 203-13 (1951).—*C.A.* 46, 4878*d*.

The oxides and hydrous oxides of Mn showed polymorphism as well as variability of valence and compn. X-ray diffraction techniques served to distinguish between the different phases and, in some instances, to locate the positions of the ions within the unit cell. In this system x-ray and chem. methods could only rarely distinguish with certainty between different valency states. The introduction of foreign metal ions caused departures from stoichiometry, alterations in the mean metal-oxygen bond lengths, and hence alterations in thermodynamic properties. The speed of reductions and of the exchange reaction did not appear to depend on the active O-content, but more on the probable distortion caused by foreign atoms in the lattice, and on the surface area.

13320. Westrik, R. **Crystallographic and magnetochemical study of the structure of catalysts.** *Chem. Weekblad* 47, 444-52(1951).—*C.A.* 46, 2383*h*.

13321. Wilsdorf, H.G.F. **Structure of amorphous aluminum oxide films.** *Nature* 168, 600-1(1951).—*C.A.* 46, 4876*a*.

A mol. group was constructed by trial and error such that the electron diffraction pattern calcd. agreed with expt. A particle consisting of 2 Al_2O_3 mols. gave good results. This particle was an octahedron of 6 closely packed O ions with 4 Al ions in a tetrahedral arrangement.

13322. Woodward, Leroy A. and Lyons, S.C. **The mechanism of gloss development in clay-coated sheets.** *Tappi* 34, 438-42(1951).—*C.A.* 46, 4227*b*.

From electron micrographs, there was a sharp change in kaolinite particle shape with increasing diameter, as the apparent spherical diameter exceeded 2 μ. Below 2 μ, the particles were hexagonal, platelike crystals. Above 2 μ, the particles were stacked aggregates of the fine crystals.

13323. Yamaguchi, Shigeto. **Diffraction from a synthetic-ammonia catalyst of iron oxide.** *J.*

Phys. & Colloid Chem. 55, 1409-10(1951).—*C.A.* 46, 1855*c*.

Sample A showed a mixt. of powder crystals of the spinel type and single crystals giving rise to Kikuchi lines. Sample B showed large crystal grains of the spinel type. B gave better yields of NH_3 at 480°C, but had half the life of A. They were equal in activity at 610°C.

13324. Yoshioka, Shozo and Yamamoto, Hisashi. **The structure of thin films of paraffin on the surface of metals. I. II.** *Oyo Butsuri* (J. Applied Phys.) 20, 242-6, 286-9 (1951).—*C.A.* 46, 5922*e*.

An electron-diffraction study was made of the structure of thin films of $C_{25}H_{52}$ on polished Cu surface up to 500 layers. The internal elec. potential was calcd. up to the 6th layer line of the diffraction patterns and 5.04 ± 0.35 v. was obtained. The effect of roughness of the Cu surface on the orientation of paraffin mols. was studied by the electron-diffraction method.

13325. Zhdanov, G.S. and Razmanova, Z.P. **X-ray analysis of catalysts with aluminum hydroxide base.** *Izvest. Akad. Nauk S.S.S.R., Ser, Fiz.* 15, 202-8 (1951).—*C.A.* 45, 8863*i*.

The $Al(OH)_3$ was prepd. by 3 methods. The following phases were observed: boehmite (γ-$Al_2O_3.H_2O$), bayerite (metastable $Al_2O_3.3H_2O$), their mixt., and hydrargillite (stable $Al_2O_3.3H_2O$). Fast settling by the mech. Bayer method gave bayerite; slow settling, hydrargillite; annealing led to boehmite. The initial boehmite structure changed into less-dispersed bayerite. Annealing to 450°-600°C led to γ-Al_2O_3. The activity of the catalysts measured on the dehydration reaction of EtOH dropped rapidly at the transformation point to α-Al_2O_3.

13326. Allen, J.A. **Oxide films on electrolytically polished copper surfaces.** *Trans. Faraday Soc.* 48, 273-9(1952).—*C.A.* 46, 7908*b*.

Surfaces of polycryst. Cu sheet polished electrolytically in H_3PO_4 were examd. electrometrically and by electron diffraction. The surfaces were initially free from oxide films when removed from the polishing bath. The subsequent growth of oxide films in air at room temp. depended on the washing procedure adopted. Surfaces freed from phosphate contamination oxidized rapidly, giving films 15 A. thick after 0.5 hr and 20-25 A. after 17 hrs.

13327. Beckett, R.J. and Croft, R.C. **The structure of graphite oxide.** *J. Phys. Chem.* 56, 929-35 (1952).—*C.A.* 47, 2008*d*.

If in graphite oxide O was contained between graphite layers by epoxy linkages or the like, the layers should be less rigid in graphite oxide than in graphite because of the satn. of double bonds. The predicted flexibility was verified by electron-microscope observations of small ($\sim 1\mu$ across) particles. The particles were deposited from dispersions and shadow-cast with U. Micrographs of graphite oxide all showed extensive folding. The folds were predominantly along straight lines with no obvious preferred direction.

13328. Benesovsky, F. and Vidmajer, A. **Two granular forms of sublimed molybdenum trioxide.** *Österr. Chem.-Ztg.* 53, 158-60 (1952).—*C.A.* 46, 10701*g*.

The MoO_3 obtained industrially by sublimation consisted of 2 forms which were separable through d. differences. They differed mainly in phys. properties. In the electron microscope the heavy form appeared as spheres, the light as needlelike platelets.

13329. Berestneva, Z. Ya.; Koretakaya, T.A., and Kargin, V.A. **The mechanism of formation of the colloidal particles of a gold sol.** *Kolloid. Zhur.* 14, 395-8(1952).—*C.A.* 47, 3083*d*.

Electron microscope and electron diffraction showed that Au sols (prepd. by reducing $AuCl_3$ with P) originally contained relatively large amorphous particles, but these broke down to small crystals in, e.g., 5 min. In Au sols grown on nuclei both stable cryst. and unstable amorphous particles were present.

13330. Bernard, René; Pernoux, Emile, and Teichner, Stanislas. **Application of the electron microscope to the measurement of specific surfaces. Determination of the efficiency of grinding.** *J. chim. phys.* 49, 147-56 (1952).—*C.A.* 46, 7843*d*.

The nos. and sizes of particles contained in very fine powders, in suspensions, etc., were detd. with the electron microscope by making use of statistical evaluations of a large no. of measurements. From the nos. of particles per unit area and their av. diam. the sp surface was calcd. Measurements on 5 particles of wolframite gave sp surfaces in good agreement with results obtained by the N_2 adsorption method.

13331. Brady, Edward L. and Zemany, Paul D. **Effect of various gases on potassium-ion emission from hot platinum.** *J. Chem. Phys.* 20, 294-7 (1952).—*C.A.* 46, 7421*h*.

The effect of several bases on the emission of K ions from a hot Pt surface was studied. O_2, CCl_4, Br_2, and He caused a marked decrease in the K-ion emission; N_2 had a smaller effect; and H_2 caused an increase in the emission.

13332. Bramao, Luis; Cady, J.G.; Hendricks, S.B., and Swerdlow, Max. **Criteria for the characterization of kaolinite, halloysite, and a related mineral in clays and soils.** *Soil Sci.* 73, 273-87 (1952).—*C.A.* 47, 5055*a*.

Three criteria, used to sep. and identify kaolinite and halloysite, were: the shape of the main endothermic peak on the D.T.A. curve of kaolin minerals, the presence of *(hkl)* x-ray reflection with *h*, *k*, or *l* not equal to zero and of (001) reflections from interplanar spacings from 7.15 to 7.20 A.; and electron-microscopical observation of hexagonal plates of kaolinite and the cylindrical forms of halloysite. The kaolin mineral in many soils showed characteristics of of both kaolinite and halloysite.

13333. Danilov, V.I. and Serikov, A.S. **Small-angle scattering of x-rays and the porous structure of active carbons.** *Doklady Akad. Nauk S.S.S.R.* 83, 71-4 (1952).—*C.A.* 46, 8457*b*.

One single x-ray scattering intensity curve was detd. for an active carbon heated 1 hr at 1000°C, for the range of $s = \sin\theta/\gamma$ from 0.01 to

1.00, comprising small, medium, and large angles. The intensity curve was made to coincide with the curve of independent (coherent + incoherent) scattering for large s. Between $s = 0.05$ and 1.0, the intensity curve oscillated relative to scattering, as in the case of liquids and amorphous bodies. In the range of $s < 0.05$, the intensity increased rapidly with decreasing s, with the intensity lying well above scattering.

13334. DANILOV, V.I. AND ZUBKO, A.M. **Fine structure of active carbons.** *Doklady Akad. Nauk S.S.S.R.* 82, 385-8 (1952).—*C.A.* 46, 8456*i*.

The structures of a no. of carbons (activated, natural, or low-temp. cokes) were investigated by the method of integral analysis of x-ray intensity curves. Radial at. distribution functions were compared with various structure models. The results were plotted in the form of $4\pi R^2 p(R)$, where p = d. (in atoms/A.) at the distance R, as a function of R. For an active carbon heated 25 hrs *in vacuo* at 1000°C, maxima were found at R = 1.4, 2.55, 4.1, and 5 A. For different carbons, the positions of the maxima lay at the same R; these concns. coincided with the atom concn. in graphite lattices. Different carbons showed different degrees of order, always increasing with the temp. of heating.

13335. DONNET, JEAN B. AND BOSSIER, JACQUELINE. **Determination of the form and the dimensions of particles of carbon black by electron microscopy.** *Compt. rend.* 234, 195-8 (1952).—*C.A.* 46, 4878*b*.

The effect of electron bombardment on the size and shape of carbon black particles during electron microscopic examn. was checked. The contamination was apparent if the observations were made on films of Be. Carbon black particles were found to be spherical. No.-av. diam. = 301 A. Vol.-av. diam. = 372A.

13336. ELLIOTT, R.L. AND MANOGUE, B. **An electron-microscope study of the surface structure of wool.** *J. Soc. Dyers Colourists* 68, 12-14(1952). —*C.A.* 46, 3285*a*.

The mode of dye absorption and retention by wool was detd. by the properties, condition, and state of the histological phases of the fiber. A replica technique was used to investigate the effect of various nonfelting treatments as regards surface structure of the fiber. There was a definite change of the whole surface and the heterogeneous phys. (and probably chem.) structure of the cuticle of wool was confirmed. Several electron micrographs were shown and their indications pointed out.

13337. ERDMANN-JESNITZER, F. AND GUNTHER, F. **The nature of copper surfaces between 500° and 850°C.** *Z. Elektrochem.* 56, 386-90 (1952)(in German).—*C.A.* 47, 3775*e*.

Several different surface states of Cu were formed with the layer thickness of from 10^{-3} to 10^{-4} mm. Melted surface layers on solid Cu base were used at about 0.7 times the known m.p. temp. At about 760°C, Cu showed an increasing surface activity with increasing temp. Measurements were made by using both monochromatic light and x-rays reflected off the surfaces under consideration.

13338. EVANS, D.M. AND WILMAN, H. **Crystal growth and orientation in deposits condensed from the vapor.** *Acta Cryst.* 5, 731-8 (1952).—*C.A.* 47, 3073*h*.

Crystal orientation on smooth substrates initially at room temp. was investigated by electron diffraction. The effects of substrate roughness, vapor-steam obliquity, deposit thickness, crystal habit, and mobility of the deposit atoms were investigated. Materials (Zn, Cd, Sb, Bi, NaCl) having high at. mobility had initially a densely populated plane on the av. parallel to the mean substrate plane. Materials (Fe, NaF, PbS, CaF_2, Al) with low mobility had little or no orientation in thin layers.

13339. FEITKNECHT, W. **The breakdown of the oxide film on metal surfaces in acid vapors, and the mechanism of atmospheric corrosion.** *Chimia (Switz.)* 6, 3-13 (1952).—*C.A.* 46, 6069*e*.

Initial corrosion of Zn, Cd, Ni, Fe, and Cu in wet HCl was studied. Observations with electron microscope, systematic analysis of consecutively formed primary products of corrosion, and measurements of wt changes showed the existence of 3 different types of corrosion. Corrosion of Ni and Fe started in isolated points, the no. of points increasing with time. A uniform film, whose transparency decreased with time, covered Zn and Cd. A uniform film of copper oxide on Cu had a thickness which increased while a film of $CuCl_2$ was formed. Initial corrosion in wet HCl was an electrochem. process for which a crit. degree of humidity was necessary.

13340. GARROD, R.I. **The use of gold leaf as a reference material in the determination of lattice constants by electron diffraction.** *Proc. Phys. Soc.* (London) 65A, 292-3(1952).—*C.A.* 46, 10858*d*.

A series of electron-diffraction studies on NaCl with Au in the form of foil was described. For a crystal size larger than 100 A. the lattice parameter obtained for NaCl films agreed with the x-ray value. Beaten Au leaf was unreliable as a reference material for accurate work.

13341. GAY, P. AND HIRSCH, P.B. **The crystalline character of abraded surfaces.** *Symposium on Properties of Metallic Surfaces (Inst. Metals, London)* 1952, 123-32.—*C.A.* 47, 2992*d*.

The effect of various abrasive treatments on the surface structure of calcite was investigated by x-ray and electron diffraction methods. A crystal of calcite rubbed with soft wood had an electron diffraction pattern in which the Kikuchi lines disappeared and the diffraction spots elongated in a direction perpendicular to the shadow edge. X-ray diffraction examn. of a calcite crystal ground on coarse carborundum indicated that small particles were produced during abrasion and that large plastic curvatures occurred on the surface.

13342. Grasenick, F. and Haefer, R. **Electron microscope investigation of surfaces with a carbon covering.** *Monatsh.* 83, 1069-82 (1952).—*C.A.* 47, 1483*f*.
Colloidal carbon was sputtered on the surfaces of samples and the resulting replicas used for electron microscope studies. Four methods of prepn. were tried: (1) discharge in a hydrocarbon atm. and the subsequent action of an electron beam; (2) vaporization of carbon electrodes in H_2 and A; (3) action of an electron beam on the object in an atm. of gaseous hydrocarbon at pressures of 10^{-2}—10^{-4} mm; and (4) adsorption of org. substances. MgO and diatomaceous earth materials were used as the samples.

13343. Hagihara, Hitoshi. **Mono- and multilayer adsorption of aqueous xanthate on galena surfaces.** *J. Phys. Chem.* 56, 616-21(1952).—*C.A.* 46, 8458*g*.
The action of aq. xanthate on galena surfaces was studied by electron diffraction. Minute unimolecular patches adsorbed on the galena lattice were formed on both fresh and slightly oxidized galena faces. The monolayer may be composed of xanthic acid mols. adsorbed with their polar heads attached to the Pb atoms of the galena lattice.

13344. Hanson, A.W. and Lipson, H. **Optical methods in x-ray analysis. III. Fourier synthesis by optical interference.** *Acta Cryst.* 5, 362-6 (1952).—*C.A.* 46, 7422*h*.
A method of Fourier synthesis by optical interference was described, which involved the representation of a reciprocal-lattice section by an array of holes in an opaque plate. Intensities could be controlled by varying the orientation of mica plates between crossed nicols, while phase changes sufficient for the synthesis of centrosymmetrical projections were effected by interference between the fast and slow components into which the mica resolved the incident light.

13345. Hast, Nils. **Resistant surface films of crystals.** *Arkiv Fysik* 4, 535-9(1952)(in English).—*C.A.* 46, 8923*g*.
An electron-microscopic investigation indicated the presence of veil-like surface films, reproducing the shapes of crystals of NaCl, marble, and rock salt, which were left after soln. of the crystals. These films had a porous structure of threads, through which the material of the crystal must have diffused during the soln. process. The rate of growth of the crystals and the rapidity of the change from the growing process to soln. had some effect on the character of the threads. The origin of the surface films may be impurities in the soln. but not adsorbed gas mols. or dust particles.

13346. Hauser, Ernst A. and LeBeau, D.S. **The surface structure and properties of colloidal silica and alumina.** *J. Phys. Chem.* 56, 136-9 (1952).—*C.A.* 46, 10785*b*.
Thermal analysis and x-ray diffraction studies proved the amorphous structure of synthetic silica gels, silicic acid gel, alumina-silica gel, and magnesia-silica gels. The magnesia-silica gel alone showed an exothermic peak at 810°C, probably assocd. with a structural change and formation of a new compd. which was also amorphous. Ultramicroscopic studies and electron photomicrographs indicated that the particles were aggregates.

13347. Honigmann, B. and Stranski, I.N. **Habit change in hexamethylenetetramine crystals at constant temperature and under the influences of temperature fluctuations.** *Z. Electrochem.* 56, 338-42 (1952).—*C.A.* 46, 9923*f*.
A growing hexamethylenetetramine crystal was sealed in a closed tube in the presence of its own vapors. The (001) faces developed as the normal crystal habit, but at the very start of the growth both the (001) and (112) faces were present as submicroscopic faces. The growth depended on both time and temp. except that below 70°C there was no possibility for a habit change. The effect of gas mols. of N_2, O_2, CO_2, and NH_3 was tried; NH_3 was held back, whereas N_2, O_2, and CO_2 were physically adsorbed by the crystal.

13348. Kefeli, L.M. and Lel'chuk, S.L. **Structure of skeleton catalysts.** *Doklady Akad. Nauk S.S.S.R.* 84, 285-8 (1952).—*C.A.* 46, 10822*c*.
When the sol. component was leached out from a binary alloy, the remaining metal regrouped into its characteristic lattice; e.g., after the Al was leached out from the rhombohedral Ni_2Al_3, the skeleton Ni became cubic. On incomplete leaching, only the unchanged Ni_2Al_3 retained its rhombohedral lattice, but all the Ni was cubic. In the γ-phase of the Cu-Zn system, with 52-atom elementary cell of Cu_5Zn_8, the Cu remaining after dissoln. of the Zn with 3% HCl crystallized in the normal cubic lattice of Cu. The same happened upon removal of Mg and Zn from the ternary alloy Al_2CuMg.

13349. Kefeli, L.M. and Sevast'yanov, I.G. **Dispersity of the nickel-skeleton catalyst.** *Doklady Akad. Nauk S.S.S.R.* 83, 863-4(1952).—*C.A.* 46, 8489*g*.
By measurements of the width of Debye lines, the mean crystal size of a skelton Ni catalyst obtained by alk. leaching of a Ni_2Al_3 alloy was shown to decrease with decreasing temp. of the leaching and with decreasing concn. of the alkali. In leaching with 20% alkali at 103-7° 50°, 20°, 10°C, and with 10% alkali at 50° and 20°C, the mean crystal size was, resp., 176, 116, 103, 88, and 99 and 52 A.

13350. Kitazaki, Umeka; Yagishita, Hideharu, and Araki, Harumi. **Coking. II. X-ray analysis of the structural change of coal by heating.** *Misc. Repts. Research Inst. Natural Resources* No. 25, 51-60(1952).—*C.A.* 47, 847*i*.
By the x-ray diffraction patterns and thermoanalysis, the structural change of soft to hard coals during coking was traced from the loss of the primary macro-structure of C-ring nuclei with low hydrocarbon side-chain attached at 230-600°C to the graphitization (of a uniform pattern) at about 800°C. The coking property seemed to depend upon the primary structure, the coal with larger C-ring

nuclei with more numerous hydrocarbon attachments being coked at higher temp.

13351. KLIMENOK, B.V. AND SHEKHTER, A.B. **Electron-microscopic investigation of the coke formed on aluminosilicate catalysts in the cracking of hydrocarbons.** *Doklady Akad. Nauk S.S.S.R.* 83, 109-10(1952).—*C.A.* 46, 8842*d*.

Electron-microscopic pictures were taken of the same spot of the catalyst in the course of cracking of C_6H_{14} and of 2,3,4-trimethylpentane at 500°C. A change of structure was noticeable after 20 min. Porosity disappeared, with the pores becoming clogged up with a carbon deposit. The specific surface area of this catalyst was about 400 m^2/g, and the deposit was evidently multimol., hence the deposition of coke took place only on a small fraction of the catalyst surface.

13352. LAGERGREN, STIG AND MAGNELI, ARNE. **The tantalum-oxygen system.** *Acta. Chem. Scand.* 6, 444-6(1952)(in English).—*C.A.* 47, 6228*a*.

Ta powder and Ta_2O_5 were mixed and heated *in vacuo*. The product was investigated by x-ray diffraction. No reaction could be observed even when the heating, in sealed SiO_2 tubes, was prolonged (10 days at 1100° or 2 days at 1250°C). In a zirconia crucible at 1800°C, there was some reduction to Ta metal, and a new oxide phase appeared. This phase could not be prepd. by heating mixts. of Ta and Ta_2O_5, but when Ta_2O_5 was heated *in vacuo*, it was transformed into the new phase. When the transformed oxide was heated in O_2 at 1000°C, it reverted to ordinary Ta_2O_5 with no change in wt.

13353. MAIRE, J. AND MATHIEU-SICAUD, A. **Electron-microscope study of graphitic acid gels.** *Bull. soc. franç. minéral. et crist* 75, 599-604(1952). —*C.A.* 47, 5216*h*.

Graphitic acid was formed by the action of a mixt. of 20 g $KClO_3$ and 20 ml fuming HNO_3 on 1 g of either natural or artificial graphite for 2 hrs. The particles of Na graphite formed continuous membranes and at the same time formed gels, with continuous action by drying until the acid groups located at the periphery of the particles were satd. with Na.

13354. MIURA, KIN'ICHIRÔ. **A relation between the particle size and color of gold sol.** *Kagaku* (Science) 22, 545-6(1952).—*C.A.* 46, 10782*f*.

Electron microscope observations were correlated with light absorption of gold sol. prepd. by various reducing reagents. The log of the particle diam. was proportional to the frequency of the absorption max.

13355. MOONEY, R.W.; KEENAN, A.G., AND WOOD, L.A. **Adsorption of water vapor by montmorillonite II. Effect of exchangeable ions and lattice swelling as measured by x-ray diffraction.** *J. Am. Chem. Soc.* 74, 1371-4(1952).—*C.A.* 46, 6460*a*.

The univalent ions of Li, Na, K, Rb, and Cs were added to montmorillonite as solns. of the hydroxides; bivalent ions were added in the form of the solids $MgCO_3$, CaO, $Sr(OH)_2$, and $Ba(OH)_2$. Correlation between the shapes of the isotherms, heat of desorption, and x-ray diffraction data provided evidence that the adsorbed H_2O was present in discrete monolayers.

13356. NIELSEN, ANDERS AND BOHLBRO, HANS. **Investigation on surface properties of reduced iron catalysts for the synthesis of ammonia and correlation with crystal sizes and high-pressure conversion activities.** *J. Am. Chem. Soc.* 74, 963-6 (1952).—*C.A.* 46, 5414*d*.

Com. triply promoted K_2O-CaO-Al_2O_3-Fe catalysts were examd. by adsorption measurements, and the adsorption data were correlated with x-ray data and high-pressure conversion measurements. Crystal sizes detd. from line broadening in x-ray patterns and surface areas derived from low-temp. A and N_2 adsorption were in satisfactory agreement. The more active catalyst had the smaller surface area and the smaller CO chemisorption at -78°C.

13357. NODA, TOKICHI AND SATO, SHINYA. **X-ray study of carbon brushes.** *Bull. Chem. Soc. Japan* 25,195-8(1952).—*C.A.* 47, 5755*h*.

X-ray diffraction methods were used to det. unit-cell dimensions of 10 specimens of carbon brushes. D.'s were calcd. from the unit-cell data, and conclusions drawn concerning the amt. of graphitization in soot-type and pitch-coke carbon brushes.

13358. PEYTAVY, ANDRÉ ANTOINE AND LAHOUSTE, JEAN. **Technique for the use of x-rays in the study of coking.** *Compt. rend.* 234, 934-5 (1952).—*C.A.* 46, 8831*g*.

Movement of the plastic zone and the occurrence of fissuration in a cylindrical sample of coal being heated on a hot plate was followed by passing x-rays through the coal, parallel to the surface of the hot plate, with the screen placed on the opposite side of the coal.

13359. PINNICK, H.T. **X-ray diffraction of heat-treated carbon blacks.** *J. Chem. Phys.* 20, 756-7 (1952).—*C.A.* 46, 8925*g*.

Studies by x-ray diffraction were made of various carbon blacks with particle sizes ranging from 50 to 3000 A., all graphitized to 3000°C. The av. crystallite diam. was about 1/3 of the particle size. The particles retained their individuality after graphitization. For comparison, a soft coke was heat-treated to various temps. to give crystallite sizes comparable to those of the carbon blacks. The cross-lattice 101 line first appeared at a crystallite diam. of 150 A.; this line appeared at the same particle size in the carbon blacks.

13360. PORAI-KOSHITS, E.A.; KALININA, A.M., AND FILIPOVICH, V.N. **Investigation of the structure of some silica gels by the method of small-angle scattering of x-rays.** *Doklady Akad. Nauk S.S.S.R.* 86, 985-8(1952).—*C.A.* 47, 4728*h*.

The small-angle scattering method was applied to 3 samples previously studied by the vapor-adsorption method: homogeneously porous with a mean pore radius of 40 A., homogeneously course-porous with a most probable effective pore radius of 100 A., and inhomogeneously porous with the pore radius varying from about 15 to 150 A. The scattering angle α varied from 6.5′ to 2°30′. The small-angle scattering method gave the size distribution of the pores and not of the particles.

13361. RADUSHKEVICH, L.V. AND LUK'YANOVICH, V.M. **Structure of the carbon produced in the thermal**

decomposition of carbon monoxide on an iron catalyst. *Zhur. Fiz. Khim.* 26, 88-95 (1952).—*C.A.* 47, 6210*d*.

Carbon black deposits produced on Fe in a stream of CO at 600°C were examd. under the electron microscope at magnifications of 8000-15,000, with a resolution up to 50-60 A. The majority of the carbon particles were of an elongated wormlike shape. Particles grown on individual Fe grains were threadlike, and apparently consisted of Fe carbides. Some unusual formations consisting of 2 threads twisted together were observed.

13362. Richardson, H.M. and Wilde, F.G. **An x-ray study of the crystalline phases that occur in fired clays.** *Trans. Brit. Ceram. Soc.* 51, 387-400(1952); reprinted from *Brit. Ceram. Research Assoc. Research Paper* No. 41, (1949).—*C.A.* 47, 1350*f*.

The chem. analysis and the cryst. impurities of 7 clays were detd. The cryst. phases formed during firing at 800-1300°C were identified by the x-ray powder technique. The importance of the crystn. of γ-Al_2O_3 from amorphous Al_2O_3 and its combination with SiO_2 to form mullite was discussed. The value of an x-ray powder photograph in predicting the firing temp. of a firebrick was examd.

13363. Robin, Jacques and Bérnard, Jacques. **Research on the structure and stability of the phases in the system Fe_2O_3-Co_3O_4.** *Compt. rend.* 234, 734-5 (1952).—*C.A.* 46, 5415*i*.

Mixed oxides of Fe_2O_3 and Co_3O_4 produced by heating solid solns. of Fe and Co oxalates at 300°C gave a single phase of spinel structure. Samples of different compns. were heated to different temps. up to 1000°C and examd. with x-rays. A phase diagram was constructed. From 0 to 33% Co and 300 to 800°C, there was Fe_2O_3 and spinel; this 2-phase region contracted at higher temps. to 30% Co at 1000°C. At 50-91% Co and up to 860°C there were 2 spinels in equil. At more than 51% Co and above 880°C there was CoO in equil. with spinel.

13364. Roof, Raymond B. Jr. **Crystallography of nickel kieselguhr.** *J. Chem. Phys.* 20, 1181-2 (1952).—*C.A.* 46, 9922*e*.

A Ni kieselguhr hydrogenation catalyst was examd. by x-rays. Ni and NiO were present and showed their usual lattice parameters. The reported existence of hexagonal close-packed Ni may be an incorrect interpretation of the composite pattern of Ni and NiO. The linear dimensions of the Ni and NiO particles in the prepn. were approx. 330 and 160 A., resp.

13365. Sasaki, Nobuyi and Osumi, Yoshio. **Microscopic investigation of fused catalysts for ammonia synthesis. I. Optical and surface-electron microscopic observations.** *J. Chem. Soc. Japan,* Pure Chem. Sect. 73, 808-11 (1952).—*C.A.* 47, 4560*i*.

The polished surfaces of ordinary unreduced catalyst for NH_3 synthesis and of Fe_3O_4 were investigated with a microscope. The former were crystal grains with their cleavage planes oriented regularly, while the latter lacked the appearance of definite crystal grains. Various unreduced catalysts with various promoters were subjected to electron microscope test. Those contg. K gave a pattern corresponding to dispersion at the grain boundary at about 1000°C.

13366. Sawamura, Hiromitsu. **Electron-microscopic observation of aluminum hydroxide.** *J. Sci. Research Inst.* (Japan) 46, 15-16(1952).—*C.A.* 47, 3656*b*.

The aging of freshly prepd. $Al(OH)_3$ gel was followed with the electron microscope. At 2 hrs a few fibers of 100 to 200 A. diam. were observed. At 24 hrs most of the crystals were arranged in fibers of 200 to 500 A. diam. The crystals themselves were too small (<50A.) to be observed.

13367. Sennett, R.S.; McLauchlan, T.A., and Scott, G.D. **Electron-microscope studies of evaporated cadmium and zinc.** *Can. J. Phys.* 30, 370-2(1952). —*C.A.* 47, 4159*g*.

Evapns. were effected in a microscope, and continuous observations during condensation were made. The particles first seen appeared suddenly. They had a regular cryst. shape, and were often as large as 200 A. At first they remained regular while increasing in size, but later developed irregular spurs, secondary crystallites, or became linked together with their neighbors. This behavior was very different from that of Ag and Au in which the aggregates appeared irregular in all stages.

13368. Shishakov, N.A. **Protective films of oxide and hydroxide on magnesium.** *Zhur. Fiz. Khim.* 26, 358-63 (1952).—*C.A.* 47, 6207*c*.

Electron diffraction showed that on addn. of dry air to evapd. Mg, the usual (cubic) MgO, a 4.20 A., formed. Mg treated with alk. CrO_3 solns. was coated with a hexagonal $Mg(OH)_2$, a 3.13, c/a 1.50. On Mg in boiling H_2O or hot H_2O vapor a new hydroxide formed, presumably rhombic, a 3.792, b 10.16, c 2.842. This hydroxide was a better protector against corrosion than the other oxides and hydroxides.

13369. Stech, Berthold. **Structural change produced in crystals by α-particle bombardment.** *Z. Naturforsch.* 7a, 175-85(1952).—*C.A.* 46, 7902*g*.

Fine cryst. powders of grain size smaller than the range of the α-particles were loaded into glass tubes of 3 mm diam. and exposed to emanations from 80 to 100 mc. Rn. Debye-Scherrer photographs were recorded of irradiated and unirradiated samples. Graphite, highly dispersed carbon, metallic Se, ZnS, HgS, CaF_2, NaF, KF, and Na_2CO_3 showed no noticeable changes in position, intersity, or sharpness of the rings on the x-ray patterns. $KMnO_4$, As_2O_3, Na oxalate, anthracene, hexamethylenetetramine, NH_4 tartrate, and urea showed noticeable changes.

13370. Suito, Eiji and Arakawa, Masafumi. **Observation by the electron microscope on the state of dispersion of various fillers in vulcanized rubber.** *Proc. Japan. Acad.* 28, 48-53(1952).—*C.A.* 47, 5713*c*.

Four different fillers, carbon black, basic Mg carbonate, light $CaCO_3$, and ultrafine $CaCO_3$, were dispersed in a standard rubber formulation. Pos. replicas of methyl methacryl-Al of cut sections of the vulcanized rubber were photographed with the electron microscope, and comparisons were made with similar photographs of the various fillers themselves. In rubber, the fillers were dispersed as primary particles, although when by themselves they were observed as aggregates.

13371. SULLIVAN, BARBARA M. AND MCMURDIE, HOWARD F. **Crystal forms of chromium orthophosphate.** *J. Research Natl. Bur. Standards* 48, 159-62 (1952)(Research Paper No. 2300).—*C.A.* 46, 7839*i*.

As the hexahydrate of $CrPO_4$ was heated, it began to lose water at 100°C, and at 130°C the structure broke down to an amorphous one, with a gradual transition as indicated by x-ray patterns. When powd. hexahydrate was heated, it formed stable α-$CrPO_4$ at 972°C.

13372. SUZUKI, KOICHI; KITAZAKI, U., AND YAGISHITA, H. **The elementary structure of coal with special reference to its coking property.** *Japan. J. Geol.* 22, 241-56(1952).—*C.A.* 47, 3542*h*.

X-ray analysis of coal of high rank showed a lamellar structure closely resembling that of graphite, and in coal of low rank a structure resembling that of amorphous carbon. Anthracite had a three-dimensional structure of the graphite type, though the unit cell was smaller and the atom arrangement was far more irregular than in graphite. Good coking coal had a two-dimensional lamellar structure.

13373. TALVENHEIMO, GERHARDT AND WHITE, J.L. **Analysis of clay minerals with the x-ray spectrometer.** *Anal. Chem.* 24, 1784-9(1952).—*C.A.* 47, 2638*h*.

A Norelco Geiger-counter x-ray spectrometer was used for the analysis of mixts. of bentonite, illite, and kaolinite clays. The method indicated that analysis good to 5-10% accuracy were possible under ideal conditions of analyses. The concn. of clay, the type of scattering cation, the nature and amts. of solvating compd., the relative humidity of the environment during drying, and the presence of accessory minerals all influenced the intensities of the diagnostic basal reflections for analysis.

13374. TESNER, P.A. AND ECHEISTOVA, A.I. **Electron-microscopic study of the growth of lampblack particles.** *Doklady Akad. Nauk S.S.S.R.* 87, 1029-31 (1952).—*C.A.* 47, 6210*f*.

Lampblack particles from an aerosol were examd. after different lengths of contact with streams of CH_4, C_6H_6, or cyclohexane. The growth proceeded regularly by layers, so that the outer shape of each particle remained unchanged. Therefore, measurements of the outer dimensions of the particles permitted detn. of the rates of carbon deposition at different temps. At still higher temps., threadlike formations were observed. When the threads were taken out and then put back again into the stream of hot hydrocarbon, growth in length ceased and only the thickness increased, but at a rate very much slower than the growth of thickness of regular lampblack particles.

13375. THIELE, H. AND KIENAST, G. **Effect of ions on the structure of gels.** *Kolloid-Z.* 127, 134-44(1952).—*C.A.* 47, 25*d*.

The structures of anisometric colloids, such as V_2O_5, Hg sulfosalicylic acid, and Fe_2O_3 sols, were detd. by chem. and electron-microscope methods. The effect of ions on the birefringence of these sols depended on the electrolyte concn. Multivalent ions gave trouble because of partial hydrolysis and aggregation. The formation of ionotropic gels proceeded in the sequence: diffusion, alignment, ion exchange, gel formation. The degree of order increased from sol to thixotropic gel to ionotropic gel.

13376. WATT, GEORGE W. AND PARKER, SIDNEY G. **The composition of W-6 Raney nickel.** *J. Am. Chem. Soc.* 74, 1103-4 (1952).—*C.A.* 47, 4715*e*.

Al_2O_3 was not a constituent of W-6 Raney Ni prepd. by the method of Adkins and Billica; Al_2O_3 formed during the soln. of samples taken for analysis. X-ray diffraction showed no max. attributable to any of the known forms of Al oxide or its hydrates.

13377. WEST, W.J. **Size determinations of clay particles in water suspensions by use of low-angle x-ray diffraction.** *J. Colloid Sci.* 7, 295-305(1952).—*C.A.* 46, 10783*a*.

Particle-size detn. of clay suspended in H_2O was made by low-angle x-ray diffraction without disturbance of the sample. Expts. with several clays used in com. drilling muds showed particle size to increase by swelling during formation of the suspension. The systems with the largest particles had the largest viscosity and gel strength.

13378. WILLIAMS, E.C. **Anisotropic lattice distortion in evaporated deposits of face-centered-cubic metals.** *Research* (London) 5, 392-3(1952). —*C.A.* 46, 10755*f*.

Precision measurements on electron diffraction transmission patterns of Cu, Ag, and Au deposited by evapn. *in vacuo* onto thin collodion films, indicated lattice distortion explained by dislocations. Reflecting planes should be almost parallel and close to a free surface.

13379. YAMAGUCHI, SHIGETO. **Structure of oxide replicas for electron microscopy.** *J. Applied Phys.* 23, 445-7(1952).—*C.A.* 46, 6456*a*.

The structure of oxide films, which could be used as replicas for electron microscopy, was investigated. In order to obtain a replica of the metal surface by using the oxide film formed on it and isolated from it, the oxide crystals composing the film must be oriented relative to the orientation of the substrate face. The oxide crystals formed on metal whose atom distances coincided with those of the substrate crystal could compose a replicating film of the specimen surface.

13380. YAMAGUCHI, SHIGETO. **Structure of oxide-film replica for electron microscope.** *Repts. Sci. Research Inst.* (Japan) 28, 86-8(1952).—*C.A.* 46, 10776*h*.

The oxide-film replica from the etched (with EtOH-Br) surface of an Fe monocrystal peeled smoothly and showed, by use of an electron microscope, octagonal crystals of Fe_3O_4 in relief with regular cryst. orientation (detd. by electron diffraction). That from permalloy (Ni 81.5%) peeled with curl or tear and showed flat octagonal crystals of NiO with irregular or amorphous cryst. structure.

13381. BAGNO, ODETTE. **The precipitation of nickel hydroxides by mixtures of sodium hydroxide and sodium carbonate.** *Compt. rend.* 236, 1275-8(1953).—*C.A.* 47, 6810*g*.

Titration of $NiCl_2$ solns. with $NaOH\text{-}Na_2CO_3$ mixts. gave pH curves that showed the effect of Na_2CO_3 on the formation of $Ni(OH)_2$. X-ray studies showed that the ppt. was $Ni(OH)_2$, but this product formed at pH 7.3 in 100% Na_2CO_3 compared to pH 11.2 in 100% NaOH. The basic carbonate was not formed. Studies of rate of pptn. indicated that 24 hrs was required to permit the exchange of OH^- for CO_3^{--} adsorbed on the ppt. This was supported by x-ray analysis.

13382. COWLEY, J.M. **Stacking faults in γ-alumina.** *Acta Cryst.* 6, 53-4(1953).—*C.A.* 47, 6729*e*.

Extra spot and line segments observed in single-crystal electron-diffraction patterns of γ-Al_2O_3 were interpreted in terms of faults in the cubic close-packed stacking of the O atoms. Near the fault planes some Al atom sites were "unfavorable" in that they were nearer than usual to other Al sites.

13383. HONJO, GORO. **Electron-diffraction studies on oxide films formed on metals and alloys. II. Selective oxidation of alloys.** *J. Phys. Soc. Japan* 8, 113-18(1953).—*C.A.* 47, 5334*b*.

Surface oxidation products on Cu alloys contg. 0.3% Be, 0.5% Al, 0.1% Mg, 7% Mn, and 7% Ni, and Fe with 13% Al subjected to varying oxidation conditions in the range from 300 to 900°C at 10^{-4}-760 mm. Hg pressure were studied with electron-diffraction methods. In reduced air pressures, the selective oxidation of the baser component generally took place. When the supply of the baser metallic ions toward the surface by diffusion was ample enough to consume the O atoms attacking the specimen surface, only the oxide of the baser component was formed. When the supply of O atoms to the surface overcame that of the baser metallic ions, the oxide of the nobler component also formed until at high air pressures the nobler component, having a much larger content in the alloys studied, became so abundant as to conceal the oxide of the baser component.

13384. LÜTZKENDORF, W. **The hiding power of pigments as a function of their particle size.** *Farbe u. Lack* 59, 7-16 (1953).—*C.A.* 47, 2999*b*.

Electron-microscopic measurements were used to show that the hiding power of a pigment increased with decreasing particle size, until its particle size fell below the wave length of the light which the pigment reflected or absorbed. The pigment then became colloidal or translucent, and finally became transparent when its particle size decreased below half that wave length. This was demonstrated with a large no. of pigments.

13385. RUSTON, W.R. **X-ray investigation of microcrystalline graphitic carbon. Apparent increase of the interlayer spacing with decreasing crystallite dimensions.** *Fuel* 32, 52-61(1953).—*C.A.* 47, 2591*i*.

The observed increase in the interlayer spacing of microcryst. graphitic carbons was found to be false. The higher values previously reported were due mainly to a shift of the (002) group x-ray powder reflection whose max. was considerably displaced towards smaller glancing angles as a result of the continuous intensity factors. The interlayer spacings of microcryst. graphitic carbon were the same as, or only slightly greater than, that of well-crystd. graphite.

13386. STREULI, C.A.; SCHERAGA, H.A., AND NICHOLS, M.L. **X-ray investigation of several contaminated barium sulfate precipitates.** *Anal. Chem.* 25, 306-10(1953).—*C.A.* 47, 5248*i*.

X-ray investigation of $BaSO_4$ ppts., contaminated by Fe^{3+}, Cl^-, and NO_2^-, indicated no change in diffraction pattern due to contamination. Variation in unit cell vol. was attributed to solid soln.

VI-8. Properties of Graphite and Diamond

13387. NÄSÄNEN, REINO. **Oxidation of graphite in the glow discharge.** *Ann. Acad. Sci. Fennicae* A52, No. 5, 51 pp. (1940).—*C.A.* 37, 6560⁹.

If the graphite was the anode, only CO_2 was formed in O_2; the C consumption in $O_2 + CO_2$ was much lower than if graphite was the cathode. CO formed by the combined action of the activated, slow mols., the ions and the fast mols.; the CO_2 was produced only by the ions and the fast mols. derived from these ions, as the CO yield was not decreased by the flowing stream of O_2. A moving stream of CO_2 decreased the CO yield. At a graphite cathode, CO was not oxidized appreciably in O_2 + CO mixts. The oxidation products were the results of a primary decompn.

13388. WEISS, JOSEPH. **Fluorescence and oxidation in conjugated ring systems.** *Nature* 145, 744-5 (1940).

Graphitic oxide should be considered as a salt similar to the other graphite salts where the anion HSO_4^- or ClO_4^- was replaced by O_2^- (or possibly partly by HO_2^-). This structure only referred to the "active" oxygen in graphitic oxide. The rest of the oxygen was present partly in the form of OH groups (possibly OH-ions) or as molecular water.

13389. BĂLĂNESCU, SANDA. **The graphite content of the graphitic schists from the Oltet Mountains (Gorj County).** *Inst. geol. Romaniei, Studii tech. econ. Ser. B, No.* 16, 21-32(1941). —*C.A.* 42, 8119*h*.

Graphite-bearing rocks were analyzed, by using the wt loss by calcination as an approx. indicator for the carbon and graphite contents. Elementary analysis at 700°C in O_2 was used for finding exact values. In order to distinguish between anthracite and graphite in the samples, the graphite was detd. in form of graphitic acid by oxidation with $KClO_3$ and a mixt. of H_2SO_4 and HNO_3. In addn. to the rock samples, com. graphite samples were also analyzed.

13390. BASSET, J. **Density of graphite and determination of the mean coefficient of compressibility between 1 and 20,000 kilograms per square centimeter.** *Compt. rend.* 213, 829-31(1941).—*C. A.* 37, 5296^7.

The d. of natural and artificial graphite measured after 3 compressions at 20,000 kg/cm^2 and degassing twice in vacuum at 2100°C had a max. value in a natural specimen of 2.180. The mean coeff. of compressibility of this specimen at 18°C was given.

13391. DAKE, H.C. **Fluorescence in diamonds.** *Gemmologist* 11, 55(1942); *Mineralog. Abstracts* 8, 269(1942).—*C. A.* 39, 2944^7.

In ultraviolet light, diamonds may fluoresce blue or yellow or may be nonfluorescent. Spectrochem. analysis showed traces of Al, Ca, Cr, Fe, Mg, Mn, Ni, Rh, Si, Ag, and Ti. Blue fluorescent diamonds showed an excess of Cr; yellow, of Al; nonfluorescent diamonds had no preponderance of any foreign element.

13392. GUINIER, ANDRÉ. **Abnormal diffusion of x-rays in the diamond.** *Compt. rend.* 215, 114-14(1942).—*C. A.* 38, 6152^6.

Four weak spots appeared near the original position of the Bragg spots after the crystal was turned slightly. One of these was diffuse and was produced by thermal agitation. The other 3 were sharp and their intensities were independent of temp. This phenomenon was most pronounced at the 111 position, but was also studied at the 220, 113 and 400 positions.

13393. BANNISTER, F.A. AND LONSDALE, K. **Laboratory synthesis of diamond. An x-ray study of diamonds artificially prepared by J. B. Hannay in 1880.** *Nature* 151, 334-5(1943); *Mineralog. Mag.* 26, 315-24(1943).—*C. A.* 37, 3650^2, 6175^1.

X-ray investigations showed that 11 of 12 artificial diamonds prepd. by Hannay in 1879-80 were pure or nearly pure diamond of the rare type II variety.

13394. CHUGUNOV, P. AND BRUNS, B. **Wetting and swelling of graphite.** *Acta Physicochim. U.R.-S.S.* 18, 351-7(1943)(in English).—*C. A.* 38, 5709^9.

Measurements of the contact angles of gas bubbles on the surface of graphite were made. The quantity of O_2 evolved on decompg. the graphite salts obtained, both by treatment with a mixt. of HNO_3 and H_2SO_4, and by anodic oxidation, was equiv. to the quantity of fixed H_2SO_4. The mechanism of the formation of graphitic acid salts was similar to that of the hydrolytic adsorption of strong acids by activated charcoal.

13395. COE, GLEN D. **The burning rate of natural graphite.** *U.S. Bur. Mines, Rept. Investigations* 3692, 9 pp. (1943).—*C. A.* 37, 4209^7.

A procedure for detg. burning rate of natural graphite was proposed and detns. on 6 graphite concentrates presented. Ceylon graphite had a much higher burning rate than any other tested. Gang minerals reduced the burning rate. The test was useful in evaluating graphites that were to be used at high temps.

13396. DESCH, C.H. **Artificial production of diamonds.** *Nature* 152, 148-9(1943).—*C. A.* 37, 6174^9.

13397. GÜNTHER, P.L.; GESELLE, P., AND REBENTISCH, W. **Researches on the diamond problem.** *Z. anorg. allgem. Chem.* 250, 357-72(1943).—*C. A.* 37, 5307^6.

The expts. of Moissan cannot be claimed as a successful diamond synthesis. A special app. was developed which permitted a piston-thrust pressure up to 120,000 kg/cm^2 for a short time at high temp. Highly heated graphite and charcoal were subjected to this pressure, but a direct change to diamond did not occur.

13398. RAMAN, C.V. **The structure and properties of diamond.** *Current Sci.* 12, 33-42(1943).—*C. A.* 37, 6174^9.

13399. SANDERSON, L. **Graphite.** *Can. Mining J.* 64, 283-4(1943).—*C. A.* 37, 4209^7.

The properties and uses of graphite were outlined.

13400. VERRIEN, JEAN AND DEVÈZE, HENRI. **Variation of the electric resistance of graphite granules with pressure and its anomalies.** *Cahiers phys.* 13, 61-4(1943).—*C. A.* 40, 2368^3.

The resistance of a mass of irregular graphite granules, at const. temp., to an elec. current was measured for a range of applied pressures. The curves showing the resistance-pressure variations indicated not only the presence of hysteresis, but also a lag, which caused the resistance to pass through max. and min. at the points where the pressure was reversed.

13401. WINTER, HEINRICK. **Transition of amorphous carbon into graphite.** *Glückauf* 79, No. 24/25/26, 316-20(1943).—*C. A.* 38, 3177^8.

Studies of carbon allotropes, with special attention to the elec. cond. and x-ray studies, were reviewed.

13402. BAI, K. SUNANDA. **The ultraviolet absorption spectrum of diamond.** *Proc. Indian Acad. Sci.* 19A, 253-60(1944).—*C. A.* 39, 459^9.

The relationship between the ultraviolet absorption spectra and luminescence properties of 47 diamonds were studied. In general, the ultraviolet transparency of these diamonds increased with their intensity of fluorescence. Diamonds showing yellowish green and blue fluorescence had transmissions extending to 2250 A. Absorption lines appeared at 2359.0 and 2356.5 A., with 5 bands on one side at 2405, 2399, 2396, 2395 and 2388 A., and 3 bands on the other side at 2314, 2309-2306 and 2300-2296 A. The bands sharpened and shifted toward shorter wave lengths at liquid-air temp.

13403. BAI, K. SUNANDA. **Luminescence patterns in diamonds.** *Proc. Indian Acad. Sci.* 19A, 274-9(1944).—*C. A.* 39, 460^3.

Patterns of luminescence, showing variations in intensity and color, were observed in cleavage plates of certain diamonds irradiated by long-wave ultraviolet radiation. Diamonds having both blue and yellow luminescence appeared always to exhibit such patterns although blue-luminescent diamonds usually did not.

13404. BUERSCHAPER, ROBERT A. **Thermal and electrical conductivity of graphite and carbon at low temperatures.** *J. Applied Phys.* 15, 452-4 (1944).—*C.A.* 38, 3526^1.

Specimens 32 cm long and 2.9 cm diam. were cut from Acheson graphite electrodes and from carbon electrodes. Measurements were made from -191° to 100°C. The conds. increased with rising temp. except for the thermal cond. of graphite, which decreased with rising temp. Two values were always found for graphite, depending upon whether the cond. was measured parallel to the original electrode (longitudinal) or at right angles to it (radial). The longitudinal conds. were always about twice the radial.

13405. HOFMANN, ULRICH. **The boundary between graphite and aromatic compounds.** *Naturwissenschaften* 32, 260-8(1944).—*C.A.* 40, 2956^4.

Work on similarity of graphite electron structure with that of aromatic compds. was reviewed. No sharp boundary was found; the intermediary stages of graphite nuclei in coal and in various charcoals constituted a gradual change from aromatic compd. to cryst. graphite.

13406. KRAUS, EDWARD. **"Laboratory" diamonds.** *S. African Mining and Eng. J.* 55, 595(1944).—*C.A.* 39, 851^7.

13407. KRISHNAN, R.S. **The Raman spectrum of diamond.** *Proc. Indian Acad. Sci.* 19A, 216-23 (1944).—*C.A.* 39, 459^3.

Diamonds of the ultraviolet transparent type were investigated. The 2536 resonance line of Hg was used as exciter. The following lines recorded, in addn. to the 1332 line: 1925, 2175.5, 2245, 2267, 2300.5, 2467, 2495, 2518, 2609.5 and 2664.6 (frequency shifts in cm^{-1}). These lines were octaves and allowed combinations of some of the 8 fundamental frequencies of oscillation of the diamond structure.

13408. KRISHNAN, R.S. **Experimental evidence for the existence of the four possible structures of diamond.** *Proc. Indian Acad. Sci.* 19A, 298-303(1944).—*C.A.* 39, 460^7.

The theory that the tetrahedral and octahedral forms of diamond each have 2 variants was tested by applying x-ray and Raman spectrographic techniques. The co-existence of the 2 variants of the tetrahedral structure was confirmed from the observed increased intensities of x-ray reflections in such diamonds. With the simultaneous occurrence of the variants of the octahedral structure in the same crystal, oscillation patterns showed a waviness such as would be observed if there were a difference in the crystal spacings of the alternate layers.

13409. KRISHNAN, R.S. **Thermal expansion of diamond.** *Nature* 154, 486-7(1944).—*C.A.* 39, 851^8.

By use of an x-ray method, the change in the lattice spacing of diamond was detd. The coeff. of cubic expansion was: 298-378°K, 4.50×10^{-6}; 378-478°, 6.70; 478-573°, 8.58; 573-673°, 9.81; 673-773°, 10.70; 773-873°, 11.55; and 873-923°, 12.30.

13410. MANI, ANNA. **The fluorescence and adsorption spectra of diamond in the visible region.** *Proc. Indian Acad. Sci.* 19A, 231-52(1944).—*C.A.* 39, 459^7.

Thirty-two diamonds were studied at room temp. and liquid-air temp. with a two-prism spectograph. The fluorescence and the absorption spectra in the visible region were related. In blue-fluorescing diamonds the 4152 system predominated; in yellow-fluorescing diamonds the 5032 system was the more prominent. Thirty-six electronic lines other than 4152 and 5032 were found in the visible region, some characteristic of the yellow, others of the blue, florescence.

13411. MANI, ANNA. **Polarization of Raman scattering and of fluorescence in diamond.** *Proc. Indian Acad. Sci.* 20A, 117-21(1944).—*C.A.* 39, 1104^5.

The polarization of the 1332 cm^{-1} Raman line of diamond was measured for an octahedral crystal immersed in α-bromonaphthalene with the incident light unpolarized, polarized in the plane of scattering, or perpendicular to this plane.

13412. MANI, ANNA. **Fluorescence and absorption patterns in diamond at low temperatures.** *Proc. Indian Acad. Sci.* 20A, 323-8(1944).—*C.A.* 39, 3205^5.

The luminescence and absorption patterns shown by ten cleavage plates of diamond at liquid-air temp. were studied spectroscopically. In blue luminescent diamonds a close correlation existed between the variations in intensity of the principal electronic line at 4152 A. and those of the fainter lines at 4197 and 4206 A. and the subsidiary bands at longer wave lengths. For yellow luminescent diamonds a similar correlation existed between the intensities of the 4152, 5032, and 5359 A. systems and the lines at 4123 and 4194 A.

13413. PANT, DEVI DATT. **The photoconductivity of diamond. I. Experimental results.** *Proc. Indian Acad. Sci.* 19A, 315-24(1944).—*C.A.* 39, 460^9.

The photoconductivities under ultraviolet radiation of 36 diamonds were measured. Diamonds were classified into 3 groups, depending on whether they showed high, medium or low photoconductivities. The diamonds showing the highest conductivities were transparent to ultraviolet radiation to 2250 A. and beyond, and were nonluminescent. The diamonds showing the lowest conductivities had strong absorption bands between 3000 A. and 2800 A., with practically complete extinction at shorter wave lengths.

13414. PANT, DEVI DATT. **The photoconductivity of diamond. II. Theoretical considerations.** *Proc. Indian Acad. Sci.* 19A, 325-33(1944).—*C.A.* 39, 461^3.

Exptl. evidence indicated that atoms situated at slight irregularities in the crystal formed the photoelec. active centers. This explained the high photo-cond. of the highly imperfect ultraviolet-transparent diamonds and the low photocond. of the more nearly perfect ultraviolet-opaque type. Extended surfaces of discontinuity provided channels along which trapped electrons might move; this produced the secondary currents.

13415. RAMACHANDRAN, G.N. **X-ray topographs of diamond.** *Proc. Indian Acad. Sci.* 19A, 280-92 (1944).—*C.A.* 39, 450^{2}.

The topograph was a topographic map representing the variations of the reflecting power for x-rays over the area of a crystal plate. It was obtained by using white x-radiation slightly diverging from a pinhole, and photographing the Laue reflection from a set of crystal planes. Eighteen topographs of cleavage plates of diamond showed patterns that could be correlated with other patterns obtained from other properties of diamond, luminescence, ultraviolet transparency, birefringence.

13416. RAMACHANDRAN, G.N. **X-ray reflections and the structure of diamond.** *Proc. Indian Acad. Sci.* 19A, 304-9(1944).—*C.A.* 39, 449^{6}.

Two diamonds fluorescing in blue, one weakly, the other strongly, were investigated. Laue patterns were taken, with the beam normal to (111), of cleavage planes (111). The intensity of all the spots was greater with the more fluorescent diamond. The ratio of the intensities of corresponding spots in the two crystals varied.

13417. RAMAN, C.V. **The crystal symmetry and structure of diamond.** *Proc. Indian Acad. Sci.* 19A, 189-98(1944).—*C.A.* 39, 449^{4}.

The C atoms in diamond must have tetrahedral symmetry of electron orbital movements and spins. The atoms on the 2 Bravais lattices were oriented in space and with respect to each other in 4 distinct ways; hence, there were 4 possible structures for diamond. Two of these had the symmetry T_d, the other 2 the symmetry O_h.

13418. RAMAN, C.V. **The nature and origin of the luminescence of diamond.** *Proc. Indian Acad. Sci.* 19A, 199-215(1944).—*C.A.* 39, 459^{1}.

Luminescence in diamonds was essentially phys. in origin, and not due to the presence of impurities. Many cleavage plates showed luminescence patterns with geometric characters, whose origin was found in the twinning of the different possible diamond structures.

13419. RAMAN, C.V. AND RENDALL, G.R. **Birefringence patterns in diamond.** *Proc. Indian Acad. Sci.* 19A, 265-73(1944).—*C.A.* 39, 449^{9}.

There were 2 kinds of birefringence in diamonds. One, irregular in character, was due to structural imperfections and was negligible in perfect crystals. The other, geometric or structural, produced regular patterns in perfect crystals.

13420. RENDALL, G.R. **Ultraviolet transparency patterns in diamond.** *Proc. Indian Acad. Sci.* 19A, 293-7(1944).—*C.A.* 39, 460^{5}.

Irradiation of diamonds with the 2536-A. line of Hg and photography of the screening effect of the diamonds on the fluorescence of U glass gave a simple technique of detg. the transparency of different portions of the stones to radiation of this wave length.

13421. RILEY, D.P. **Lattice constant of diamond and the carbon to carbon single bond.** *Nature* 153, 587-8(1944).—*C.A.* 38, 4849^{3}.

Diamond dust with particle sizes 0.01-0.001 cm had a lattice const. of 3.5597 ± 0.0001 kX. The C—C bond length was 1.54140 ± 0.00009 kX. or 1.54453 ± 0.00009 A.

13422. ROBERTSON, ROBERT. **Diamond.** *Chemistry & Industry* 1944, 18-24.—*C.A.* 38, 3178^{6}.

Two varieties of diamonds were based on differences in phys. properties. The occurrence of the rate Type II was 2% in 300 specimens examd. Recent x-ray studies showed that in diffraction patterns of the Type I diamonds, streamers, which in some patterns were resolved into spots, were assocd. with reflections from the 111 planes. These were absent in patterns of Type II diamonds. Type II diamonds showed a striated or mosaic structure while Type I diamonds did not.

13423. SAKSENA, BISHAMBHAR DAYAL. **Thermal expansion of diamond.** *Proc. Indian Acad. Sci.* 20A, 92-9(1944).—*C.A.* 39, 1792^{7}.

An expression for thermal expansion based on the new lattice theory of Raman was given. In applying this expression the frequencies were divided into a higher and a lower group. The vol. dependency was assumed to be different for each group but the same within the group.

13424. SIGAMONY, A. **Magnetic susceptibility of diamond.** *Proc. Indian Acad. Sci.* 19A, 310-14 (1944).—*C.A.* 39, 448^{9}.

No correlation was found between values of magnetic susceptibility and other phys. properties such as color, absorption, luminescence and photocond. in an examn. of 40 specimens of diamond.

13425. LONSDALE, KATHLEEN. **Are there four possible diamond structures?** *Nature* 155, 144(1945). —*C.A.* 39, 2018^{2}.

There was no x-ray evidence, on the basis of lattice-const. variations, for the existence of the various structures postulated by Raman.

13426. MANI, ANNA. **Excitation curves of luminescence in diamond.** *Proc. Indian Acad. Sci.* 21A, 280-7(1945).—*C.A.* 39, 5179^{8}.

The fluorescence spectra of blue and yellow luminescent diamonds were studied as a function of exciting light wave length in the range 3700-6500A.

13427. NELSON, J.B. AND RILEY, D.P. **The thermal expansion of graphite from 15° to 800°C. I. Experimental.** *Proc. Phys. Soc. (London)* 57, 477-86(1945).—*C.A.* 40, 3957^{2}.

The variation with temp. of the a and c unit cell dimensions of hexagonal Ceylon graphite was detd. in the range 15°-800°C by the x-ray powder method. At 14.6°C, $a = 2.4562 \pm 0.0001$ kX. $c = 6.6943 \pm 0.0007$ kX. The C-C bond length was 1.4210 ± 0.0001 A. The a dimension showed a slight contraction up to about 400°C, a small expansion occurred above this temp. The coeff. of thermal expansion in the c direction, was large, the av. value over the temp. range was 28.3×10^{-6}.

13428. Nelson, J.B. and Riley, D.P. **Orientation effect in powder photographs of graphite.** *Phil. Mag.* 36, 711-14(1945).—*C.A.* 40, 6929^3.
The doubling of 000*l* lines in powder photographs of graphite was due to preferred orientation of crystals in the specimen, particularly at the surface of the specimen. An extrapolation procedure to obtain accurate values of the *c* dimension was described.

13429. Ramachandran, G.N. **Crystal structure of diamond.** *Nature* 156, 83(1945).—*C.A.* 39, 4538^7.

13430. Raman, C.V. **Allotropic modifications of diamond.** *Nature* 156, 22-3(1945).—*C.A.* 39, 4538^6.
Although all diamonds scattered an intense line at 1332 cm^{-1}, the corresponding infrared absorption appeared in some diamonds (with tetrahedral structure) but not in others (cubic). This and other evidence showed that there were allotropic modifications of diamond.

13431. Riley, D.P. **The thermal expansion of graphite. II. Theoretical.** *Proc. Phys. Soc.* (London) 57, 486-95(1945).—*C.A.* 40, 3957^4.
Certain of the elastic moduli for graphite were estd. at 18°C: $S_{11} + S_{12} = 1.8 \times 10^{-13}$ cm/dyne, $S_{13} = 4.3 \times 10^{-13}$, $S_{33} = 58.5 \times 10^{-13}$. Hence, the two linear compressibilities were, at 18°C, approx. $K_1 = 2.5 \times 10^{-13}$ cm^2/dyne, $K_{11} = 50 \times 10^{-13}$ cm^2/dyne. The theory derived was not restricted to low temps.

13432. Riley, H.L. **The lamellar compounds of carbon.** *Fuel* 24, 8-16, 43-54(1945).—*C.A.* 39, 2917^8.
The compds. included the graphite salts bisulfate, nitrate, perchlorate, biselenate, phosphate, pyrophosphate and arsenate, graphite monofluoride, graphite bromide, alkali graphites, graphite-ferric chloride, graphite oxide, pyro-graphitic acid, graphite sulfide, and the graphite-hydrogen combinations. Alkali graphites, graphite salts, graphite monofluoride, and graphite oxide were definite compds. Graphite bromide appeared to be an adsorption complex; graphite-$FeCl_3$ may also be an adsorption complex, but the compd. was surprisingly stable.

13433. Sutherland, G.B.B.M. and Willis, H.A. **Some new peculiarities in the infrared spectrum of diamond.** *Trans. Faraday Soc.* 41, 289-92(1945).—*C.A.* 39, 4801^3.
The spectra of 6 diamonds were detd. between 1 and 14 μ with a rock-salt prism-spectrometer of high resolving power. Strong absorption bands at 7.78 and 8.3 μ were present in Type-I, but were absent in Type-II diamonds. With 3 Type-I diamonds examd. a new absorption band was detd. at 9.05 μ, while one diamond had a new band at 7.08 μ not hitherto reported. This same diamond lacked a band at 7.27 μ common to the other 2 diamonds.

13434. Trombe, F.; Foëx, M., and Bardet, J. **The purification of graphite.** *Ann. chim.* 20, 701-23; *Compt. rend.* 220, 691-3(1945).—*C.A.* 40, 4926^2.
Rods of graphite were purified by heating electrically, with the rod as the resistor. Fe and Mn could be eliminated completely in 5-min. heating at 1450°C. Cu, Al, Ca, V, Ti, Si, Mg, and B required higher temps. in that order, up to 3000°C for complete removal. At 2650°C only 0.001% of the impurity (B and Mg) remained.

13435. Achyuthan, K. **Local variations in the photoconductivity of diamond.** *Proc. Indian Acad. Sci.* 24A, 162-7(1946).—*C.A.* 41, 1935*f*.
Three cleavage plates of well-polished diamonds, showing variations of ultraviolet transparency over their area, were studied. An elec. field was applied across a particular area by means of 2 pointed metallic electrodes pressing on the faces of the plates. A 4th plate, completely transparent to ultraviolet above 2250 A. and to the 8-μ infrared region throughout its area, showed variations of photocond.

13436. Adie, R.J. **Mechanical method for the estimation of graphite.** *Trans. & Proc. Geol. Soc. S. Africa* 49, 209-11(1946).—*C.A.* 44, 3840*d*.
Graphite was sepd. from assocd. minerals by crushing through 60 mesh, and floating on a liquid of sp. gr. 2.40. A suitable liquid was a mixt. of 37% CCl_4 and 63% $CHBr_3$.

13437. Chandrasekharan, V. **Phosphorescence patterns in diamond.** *Proc. Indian Acad. Sci.* 24A, 182-6 (1946).—*C.A.* 41, 1936*b*.
Patterns in 12 cleavage plates revealing the variations in intensity of phosphorescence in different regions of the same diamond were recorded by contact photography.

13438. Chandrasekharan, V. **The thermoluminescence of diamond.** *Proc. Indian Acad. Sci.* 24A, 187-92 (1946).—*C.A.* 41, 1936*c*.
After exposure to ultraviolet light, blue-fluorescent diamonds showed thermoluminescence, the greenish yellow glowed at room temp. changing to blue and brightening on heating to 270°C. Green fluorescent diamonds showed greenish yellow thermoluminescence.

13439. Chandrasekharan, V. **The phosphorescence of diamond.** *Proc. Indian Acad. Sci.* 24A, 193-7 (1946).—*C.A.* 41, 1936*d*.
Fluorescent diamonds retained energy after ultraviolet irradiation, a part being released at room temp. as phosphorescence. When they were illuminated with long-wave radiations, the energy was emitted as a flash of visible light. Ultraviolet light below 3000 A. produced the greatest activation.

13440. Gibson, J. **Structure of graphite.** *Nature* 158, 752 (1946).—*C.A.* 41, 2297*b*.
X-ray diffraction photographs of natural and artificial graphites showed certain faint lines (some single and some double) that could not be explained by structures that had been proposed for graphite. The extra lines were attributed to a structure closely related to the ordinary graphite structure, and the extra double lines to 000*l* reflections.

13441. Krishnan, R.S. **The second-order Raman spectrum of diamond.** *Proc. Indian Acad. Sci.* 24A, 25-32 (1946).—*C.A.* 41, 1557*g*.
A spectrum of the second order was recorded exhibiting an intense line and no fewer than 10

Raman lines of comparatively feeble intensity. The second-order spectra became visible with an exposure of 15 min. and the anti-Stokes of the principal line 1332-cm^{-1} appeared with an exposure of 45 min. Ten distinct Raman lines with frequency shifts 2176, 2190, 2225, 2253, 2299, 2330, 2430, 2460, 2502 and 2666 cm^{-1} were reported.

13442. KRISHNAN, R.S. **Thermal expansion of diamond.** *Proc. Indian Acad. Sci.* **24A**, 33-44 (1946).—*C.A.* 41, 1904*e*.

The thermal expansion of diamond in thin plates was studied over the range 28°-605°C by the x-ray diffraction method; the variation of the lattice spacings with increase in temp. was measured, and the coeff. of expansion calcd. The coeff. of vol. expansion of diamond varied from 4.36 × 10^{-6} in the range 28°-105°C to 11.76 × 10^{-6} at 505°-605°C.

13443. KRISHNAN, R.S. **Temperature variations of the Raman frequencies in diamond.** *Proc. Indian Acad. Sci.* **24A**, 45-57(1946).—*C.A.* 41, 1934*e*.

The thermal variation of the Raman frequencies in diamond with the known thermal expansion data were recorded. Two independent sets of expts. were carried out to det. the variation of the intense principal line of the first order and the less-intense lines of the second order. The frequency of the line decreased from 1333.2 at liquid air temp. to 1316.0 cm^{-1} at 703°C. The relative change of the principal frequency with relative change of vol. decreased from a high value at liquid-air temp. to a const. small value above 127°C.

13444. LONG, L.H. AND NORRISH, R.G.W. **The two heats of atomization of carbon.** *Nature* 157, 486(1946).—*C.A.* 40, 3972^5.

The most probable value was Herzberg's figure, L_1 = 125 kcal (corresponding to D(CO) = 9.14 e.v.).

13445. LONG, L.H. AND NORRISH, R.G.W. **The thermochemistry of carbon: valence states, heats of sublimation, and energies of linkage.** *Proc. Roy. Soc.* (London) A187, 337-57(1946).—*C.A.* 41, 1542*g*.

Discrepancies in the calcd. values of the latent heat of sublimation of carbon into monatomic vapor was due to the neglect of the energy required to raise the C atoms from the ground (^3p) state to the lowest quadrivalent (^5s) electronic configuration corresponding to that in which it was normally found in chem. combination. The most probable and satisfactory value for the latent heat of sublimation was 125.0 kcal at 0°K.

13446. PIERREY, JACQUES. **Study of the thermal expansion of graphite.** *Compt. rend.* 223, 501-3 (1946).—*C.A.* 41, 1138*g*.

An optical method was used to follow the expansion of a pressed sample of parallel graphite platelets over the range 0° to 2300°C. The coeff. of thermal expansion in the range 0° to 500°C was 17.2 × 10^{-6} in the *c* direction, 1.3 × 10^{-6} in the *a* direction. In the range 1500°-2300°C, the resp. coeffs. were 27.7 × 10^{-6} and 3.2 × 10^{-6}.

13447. RAMACHANDRAN, G.N. **The crystal symmetry of diamond and its x-ray reflections.** *Proc. Indian Acad. Sci.* **24A**, 58-64 (1946).—*C.A.* 41, 1904*g*.

The symmetry of the diamond structure in relation to its x-ray reflection was considered. The presence or absence of the 200 or the 222 reflection could not uniquely decide whether the symmetry was tetrahedral or octahedral.

13448. RAMACHANDRAN, G.N. **The nature and origin of the laminations observed in diamond.** *Proc. Indian Acad. Sci.* **24A**, 65-80 (1946).—*C.A.* 41, 1904*h*.

The geometric birefringence patterns of the cleavage plates of diamond were attributed to the existence of definitely oriented laminations inside the crystal under strain.

13449. RAMACHANDRAN, G.N. **The luminescence of diamond excited by x-radiation.** *Proc. Indian Acad. Sci.* **24A**, 81-94(1946).—*C.A.* 41, 1934*h*.

The fluorescence of diamond when irradiated with x-rays was much weaker and varied over a smaller range of intensities than that excited by ultraviolet light. The color and pattern of luminescence were the same for both excitations except that the x-rays had less contrast.

13450. RAMACHANDRAN, G.N. **X-ray topographs of diamond. II.** *Proc. Indian Acad. Sci.* **24A**, 95-103, (1946).—*C.A.* 41, 1905*a*.

X-ray topographs, viz., photographic representations of the variations in the x-ray reflecting power over the area of a thin crystal plate of diamond, were photographed by using white x-rays diverging from a pinhole and obtaining Laue reflections from the full area of the cleavage plate.

13451. RAMACHANDRAN, G.N. AND CHANDRASEKHARAN, V. **Luminescence as "forbidden" electronic transitions in diamond.** *Proc. Indian Acad. Sci.* **24A**, 176-81(1946).—*C.A.* 41, 1936*a*.

The doublet centered at 4152 A. occurring in the spectrum of all fluorescing diamonds arose from "forbidden" transitions due to differences in electronic energy levels. Another fluorescent line was recorded at 7930 A.

13452. RAMAN, C.V. AND RAMASESHAN, S. **The crystal forms of diamond and their significance.** *Proc. Indian Acad. Sci.* **24A**, 1-24 (1946).—*C.A.* 41, 1521*f*.

Crit. examn. of some 72 diamonds in their natural form obtained from various sources indicated that the standard terminology of geometric crystallography could not be used to describe properly and to classify its forms. Exptl. evidence of some definite proposition concerning the proper basis of description and classification was indicated.

13453. RAMANATHAN, K.G. **Variations in the absorption of infrared radiation by diamond.** *Proc. Indian Acad. Sci.* **24A**, 130-6 (1946).—*C.A.* 41, 1935*a*.

The ultraviolet transmission limit of a diamond progressed further and further into the ultra-violet as the absorption decreased in the 8-μ region.

13454. RAMANATHAN, K.G. **The absorption of ultraviolet radiation by diamond.** *Proc. Indian Acad. Sci.* **24A**, 137-44 (1946).—*C.A.* 41, 1935*b*.

The thinnest diamonds of the ultraviolet-opaque type showed transmission to 2240 A., which was also the limit for the ultraviolet-transparent type. In blue luminescent diamond 5 new absorption bands of 2244, 2248, 2255, 2261, and 2294 A. were recorded at room temp.

13455. RAMANATHAN, K.G. **The absorption spectrum of diamond in the visible region.** *Proc. Indian Acad. Sci.* 24A, 145-9 (1946).—*C.A.* 41, 1935*c*.
The absorption spectrum of diamonds exhibiting a weak blue fluorescence was investigated in the visible region, with large absorption paths being secured by the method of multiple transmission.

13456. RAMANATHAN, K.G. **The infrared absorption spectrum of diamond.** *Proc. Indian Acad. Sci.* 24A, 150-61 (1946).—*C.A.* 41, 1935*e*.
The absorption spectra of 4 typical diamonds, 3 of them luminescent and the 4th nonluminescent, were investigated in the infrared in the wavelength range 4.5 to 13 μ with a rock-salt-prism spectrometer and radiomicrometer. Within allowance for reflection, the nonluminescent diamond was found to be completely nonabsorbing in the frequency range 770-1400 cm^{-1}.

13457. RAMASESHAN, S. **The Faraday effect in diamond.** *Proc. Indian Acad. Sci.* 24A, 104-13 (1946).—*C.A.* 41, 1905*c*.
A large Rutherford electromagnet capable of giving fields of 23,000 gausses and an image of the W bead of a powerful point-o-lite lamp focused on the slit of a const.-deviation spectrograph were used to measure the magnetic rotation of diamond over a range of 4800 to 6000 A. where background intensity was negligible.

13458. RAMASESHAN, S. **The cleavage properties of diamond.** *Proc. Indian Acad. Sci.* 24A, 114-21 (1946).—*C.A.* 41, 1905*e*.
The (111) cleavage was the most nearly perfect and most abundant, because this plane had the min. cleavage energy and on either side of it lie layers of atoms having 3 times its cleavage energy.

13459. RAMASESHAN, S. **A theory of the crystal forms of diamond.** *Proc. Indian Acad. Sci.* 24A, 122-9 (1946).—*C.A.* 41, 1905*g*.
The shape of the crystal was controlled by the varying surface tension of the molten carbon liquid in different directions due to the nonrandom orientation of the valence bonds between the atoms. A semiquant. form for the theory of crystal shapes was presented.

13460. RENDALL, G.R. **Geometric patterns of fluorescence in diamond.** *Proc. Indian Acad. Sci.* 24A, 168-75— (1946).—*C.A.* 41, 1935*h*.
The blue and yellow patterns of luminescence exhibited by 19 cleavage plates of diamond were photographed with appropriate light filters and reproduced with the patterns of transparency to the 2536-A. radiation of the Hg arc and their birefringence patterns.

13461. RIMSKI-KORSAKOV, W. AND TRAUCKI, B.I. **The industrial use of carbon.** *Industria y quím.* 8, 148-55 (1946).—*C.A.* 41, 588*b*.
Metallurgical and petroleum cokes were suitable carbon sources. A ceramic carbon was developed that would endure temps. of 1600°C and severe usage in combustion chambers. Granulated carbon resistances for elec. furnaces were also made successfully from Argentine carbons.

13462. SZYMANOWITZ, RAYMOND. **Colloidal graphite.** *Colloid Chemistry* 6, 436-58(1946).—*C.A.* 40, 2245^8.
Properties of graphite were discussed, and its use as a solid lubricant, colloidalization of graphite and lubrication with the colloid, and graphitoid surfaces and their function.

13463. TOLANSKY, S. AND WILCOCK, W.L. **Topography of the face of a diamond crystal.** *Nature* 157, 583(1946).—*C.A.* 40, 5363^4.
Triangular pits, frequently observed on natural octahedron faces of diamond crystals were hitherto ascribed to etching or soln. The depth of such pits varied between 60 and 600 A., i.e., 30-300-atom layers.

13464. BRIDGMAN, P.W. **An experimental contribution to the problem of diamond synthesis.** *J. Chem. Phys.* 15, 92-8(1947).—*C.A.* 41, 2295*b*.
Pressure up to 30,000 kg/cm^2, and in one case 45,000 kg/cm^2, was applied to graphite alone, or to graphite seeded with diamonds, at temps. above 2000°C. No detectable transformation of graphite to diamond was found in any of the expts. In the expts. with internal heating it was established that the rate of inversion of diamond into graphite at a temp. above the m.p. of Mo was a function of the pressure.

13465. CORY, M.T. AND THACHER, F.B. **Carbon- a blast-furnace refractory.** *Blast Furnace Steel Plant* 35, 1482-7(1947).—*C.A.* 42, 1400*i*.
Characteristics of carbon and graphite, which made them suitable for refractory applications, were that they did not wet either metal or slag. The thermal expansion of both carbon and graphite was well below any of the com. ceramic refractories. The compressive strength of carbon or graphite (3500-7000 p.s.i.) was comparable to fireclay brick (1000-5000 p.s.i.). However, carbon remained strong even at 3500°F, while fireclay was relatively weak at 2500°F. Carbon was also very resistant to erosion.

13466. GOUDSMIT, S. **Heat of atomization of carbon.** *Nature* 159, 742-3 (1947).—*C.A.* 41, 5350*c*.
An old calcn of the metastable ^5S state of the C atom was discussed.

13467. HAGSTRUM, HOMER D. **The dissociation energy of carbon monoxide and the heat of sublimation of carbon.** *Phys. Rev.* 72, 947-63(1947). —*C.A.* 42, 801*g*.
A new interpretation of the effects in the spectrum that brings agreement with the electron-impact value was possible. Satisfactory agreement could be attained among all data bearing on D(CO) and $L_1(C)$, the heat of sublimation of carbon.

13468. KARUNAKARAN, C. AND RAO, M. NARASINGA. **Analysis of graphite.** *Current Sci.* (India) 16, 218(1947).—*C.A.* 42, 486*f*.
For a simple and rapid detn. of C in graphite, heat the sample to const. wt at 200-10°C and oxidize in a Pt crucible in a stream of dry O_2 passed in through a perforated cover. Const. wt

was reached in 30 min. Results were 2-4% higher than by wet oxidation.

13469. Krishnan, R.S. **Raman spectrum of diamond under high resolution.** *Nature* 159, 60-1 (1947). —*C.A.* 41, 2335*c*.
The spectrum was a series of sharply defined lines. All lines were either octaves or allowed combination tones of the crystal lattice which were Raman-inactive in the first order. The vibration spectrum of the diamond lattice in the infrared was discrete.

13470. Mellor, D.P. **The possibility of a chemical synthesis of diamond.** *J. Chem. Phys.* 15, 525-6(1947).—*C.A.* 41, 6099*i*.
Hannay in 1880 heated a mixt. of light paraffin, bone oil (mainly pyridine), and Li, in a sealed Fe container; 3 of 80 cylinders withstood red heat. These conditions, inadequate to transform graphite to diamond, might have produced diamond directly by a process of polymerization.

13471. Nelson, J.B. and Riley, D.P. **Structure of graphite.** *Nature* 159, 637-8(1947).—*C.A.* 41, 6453*f*.
A no. of x-ray powder diffraction-pattern photographs of artifical and natural graphite were reexamd. Photographs were taken of purified Ceylon graphite (ash content = 0.07%), and no extra lines other than weak rhombohedral lines were noted.

13472. Ramachandran, G.N. **Thermo-optic behavior of solids.** *Proc. Indian Acad. Sci.* 25A, 266-79 (1947).—*C.A.* 41, 5767*h*.
The *n* variation was represented as the sum of 2 terms, one arising from the change in the no. of dispersion centers and the other from the variation of the frequencies. Accurate data of the thermal variation of the *n* of diamond were obtained for the first time from -180° to 450°C for three wave lengths, 4358, 5461, and 5893 A.

13473. Raman, C.V. **The vibration spectra of crystals. I. Basic theory. II. The case of diamond.** *Proc. Indian Acad. Sci.* 26A, 339-55, 356-69(1947).—*C.A.* 42, 4061*a,c*.
In diamond the C atoms were arranged in 2 similar interpenetrating Bravais lattices of the face-centered cubic type, each atom in one of the lattices being linked to 4 atoms in the other lattice by valence bonds along the four trigonal sym. axes of the crystal. The 9 observed characteristic frequencies of diamond were due to the oscillations of the lattices with respect to each other, to the normal sym. and antisym. oscillations of the cubic and octahedral planes, and to the tangential sym. and antisym. oscillations of the same planes.

13474. Ramanathan, K.G. **The infrared absorption spectrum of diamond and its variations.** *Proc. Indian Acad. Sci.* 26A, 469-78 (1947).—*C.A.* 42, 4063*b*.
The infrared absorption of 9 cleavage plates of diamond were investigated with a 10-fold increase in detector sensitivity. All the specimens irrespective of their other phys. properties showed a band extending from 1500 to 2700 cm^{-1} with two very strong max. at 2010 and 2170 cm^{-1} and a weaker one at 2470 cm^{-1}. The absorption between 750 and 1400 cm^{-1}, due to the fundamental vibration frequencies of the crystal, was of variable intensity in the different specimens.

13475. Ramanathan, K.G. **The emission and absorption spectra of luminescent diamonds.** *Proc. Indian Acad. Sci.* 26A, 479-80 (1947).—*C.A.* 42, 4064*b*.
Reproductions were presented of spectrograms and micro-photometer tracings of the emission and absorption spectra of diamonds that showed blue luminescence under irradiation.

13476. Rooksby, H.P. and Steward, E.G. **Structure of graphite.** *Nature* 159, 638-9(1947).—*C.A.* 41, 6453*h*.

13477. Rüdorff, Walter. **Saltlike compounds of graphite with hydrofluoric acid.** *Z. anorg. Chem.* 254, 319-29(1947).—*C.A.* 43, 2534*a*.
The reaction of graphite and water-free HF in an oxidizing medium, such as an elec. cell, $K_2Cr_2O_7$ soln. in HF, or F_2 bubbled through HF, produced blue compds. The degree of oxidation, as detd. by reaction with HI, indicated one anion to 24 C atoms. The F content indicated C/F ratio of 1:4.

13478. Rüdorff, Walter and Rüdorff, Gerda. **Tetracarbon monofluoride, a new graphite-fluorine compound.** *Chem. Ber.* 80, 417-23 (1947). —*C.A.* 43, 2107*f*.
Graphite reacted very readily with gaseous F_2 and HF at room temp. to form a hitherto unknown C-F compd. which was distinctly different from $(CF)_x$. Adsorbed or occluded HF was not removed completely by evacuation at room temp., as shown by an expt. with graphite and HF-laden N_2. X-ray examn. showed that the F atoms were in layers between two C planes, probably in one layer below and in a layer above each C layer at a distance of about 1.4 A.

13479. Ruess, G.L. **The structure of glance carbon.** *Monatsh.* 76, 253-62(1947).—*C.A.* 41, 6100*d*.
The cryst. dimensions of glance carbon were detd. by interference measurements. The temp. of formation was between that of soot and retort graphite. X-rays showed that the single crystal had its lower and upper surfaces parallel. The strong small-angle scattering was explained as intercryst. interference and was used for estn. of the crystal size.

13480. Tolansky, S. and Wilcock, W.L. **Interference studies of diamond faces. A crossed-fringe technique.** *Proc. Roy. Soc.* A191, 182-94 (1947).—*C.A.* 42, 4815*f*.
The curvature of diamond faces and the occurrence of triangular pits were attributed to growth and not to soln. Irregular depressions that were observed were attributed to a soln. mechanism.

13481. Achyuthan, K. **Directional variations of photoconductivity in diamond.** *Proc. Indian Acad. Sci.* 27A, 171-5 (1948).—*C.A.* 42, 6638*i*.
Five cleavage plates of diamond of varying thicknesses showed variations in photocond., being a max. in the direction of some laminae inside the diamond. Wherever birefringence was weak, the relative value of photocond. was greater than in other regions.

13482. BHAGAVANTAM, S. AND RAO, D.A.A.S. NARAYANA. **Dielectric constant of diamond.** *Nature* 161, 729(1948).—*C.A.* 42, 6186*h*.

An ultraviolet-opaque diamond about 2 cm² in area and 1.42 mm thick, and an ultraviolet-transparent diamond about 1 cm² in area and 1.27 mm thick were examd. The dielec. consts. were 5.70 and 5.65, resp., at a frequency of 1.6 mc. per sec. and 26°C.

13483. BODVAN-GRIFFITH, C.L. **Carbon and graphite for the chemical engineer.** *Ind. Chemist* 24, 666-74(1948).—*C.A.* 45, 5909*h*.

Crucible walls and Fe runners were lined with carbon which was not wetted by molten Fe, had good mech. strength at high temp., and high resistance to thermal shock or steep temp. gradients. Carbon was used for boats, etc., for sintering WC. As a lining in a chem. plant, carbon blocks were set in special cements. The degree of resistance of the blocks and cements to various concns. of acids and acid mixts. and to a no. of miscellaneous org. and inorg. chemicals were tabulated. The largest application for carbon lining was in steel works where HF was used for pickling.

13484. BREWER, LEO. **The vapor pressure and melting point of graphite.** *J. Chem. Phys.* 16, 1165-6(1948).—*C.A.* 43, 1638*e*.

A heat of sublimation of 170 kcal, an atm. sublimation point of approx. 4000°K, and a m.p. above 5000°K, were preferred.

13485. CHANDRASEKHARAN, V. **Fluoresence and phosphorescence of diamond at different temperatures.** *Proc. Indian Acad. Sci.* 27A, 316-20 (1948).—*C.A.* 42, 6669*a*.

All diamonds showed an electronic fluorescence line at 4156A. This line was quite sharp at -180°C and decreased in sharpness and peak intensity as the temp. was raised until at 350°C it was lost in the background. The integrated intensity of the line was const. within exptl. error from -180° to 150°C.

13486. GAYLORD, W.M. **Carbon and graphite.** *Chem. Eng.* 55, No. 3, 225(1948).—*C.A.* 42, 3637*f*.

13487. GILLES, PAUL W. AND JENKINS, FRANCIS A. **The vapor pressure and heat of sublimation of graphite.** *J. Chem. Phys.* 16, 797-807 (1948).—*C.A.* 42, 7153*e*.

The heat of sublimation of graphite and the heats of dissocn. of CO and C_2 were established by the direct detn. of the total vapor pressure of graphite by an equil. effusion method and by the detn. of the partial pressure of C_2(gas) in equil. with graphite. The heat of sublimation of graphite to C(*g*) was $\Delta H_o = 170.39 \pm 0.20$ kcal/mole at 0°K. The heat of sublimation of graphite to C_2(*g*) was $\Delta H_o = 233.1 \pm 7$ kcal/mole.

13488. HOUSTON, W.V. **Lattice vibrations and specific heat of diamond.** *Z. Naturforsch.* 3a, 607-11(1948).—*C.A.* 44, 6226*d*.

The at. heat of diamond from 0° to 1400°K was calcd. from the total frequency spectrum of the vibrations of the diamond lattice.

13489. KIRSCHBAUM, EMIL. **Heat transfer in evaporation with graphite and porcelain tubes.** *Angew. Chem.* B20, 235-6 (1948).—*C.A.* 43, 448*i*.

Heat-transfer coeffs. were presented for graphite tubes (28 mm inside diam., 49 mm outside diam., 1900 mm long) and for porcelain tubes (24.6 × 35.8 × 1900) as functions of water velocity in the tubes, and of total decrease in temp.

13490. LONG, L.H. **The vapor pressure and heat of sublimation of graphite.** *J. Chem. Phys.* 16, 1087(1948).—*C.A.* 43, 457*c*.

The vapor pressure of graphite as 1 atm. at 4630°K, and the heat of sublimation of 170 kcal/g-atom were shown to be inadmissable.

13491. MAJUMDAR, K.K. **Studies in colloidal graphite. I. Preparation of colloidal graphite in water from Indian raw materials.** *J. Indian Chem. Soc., Ind. & News Ed.* 11, 105-6 (1948).—*C.A.* 43, 5159*d*.

Colloidal graphite in water was prepd. by grinding purified Indian graphite with 25% Na oleate in a 3-roll mill. Coarser particles were sepd. from the colloid by diln. and sedimentation. The colloid was concd. by coagulation with mineral acid, and the coagulum was peptized by grinding additionally with 10% Na oleate and a little alkali.

13492. MAJUMDAR, K.K. **A rapid method for analysis of colloidal graphite.** *Science and Culture* 13, 510(1948).—*C.A.* 43, 5159*e*.

Colloidal graphite (1-3 g) in oil and 30 ml of a mixed solvent such as C_6H_6 and alc. plus glacial HOAc were centrifuged at 2,000-3,000 r.p.m. After decantation the content of the tube was dried at 105°C for 10-15 min. to det. wt of graphite and ash. The ash was detd. by combustion.

13493. MAJUMDAR, K.K. **Beneficiation of graphite from Mysore State.** *J. Sci. Ind. Research* (India) 7B, 167-8(1948).—*C.A.* 43, 6373*e*.

The ore required grinding to about 300 mesh to sep. the mineral from impurities. The powd. ore was then subjected to bulk flotation in a Denver Sub-A Flotation Cell of 1000-g capacity under different conditions. The concentrate from bulk flotation could be ground wet to -325 mesh and refloated a few times to improve the grade.

13494. NACHREINER. **Carbon bricks for lining containers and apparatus.** *Seifen-Öle-Fette-Wachse* 74, 139-40 (1948).—*C.A.* 42, 8445*c*.

The production of pressed tiles from coke with subsequent transformation of the carbon into graphite in an elec. oven was described.

13495. SAVAGE, ROBERT H. **Graphite lubrication.** *J. Applied Phys.* 19, 1-10 (1948).—*C.A.* 42, 2753*i*.

The slipperiness of graphite depended not only on the crystal structure, but also on adsorption films, especially water, which covered the C atoms and provided surfaces of low cohesion. In a vacuum, graphite brushes seized upon a moving base of Cu or graphite and wore away as a fine dust. This wear and accompanying high friction were instantly stopped by condensible vapors at pressures below 5 mm Hg. These substances, such as H_2O, C_6H_6, or NH_3, apparently covered the graphite with a reversibly adsorbed film, sensitive to the temp. and pressure at the surface.

13496. SPENCER, HUGH M. **Empirical heat-capacity equations of gases and graphite.** *Ind. Eng. Chem.* 40, 2152-4(1948).—*C.A.* 43, 1638*b*.

Quadratic or cubic empirical heat-capacity equations were given for solid graphite and for 117 gases in the hypothetical ideal state at 1 atm. All equations cover the range 298.16-1000° K, most equations 298.16-1500°K.

13497. VARDHAN, HARSH. **Determination of the crystallographic axes of diamond.** *J. Sci. Ind. Research* (India) 7B, 189-93 (1948).—*C.A.* 45, 2767*i*.

Many of the properties of diamond (e.g., hardness) depend on direction. Fifty-five Laue radiographs, covering all possible orientations of the diamond, were reproduced on a chart.

13498. VENCOV, S. **Purification of carbon electrodes used for spectrographic analysis.** *Bull. Inst. Natl. Cercetari Tehnol.* 3, 471-5(1948).—*C.A.* 43, 3732*b*.

The electrodes were boiled and soaked at high temp. in a mixt. of concd. HCl and HNO_3, H_2SO_4, NH_4OH, and glacial AcOH, rinsing them with distd. water before each new cleaning soln. After drying in an elec. furnace, the electrodes were subjected to thermal treatment in N_2. This eliminated most of the impurities leaving only B, Cu, Si, and Fe.

13499. BLACKWELL, D.E. AND SUTHERLAND, G.B.B.M. **Vibrational spectrum of diamond.** *J. chim. phys.* 46, 9-15(1949).—*C.A.* 44, 8771*f*.

The infrared absorption spectra of some 250 diamonds between 2 and 15 μ were detd. All the diamonds absorbed in the region of 4 to 6 μ, but the diamonds of type I had an additional absorption band in the 7 to 11 μ region. Some type II diamonds (those lacking the 7-11 μ band) had an extra band 2940 and 2780 cm^{-1}. Type I began to absorb in the ultraviolet near 3,000 A., while type II transmitted to 2,250 A.

13500. DOORSELAER, M. VAN; EECKHOUT, J., AND GILLIS, J. **Spectrochemical analysis of a solution on graphite.** *Congr. groupement avance. méthod anal. spectrograph. produits mét.* 12, 51-7(1949).—*C.A.* 45, 4168*f*.

When adsorption of the soln. on graphite took place above 100°C, the sensitivity of spectral lines was at a max. and their relative intensities were const. An increase in the concn. of the soln. gave a greater sensitivity, except in the case of some elements such as Al, but did not influence the relative intensities. The effect of the vol. of the soln. on the electrode was negligible.

13501. GOLDFINGER, PAUL AND JEUNEHOMME, WILLIAM. **The vapor pressure and heat of sublimation of carbon.** *Rév. inst. franc. pétrole* 4, 427-34 (1949).—*C.A.* 44, 6695*e*.

The vapor pressure measurement was based on the intensity of an at. beam of carbon coming from a 17.5×10^{-3} cm^2 wide opening of a graphite crucible having an inner surface of 80 cm^2. At 2100°K expts. of 30 and 80 min., resp., yielded a faint deposit on a receiver at 10.7 and 16 cm distance from the opening. This deposit disappeared on burning. It seemed to have come from the at. beam of carbon expected at this temp. if the heat of fusion had a value of 125 or 136 kcal/mole. Calcns. indicated that it consisted of 10^{17} atoms/cm^2, and that the accommodation coeff. was 10^{-5}.

13502. HOERNI, JEAN AND WEIGLE, JEAN. **Structure of graphite.** *Nature* 164, 1088(1949).—*C.A.* 44, 3326*h*.

The electron-diffraction patterns of single crystals of graphite of various origins showed the presence of new spots that would be indexed as (1/2, 0, 0) or (1/2 , 1/2, 0) in the usual unit cell. These spots were very weak and did not appear in similar structures such as molybdenite. They required the assumption of a unit cell with a basal plane twice as large as the usual one.

13503. LAIDLER, K.J. AND CASEY, E.J. **Heats of dissociation of carbon-hydrogen bonds in methane and its radicals.** *J. Chem. Phys.* 17, 1087-91(1949).—*C.A.* 44, 2362*h*.

The value of 170.6 kcal per mole for the heat of sublimation of graphite was the most probable one. This figure was consistent with a value of 393 kcal for the heat of removing the four H atoms from CH_4, the assignment of the heats of the successive dissocns. being: $CH_4 = CH_3 + H$ - 101 kcal; $CH_3 = CH_2 + H$ - < 87 kcal; $CH_2 = CH + H$ - > 125 kcal; $CH = C(^3P) + H$ - 80 kcal.

13504. LONG, L. H. AND NORRISH, R. G. W. **The latent heat of vaporization of carbon.** *Trans. Faraday Soc.* 45, 1158(1949).—*C.A.* 44, 4768*b*.

13505. NEWTON, ROBERT R. **Space-charge effects in bombardment conductivity through diamond.** *Phys. Rev.* 75, 234-46(1949).—*C.A.* 43, 3279*f*.

Electrons excited to the conduction band of an insulator under electron bombardment were, in general, not able to leave the insulator, but became trapped in imperfections in the crystal lattice. The trapped electrons gave rise to a space charge which modified the motion of electrons excited to the conduction band subsequent to the trapping.

13506. PAULING, LINUS AND SHEEHAN, WILLIAM F. JR. **Dissociation energy of carbon monoxide and the heat of sublimation of graphite.** *Proc. Natl. Acad. Sci. U. S.* 35, 359-63(1949).—*C.A.* 43, 8254*g*.

Values of 9.77 e.v. and 140 kcal/mole, resp., were reported.

13507. PERRET, A. AND RIETHMANN, J. **Reaction of carbon with calcium, barium, and magnesium nitrides and their relations with the cyanide-cyanamide equilibrium.** *Helv. Chim. Acta* 32, 1378-90(1949)(in French).—*C.A.* 43, 8930*d*.

Mixts. of Ca_3N_2 and natural graphite were heated to 850°-1180°C in a closed vessel and cooled suddenly. Relatively little $Ca(CN)_2$, but up to 70% CaNCN was formed. When Ba_3N_2 was treated in the same way, $Ba(CN)_2$ was the major product even at lower temp., but the total amt. of $Ba(CN)_2$ formed was less at low temps. and rose with temp. With Mg_3N_2 no reaction occurred up to 1200°C.

13508. Sainz, Alfredo F. **The use of graphite and additives in oils.** *Bol. inform. petrol. (Buenos Aires)* 26, 41-60(1949).—*C.A.* 43, 7675*f*.

13509. Tawde, N. R. **Dissociation energy of C_2.** *J. Univ. Bombay* 17A, Pt. 5, 9-11(1949).—*C.A.* 43, 8877*f*.

A dissocn. energy of 4.22 e.v. was estd. for C_2 from several concordant detns. of the intensity distribution in the Swan bands of C_2.

13510. Bacon, G. E. **X-ray and neutron diffraction by graphite layers.** *Nature* 166, 794(1950). —*C.A.* 45, 4130*e*.

Measurement of the x-ray diffraction pattern of carbon at 20° and 500°C verified an explanation of the anomalous two-fold increase in the x-ray diffraction intensity for the two-dimensional C band. The observed pattern indicated the anomaly to be due to an asymmetric electron distribution around the C—C bond.

13511. Bacon, G. E. **Unit-cell dimensions of graphite.** *Acta Cryst.* 3, 137-9(1950).—*C.A.* 44, 7116*d*.

The *c* axis length was measured for samples with crystallite thickness *t* from 50 to 450 A. A linear relation existed between *c* and $1/t$. The *a* axis remained const. as *t* decreased, although the *hk*·0 lines were displaced by increasing amts. of turbostratic material.

13512. Bacon, G. E. **The rhombohedral modification of graphite.** *Acta Cryst.* 3, 320(1950).—*C.A.* 45, 8233*c*.

Results of x-ray examn. supported the conclusion that the proportion of *ABC* structure in well-crystd. graphite as formed was only a few %, but that it may be considerably increased by powdering.

13513. Barriol, Jean and Metzger, Jacques. **Application of the molecular orbital method to the graphite network.** *J. chim. phys.* 47, 432-6(1950).—*C.A.* 44, 9199*g*.

The resonance energy, E_r, and the mobile order of the bonds in a hexagonal graphite network were calcd. for an indefinite mol. plane, the interaction of the adjacent planes being neglected. The cyclic conditions of Born were applied in the mol. orbital method. The limiting value calcd. for E_r was 0.383 B, where B was a resonance integral between adjacent orbitals amounting to approx. 20 kcal/mole. The calcd. bond energy in graphite was found to be 124.5 kcal/mole, compared with 127 kcal/mole obtained by Walsh.

13514. Bishui, B. M. **Origin of fluorescence in diamond.** *Indian J. Phys.* 24, 441-60(1950).—*C.A.* 45, 6931*e*.

A study of the fluorescence and absorption in the visible region of 6 diamonds showed that the fluorescence behaved similarly to an impurity fluorescence, and that the impurity was of a chem. nature. Lattice defect produced by strain was not the cause of the fluorescence.

13515. Brill, R. **The covalent bond in diamond and the x-ray scattering factor of covalent-bonded carbon.** *Acta Cryst.* 3, 333-7(1950).—*C.A.* 44, 10435*i*.

By Fourier synthesis it was found that the formation of a C covalent bond consisted in concentrating about one-half to three-quarters of one electron of the outer shell in every chemical bond. An x-ray at. scattering curve was given for the covalent-bonded C atom.

13516. Bull, C. and Garlick, G. F. J. **The luminescence of diamonds.** *Proc. Phys. Soc. (London)* 63A, 1283-91(1950).—*C.A.* 45, 4561*f*.

The luminescence of diamonds appeared to be characteristic of the matrix crystal, and a tentative model for the emission centers was given. The thermoluminescence curves of all diamonds exhibiting thermoluminescence were similar in form, indicating that luminescence in diamond was a property of the matrix and not due to impurities. This was supported by other exptl. results.

13517. Busso, R. H. **Comparison with experiment of theoretical studies on the structure and reactivity of graphite.** *J. chim. phys.* 47, 533-9(1950).—*C.A.* 45, 4120*g*.

Studies of adsorption, catalysis, and oxidation of graphite were quoted to show that the reaction occurred at active centers that were on the edges of the mol., e.g., the prismatic surfaces. Structures for various types of active centers were discussed.

13518. Busso, Raoul H.; Chalvet, O.; Daudel; Sandorfy, C., and Vroelant, C. **Application of wave mechanics to the determination of the structure and chemical properties of graphite.** *J. chim. phys.* 47, 525-32(1950).—*C.A.* 44, 10428*d*.

Methods of study of π electrons, bond index, interat. distance, bond energy, resonance, index of free valence, autopolorizability, heat of activation, and chem. reactivity in the graphite lattice were presented. Atoms along the edge of the mol. had greater reactivity.

13519. Custers, J. F. H. **The nature of the opal-like outer layer of coated diamonds.** *Am. Mineral.* 35, 51-8(1950).—*C.A.* 45, 501*c*.

Zoned diamond crystals were described consisting of a clear inner core coated by a dull gray layer averaging 0.5 mm in thickness. The outer coating was diamond (resembles opal only in its luster) contg. abundant unknown black inclusions. The contact plane between coating and inner core was (111).

13520. Ess, H. and Rossel, J. **Properties of the diamond as a crystal counter.** *Helv. Phys. Acta* 23, 484-7(1950).—*C.A.* 45, 2321*a*.

The initial charge in the diamond was produced by irradiation with α-particles from Po or γ-rays from Ra. The direction of the incident radiation was parallel to an elec. field of 8000 or 6400 v. per cm. By reversing the field, either the motion of the electrons or that of the pos. holes in the crystal could be observed. After amplification with a preamplifier and a proportional amplifier, the impulses were observed with an oscillograph.

13521. Freeman, G. P. and Velden, H. A. van der. **Photoelectric properties of diamond, measured with a crystal counter.** *Physics* 16, 486-92 (1950)(in English).—*C.A.* 45, 2305*g*.

Measurements of the function of Hecht (movement of liberated electrons in the field) were described for diamond. The results differed from earlier measurements with light or electron irradiation. The crystal counter permitted more accurate and reliable photoelec. measurements.

13522. GESSNER, H. **Sedimentation analysis of diamond powders.** *Kolloid-Z.* 118, 165-72(1950). —*C.A.* 45, 3218*g*.
The size of an individual fraction had a mean square error of 1.5% of the total sample size. The method and app. were fully described.

13523. HOERNI, JEAN. **Diffraction of electrons by graphite.** *Helv. Phys. Acta* 23, 587-622 (1950).—*C.A.* 45, 3707*i*.
A dynamic diffraction theory was developed and applied to graphite. If the diffraction pattern consisted of only 2 intense spots, the theory made it possible to calc. the thickness of the crystal and certain structure factors. When 3 or 4 intense spots occurred, an effective dispersion surface was used to account for the observed pattern. A study of different samples of graphite indicated that there were several ways of forming successive at. layers.

13524. KRYLOV, V. N.; POLUBELOVA, A. S., AND BOGDANOVA, A. G. **Effect of free carbon in the binder on the quality of electrocarbon or electrode products.** *Zhur. Priklad. Khim.* (J. Applied Chem.) 23, 365-9(1950).—*C.A.* 47, 295*a*.
Donets anthracite was ground to a const. granulometric compn. and pressed (1 min. at 140°C under 1500 kg/cm^2) with 7 different binders with free C contents ranging from 1.87 to 30.24%, softening temp. from 59.7 to 95.6°, volatile matter from 69.14 to 54.58%, cokable C from 28.99 to 15.18%. The d. of the samples increased up to 16% C in the binder, after which the porosity increased with further increasing free C content. The optimum amt. of binder depended on its free C content; with 1.87% free C, the optimum amt. should not exceed 20%, but with 30% free C, a binder content of 24% was preferable.

13525. LEX, W. **Graphite as boiler protection.** *Die Technik* 5, No. 6, appendix, *Fertigungstech.* 3, 35-6(1950).—*C.A.* 44, 9693*f*.
In order to delay boiler incrustation and facilitate its removal, cryst. graphite should be contained in the paint used for coating the inner surfaces. The carbon content of the cryst. graphite was about 87%. As it was extremely finely ground, it could readily be added as suspension in paints which then gave a film from which the scale could easily be removed by brushing.

13526. MAJUMDAR, K. K. **Method for the analysis of natural graphite.** *J. Sci. Ind. Research (India)* 9B, 22-3(1950).—*C.A.* 44, 6343*i*.
A 1.0-g sample of graphite was heated in a covered porcelain or silica crucible for 7 min. at about 800°C for the detn. of volatile matter. The graphite was then burned off in a muffle furnace and the ash content detd. The C content was calcd. by subtracting the sum of the volatile matter plus ash from 100%. The results were in good agreement with values obtained by other methods.

13527. MAJUMDAR, K. K. **Colloidal graphite. II. Preparation of colloidal graphite in mineral oil.** *J. Indian Chem. Soc., Ind. & News Ed.* 13, 147-9(1950).—*C.A.* 45, 8214*f*.
Colloidal graphite in oil was prepd. by repeated grinding in the presence of suitable protective colloids. In one process, colloidal natural graphite was prepd. in water with Na oleate as the protective colloid. The colloid was then coagulated by the addn. of $Al_2(SO_4)_3$, then the coagulum was mixed with mineral oil and heated to remove water.

13528. MARSHALL, A. L. AND NORTON, F. J. **Carbon vapor pressure and heat of vaporization.** *J. Am. Chem. Soc.* 72, 2166-71(1950).—*C.A.* 44, 7137*a*.
Vapor pressures were computed from the measured sublimation rates by use of the Langmuir equation with the accommodation coeff. set equal to unity. From these data, the heat of evapn. of carbon was calcd. and a value of $\Delta H_0^\circ = 175.2$ kcal per mole found. This was in agreement with recent exptl. detns. and with the spectroscopic theoretical value of 170 kcal.

13529. MCKAY, KENNETH G. **Electron-bombardment conductivity in diamond. II.** *Phys. Rev.* 77, 816-25(1950).—*C.A.* 44, 6255*i*.
An earlier study of electron-bombardment conductivity in diamond was revised by the use of an improved alternating field method of internal space-charge neutralization. In addn., lower limits were set for the mobilities of electrons and pos. holes at room temp. Measurements were also made of the decay of current due to internal space-charge fields which were in reasonable agreement with theory.

13530. MIZUSHIMA, SANCHI. **Electrical resistance of graphite.** *Ôyô Butsuri* (J. Applied Phys.) 19, 138(1950).—*C.A.* 46, 3360*e*.
The difference in elec. resistance between a natural graphite single crystal and an artificial annealed sample was discussed.

13531. MROZOWSKI, S. **Electric resistivity of polycrystalline graphite and carbons.** *Phys. Rev.* 77, 838(1950).—*C.A.* 44, 6224*c*.
The effect of crystal dimensions (25-1000 A. wide) and temp. (150-770°K) on the elec. resistance of graphite and carbon was examd. The polycryst. carbons were true semiconductors with an activation energy depending on the size of the crystallites. They showed a metallic cond. for $kT \gg \Delta E$, an intrinsic semicond. for $kT \sim \Delta E$ gradually changing as the temp. decreased into a free-electron-excess semicond.

13532. PALMERI, VICTOR R. **Graphite.** *Industria Minera* (Buenos Aires) 98, No. 3, 8-9, 50-51 (1950); *Ceram. Abstr.* **1952**, 41 (in *J. Am. Ceram. Soc.* 35, No. 3).—*C.A.* 47, 6618*a*.
The phys. properties of pure graphite were summarized, and the manuf. of graphite crucibles described. A similar technique was applied in the manuf. of heating elements for a small kiln applied to the heat-treatment of minerals. The

purification by flotation of Argentine graphites was feasible but, owing to the very small size of the crystals, could not be used in the manuf. of crucibles.

13533. Parmeggiani, Luigi. **Graphite pneumoconiosis.** *Brit. J. Ind. Med.* 7, 42-5(1950).—*C.A.* 44, 10961*e*.
Twenty-four cases of pneumoconiosis found among graphite workers of the Chisone Valley, Italy, were examples of benign mixed pneumoconiosis, in which graphite tended to alleviate the scelerosing action of silica.

13534. Picon, Marius and Flahaut, Jean. **Existence of an azeotrope graphite-manganese sulfide. I. Depolarization and ionization of carbon.** *Compt. rend.* 230, 1954-6(1950).—*C.A.* 44, 8722*e*.
MnS and graphite sublimed together above 1375°C at 0.01 mm pressure. This volatilization, occurring 900°C below the sublimation temp. of carbon, constituted the first example of an azeotrope among sublimable substances.

13535. Polinard, Ed. **A tetrahedral form of diamond.** *Ann. soc. geol. Belg. Bull.* 74, B59-63(1950).—*C.A.* 45, 6893*h*.
A twinned diamond crystal found in the Belgian Congo was formed by the joining of 2 tetrahedrons along the (111) face, each crystal being sym. with respect to the twin plane.

13536. Ramachandran, G. N. **Photoelasticity of diamond.** *Proc. Indian Acad. Sci.* 32A, 171-3 (1950).—*C.A.* 45, 4513*f*.
The photoelastic consts. of diamond were redetd: $q_{11} = -5.0_5$, $q_{12} = 2.1_5$, $q_{44} = -2.8 \times 10^{-14}$ cm^2/dyne and $p_{11} = -0.31$, $p_{12} = 0.09$, $p_{44} = -0.12$.

13537. Slawson, Chester B. **Twinning in the diamond.** *Am. Mineral.* 35, 193-206(1950).—*C.A.* 45, 500*i*.
The twin plane on diamond was shown by structural considerations to be (111). The geometrical concept of twinning was inadequate because reflection across either (111) or (112) gave identical relationships. In both normal and twinned growth across (111) first and second coördinations were identical; differences appeared only in 3rd and 4th coordinations.

13538. Tabaczyński, J. **Separation of graphite by flotation.** *Przemysl Chem.* 6(29), 154-65 (1950).—*C.A.* 45, 10153*g*.
Graphite was sepd. from the end products (chiefly $CaCO_3$) produced when $CaCN_2$ was hydrolyzed with superheated steam. By use of flotation and further enrichment by chem. treatment, one metric ton of starting material gave approx. 75 kg of graphite dust, 10 kg of cryst. graphite contg. 75-90% C, and 7 kg of low-grade graphite contg. 60% C.

13539. Takahashi, Kusuhiko. **The manufacture of layer-type dry battery. I. Graphite powder for duplex electrode.** *J. Electrochem. Soc. Japan* 18, 210-13(1950).—*C.A.* 45, 7447*b*.
The change of specific resistance and apparent d. of several artificial and natural graphite powders with increasing or decreasing pressure was measured under wet and dry states.

13540. Ahearn, A. J. **Effect of inhomogeneities on the electrical properties of diamond.** *Phys. Rev.* 84, 798-802(1951).—*C.A.* 46, 2913*d*.
The well-known lattice imperfections were not distributed homogeneously in the phys. crystal, and the resulting fluctuations in the height of the energy bands relative to the Fermi level might produce interspersed "pools of mobile charge" sepd. by barriers within the diamond. These pools and barriers should lead to dielec. losses at high frequencies. Expts. supported the suggestion that inhomogeneous fields at least partially accounted for the inhomogeneities in bombardment conduction. Serious errors in the normal estimates of range and mobility of electrons or holes in insulators could be introduced by neglecting these field inhomogeneities.

13541. Bacon, G. E. **Interlayer spacing of graphite.** *Acta Cryst.* 4, 558-61(1951)(in English).—*C.A.* 47, 937*i*.
The interlayer spacing *c* of graphite was deduced from the spacings of the 0008 and the 1126 lines in the x-ray photographs of three graphite specimens: A_3 which was the most cryst. one, Ceylon graphite and A_2 which was the least cryst. one. Designating the proportion of disoriented layers in the specimen by *p*, even on the assumption of a random distribution of disoriented layers in a parallel stack of graphite layers, the relation between *p* and the mean value of *c* was linear when *p* was small.

13542. Bacon, G. E. and Franklin, R. E. **The *a* dimension of graphite.** *Acta Cryst.* 4, 561-2 (1951)(in English).—*C.A.* 47, 938*b*.
Warren's equation of the displacement of the maxima of the (*hk*) bands in random-layer structures was used to account for the difference in the values of the *a* dimension of graphite specimens of different degrees of cryst. imperfection. These were deduced from the positions of the (*hki0*) lines in x-ray photographs.

13543. Besairie, Henri; Guigues, Jean; Laplaine, Louis, and Lautel, Robert. **Graphite in Madagascar.** *Haut Comm. Madagascar et Dependances, Trav. Bur. Geol.* No. 27, 1-94(1951).—*C.A.* 45, 6546*b*.
Mining operations and flotation concn. of graphite were described.

13544. Bishui, B. M. **The fluorescence in diamond excited by x-rays.** *Indian J. Phys.* 25, 575-80(1951).—*C.A.* 46, 6939*e*.
The spectra of Type I (common) and Type II (rare) diamonds excited by x-rays were photographed and compared with those excited by ultraviolet light. The x-ray-excited spectrum of Type I showed continuous fluorescence between 3700 and 5650 A., while Type II showed no fluorescence in the visible region.

13545. Burdick, Milton D.; Zweig, Benson, and Moreland, R. Eugene. **Linear thermal expansion of artificial graphites to 1370°.** *J. Research Natl. Bur. Standards* 47, 35-40(1951)(Research Paper No. 2225).—*C.A.* 46, 1321*c*.
The linear thermal expansion in vacuum of 3 grades of artificial graphite was detd. at 20°-1370°C. Three samples were cut from each of the

3 graphite blocks, 2 perpendicular and 1 parallel to the extrusion- or molding-pressure direction. These were machined into right cylinders 3/8 in. in diam. and 2 in. in length. Expansion measurements were made with a dilatometer. The vacuum was less than 2 × 10^{-4} mm.

13546. CROFT, R. C. AND THOMAS, R. G. **Lamellar compounds of graphite with chromyl chloride and chromyl fluoride.** *Nature* **168**, 32-3(1951). —*C. A.* **45**, 9410*i*.

Graphite complexes were prepd. by treating warm CrO_2Cl_2 or CrO_2F_2 with graphite. The CrO_2Cl_2 complex contained from 43.0% to 36.3% CrO_2Cl_2, depending on the fineness of the graphite. The lamellar nature of the compd. was confirmed by x-ray diffraction data, which showed C layer plane distances of 3.45 A. for graphite and 9 A. for the new compd. Heating to 200°-300°C released the CrO_2Cl_2, exfoliated the graphite, and caused at least a hundred-fold increase in its vol.

13547. FIELD, F. H. **New calculation of the latent heat of sublimation of carbon and the first carbon-hydrogen dissociation energy in methylene from electron-impact data.** *J. Chem. Phys.* **19**, 793(1951).—*C. A.* **45**, 7396*d*.

The energy of removing a H atom from CH_2, calcd. from data in the literature was either 88 or more than 93 kcal/mole; the former was preferred. The 4 successive heats of dissocn. of CH_4 were, then, 101, 92, 88, and 80 kcal/mole. This led to 139 kcal/mole for the heat of sublimation of carbon.

13548. FRANKLIN, ROSALIND E. **Graphitizable and nongraphitizable carbons.** *Compt. rend.* **232**, 232-4(1951).—*C. A.* **45**, 6895*d*.

Carbons that did not form graphite up to 3000°C (from sugar, O-rich oils, and the pyrolysis of polyvinylidine chloride) resulted when a rigid and porous structure was formed below 500°C. These carbons when prepd. at 1000°C contained graphitic packets of 2-4.5 layers with layer diams. 12-20 A. and they showed strong scattering of x-rays at small angles. When heated between 1000° and 3000°C the packets grew to no more than 12 layers with diams. to 70 A. Graphitizable carbons (from petroleum coke, pitch coke, and the pyrolysis of polyvinyl chloride) were less porous when prepd. at low temps. and showed less x-ray scattering at small angles.

13549. FRANKLIN, ROSALIND E. **The structure of graphitic carbons.** *Acta Cryst.* **4**, 253-61 (1951).—*C. A.* **45**, 8840*e*.

In the graphitic carbons the graphite-like layers were grouped in parallel packets within which there was a random distribution of oriented and disoriented layers. The interlayer spacing in the nongraphitic carbons was const. at 3.44 A. and in graphite it was const. at 3.354 A. In the graphitic carbons the apparent interlayer spacing decreased with increasing graphitization. Whatever the degree of graphitization, the small groups of orientated and disorientated layers within the parallel-layer packet retained the spacings characteristic of graphite and the nongraphitic carbons, resp.

13550. FREEMAN, G. P. AND VELDEN, H. A. VAN DER. **Some aspects of the counting properties of diamond.** *Physica* **17**, 565-72(1951)(in English). —*C. A.* **46**, 355*i*.

Counting properties of a diamond crystal were studied with a Po-source. The product of the mobility and the mean free time was 5.3 × 10^{-5} cm^2/v. The energy required to liberate one electron in a diamond crystal ≦ 8.6 e.v. The ultraviolet-transparent parts of the crystal (diamond 11) were responsible for the counting of α-particles.

13551. GREEN, LEON, JR. **The behavior of graphite under alternating stress.** *J. Applied Mechanics* **18**, 345-8(1951).—*C.A.* **46**, 695*h*.

The fatigue properties of grade-AUF extruded polycryst. graphite were investigated at ambient and elevated temps. This graphite had a high degree of grain orientation and was graphitized at 3000°C. The endurance limit of this graphite was found to increase from 2500 p.s.i. at room temp. to about 4400 p.s.i. at 3550°C.

13552. GUPTA, N. N. **Formation of graphite at 1000°C.** *J. Sci. Ind. Research* (India) **10B**, 122(1951).—*C. A.* **45**, 8859*a*.

Several org. substances were exposed to high temps. and pressures. X-ray examn. indicated that graphite was formed. The elec. conds. of these substances were similar to those of graphite, and the sp. gr. was greater than that of water.

13553. HADERT, HANS. **Colloidal graphite.** *Seifen - Öle - Fette-Wachse* **77**, 170-1(1951).—*C. A.* **45**, 6823*e*.

The use of colloidal graphite was reviewed.

13554. HENNING, GERHART. **The properties of interstitial compounds of graphite. I. The electronic structure of graphite bisulfate.** *J. Chem. Phys* **19**, 922-9(1951).—*C. A.* **46**, 337*e*.

The elec. resistance, temp. dependence, and the Hall coeffs. of graphite bisulfate compds. were detd. at various oxidation stages. The measurements indicated that the oxidation removed electrons from a nearly full conduction band. Reduction of the lamellar bisulfate compds. produced residue compds. which retained about a third of the bisulfate ions and half the H_2SO_4 originally present in the lamellar compds.

13555. HÉROLD, ALBERT. **Action of potassium on graphite.** *Compt. rend.* **232**, 838-9(1951).—*C. A.* **45**, 6110*b*.

Curves of temp. *vs.* compn. for the system K-graphite indicated the existence of KC_8, KC_{24}, and KC_{40}. A sudden change in compn. near 107°C was manifested by a change in color from brown ocher to deep blue.

13556. ISHIKAWA, SEICHI AND HIRABAYASHI, KIHO. **Natural graphite. I. Purification.** *Repts. Sci. Research Inst.* (Japan) **27**, 482-5(1951).—*C. A.* **46**, 6340*b*.

Natural graphite after pulverizing (to 2-5 μ in diam.) was fused with NaOH at 600°-800°C for 30 min. and boiled with dil. HCl in a Ni crucible, repeating the process twice. The ash content was reduced to 0.1%.

13557. Kitano, Yoshiharu and Komatsu, Kôzô. **Electrical conductivity of graphite.** *Busseiron Kenkyû* (Researches on Chem. Phys.) No. **36**, 41-55(1951).—*C.A.* 46, 6890*g*.

Math.-theoretical calcn. was given of the elec. cond. of graphite according to the Block theory of metals. The agreement with exptl. results was poor, the cause of which may be an assumption for the transition probabilities of electronic energy levels.

13558. Kitazaki, Umeka. **Fine structure of graphite.** *Misc. Repts. Research Inst. Nat. Resources* No. **24**, 21-7(1951).—*C.A.* 47, 937*g*.

X-ray and electron-diffraction analyses of several natural and artificial graphite specimens showed that scaly graphite was most orderly oriented, earthy graphite less orderly, and Acheson's colloidal graphite the least orderly. With increasing graphitization graphite layers increased progressively in size and no. per parallel packet, and the apparent interlayer spacing decreased.

13559. Klick, Clifford C. and Maurer, Robert J. **Mobility of electrons in diamond.** *Phys. Rev.* **81**, 124-30(1951).—*C.A.* 45, 2304*i*.

The mobility of electrons in diamond was measured by means of the Hall effect. The mobility was inversely proportional to the 3/2 power of the abs. temp. The measured room-temp. value of the mobility was 900 as compared with the theoretical estimate of 156 $cm^2/v.$-sec.

13560. Komatsu, Kôzô and Nagamiya, Takeo. **Theory of the specific heat of graphite.** *J. Phys. Soc. Japan* **6**, 438-44(1951).—*C.A.* 46, 5419*h*.

The graphite crystal was considered to be a system of thin elastic plates spaced at a const. distance of 3.40 A. The vibrations of the system were separated into independent parts: the bending vibrations in which the displacements were normal to the planes of the plates, and the extensional and shearing vibrations in which the displacements were parallel to the plates. The consts. of the elastic force acting on neighboring plates were derived from the measured elastic consts. of graphite, mainly the compressibility. Observed values of the sp. heat were lower than the calcd. values up to 270°K, and the values of C_p as calcd. by the Debye formula were considerably lower than either calcd. or observed values for temps. up to approx. 700°K.

13561. Lukesh, Joseph S. **The possible identity of rhombohedral and orthorhombic graphite.** *J. Chem. Phys.* **19**, 383-4(1951).—*C.A.* 45, 6893*g*.

The possible relation was discussed between the satellite reflections observed in single-crystal photographs and the extra reflections frequently found in powder photographs of graphite. The superstructure reflections could not be due to the rhombohedral form, nor were they due to impurities. The orthorhombic character apparently was inherent in the graphite structure, possibly as a result of a localization of a bond of order 1/2.

13562. Lukesh, Joseph S. **Anomalous x-ray diffraction spectra in graphite.** *J. Chem. Phys.* **19**, 1203-4(1951).—*C.A.* 46, 3391*g*.

A sample of graphite was made the anode and electrolyzed in a KBr soln. The sample then showed x-ray peaks at the positions of 5 of the rhombohedral reflections. It was not certain whether oxidation occurred or whether Br entered the lattice. Several other anomalous spectra (nonrhombohedral) appeared after the Br treatment; notable were lines at 27°15′, 38°30′, and 63°30′.

13563. Lukesh, Joseph S. **The symmetry of graphite.** *Phys. Rev.* **84**, 1068(1951).—*C.A.* 46, 4310*a*.

With Mo $K\alpha$ radiation, the earlier results were confirmed and extended.

13564. Maire, Jacques. **The reaction of Brodie mixture with graphitizable and nongraphitizable carbons.** *Compt. rend.* **232**, 61-3(1951).—*C.A.* 45, 6110*c*.

The Brodie reaction (formation of graphitic acid by means of HNO_3 + $KClO_3$ at 60°C), with different kinds of carbons was followed by gain in wt and by x-ray diffraction. Wt of $KClO_3$ used was 10 times that of the carbon, and 30 ml of HNO_3 was used. The reaction time was 1 hr, and the carbon was 200-250 mesh. Nongraphitizable carbons did not increase in wt and their x-ray patterns did not change; graphitizable carbons increased in wt by 20-40%, and their x-ray patterns indicated almost complete change to graphitic acid. The same cross-links which, in nongraphitizable carbons, prevented the rearrangement of the graphite crystallites to form graphite, also prevented the expansion of the structure involved in forming graphitic acid.

13565. Malmstrom, C.; Keen, R., and Green, L. Jr. **Some mechanical properties of graphite at elevated temperatures.** *J. Applied Phys.* **22**, 593-600(1951).—*C.A.* 45, 6817*g*.

The short-time tensile breaking strength of various grades of graphite was measured as a function of temp. from room temp. to the sublimation point. A characteristic common to all the strength *vs.* temp. curves was that the strength approx. doubled in going from room temp. to about 2500°C and then decreased rapidly to zero near the sublimation point. Graphite could be used as a structural material at temps. much higher than those permissible with other materials.

13566. McDonald, A. D. and Benfield, D. A. **Recovery of diamond from scrap sintered tungsten carbide.** *Ind. Diamond Rev.* **11**, 155-7(1951).—*C.A.* 46, 7681*f*.

Break material contg. diamonds > 14 mesh into 12-g pieces, heat overnight at 800°C, and fuse with NaOH. Ext. first with water and then with HCl. Alternate method. Crush material contg. diamonds < 60 mesh and fuse with 10:1 $NaOH:NaNO_3$ 4-5 hrs with hourly addn. of $NaNO_3$. Ext. with HCl or 1:1 $HCl:HNO_3$.

13567. Mizushima, Sanchi and Okada, Jun. **Notes on the electrical and thermal conductivities**

of graphite and amorphous carbon. *Phys. Rev.* 82, 94-5(1951).—*C.A.* 45, 4889*h*.

Values of ρT (resistivity times, abs. temp.) were plotted at 300-1300°K for carbon filaments graphitized 0.5 hr at 2000°, 2500°, and 3000°C, and for 1 hr at 3000°C. The variation with temp. (80°-3000°K) of the thermal diffusivities of various samples of carbon and of silica were plotted.

13568. MORGENSHTERN, Z. L. **Mechanism of the luminescence of diamonds.** *Zhur. Exptl. Teoret. Fiz.* 21, 230-5(1951).—*C.A.* 45, 7876*d*.

Different samples of diamond showed the fluorescence line 415 mμ and the accompanying bands; some showed also the 503-mμ line and less-marked accompanying bands. In one sample the 415-mμ system was absent. This diamond showed an afterglow sufficiently bright and long for the detn. of the decay law which proved to be hyperbolic $I = (a + bt)^{-2}$, with a and b depending on the exciting intensity E. Diamonds with the typical fluorescence spectrum did not decay hyperbolically, but along a curve resulting from 2 exponentials.

13569. MÜLLER, H. **A method for approximate determination of the location of energy bands in crystals.** *Ann. Physik* 9, 141-50(1951).—*C.A.* 46, 802*i*.

Application of the method of Wigner and Seitz, and that of Slater with H-functions permitted estn. of the position of energy bands in crystals. The functions depended on a known empirical parameter. The effect of lattice structure could be distinguished from that of the atoms. Results were given for C (diamond), Si, and Ge.

13570. OWEN, W. S. AND STREET, B. G. **The crystal structure of graphite in cast iron.** *J. Iron Steel Inst.* (London) 167, 113-16(1951).—*C.A.* 45, 4621*a*.

Examn. by the x-ray powder method of graphite extd. from an Fe-C-Si alloy of high-purity materials and of graphites from com. cast Fe indicated no variation in the size of the unit cell from the accepted value for pure graphite. Graphite from these sources was, therefore, concluded to be appreciably pure C.

13571. RAMAN, C. V. **Luminescence of diamond. IV.** *Current Sci.* (India) 20, 55-60(1951).—*C.A.* 45, 8894*f*.

The structure and crystal symmetry of diamond, crystal form, and the origin of the blue and green luminescence was given together with photographs of diamond crystals.

13572. SEN GUPTA, PRABHAT K. **The limits of predissociation in the spectrum of carbon monoxide and the latent heat of sublimation of graphite.** *Indian J. Phys.* 25, 267-73(1951).—*C.A.* 46, 7426*h*.

From a survey of available data on predissocn. phenomena in CO, the energy of dissocn. into C (^{3}P) and O (^{3}P) was 8.87 e.v., and the latent heat of sublimation of graphite into C (^{3}P) atoms, 118.74 kcal.

13573. SEN GUPTA, PRABHAT K. **Energy of dissociation of carbon monoxide and the latent heat of dissociation of graphite.** *Science and Culture* 16, 534-5(1951).—*C.A.* 46, 8930*i*.

The value 8.87 v., taken for the dissocn. of CO into $C(^3P)$ and $O(^3P)$, explained satisfactorily the predissocn. phenomena in the spectrum of CO and led to values for the heat of sublimation of graphite of 118.74, 147.80, and 180.31 kcal. according as the products of dissocn. were $C(^3P)$, $C(^1D)$, or $C(^1S)$ atoms, resp.

13574. SÖHNGEN, R. **Graphite heat exchangers.** *Chem.-Ing.-Tech.* 23, 81-5, 165(1951).—*C.A.* 45, 5981*d*.

Phys. data and structural details were presented for exchangers of German design.

13575. STRAUMANIS, M. E. AND AKA, E. Z. **Precision determination of lattice parameter, coefficient of thermal expansion, and atomic weight of carbon in diamond.** *J. Am. Chem. Soc.* 73, 5643-6(1951).—*C.A.* 46, 2369*g*.

The lattice parameters of 4 kinds of diamond, white boart, gray boart, and two stones of gem quality, were detd. at the const. temps. 10°, 20°, 30°, 40°, and 50°C (± 0.02°) by use of the asymmetric method with a 64-mm precision x-ray camera. Spectrographic analysis revealed the presence of traces of 15 elements in the samples. The results indicated that the diamond lattice was sound; there were neither vacant sites nor interstitial atoms. The minor impurities found in diamond samples were not dissolved but mechanically included.

13576. TATEVSKIĬ, V. M.; MENDZHERITSKIĬ, E. A., AND KOROBOV, V. V. **The additive scheme of the heats of formation of hydrocarbons and the problem of the heat of sublimation of graphite.** *Vestnik Moskov. Univ.* 6, No. 5, *Ser. Fiz. Mat. i Estest. Nauk* No. 3, 83-6 (1951).—*C.A.* 46, 333*d*.

A change of datum could cause only a change of the numerical values of the heats of the different types of C—C bonds and of the C—H bond, but could not affect the validity of the scheme itself. For this statement to be valid, it was sufficient that, for each class of hydrocarbons, the no. n of C atoms be representable as a linear combination of the nos. n_1, n_2,....of C—C bonds of each type, and of m, of the form $n = \alpha n_1 + \beta n_2 + \ldots \gamma m$, where the coeffs. α, $\beta \ldots \gamma$ were consts.

13577. WEAVIND, R. G.; WOLF, I., AND YOUNG, R. S. **Flotation of diamonds.** *Trans. Am. Inst. Mining Met. Engrs.*, *Tech. Note*, No. 76B (in *Mining Eng.* 3, No. 7, 596)(1951).—*C.A.* 45, 8167*e*.

Flotation of — 16 mesh diamonds, which were naturally H_2O repellent, may be carried out using either Aerofloat 25 (0.15 lb per ton) together with cresylic acid (0.18 lb per ton), or du Pont B23 as frother with kerosine as auxiliary oily conditioner or froth stiffener. A pH between 7 and 9, and a 5- to 10-min. flotation period were necessary. Diamonds larger than 16-mesh could not be recovered satisfactorily by flotation.

13578. WEGLORZ, EMIL. **Retort graphite.** *Gaz, Woda i Tech. Sanit.* 25, 278-80(1951).—*C.A.* 46, 5896*e*.

Phys. and chem. properties, and industrial applications of retort graphites obtained from 34 gas works were given, also the chem. compns. of ashes contained in them.

13579. Young, R. S. and McDonald, A. D. **Diamonds from dust.** *Iron Age* 167, No. 26, 76-7 (1951).—*C. A.* 45, 8221*g*.

The liquid was sepd. from the nonmagnetic portion, and the powder heated in a muffle furnace to 400°C for 0.5 hr. The magnetic material also contained some diamond powder; this could be recovered by fusion with twice its wt of KOH contg. about 1% K_2CO_3 and 1% KNO_3, cooling, boiling with water, washing out the alkali, heating with 9 parts of HCl and 1 part of HNO_3, washing the residue, and heating to 400°C.

13580. Bacon, G. E. **The decrease of the crystalline perfection of graphite by grinding.** *Acta Cryst.* 5, 392(1952).—*C. A.* 46, 7392*e*.

The decrease of crystallite size and perfection on grinding of elec.-furnace graphite was investigated.

13581. Brennan, Robert O. **The interlayer binding in graphite.** *J. Chem. Phys.* 20, 40-8 (1952).—*C. A.* 46, 6481*i*.

The repulsive energy between layers of the graphite crystal was calcd. as an interaction of linear combination of at. orbitals mol. orbitals in the layers. The van der Waals attractive term was found by setting the energy min. to fall at 3.37A. When values of the effective nuclear charge and effective quantum no. were used, the interlayer binding energy was 3.99 kcal/mole. The compressibility, calcd. under plausible assumptions, was in satisfactory agreement with the exptl. value.

13582. Brewer, Leo. **Recent determinations of the vapor pressure of graphite.** *J. Chem. Phys.* 20, 758-9(1952).—*C. A.* 46, 8921*f*.

Expts. indicated that *f*, the sticking coeff., cannot be very small. Perhaps C_2 had a high and C a low *f* value. The method of presenting the vapor-pressure data was discussed.

13583. Dienes, G. J. **Mechanism for self-diffusion in graphite.** *J. Appl. Phys.* 23, 1194-1200(1952).—*C. A.* 47, 1453*a*.

Calcns. for vacancy and direct interchange mechanisms were based on at. interactions within the graphite hexagonal layers. These interactions were obtained from the known systematic change of C-C bond strength with interat. distance. For calcg. the energy of formation of an interstitial C atom, a potential function was devised to account for interaction between the planes, consisting of 2 terms, a van der Waals' attraction and an exponential-type repulsion. The adjustable consts. were evaluated from known phys. data. The interplanar cohesive energy of graphite was 4.36 kcal/mole.

13584. Doehaerd, Th.; Goldfinger, Paul, and Waelbroeck, F. **Direct determination of the sublimation energy of carbon.** *J. Chem. Phys.* **20**, 757(1952).—*C. A.* 46, 8921*d*.

Rates of evapn. from a hot carbon surface and of effusion from a graphite furnace were detd. over the range 2450° to 2840°K. The sticking coeff. *f* was much smaller than unity and the results lead to the spectroscopic value of 141.26 kcal/mole for the heat of sublimation of carbon. The rate of effusion per unit aperture area increased with decreasing ratio of aperture area to total area. The results were compatible with a value of *f* between 1/500 and 1/5000.

13585. Eyring, Henry and Cagle, F. William Jr. **An examination into the origin, possible synthesis, and physical properties of diamonds.** *Z. Elektrochem.* 56, 480-3(1952)(in English).—*C. A.* 46, 11051*g*.

A consideration of the geol. formation of diamonds indicated that they were formed at great depth and under conditions of thermodynamic stability. An explanation of some of the properties of the diamond was offered in terms of its highly localized electronic bonding.

13586. Faris, F. E.; Green, L. Jr., and Smith, C. A. **The thermal dependence of the elastic moduli of polycrystalline graphite.** *J. Appl. Phys.* 23, 89-95(1952).—*C. A.* 46, 4305*a*.

Young's modulus and the shear modulus of grade SA-25 molded graphite and grade AUF extruded graphite were measured as functions of temp. in the range from 25° to 2000°C. In the case of the extruded material, variations of the 2 moduli with position and direction relative to the axis of extrusion were also investigated. The moduli increased with temp., a behavior in contrast with that exhibited by most materials. The bulk modulus and Poisson's ratio at room temp. were calcd. from the data for the nominally isotropic SA-25 graphite to be 6×10^{10} dynes/cm^2 and 0.27, resp.

13587. Feldman, M. H.; Goeddel, W. V.; Dienes, G. J., and Gossen, W. **Studies of self-diffusion in graphite using carbon^{14} tracer.** *J. Appl. Phys.* 23, 1200-6(1952).—*C. A.* 47, 1453*f*.

Self-diffusion in graphite was measured from 1835° to 2370°C by observing the penetration of C^{14} tracer initially applied to one end of a graphite rod. The exptl. data agreed with a diffusion mechanism consisting of concurrent vol. and grain-boundary processes.

13588. Ganzhorn, K. **Homopolar and metallic bonds of diamonds.** *Naturwissenschaften* 39, 62(1952).—*C. A.* 47, 376*f*.

The diamond lattice could be calcd. on the basis of homopolar directional bonds between neighboring atoms as well as on the basis of cell structure with metallic bonds. Both calcns. led to the same system of energy bands.

13589. Grenville-Wells, H. J. **Diffraction effects observed in diamond in the vicinity of the collimated incident beam.** *Acta Cryst.* 5, 146-7(1952).—*C. A.* 46, 4309*i*.

The presence of strong absorption conics on divergent-beam photographs of diamond indicated that there should be a diminution in the intensity of the transmitted beam when the crystal was in the Bragg position. An attempt to observe this photographically with Cu *Kα* radiation, monochromatized by reflection from a calcite crystal, was made for the (111) reflection from a diamond plate.

13590. GRENVILLE-WELLS, H. J. **The graphitization of diamond and the nature of cliftonite.** *Mineralog. Mag.* **29**, 803-16(1952).—*C.A.* 46, 4429*c*.

Complete conversion of diamond to graphite was always polycryst., but the partial conversion showed a strong preferred orientation. When a diamond was graphitized either a hexagonal close-packing structure (common) or a cubic close-packing structure (rare) occurred. Upon heat-treatment, the preferred orientation of the graphite formed on a cube and on an octahedron of diamond was identical, the hexagonal axis of the graphite being parallel with the trigonal axis of the diamond and independent of the habit.

13591. GURNEY, RONALD W. **Lattice vibrations in graphite.** *Phys. Rev.* **88**, 465-6(1952).—*C.A.* 47, 2008*c*.

In both natural and artificial graphites the crystallites were reported to be agglomerates of smaller units, each contg. perhaps not more than 12 to 17 well-ordered planes. For at. displacements perpendicular to a plane the restoring forces were much weaker than for similar displacements in the plane itself. For the latter the restoring forces were so strong that these lattice vibrations were not excited at low temps. The requisite adaptation of the Debye theory of sp. heat was given; it led to a T^2 law instead of the familiar T^3 law at low temps.

13592. HALL, G. G. **The electronic structure of diamond.** *Phil. Mag.* **43**, 338-43(1952).—*C.A.* 46, 10718*h*.

The theory of equiv. orbitals was applied to the case of diamond. Each orbital was localized and corresponded to a C—C bond. The equations were equally applicable to Si.

13593. HENNIG, G. AND MEYER, L. **Search for low-temperature superconductivity in graphite compounds.** *Phys. Rev.* **87**, 439(1952).—*C.A.* 46, 9403*g*.

Graphite and graphite compds. with Br, K, Ca, B, ammonium, and bisulfate were investigated for super-cond. down to 1.25°K. None became superconducting.

13594. HERMAN, FRANK. **Electronic structure of the diamond crystal.** *Phys. Rev.* **88**, 1210-11 (1952).—*C.A.* 47, 3076*i*.

The energy-band structure of diamond was investigated by means of Herring's orthogonalized plane wave method. Some features of this solution differed significantly from previous results.

13595. HOWE, JOHN P. **Properties of graphite.** *J. Am. Ceram. Soc.* **35**, 275-83(1952).—*C.A.* 47, 373*a*.

Graphite crystals were highly anistropic. Special properties were largely due to the strong semimetallic bonds between C atoms in plane layers and to the relatively weak bonding between planes. Details of structure were partly due to the Frank dislocation mechanism for crystal growth. Graphite crystals were easily deformed in slip on the basal plane, but in polycryst. form were stong at high temps., various forms of graphite having breaking stresses of approx. 4000-7000 p.s.i. above 2400°C.

13596. ISHIKAWA, SEIICHI AND HIRABAYASHI, KIHO. **Natural graphite. II. Preparation of colloidal graphite.** *Repts. Sci. Research Inst.* (Japan) **28**, 313-15(1952).—*C.A.* 47, 6617*g*.

Natural granular graphite was most easily dispersed in $0.003N$ NaOH by Bredig's method into colloidal graphite. One sample mass-produced by passing a 200-v. 3-phase a.c. between 3 graphite electrodes in the NaOH contg. natural graphite was composed microscopically mainly (90%) of particles 0.5-2.0 μ in diam. with scattering of those 3-10 and below 0.5 μ.

13597. KEYSER, W. L. DE AND CYPRES, R. **Preparation of graphite for (use) in nuclear reactors.** *Bull. centre phys. nucleaire univ. Bruxelles* No. 35, 28 pp. (1952).—*C.A.* 47, 4063*i*.

The optimum temp. for coking gas in a graphite resistance furnace was found to be 1400°C. Higher temp. favored coke production and the higher-temp. coke gave the best graphite. Impurities especially B, were eliminated by the use of carbon of high purity as a refractory as well as for the electrode. Traces of B were evolved from the electrode but did not condense in the coke since it formed preferentially at the hottest part of the furnace. Graphitization of the coke was carried out at 2600°-2800°C. Other impurities of graphite were found to be Ca, Mg, Cu, Si, and Fe.

13598. KLEMENS, P. G. **Lattice imperfections of diamond.** *Phys. Rev.* **86**, 1055(1952).—*C.A.* 46, 8452*e*.

13599. KOBAYASHI, SHIGEHIRO. **Elastic constants of diamond.** *Busseiron Kenkyû* (Researches on Chem. Phys.) No. 49, 34-40(1952).—*C.A.* 46, 5923*g*.

A secular equation of the normal modes of vibration for the diamond lattice was set up and the acoustic part solved. The relations among elastic const. C_{11}, C_{12}, and C_{14} and force consts. K_1, K_2, and K_3 were: $C_{11} = (K_1 + 12K_2 + 12K_3)/3a$, $C_{12} = (K_1 - 6K_2 + 6K_3)/3a$, and $C_{14} = (K_1 + 2K_2 + 6K_3)/3a$, where a is the lattice const. of diamond. The more general treatment, which took account of the interaction between the optical and the acoustic parts of the normal vibration, led to a different expression for C_{14}, i.e. $C_{14} = [\{18K_1K_2/(K_1 + 8K_2)\} + 6K_3]/3a$. $K_1 = 3.11$, $K_2 = 0.200$, and $K_3 = 0.377$ (in units of 10^5 dynes/cm).

13600. KRISHNAN, K. S. AND JAIN, S. C. **Thermionic constants of graphite.** *Nature* **169**, 702-3(1952).—*C.A.* 46, 9968*f*.

The method was based on the detn. of the satn. vapor pressure of the electron gas in equil. with the substance at different temps.

13601. MEYER, LOTHAR; PICUS, G. S., AND JOHNSTON, W. G. **Electric conductivity of graphite at liquid-helium temperatures.** *Proc. NBS Semicentennial Symposium Low-Temp. Phys., Natl. Bur. Standards Circ.* **519**, 249-52(1952).—*C.A.* 47, 5201*e*.

Graphite filaments were produced by thermal decompn. of pure CH_4. The filaments showed strong orientation of the graphite planes parallel to the filament axis. From the width of the x-ray diffraction lines the grain size of the graphite was estd. to be 200-300 A. Filament resistances were measured from 1°K to room temp.

13602. MROZOWSKI, S. **Semiconductivity and diamagnetism of polycrystalline graphite and condensed ring systems.** *Phys. Rev.* 85, 609-20 (1952).—*C.A.* 46, 5383*b*.

The electronic current in substances extending from condensed-ring mol. solids to polycryst. graphite flowed preferentially along the benzene-ring planes. Scattering of electrons was due to thermal lattice vibrations and to the boundaries of mol. planes, where electrons passed through potential barriers into the neighboring crystallites. When, in the process of carbonization, foreign atoms were removed from peripheries, the C atoms left with free, unattached valencies played a role of donors and became a source of conduction (excess) electrons.

13603. OKADA, JUN AND IKEGAWA, TATSUO. **Electrical resistivity of artificial graphite.** *J. Applied Phys.* 23, 1282-3(1952).—*C.A.* 47, 3644*h*.

The effect was studied of calcining temps. of coke used to make graphite on the elec. resistivity of graphite manufd. from it.

13604. O'KEEFE, PHILIP. **Carbon and graphite materials and parts.** *Materials and Methods* 35, No. 4, 119-34(1952).—*C.A.* 46, 5896*d*.

Chem., phys., mech., and elec. properties, design and fabrication, and applications of carbon materials were given.

13605. PRINGSHEIM, PETER AND VORECK, RUTH CASLER. **Color centers in diamonds.** *Z. Physik* 133, 2-8 (1952).—*C.A.* 47, 2603*g*.

Two samples of diamond of type 1 and one of type 2 (the former having the ultraviolet absorption edge at 3200 A., the latter at 2300 A.) were exposed to irradiation by fast neutrons. A new absorption extending from the ultraviolet to the blue-green gave the crystals a bluish tinge; in addn. a flat absorption peak appeared at 6200 A. A sharp line at 5030 A. occurred in both the absorption and the fluorescence of some diamonds. Similarly, a band at 4156 appeared in blue-fluorescent diamonds of type 1.

13606. SOHNGEN, RUDOLF. **Investigation of strength properties of graphite as a basis for the design of pressure equipment.** *Chem.-Ing.-Tech.* 24, 485-92(1952).—*C.A.* 47, 4*g*.

Three types of graphite, unimpregnated (porosity 12-13%), normal and special impregnated, were tested at -50°, 20°, and 150°C for tensile, compressive, bending, and impact strengths. On the basis of the results it was recommended that a safety factor of 9 be used (as for cast iron) for impregnated materials.

13607. WAELBROECK, F. **Mechanism of evaporation of graphite.** *J. Chem. Phys.* 20, 757-8(1952).—*C.A.* 46, 8921*e*.

The sticking coeff. of carbon was complex. Discrepancies between exptl. results and theoretical calcns. largely disappeared if it was assumed that the rate of evapn. from a graphite surface was detd. mainly by the rate of evapn. of C_2 mols., whereas C mols. predominated in the equil. gas mixt.

13608. WEAVIND, R. G. **The treatment and recovery of refractory diamonds.** *J. Chem. Met. & Mining Soc. S. Africa* 52, 243-64(1952).—*C.A.* 47, 4523*c*.

Diamonds which did not adhere to grease were difficult to recover because a film of Fe, Mg, and Ca salts rendered their surfaces wettable by water. Treatment of diamondiferous gravel contg. refractory diamonds with whale acid oil dissolved in NaOH rendered the diamond surfaces hydrophobic and left the gravel surfaces hydrophyllic.

13609. WOHLFARTH, E. P. **Electrostatic contribution to the elastic constants of solids with a diamond structure.** *Phil. Mag.* 43, 474-6(1952). —*C.A.* 46, 10746*b*.

The quasigeometrical effect was studied further by assuming central forces to act between every atom in the diamond lattice. By consideration of Ge and Si, the solids were stabilized by a contribution arising from a nonuniform distribution of electronic charge such as would reside in the directed-valency-bond method.

13610. WYNNE-JONES, W. F. K.; BLAYDEN, H. E., AND ILEY, R. **Magnetic studies of carbon and of the carbonizing process.** *Brennstoff-Chem.* 33, 268-73(1952).—*C.A.* 46, 11631*h*.

Diamagnetic susceptibilities in c.g.s. units per g varied from a max. of 6.2 to 6.3 for certain natural graphites down to values below 1 for carbon blacks. Measurements were made at 4 different field strengths and extrapolated to infinite field strength, in certain cases. The variable results for the graphites were attributed to variations in particle size or slight variations in structure. The natural graphites with the highest susceptibility values gave indistinct x-ray diffraction figures, while an electrode graphite with low ash content and a natural Ceylon graphite with relatively low susceptibility gave the sharpest diffraction figures. For the carbons, the method of prepn. was important.

13611. YOUNG, R. S.; SIMPSON, H. R., AND BENFIELD, D. A. **Determination of diamond.** *Anal. Chim. Acta* 6, 510-16(1952)(in English). —*C.A.* 46, 7935*i*.

Analytical procedures were outlined for detg. the diamond content of grinding wheels, drill crowns, saws, drills, hones, polishing powders and pastes, and other tools and materials employing industrial diamonds. The isolation and detn. of diamond was often a rather complicated task.

13612. EATHERLY, W. P. AND McCLELLAND, J. D. **Anisotropic susceptibility of polycrystalline graphite.** *Phys. Rev.* 89, 661-2(1953).—*C.A.* 47, 6727*f*.

A math. analysis and exptl. work showed that manufactured graphite had the same susceptibility as natural graphite, with a minor correction for intercryst. carbon, or for crystallites too minute to develop a cryst. field.

13613. MORRISON, A. W. **Delanium carbon and graphite.** *Research* (London) 6, 29-35(1953).—*C.A.* 47, 4582*g*.

Synthesis of carbon in a stable form from a mixt. of micronized coal and graphite by pressing into blocks or extruding into tubes and heating at a rate of 5°/hr until 1000°C was reached produced a new type of carbon. From this material Delanium graphite was produced by heating electrically to 2800°C. The properties and uses of the new forms of carbon were discussed.

13614. MROZOWSKI, S. **Electric resistivity of interstitial compounds of graphite.** *J. Chem. Phys.* 21, 492-5(1953).—*C.A.* 47, 5752*g*.

The formation of interstitial compds. was assumed to be accompanied by creation of excess holes in the otherwise full band of graphite. It was shown that a linear energy-momentum relation at the Brillouin-zone corners was incapable of explaining the decrease of the elec. resistance with oxidation. For a more general model, the decrease in relative resistance should be independent of temp. for large oxidations if suitable corrections for the initial conditions were made. Data for polycryst. graphite corrected for the existence of an energy gap and of excess holes in the untreated material gave curves that converged for higher oxidation with the curve for natural graphite.

13615. TOLANSKY, S. **Microtopography of diamond surfaces.** *Research* (London) 6, 8-15(1953).—*C.A.* 47, 4680*i*.

Natural, etched, abraded, and polished diamond faces were studied by interferometry and other optical means. New growth features were revealed, including the discovery that the trigon pattern characteristic of gemstone-quality diamonds was a growth phenomenon, rather than one due to etching. Etching of 111 faces produced triangles whose orientation opposed that of the trigons, and which sometimes resulted in a spiral linking of the triangles. Polishing of diamonds was shown to be inferior to that of glass and prohibitively expensive.

13616. TSUZUKU, TAKURO. **Structure and properties of graphite crystallites.** *Kagaku* (Science) 23, 32-3(1953).—*C.A.* 47, 3648*d*.

Electron microscopy and diffraction studies were made of carbon crystallites in the process of graphitization. The sample was artificial graphite prepd. at 2500°C in which the ash content was less than 0.05%. Microscopy specimens were prepd. by the suspension method and some were shadow-cast with Cr. Straight-line edges a few μ long were observed; this indicated that the configurational ordering as a single crystal extended over much wider region than expected from the diffuse width of Debye diffraction rings. Electron diffraction gave clear Laue spots of graphite. In every photograph, bending lines like those of folded paper were found which suggest that these platelets had considerable degree of freedom along the *c*-axis, being rather flexible.

Chapter VII. PREPARATION OF ADSORBENTS

VII-1. Preparation of Carbon Adsorbents

13617. Alexandrescu, Nestor C. **The process of preparation of charcoal sticks for reduction.** *Bull. Soc. chem. Romania* 1, 11-2(1919).—*B. C. A.* **1920A**, *ii*, 47.

The following process for the prepn. of charcoal sticks for use in the reduction test in qual. analysis was given: thin wood chips, were boiled for two min. in a 2.5% soln. of ammonium phosphate, and then dried at a temp. not to exceed 60°C. When it was required to carry out the test, half the stick was burnt, and then the test carried out in the usual manner on the substance previously mixed with sodium carbonate.

13618. Podrouzek, V. **Colloidal solution of elemental carbon.** *Chimie & industrie* Special No. 291-2(Mar. 1930).—*C. A.* 24, 5571.

Anodes were prepd. by molding very pure charcoal obtained by heating carbohydrates in a current of Cl_2. They were used to electrolyze a 10% $(NH_4)_2CO_3$ soln. under a very high c.d., cooling with water to prevent excessive heating until the anode was consumed. The soln. was dialyzed with stirring 30 days in an animal-membrane dialyzer. The contents of the dialyzer were filtered on a Schott crucible, washed and dried in a vacuum, giving a fairly hard, black product, contg. about 99.2% C, insol. in H_2O and acids, but easily disintegrated without residue in fairly dil. basic solns. to a very fine colloidal soln. with particles of a diam. of about 25mμ.

13619. Blayden, H. E.; Gibson, J.; Riley, H. L., and Taylor, A. **An x-ray study of carbonization—the effect of inorganic admixtures.** *Fuel* 19, 24-7(1940).—*C. A.* 34, 3047^9.

The addn. of certain inorg. reagents to cellulose produced only small alterations in the crystallographic properties of the chars prepd. from it at 600° and 1000°C. Small changes in the *a* dimension were recorded in certain cases, but none in the *c*. The considerable increase in carbon content which occurred in every case indicated that the primary action of the admixt. was the formation of nuclei around which aromatic condensation could occur.

13620. Brown, Harry L. **Bone char—its manufacture and industrial application.** *Paint, Oil Chem. Rev.* **102**, 10-11(March) 1940.

Crushed bones were carbonized in vertical iron retorts, closely sealed to exclude air. Coal was used as fuel, in addition to the volatile combustible gases from the bones. The off-take of the retorts were connected to a hydraulic main and then to condenser and scrubbers, where ammonia (2.5%) was absorbed, tar (4%) separated and the non-condensible gas (20%) conducted to holders, to be fed back to kiln. The carbonization of bone took about 8 hrs at 1100° to 1600°F. Each retort held about 300 lbs of bone and the coke yield was approximately 65%. The red hot char was dropped into coolers, which were immediately sealed to prevent loss of carbon. It was cooled for 24 hrs, dumped on belt conveyor, passed over magnetic pulley and graded.

13621. Costa, Ignacio M. **Preparation of active carbons from cereals.** *Anales inst. invest. cient. y tecnol.* (Univ. nacl. litoral, Santa Fe, Arg.) **10/11**, 127-34(1940-41)(Pub. 1942); *Industria y quim.* 4, 3-7(1942).—*C. A.* 37, 745^1; 36, 4999^5.

Wheat, maize, barley and millet were first carbonized in an Fe pan and then activated at 900°C in an Fe retort with steam superheated to 200°C. In another series, the cereals were mixed with a 50° Bé. soln. of $ZnCl_2$, the mixt. carbonized in the Fe pan, and then activated at 550°C in an atm. of CO_2; the carbon was washed with 10% HCl; then with H_2O, and dried at 110°C. The adsorbing power was detd. with a 0.1% methylene blue soln., and the adsorption isotherms drawn according to the Freundlich formula. The gas-adsorption efficiency was detd. with a current of Cl_2 dild. with 999 parts of air, at the rate of 1570 ml per min. The carbons compared favorably with com. products as color adsorbents, but were poor gas adsorbents.

13622. Dawson, T. R. and Gallie, G. **Carbon black from peat. I.** *J. Rubber Research* 9, 2-5(1940).—*C. A.* 34, 3888^2.

A sample of carbon black made from peat contained ash 9.73%, acetone-sol. substances 2.20% and d. 1.80. The coloring power in a ZnO-glycerol paste was 0.5 that of gas black, 0.75 that of lamp black and twice that of acetylene black. On the other hand, in rubber its coloring power was less than that of acetylene black.

13623. Alekseevskiĭ, E. V. and Klemushinskaya, N. V. **Activation of charcoal by potassium thiocyanate.** *J. Applied Chem. (U.S.S.R.)* 14, 914-27(1941)(French summary).—*C. A.* 39, 4214^9.

Activated charcoal was prepd. by satn. of pine splinters and apricot kernels with KSCN solns., followed by the carbonization step. Comparison with charcoals activated by solns. of other materials failed to show any advantage for the KSCN method. The pine splinters gave satisfactory products, while apricot kernels did not yield a product of adequate potency. In the former case the activation temp. of 900°C gave the most active product, which was suitable for use in the sugar industry.

13624. Alexa, Gheorghe and Rădulescu, Fluor D. **Activation processes for some kinds of carbon. I. Preparation of an active carbon from walnut shells.** *Soc. Chim. România Sect. Soc. romane Stiinte, Bul. chim. pură apl.* [2], **3A**, 107-26(1941-1942).—*C.A.* 38, 5384^4.

The I_2 no. was used as a measure of the activity (*A*). In the absence of air, walnut shells were carbonized at 300°C for 21 to 80 hrs. The *A*-value was very low and the particle size even smaller than that of the raw material. The product of such a prepn. was treated by two methods with a soln. of $ZnCl_2$: (1) shaking with the soln., (2) evacuation of the char followed satn. with the soln. After the latter treatment the *A*-value was higher. Comparisons were made of the active carbons, Acticarbon (coconut-shell), Decolarant-Mangal (wood carbon), and Carbomet (methane soot). Subsequent activation with H_2O vapor by the vacuum method for satn. produced a better carbon.

13625. ALEXA, GHEORGHE AND RĂDULESCU, FLUOR D. **Activation processes for some kinds of carbon. II. Preparation of an active carbon from walnut shells by impregnating the uncharred raw material with $ZnCl_2$.** *Soc. Chim. România Sect. Soc. romane Stiinte, Bul. chim. pură apl.* [2], **3A**, 127-40(1941-1942).—*C. A.* **38**, 5384^7.

Small pieces of crude walnut shells were satd. with a soln. of $ZnCl_2$ after evacuation, dried at 150°C, heated at 875°C for 5 hrs in a special electric quartz-tube furnace, and finally treated with H_2O vapors at 875°C for 3 hrs. The activity was greater than for carbon first charred and then treated with $ZnCl_2$ for H_2O vapor, and also the yield was better. A considerable part of the otherwise volatile material was converted into active carbon. Decreasing the amt. of $ZnCl_2$ decreased the yield and hardness of the carbon.

13626. ALEXA, GHEORGHE AND RĂDULESCU, FLUOR D. **Activation processes for some kinds of carbon. III. Preparation of an active carbon from grape seeds.** *Soc. Chim. România Sect. Soc. romane Stiinte, Bul. chim. pură apl.* [2], **3A**, 141-50(1941-1942).—*C. A.* **38**, 5384^8.

Air-dried grape seeds were subjected to vacuum and then satd. with a soln. of $ZnCl_2$. One part was carbonized after 2 hrs, a second part after 40 hrs. Carbonization was carried out in the elec. quartz-tube furnace for 5 hrs at 875°C and was followed by a 3-hr treatment with vapors of H_2O. Satn. with $ZnCl_2$ gave no noteworthy activity. No significant increase of activity was produced by the slow heating, or by treatment with vapors of H_2O. This low quality of carbon was traced back to the considerable fat content of grape seeds; the fat produced a poor active carbon.

13627. ARNBAK, L. AND DAMGAARD, J. **Wood charcoal and peat coke. Preparation in Jutland of carbon for gas producers.** *Kem. Maanedsblad nord. Handelsbl. kem. Ind.* 22, 144-8(1941); *Chem. Zentr.* 1942, I, 1578.—*C. A.* **37**, 3248^9.

The preparation of charcoal and peat coke in Jutland was described. It was done partly in earth mounds and partly in so-called French steel mounds. For use in gas producers on motor vehicles the latter was preferred, as contamination with sand was thereby avoided.

13628. BERTHELOT, CH. **Preparation and utilization of charcoal pellets "Actigaz" for gas producers in motor vehicles.** *J. soc. ing. automobile* 14, 92-6(1941).—*C. A.* 41, 588^c.

The charcoal was mixed with small amts. of coal tar, coal, wood tar, and some water into a paste which was molded into particles and then carbonized. The carbonized pellets constituted the fuel for the gas producer.

13629. DARRAH, WILLIAM C. **Vegetable constituents of coals.** *Econ. Geol.* 36, 589-611(1941).—*C. A.* **36**, 372^7.

Coal was considered to be a mixt. composed of (1) a considerable amt. of recognizable plant fragments showing microscopic cellular construction, (2) a small amt. of mineral in the form of ash derived in part from the original plant tissues, and (3) a considerable amt. of waxy material in a colloidal mixt. rich in hydrocarbons which served as a binder (vitrain) for the coal matrix.

13630. GILLET, A. AND FASTRÉ, M. L. **Carbonization of organic natural substances.** *Bull. soc. chim. Belg.* **50**, 239-56(1941); *Chem. Zentr.* 1942, I, 2734.—*C. A.* **37**, 3249^1.

Cellulose, glucose, and wood were carbonized in a current of N_2 at 440° and 505°C. Elementary analysis of the residue for C, H, and O in residue and volatile products was established. In the course of the carbonization, there was for some minutes a spontaneous splitting off of O_2 exclusively, while the C and H balance of the residue remained unchanged. After cellulose and glucose were carbonized for 2 or more hrs, an end product formed which had the composition of a glance coal.

13631. IONESCU-MATIU, AL. AND MAIOROVICI, C. **Preparation of activated charcoal from fruit pits.** *Chimie & industrie* 45, *Suppl. to No. 3, Special No.*, 163-73(1941); *Chem. Zentr.* 1942, I, 1778.—*C. A.* 37, 3249^6.

Methods for preparing activated charcoal from peach and apricot pits were studied. The kernels were removed and the shells broken down to 2-3 mm. For activation, 6 *N* H_2SO_4 was the best impregnating medium. Carbonization should be started while the material was still moist to facilitate removal of gaseous products. Final carbonization was effected by heating for 2 hrs at 1000°C in retorts with small vent holes. If $ZnCl_2$ was used for impregnation, washing with 2% H_2SO_4, then water, was required.

13632. KURIHARA, K.; YOSHIOKA, A., AND NINOMIYA, Y. **Studies on peat. I. Thermal decomposition of peat.** *J. Soc. Chem. Ind., Japan* 44, *Suppl. binding* 226-7(1941).—*C. A.* 44, 7511*e*.

Samples (0.2 g) of 3 kinds of peat (Tanemori I and II and Tenno) were heated in a thermobalance at 5°/min. in N_2 (50 ml/min.). Each peat showed a decrease in wt up to 125°C (H_2O), rapid thermal decompn. 200°-300°C, and slow decompn. 300°-600°C. In a modified Gray-King retort, 20-g samples were carbonized between 200° and 920°C and the products detd. Vigorous decompn. occurred at 200°-400°C; water near 300°C, gas 300°-400°C, and tar 400°-500°C. The gas was chiefly CO_2 below 300°C, hydrocarbons 500°-700°C, and H_2 above 700°C.

13633. KURIHARA, K. AND YOSHIOKA, A. **Studies on peat. II. The hydrogenation of peat.** *J.*

Soc. Chem. Ind., Japan **44**, *Suppl. binding* 250 (1941).—*C.A.* **44**, 7511*f*.

Tanemori and Tenno peat was hydrogenated in tetralin soln. at an initial pressure of 100 kg/cm^2 and temps. varying from 350° to 450°C with NiO, MoO_3, SnS, $SnCl_2$, or SnI_2 as catalyst. Hydrogenation proceeded smoothly giving an oil yield of about 37% for Tanemori peat and 45% for Tenno peat.

13634. NAGARAJA, A. AND JAIN, N. S. **Utilization of [sugar-factory filter-] press mud: preparation of a dyestuff.** *Proc. Sugar Tech. Assoc. India* **10**, 265-7(1941).—*C.A.* **37**, 5883^8.

Expts. on the manuf. of an activated carbon from the mud indicated the possibility of prepg. chocolate-colored S dyes. This was done by extg. with HCl or aqua regia, filtering, adding NaOH and S, and heating until nearly dry. Such dyes might be of use in producing khaki-dyed fabrics.

13635. PIROZHKOV, N. A. **New developments in the manufacture of carbon black.** *Kauchuk i Rezina* **1941**, No. 6, 41-3; *Chem. Zentr.* **1942, II**, 2431.—*C.A.* **38**, 2809^3.

In the manuf. of carbon black from mineral oil, the yields were increased by screening the flames and, by the installation of air bolters, the quality was improved. In the manuf. of thermal black in Borislav, the reflectors on the burners were enlarged, the supply of air was more closely controlled, and other details were improved, so that the yields increased and the operations were simplified.

13636. RAZOUS, P. **Manufacture of wood charcoal in mounds and portable kilns.** *Genie civil* **117**, 105-11(1941).—*C.A.* **37**, 1848^8.

On carbonization, deciduous wood gave charcoal 25-30, gas 18-25, tar 4-6 (coniferous wood up to 12% of tar) and AcOH 5-6%. White beech gave 83 kg and debarked oak 103.5 kg of charcoal per m^3 of wood. The construction and manipulation of simple mounds and those designed for tar recovery were described.

13637. BASORE, C. A. AND MOORE, O. C. **The production of lump charcoal from pine sawdust without a binder.** *Alabama Polytech. Inst., Eng. Expt. Sta., Bull. No.* 14, 33 pp. (1942).—*C.A.* **37**, 1584^4.

Fine pine sawdust was heated to 400°C for 14 min. in a mold provided with a loosely fitting piston; a pressure of 300 p.s.i. at a rate of application of 1 min. was applied to the dried and partly carbonized material for 20 sec. The briquettes were then immediately transferred to a retort maintained at 400°C and heated in the absence of air for 25 min. for smoke removal. The following results were obtained on subjecting the finished briquettes to the Bureau of Mines drop and tumbler tests before and after weathering for 8 weeks: 90.67%, 93.46% held by one-in. screen; 87.71%, 91.6% held by one-in. screen.

13638. BROOKS, R. L. **Charcoal from coconut shells.** *Proc. Agr. Soc. Trinidad & Tobago* **42**, 150-2(1942);- *New Guinea Agricultural Gazette* **1941**, *August*.

The adaptation of a 40-gal oil drum as a kiln was described.

13639. GALLO, A. **Animal black—its manufacture, properties and uses.** *Industrie chimique* **29**, 38-41(1942); *Chem. Zentr.* **1942, II**, 1385.—*C.A.* **37**, 5573^3.

Horizontal retorts were described in detail. Bones produced 60-5 kg of animal black from 100 kg bone, in addn. to NH_3 and water (corresponding to about 10-12 kg $(NH_4)_2SO_4$), 2-5 kg of tar, and approx. 15-20 kg of permanent gases. The heat content of these gases was utilized fully in this process.

13640. IMADA, FUSAO. **Studies on amorphous carbon. I.** *J. Electrochem. Assoc. Japan* **10**, 435-41(1942).—*C.A.* **44**, 9657*h*.

In the manuf. of active charcoal various materials were treated under ordinary or reduced pressure and the carbonizing process was observed. The relative adsorptive powers of the following charcoals for Cl_2 at 18°C were: camellia > oak > hemlock-spruce > cherry. Carbonized pitch was more effective than carbonized asphalt.

13641. MARTINDALE, C. **Two wartime measures: Making animal char and revivifying Hyflo Super-Cel.** *Proc. 16th Ann. Congr. S. African Sugar Tech. Assoc.* **1942**, 48-9; *Intern. Sugar J.* **45**, 126-7(1943).—*C.A.* **37**, 279^7.

Degreased bone was passed through 4 retort pipes isolated in a standard 8-tube char kiln; 2 or 3 passages were required to obtain satisfactory charring and pH. The product was stored until a char filter had been sweetened off and placed on top of the exhausted char immediately before washing off; after washing for 8 hrs with hot water, the new char passed along with the old through the revivifying furnace. Loss in weight from bone grit to finished char was 25%. Hyflo Super-Cel filter cake from Vallez filters was washed, air dried, and fed continuously into a flat-bed furnace (described) where the organic matter was partially burned off; recovery was 60%.

13642. QUARTAROLI, A. AND FONTANELLI, G. **The chemical structure of tricalcium phosphate and of calcium carbonate in phosphorites and bones.** *Ann. facoltà agrar. univ. Pisa* [*N.S.*] **5**, 416-35(1942).—*C.A.* **41**, 2520^e.

Phosphorites, bones, and artificial $Ca_3(PO_4)_2$ contained a tri-Ca phosphate of such a structure that excess of strong acid was required to form $CaHPO_4$ directly; $CaHPO_4$ contained in the superphosphates was formed by alteration from $Ca(H_2PO_4)_2$. Phosphorites and bones contained a certain amt. of $Ca_3(PO_4)_2$ which was not transformed into the mono-Ca and di-Ca salts, but only into H_3PO_4. $CaCO_3$ could not react completely with the acid if $Ca_3(PO_4)_2$ had not already reacted.

13643. SPOON, W. **Husks of Surinam palm seeds and tree seeds for the preparation of charcoal for gas adsorption.** *Ber. Afdeel. Handlsmuseum Konink. Ver. Kolon. Inst. No.* **186**, 1-12(1942); *Chem. Zentr.* **1943, I**, 1312.—*C.A.* **38**, 3456^2.

The properties of the charcoals and their adsorptive power for aq. I_2 solns. and ether vapor were given.

13644. SPOON, W. **Charcoal from** *Acacia decurrens (var. mollis)* **of the Dutch East Indies.** *Nederland. Boschbouw-Tijdschr.* 15, No. 8, 368(1942); *Ber. Afdeel. Handelsmuseum Kolonial Inst.* No. 185, 9 pp.—*C.A.* 40, 7573^9.

The acacia tree was cultivated for the high content of tanning material of its bark. Its wood was used for paper manuf. and charcoal. The latter was superior and more uniform than other charcoals and gave an excellent AcOH yield. The air-dry wood had a d. = 0.6-0.9. One m^3 of wood furnished 200 kg of charcoal (charred in piles). Acacia charcoal (0.5 g) was shaken at 25°C with 50 ml 0.05 *N* I_2 soln. After last filtration, the filtrate was titrated back with 0.05 *N* $Na_2S_2O_3$. The mg equiv. I/g charcoal = 1.13, which in 6 comparative tests was surpassed only by medium-fine and coarse beechwood charcoal (with 1.35 and 1.29, resp.).

13645. VANZETTI, BORTOLO L. **Carbon blacks from sugars: rontgenographic investigations.** *Rend. ist. lombardo sci.* 76, No. 2, 173-6(1942-43).—*C.A.* 42, 3637*g*.

Carbon blacks obtained by slow dehydration of sugars in H_2SO_4 were dried at 120°-18°C, powd., and rontgenographically investigated. They had no cryst. structure. When heated at 300°-1300°C they gradually assumed the graphitic structure.

13646. ERDOS, JOSÉ AND VIDOR, JORGE. **Activated carbon.** *Ciencia* (Mex.) 4, 77-81(1943).—*C.A.* 38, 1094^2.

A very active carbon was obtained by adding sawdust (500 g) to a mixt. of 150 ml of concd. H_2SO_4 and 600 ml of H_3PO_4 (85%), heating to 120-150°C, mixing, driving off the H_2SO_4 at 380-400°C, heating in an insulated retort of acid-resistant steel to 950-1000°C for 2 hrs, allowing to cool, washing until free from acid, drying at 120°C, grinding and sifting to a fineness of 1000 mesh. An activation temp. above 1100°C caused a rapid decline of the activity.

13647. IMADA, FUMIO. **Studies on carbon. I. Activation of amorphous carbon and preparation of active charcoal.** *Technol. Repts. Kyushu Imp. Univ.* 18, 47-52(1943).—*C.A.* 43, 5571*h*.

With conifers and breadleaves lignin was found to be the basis for active charcoal which was best prepd. by carbonizing the trees at 400-50°C under slightly reduced pressure, removing as rapidly as possible the volatile products by passing in steam from 280°C upward.

13648. IMADA, FUMIO. **Studies on carbon. III. Activation of charcoal.** *Technol. Repts. Kyushu Imp. Univ.* 18, 58-61(1943).—*C.A.* 43, 5572b.

Activation of the refined charcoal from *Quercus acuta* at 800°-900°C for 4 hrs showed optimum adsorption (of CCl_4 0.551-0.558 g/g; of Cl_2 107.5-118.1 ml/g).

13649. IMADA, FUMIO. **Studies on carbon. IV. Preparation of active carbon.** *Technol. Repts. Kyushu Imp. Univ.* 18, 62-6(1943).—*C.A.* 43, 5572*b*.

The active carbon from plant sources, especially hard woods and ext. of lignin, showed the following adsorption of Cl_2(559 (mg/g) with *Camellia japonica*, 553 with *Quercus acuta*, 583 with alkali-extd. lignin), 376 for lamp black and wood tar mixed in 1:1, 279 for coal, 249 with silkworm pupae, 167 with asphalt, and 108 with pitch washed with H_2SO_4.

13650. KURIHARA, TOZABURO. **Dry distillation of bamboo.** *J. Pharm. Soc. Japan* 63, 330-3(1943). —*C.A.* 45, 1750*e*.

Three kinds of bamboo containing 16.6% moisture were dry-distd. at 350°-450°C, and 18.45% (wt) gas distillate, 39.4% liquid, 8% tar and 29% charcoal were obtained. Best yield was obtained when the distn. temp. was maintained at 400°C. The charcoal was a light-weight substance and a fairly powerful adsorptive charcoal could be obtained by activating with steam, $ZnCl_2$, or phosphoric acid.

13651. MIDUNO, SHIGERU AND KATO, YOGORO. **Active carbon. I. Hydrated active carbon.** *J. Soc. Chem. Ind. Japan* 46, 961-6(1943).—*C.A.* 42, 6517*b*.

Filter paper, Willstätter lignin, and sawdust were treated with 70% H_2SO_4 at 150°C and washed. The products, contg. 26% combined H_2O, showed a strong adsorptive power. That prepd. from filter paper had the strongest adsorptive power; it was comparable to ordinary $ZnCl_2$-activated carbon in the decolorization of raw sugar liquor, but its adsorptive power for KCl and $CaCl_2$ was about 5 times that of $ZnCl_2$-activated carbon. Hydrated active carbon from orange peel was about equal in adsorptive power to that from filter paper.

13652. OTHMER, DONALD F. AND FERNSTROM, GEORGE A. **Destructive distillation of bagasse.** *Ind. Eng. Chem.* 35, 312-17(1943).—*C.A.* 37, 1848^4.

Experiments were undertaken to determine the yields of several products when bagasse was carbonized in a retort under different conditions of temp. and time. Per ton of dry bagasse, approx. 1050 lb charcoal, 1.2 gal of crude MeOH and 53 lb of AcOH were obtained. The amount of charcoal was considerably greater than would be produced from an equiv. amt. of dry wood, but the volatile constituents were in each case considerably lower.

13653. RIVKINA, KH. I. **The possibility of obtaining of carbonaceous sorbents from lower strata of peat.** *Torfyanaya Prom.* 1943, No. 1, 15-18.—*C.A.* 38, 631^6.

Air-dried peat, in particles 5-7 mm long and 2-3 mm in diam., was carbonized in a porcelain tube within a vertical elec. furnace at 840-80°C, depending on the ash content. During heating to 600°C, illuminating gas was passed through the tube; this was discontinued between 600° and 840°C, and after 10 min. at 840-80°C CO_2 was passed through the tube for 15 min. The carbonized peat was cooled passed through a sieve of 600 meshes/cm^2, and its adsorptive power for phenol detd. Slightly active peat coke adsorbed less than 0.03 g of phenol per g; medium active, around 0.05; and active, 0.07 and more. The adsorptive capacity was detd. on freshly prepd. material, then after 14, 28, 42 and 90 days. Most of the aging occurred within 14 days.

13654. SHIMIDU, TOSHIHIDE. **Decolorizing carbon from bagasse. II. Ash content of primary**

carbon from bagasse. *J. Soc. Trop. Agr Taihoku Imp. Univ.* **15**, 201-5(1943).—*C.A.* 42, 3157*g*.

The pithy part of bagasse, sepd. with a 6.06-mm mesh sieve, was heated in an elec. furnace at 300°C for 6 hrs or at 900°C for 3 hrs to reduce the C-content. The yield after washing with concd. HCl was 7.25 under the 1st conditions and 13% under the 2nd. The ash (about 0.2%), boiled out with HCl, analyzed SiO_2 74.21, SO_3 3.69, Fe_2O_3 + Al_2O_3 7.9,8 CaO 1.99, P_2O_5 1.07, MgO 3.14, K_2O 3.58, and Na_2O 2.35%.

13655. SHIMIDU, TOSHIHIDE. **Decolorizing carbon from bagasse. III. Activation of bagasse and cane-sugar carbon in vacuum or by oxygen.** *J. Soc. Trop. Agr. Taihoku Imp. Univ.* **15**, 226-35 (1943).—*C.A.* 42, 3157*h*.

Bagasse carbon showed max. adsorption of acid (HCl) when activated at 600°C *in vacuo* and max. adsorption of aklali (NaOH) when activated at 300°C *in vacuo*. Activation by O_2 increased the acid adsorption, a max. appearing in O_2 when activated at 900°C and in H_2 when activated at 600°, and also the alkali adsorption, a max. appearing when activated at 300°C. Cane-sugar carbon showed max. adsorption of acid when activated at 600°C *in vacuo* or in satd. O_2, the adsorption decreasing little when activated at lower temp. Adsorption of aklali was max. when activated at 300°C *in vacuo* or by O_2, the adsorption decreasing rapidly when activated at higher temp.

13656. VANZETTI, B.L. **Colloidal carbon.** *Chimica e industria* (Italy) **25**, 137-44 (1943); *Chem. Zentr.* **1943, II**, 1945-6.—*C.A.* 39, 176^3.

Carbohydrates (sugars and cellulose) were heated gradually with concd. H_2SO_4 at room temp. Besides black colloidal suspensions of varying particle size, a black elastic gel was formed which, with respect to dehydration and rehydration curves, behaved like silica gel. If this gel was heated in a vacuum, water and CO_2 were given off, and coke-like product obtained with the compn. C=59-61(%), H=3.2-3.8, O=36. The liquid contg. the H_2SO_4 after diln. exhibited an intense-blue fluorescence, which disappeared in the basic region.

13657. WARNE, L.G.G. **English wood charcoals.** *J. Soc. Chem. Ind.* **62**, 88-90 (1943).—*C.A.* 37, 6111^5.

The anatomical features of the wood were not destroyed in the prepn. of charcoal. The identification of the botanical source of wood charcoals was possible when they were in lump form by observations of the size and arrangement of the vessels and the size and frequency of the medullary rays.

13658. WARNE, L.G.G. **The identification of powdered wood charcoals.** *J. Soc. Chem. Ind.* **62**, 141-4 (1943).—*C.A.* 38, 240^1.

A "Key" for the identification of English wood charcoal powders was given. The frequency, size and arrangement of holes in the particles of charcoal were characteristic to a limited value in detg. the source of the charcoals.

13659. BERRY, A.G.V. AND EDGEWORTH-JOHNSTONE, R. **Petroleum coke. Formation and properties.** *Ind. Eng. Chem.* **36**, 1140-4(1944).—*C.A.* 39, 802^8.

Petroleum coke was essentially a disperse system composed of graphite-like crystallites embedded in an org. matrix. Expts. on the coking of a cracked asphalt under different time-temp. conditions showed that the coking process could be conveniently regarded as taking place in 4 stages, corresponding to the production of pitch, semipitch, asphaltic coke and carboid coke. The properties of these substances were described, and their bearing on the quality and com. value of petroleum coke was indicated.

13660. BERTHELOT, CH. **Simultaneous production of gasifier wood and wood charcoal.** *Carburants nat.* **5**, 101-4(1944); *Chem. Zentr.* **1944, II**, 814.—*C.A.* 40, 7573^8.

By combination of a wood-drying process with carbonization of wood, it was possible to produce simultaneously wood charcoal and a high-quality, dry gasifier wood for use in generators producing gas for automobiles. The combustible gas produced in the carbonization of the wood was used for the production of dry gases.

13661. DAS, B.B.; NIYOGI, N.C., AND SINHA, A.K. **Studies on Indian coals. XI. Production of activated carbon from Indian coals.** *J. Indian Chem. Soc., Ind. & News Ed.* 7, 137-9(1944).—*C.A.* 40, 3247^8.

Activated carbon samples were prepd. from Indian noncaking coals. Optimum temp. of carbonization of 4 samples was found to be 480°C. For activation at 1000°C, introduction of superheated steam for periods up to 60 min. was quite effective. The resulting activity for solvent-vapor adsorption compared favorably with imported activated carbon.

13662. DEY, A.C. AND VARMA, B.S. **Quality of charcoal produced in indigeneous kilns.** *Forest Research Inst. Dehra Dun, Indian Forest Leaflet* No. 56, 1-4 (1944).—*C.A.* 42, 3158*b*.

A particular lot was crushed to a coarse powder and mixed thoroughly. A portion was further powd. to pass a 60-mesh sieve, cleaned by floating on water, and dried in an oven at 105-10°C to const. wt. A sample (5g) was ashed. One g of this powder was placed in a weighed Pt crucible (1 × 1.3 in.) and closed by pushing in another weighed crucible of the same size. Both were then heated at 950°C for 7 min. The crucibles were cooled and the amt. of charcoal remaining weighed. The difference was due to loss of volatile matter. The fixed carbon was calcd. as residue after loss due to moisture, ash, and volatiles had been deducted. Porosity was calcd. from the true and apparent d. Almost any type of kiln will produce charcoal of good quality, provided carbonization temps. are well regulated.

13663. DOSS, K.S. GURURAJA AND JAIN, N.S. **Activated carbon from wax-free press mud.** *Indian Sugar* 7, 149(1944).—*C.A.* 38, 6124^7.

A good quality of activated carbon could be obtained by carbonizing the dried press muds of sulfitation cane-sugar factories. Previous extn. of the cane wax from the mud had little influence on the quality of the carbon obtained by subsequent carbonization.

13664. Fujita, Atsushi. **Chemical studies of charred animals. I.** *J. Pharm. Soc. Japan* 64, 263-9(1944).—*C.A.* 45, 819*h*.

Charred animals were special products of the Orient. Ordinary products were prepd. by the carbonization of animals in a closed pot in the absence of air 6-8 hrs at about 300°C. Ordinary chem. analyses of these products showed only the presence of C and the usual inorg. matter, such as $CaHPO_4$, Mg, K, Na, etc., and only traces of org. components. The adsorptive affinity of the charred carbon was not very remarkable, decolorizing only about 1 ml 1:1000 methylene blue soln. per g. At the same time, the charred product also contained the so-called whited baked, i.e., completely cindered ashes.

13665. Ghatak, S.N. **Briquetting molasses with waste charcoal dust.** *Proc. Sugar Tech. Assoc. India* 13, 81-9 (1944).—*C.A.* 39, 3896^6.

Charcoal dust (60-mesh) was mixed with 40% by wt of 90° Brix molasses and 10% of water. The mixt. was molded under pressure of 1.5 tons/in^2 for 30 sec, dried at 110°C, and "smoked" at 300°C in a furnace (described) until evolution of fumes ceased. The heat value of the briquets was 11,500-12,000 B.t.u.; their advantage as a gasolene fuel was that they occupied less space and were not as friable as ordinary charcoal.

13666. Gibson, J.; Riley, H.L., and Taylor, J. **Filamentous carbon.** *Nature* 154, 544(1944).—*C.A.* 39, 852^2.

Filamentous carbon was prepd. by cracking CH_4, dild. with N_2, H_2, and CO on an Fe surface at 1000°C. X-ray analysis showed that the carbon was amorphous, with the *c* axis perpendicular to the fiber axis.

13667. Oza, T.M. **Pure charcoal from cane sugar.** *J. Indian Chem. Soc.* 21, 38(1944).—*C.A.* 39, 251^1.

Heat large crystals of sugar in an open dish until brittle, then heat at 500°C for 7 hrs *in vacuo* in a tube provided with a stopcock. Heat in a current of Cl_2 (10 liters for 25 g of charcoal) at 500°C, then exhaust for 2 hrs at 500°C. Pass H_2 through a layer of the charcoal for 1 hr at room temp. and for an addnl. hr at 500°C. Grind fine, treat in a Pt dish with HF and digest for 1/2 hr. Dil. greatly with water, filter, dry, heat strongly, throw into concd. HCl and boil for 1 hr. Dil. greatly with water, filter, wash free from Cl^-, dry and exhaust at 500°C. Repeat the treatment with HF and the remainder of the process to remove the ash completely. The purified charcoal reacted with $NaNO_2$, *in vacuo*, only above 300°C; the reaction became violent only at 355°-370°C. Charcoal that had not been treated with Cl_2 reacted violently at 265°C.

13668. Tromp, F.J. and Matthee, J.J. **Activated carbon for regenerating used lubricating oil.** *J. Chem. Met. Mining Soc. S. Africa* 45, 90-9 (1944).—*C.A.* 40, 4874^2.

The carbon was prepd. by carbonizing wattle shavings, impregnated with aq. H_3PO_4 (d. 1.6), at 350°C for 2 hrs in a pilot plant (described); 95% of the H_3PO_4 was recovered by a special H_2O-percolation process and used again. The washed, dried carbon was ground so that 90-99% passed 200-mesh; finer grades were less easily filterable from the oil.

13669. Warne, L.G.G. **Further observations on powdered wood charcoals.** *J. Soc. Chem. Ind.* 63, 124(1944).—*C.A.* 38, 5384^2.

Observations on the characters of the so-called identification particles of 7 powd. hardwood charcoals allowed the identification key to be amended and extended.

13670. Warne, L.G.G. **British softwood charcoals.** *J. Soc. Chem. Ind.* 63, 191-2(1944).—*C.A.* 38, 6077^2.

Naked-eye or hand-glass inspection usually enabled hardwood and softwood charcoals to be differentiated. Hardwood charcoal was free of small vessels, but resin canals sometimes might be mistaken for the vessels characteristic of softwood charcoals. Annual rings and their width were variable in all British woods and offered no means of distinction of charcoals.

13671. Doss, K.S.G. and Jain, N.S. **Activated carbon from bagasse.** *J. Sci. & Ind. Research (India)* 3, 393-6 (1945).—*C.A.* 40, 4543^9.

A carbon as active as Carboraffin was described.

13672. La Grange, C.C. and Petrick, A.J. **The production of zeolites from bituminous coal.** *J. Chem. Met. Mining Soc. S. Africa* 45, 235-47(1945).—*C.A.* 40, 7457^9.

Treatment of S. African coal with SO_3 at 160°C formed zeolites which compared favorably with commercially available products. Attrition tests showed that a better product was obtained if a hard coal was chosen as a raw material and if activation was not carried out to a maximum. In order to convert H-zeolites to Na-zeolites, it was found advantageous to use a NaCl soln.

13673. Mukherjee, Sudhamoy and Bhattacharya, Sukhamoy. **Preparation of activated charcoal (medicinal).** *J. Sci. & Ind. Research (India)* 4, 235-7 (1945).—*C.A.* 40, 1969^9.

Shells of groundnut and coconut were carbonized with and without acidulated $ZnCl_2$ as the activating agent. Charcoals from both sources showed good adsorptive power, and this was shown in a greater degree by the charcoals obtained by use of acidulated $ZnCl_2$. $ZnCl_2$ in HCl soln. reduced the ash content by removing the acid-sol. fraction of the minerals present. Groundnut shell $ZnCl_2$-treated charcoal satisfied the tests for medicinal charcoal.

13674. Ohara, Yasumi. **The carbonization of raw rubber.** *Bull. Rubber Research Inst. Japan. No.* 1, 19-20(1945).—*C.A.* 44, 5627*e*.

Attempts were made to obtain ashless carbon for the electrode of Al refining. The result was fairly good. Raw rubber was treated with Al_2O_3, NH_3, caustic alkali or $(NH_4)_2SO_4$ to make it fusible; the fused rubber was oxidized with concd. H_2SO_4 to a brown hard product and by carbonizing this, the desired carbon with almost no ash was obtained in 50% yield.

13675. Pallacios, J. and Vigon, M.T. **The preparation of electrolytic colloidal carbon and experiments with the same.** *Anales fís. y quím* (Madrid) 41, 934-55(1945).—*C.A.* 41, 4724*g*.

Disintegration of a carbon electrode in certain mediums increased with c.d. With high c.d. more large particles and less of colloidal size were formed. Tests were made with H_2SO_4, NaOH, Na_2SO_4, $(NH_4)_2CO_3$, NH_4OH, $(NH_4)_2SO_4$, and dist. water. For equimol. concns., the most rapid formation, with fewer large particles, was with $(NH_4)_2CO_3$ and NH_4OH; the slowest with Na_2SO_4. The action of NaOH and H_2SO_4 was about the same as regards concn. of colloid, but disintegration was much greater in the H_2SO_4 solns. With NaOH, disintegration to large particles increased as pH decreased. Colloidal carbon was obtained with anodes of arc-lamp carbon, Siemens carbon rods, and German activated carbon. Disintegration was more rapid the more porous the carbon, but was accompanied by a greater proportion of large particles.

13676. Reich, Gustave T. **Production of a carbon and potash from molasses distillers' stillage.** *Trans. Am. Inst. Chem. Engrs.* 41, 233-52 (1945). —*C.A.* 39, 2619^7.

Molasses distillers' stillage having a d. of 3° to 10° Brix contained 0.3 to 1.0% of K_2O, the remainder being org. and inorg. compds. giving it a N-content of 0.03 to 0.10%. The removal of lime before fermentation of the molasses, followed by the simultaneous distn. of the alc., concn. of the stillage and finally the high-temp. carbonization of the concd. liquor resulted in recovery of a carbon having a high decolorizing power, K_2O, and tar.

13677. Reich, Gustave T. **Molasses stillage.** *Ind. Eng. Chem.* 37, 534-8 (1945).—*C.A.* 39, 3114^3.

Concd. stillage was carbonized in a stationary retort either in acid or alk. condition. The retorts used were somewhat similar to Kopper's coke oven. Carbonization not exceeding 700°F formed a hard, brittle nonhydroscopic product. The stillage treated with alk. metal compd. at 8.5 to 9 pH formed the softest carbonized product, whereas an acid stillage of 4-4.5 pH yielded the hardest. The use of lime gave the densest product. Stillage treated with alk. metal compd. gave the most porous product. The d. of the acid char was between the lime and the alk. metal compd. char. Continuous feeding of the concd. stillage to the retorts resulted in a very dense product.

13678. Wetterholm, Allan and Davidson, Bertil. **Reaction between wood charcoal and sulfur at low temperatures as related to surface area and source of charcoal.** *Iva* 17, 80-6 (1945). —*C.A.* 41, 4909*g*.

Storage of S-charcoal mixts. at 100°C caused formation of a product which resembled charcoal, but in which part of the S was no longer extractable in CS_2 or in aniline. The amt. of nonextractable S increased with time of storage. It varied with the type of charcoal, and for a given type reached a max. at a definite degree of carbonization. Nonextractable S was presumed to form surface compds. with charcoal, analogous to the adsorption of O_2 on charcoal.

13679. Askey, P.J. **Alkali activation of coke.** *Gas World* 124, No. 3205, Coking Sect., 3-7; No. 3209, Coking Sect., 13-19 (1946).—*C.A.* 40, 1988^2.

The activation of coke by addn. of Na_2CO_3 to the coal before carbonization was studied. Coke from a small oven and that from full-scale ovens were quenched with Na_2CO_3 solns. In the latter case about 12 tons of $Na_2CO_3 \cdot 10\ H_2O$ was dissolved in about 23,000 gal of water in the quenching system. The Na_2CO_3 was distributed reasonably uniformly through the coke. There was a slight marbling effect following the lines of fissure, but no general whitening of the coke. After crushing and grading the visual effect of the alk. treatment was even less apparent. Alk. quenching did not appreciably affect the phys. properties of the coke.

13680. Bergstom, Hilding and Jansson, Harry. **Control of deliveries and methods of analysis of wood charcoal.** *Jernkotorets Ann.* 130, 89-117(1946).—*C.A.* 43, 2407*c*.

Blast-furnace charcoal should contain not more than 20%, and blast-furnace charcoal for gas producers not more than 12% of H_2O. Bulk d. (dry) should be as high as possible; it was influenced by the type of wood (beech>birch>conifers), carbonization procedure, storage, and transport (degradation and segregation). Deciduous woods gave blast-furnace charcoal of higher P content than coniferous woods, and bark>heartwood, but P was readily extd. by H_2O during log-floating. The procedure for sampling charcoal from railway cars was described.

13681. Boyk, S. and Hass, H.B. **Active carbon from chlorinated coal.** *Ind. Eng. Chem.* 38, 745-8(1946).—*C.A.* 40, 5547^8.

Coal was chlorinated in a Ni tube at various temps. yielding small amts. of volatile chlorinated products and a carbon suitable for activation. The chlorinated coal was pelleted and heated in absence of air for one hr at 500°C. The pellets were crushed, sized to 8-20 mesh, and steam-activated at 800°C. Typical results using 4-20 mesh coal showed a gain in wt of 100% on chlorination. The activated carbon contained 0.12% Cl and had an accelerated chloropicrin life of 67 min. and heat of wetting of 12 cal/ml.

13682. Hintze, Wollmar W. **Peat charcoal as gas-producer fuel.** *Jernkontorets Ann.* 130, 193-8 (1946).—*C.A.* 43, 2407*e*.

Light coke (bulk d. 290-310 kg/m^3, ash 2-4 volatiles 71-74%, both on dry basis, H_2O 10-15%) gave gas of compn.: CO_2 8.7-9.0, O 0.3-0.4, CO 24.9-26.0, H 17.8-18.3, CH_4 2.5, unsatds. 0.1-0.2, N 43.7-44.6%. Dark coke (bulk d. 310-330 kg/m^3, ash 3-4, volatiles 62-64%, both on dry basis, H_2O 5-10%) gave: $CO_2$8.2, O 0.3, CO 26.0. H 18.0, CH_4 2.5, unsatds. 0.2 N 44.2%. Raw peat (H_2O 30%) gave: CO_2 9.5, O 0.4, CO 24.1, H 14.8, CH_4 1.3, unsatds. nil, N 51.3%.

13683. Hormats, Saul. **German process for manufacturing activated charcoal.** *Chem. & Met. Eng.* 53, 112-14 (1946).—*C.A.* 40, 5547^9.

Peat (70 parts) was used for a gas mask charcoal using 30 parts dry $ZnCl_2$ (in 45% by wt soln.). A plastic mass was obtained at 50° to 60°C which was extruded in vertical hydraulic multiple-orifice presses with openings of 2.2 mm. The primary activation was in a rotary kiln for 2 hrs at 700°C. The cooled char was leached with 3% HCl and hot water, and $CuSO_4$ added to improve the adsorptive properties of the charcoal for HCN. Contents were then treated with 5-6% K_2CO_3 (KOH) and washed to a residual of 2-3% alkali. The time for leaching and impregnating 2000 kg was 24-36 hrs. The charcoal was dried in direct fired rotary kiln at 120° to 150°C and subsequently heated to 850°C with steam. The charcoal was satisfactory for use in high humidity conditions. Other adsorbents for solvent recovery and decolorization were mentioned.

13684. KORSHUNOV, V.I. **Briquetting charcoal fines.** *Za Ekonomiyu Topliva* 3, No. 8/9, 3-6 (1946).—*C.A.* 41, 2558*e*.

Briquetting of charcoal fines was discussed for use in various branches of industry, such as for production of activated charcoal, in gas generators, etc.

13685. MARVIN, GEORGE G. **Sugar charcoal.** *Inorg. Syntheses* **II**. 74-5 (1946).—*C.A.* 40, 6353^6.

Pure cane sugar was placed in a muffle furnace at 800°C. While the sugar was burning, it was removed from the furnace and stirred to minimize frothing. The product was then heated until all volatile matter evolved.

13686. MINTON, A.S. **Carbonization.** *Quart. Inst. Fire Engrs.* 6, 122-7 (1946).—*C.A.* 41, 1824*i*.

The destructive distn. of org. matter and the chem. characteristics of the carbonaceous residue, volatile matter, and condensable liquid products found thereby were discussed.

13687. MORGAN, JEROME J. AND FINK, C.E. **Binders and base materials for activated carbon.** *Ind. Eng. Chem.* 38, 219-28(1946).—*C.A.* 40, 1988^6.

Carbonaceous materials, with or without a binder, ball-milled to 95% finer than 200 mesh and pressed into briquets 1-1/8 in. diam. by 1/4 in. thick under a pressure of 5000 p.s.i. were carbonized in a rotary furnace brought up to temp. at about 3° per min. and held at temp. for exactly 2 hrs. The carbon was activated with 925°C steam. The briquets were tested for flexural strength, bulk d., and ability to adsorb I_2, toluene, and chloropicrin, and to decolorize a soln. of brown sugar. Activated carbon from cellulose with binders of 25% low-melting pitch and 25% sugar, resp., had flexural strengths of 18.8 and 5.0, I_2 removed 84.1 and 91.9, chloropicrin times 25 and 27 min. A 700°C char (unactivated) of dextrose gave an I_2 removal 14.4%, a 700°C char of sucrose 16.0%, a 500°C char of cellulose 42.0%, and a 700°C char of starch 20.1%. Activated carbon briquets from lignite, steam-treated lignite, lignocellulose, cellulose, and Southern pine were essentially of the decolorizing type. Coconut-shell briquets gave an activated carbon with a chloropicrin time of 42 min.

13688. SMIRNOV, V.A.; DOBUSH, O.A., AND MYMRIKOVA, V.N. **Preparation of the decolorizing carbon Collactivit.** *Applied Chem. (U.S.S.R.)* 19, 651-8(1946)(in Russian).—*C.A.* 41, 4290*g*.

Samples were first prepd. by treating air-dry cellolignin (2g) at 150°C, with H_2SO_4 sp. gr. 1.80 (260% of anhyd. wt) for 5 min., filtering and washing 6 times with a total of 5000% H_2O. The activity *a*, detd. colorimetrically on a 6% soln. of com. xylose, was little affected by the moisture content of the initial material up to 10%, but fell rapidly with further increasing moisture, *a* falling to 1/2 for 40% H_2O. Various inorg. addns., Hg, CuO, H_3PO_4, $CuSO_4$, K_2SO_4, (5%), increased *a* by 23-36%; 0.5% $ZnCl_2$ increased *a* by 30%. On drying (at 120°C) *a* fell (approx. hyperbolically) with increasing length of drying. In storage in closed vessels at room temp. water-washed Collactivit lost *a* fastest, dried more slowly, acid-wets very slowly. Collactivit made from sawdust (pine, birch) was more active than that made from cellolignin, but yields were lower.

13689. WILLIAMS, A.E. **Activated carbon from coal.** *Mining J. (London)* 227, 1026-30 (1946).—*C.A.* 41, 2558*e*.

The type of coal used, briquetting of the powder, carbonization, activation, evaluation of activated carbon, detn. of moisture, water-sol. matter, particle size, oil-retention value, solvent recovery, and a large-scale activated-carbon plant were described.

13690. BODNÁR, LÁSZLÓ. **Distillation of sawdust and briquetting of charcoal powder.** *Magyar Kém. Lapja* 2, 245-51(1947).—*C.A.* 41, 7708*h*.

In the Holiday system 500 kg of sawdust yielded 13.5-14.0 kg of methanol. In briquetting charcoal powder the min. pressure required was 50 kg/cm². Good results were obtained with beet-sugar molasses as binding material in briquetting charcoal powder in the air-dry state (10-12% moisture content) with about 13-15% molasses. Acid wood tar caused severe corroding on machines; therefore, tars were previously neutralized by lime milk. The waste lyes of sulfite cellulose plants could be used in emergency cases as binding material.

13691. CHOWDHURY, J.K.; CHAKRABORTY, K.M., AND GHOSH, J.K. **Preparation of activated carbon from rice-husk. I. Activation by impregnation with boric acid, ammonium borate, and ammonium phosphate.** *J. Indian Chem. Soc. Ind. & News Ed.* 10, 40-6(1947).—*C.A.* 42, 6473*g*.

Rice husk was studied as a suitable raw material for the manuf. of activated carbon. After washing and sun-drying to 12.8% H_2O, analysis gave 13.6% ash, 43.7% cellulose, and 39.2% lignin (H_2SO_4). The husk was treated with varying amts. of reagent, dried, carbonized at 350°-450°C, extd. with HCl, washed and dried. Adsorption tests with I_2, 0.5 *N* AcOH, and 0.15% methylene blue soln. gave activities which were not in agreement.

13692. DANNER, CHARLES E. AND GOLDENSON, JEROME. **Determination of halogenated organic vapors in air by adsorption on specially prepared activated charcoal.** *J. Ind. Hyg. Toxicol.* 29, 218-24 (1947).—*C.A.* 41, 6494*i*.

Activated charcoal was prepd. from a puttylike mixt. of 120 g Cl-free light cylinder oil, 485 g Cl-free lampblack, and 260 g sucrose by heating in a vented Nichrome tube in 4 hrs to 800°C and holding at this temp. for 20 hrs. The tube was cooled and the fines passing a 16-mesh sieve rejected. It was then heated in a 3/4-inch silica tube in a vertical furnace to 875°C, steam passed through for 35 min. The Cl content of the product was about 0.008%. The unknown sample was passed through a column of this charcoal, 3/4 × 5 inches and Cl detd. in the ash of the charcoal. A S-free charcoal, which could probably be prepd. from sucrose alone, should be useful for detg. compds. contg. S, P, Se, or As.

13693. Krenkel, Theodore G. **The effect of temperature on the destructive distillation of wood from the white** *quebracho, Aspidosperma. Rev. facultad cienc. quim (Univ. nacl. La Plata)* 20, 19-24 (1947).—*C.A.* 42, 2418*g*.

Wood from *Aspidosperma quebracho* was placed in a retort and subjected to destructive distn. at 205°-400°C. The yields of AcOH, MeOH, Me_2CO, CO, CO_2, and charcoal were detd. The optimum temp. was found to be 300°C. Charcoal of superior quality resulted when the temp. was raised rapidly to 400°C and held there. Analyses were given for the wood used as a starting material and for the 10 different charcoals produced.

13694. Mukherjee, Sudhamoy and Bhattacharya, Sukhamoy. **Preparation of activated charcoal from bamboo.** *J. Sci. Ind. Research* 6, No. 1, B., 8-9 (1947).—*C.A.* 41, 4909*e*.

A thin bamboo (*Melocanna bambusoides*) and a thick variety (*Dendrocalamu strictus*) were used after the nodes were removed. The nodes from the thick bamboo were used separately. Solns. contg. 50-100 parts $ZnCl_2$ and 4.4-9.7 parts HCl were used for digesting 100 parts of bamboo (100 mesh) before carbonization at 600°-800°C. The charcoal was boiled with dil. HCl, washed to remove Zn, dried at 250°-300°C to remove HCl, and ground to 200 mesh. These charcoals had a much lower ash content, a higher adsorption for methylene blue, I_2, and AcOH, and a lower adsorption for caramel than a com. charcoal made in the U.S.A.

13695. Sarraillet, José M. **The preparation, activation and assay of charcoals obtained from poplar, alder, and cottonwood.** *Rev. facultad. cienc. quim.* 22, 91-109 (1947).—*C.A.* 45, 333*e*.

The yields, methods of activation, and assay of activity (adsorption of methylene blue) for the charcoals from the following woods were given: *Populus nigra* (Poplar); *Salix babylonica* (alder); *Erythrina cristagalli* (cottonwood).

13696. Simons, J.H. and McArthur, R.E. **Hydrogen fluoride as a condensing agent. XIX. Oxidation of organic compounds in liquid hydrogen fluoride.** *Ind. Eng. Chem.* 39, 364-7 (1947).—*C.A.* 41, 3439*c*.

When C_6H_6 in HF was treated with O_2 in a Cu bomb below 200°C in the presence of O-carriers, it gave PhOH and carbon with no evidence of ring rupture. The reaction took place at lower temp. when As or Se oxides were present; when Mo compds. were used, less PhOH and more carbon as well as some Ph_2 and BzOH were formed. In the absence of carriers, reaction was slower and some CO_2 was also formed. In high concns., BzOH was oxidized to carbon. At low ratios of C_6H_6 to HF, more carbon was formed, at high ratios, some CO_2 appeared. Diln. of HF with H_2O or MeOH raised the temp. required for the reaction.

13697. Žert, Karel. **Active charcoal industry in Czechoslovakia.** *Chem. Obzor* 22, 238-41 (1947). —*C.A.* 42, 2086*g*.

Present and past methods for manufg. active charcoals, their adsorbing capacity, and various applications (especially in the sugar-beet industry) were described.

13698. Alexa, Gheorghe and Rădulescu, Fluor D. **Activated carbon from nut shells and grape seeds.** *Bul. Inst. Natl. Cercetări Tehnol.* 3, 177-222 (1948) (in French).—*C.A.* 43, 9295*i*.

The prepn. of activated carbon by impregnation of nut shells and grape seeds with $ZnCl_2$, calcination at 875°C, and activation with steam was studied. The yield, homogeneity, and activity of the product depended on the uniformity of contact between the steam and the carbon, and on the temp. of the steam. The effects of superheater design, and of different methods for distributing the steam, were discussed.

13699. Araujo, Benedito de Jayme. **Beneficiation of ground charcoal and ground coke.** *Brazil, Ministerio agr., Dept.nacl. produção mineral, Lab. produção mineral, Bol.* 30, 11-28(1948).—*C.A.* 45, 7778*c*.

Mech. operations for cleaning charcoal and coke contaminated by extraneous dirt were described.

13700. Chowdhury, J.K.; Chakraborty, K.M., and Ghosh, J.K. **Preparation of activated carbon from rice husk. II. Activation by carbonizing in various gas atmospheres and secondary activation.** *J. Indian Chem. Soc. Ind. & New Ed.* 11, 83-96(1948).—*C.A.* 43, 4834*f*.

Dry rice husks were carbonized by heating at 400°C in atm. of HCl and NH_3. The primary carbon derived a basic character when carbonized in an acidic atm., and an acidic character when carbonized in a basic atm. Primary activations in N_2, steam, or CO_2 gave carbon with a poorer activity. Secondary activations with steam or CO_2 considerably increased the activity of the primary carbon. Temps. of 500-600°C were most effective, and CO_2 gave better activity than steam.

13701. Eaton, S.E.; Hyde, R.W., and Old, B.S. **Tracer study of sulfur in the coke oven.** *Am. Inst. Mining Met. Engrs., Iron and Steel Div., Metals Technol* 15, No. 7, Tech. Pub. No. *2453*, 20 pp (1948).—*C.A.* 43, 837*h*.

The results of the expt. indicated that the pyritic and org. S appeared in coke in proportion to their concn. in the coal. In view of the large initial evolution of org. S, coals contg. large amts. of org. S and small amts. of pyritic might be coked for a shorter time to produce coke contg. a given percentage of S. Coals high in pyrite S would have to be coked for a slightly longer period of time to obtain the same results.

13702. Godel, A. **Fluidization used in making activated carbon.** *Chem. Eng.* 55, No. 7, 110-11 (1948).—*C.A.* 42, 6964*a*.

A general description was given.

13703. Green, S.J. and Thakur, B. **The insoluble matter of coal tar. III. Some inorganic constituents of free carbon.** *J. Soc. Chem. Ind.* 67, 436-7 (1948).—*C.A.* 43, 3597*d*.

Zn was normally present in coals up to 0.01%, but 0.04% was found in the tar and 1-2% in the free carbon. A Zn-pyridine complex, probably $2C_5H_6N\text{-}ZnCl_2.2HCl$, was isolated from the carbon.

13704. KOROBKIN, V.A. **Optimum temperature for carbonization of wood.** *Stal* 8, 487-94(1948).—*C.A.* 44, 1246^e.

Air-dry pine wood was charred for 6 and 12 hrs at 250°-700°C. The moisture content of the sample was detd. and the yield of charcoal calcd. on a moisture-free wood basis. The yield of fixed carbon in 12-hr charring was greater (at any one temp.) than in 6-hr charring. The yield of fixed carbon increased with temp. up to 400°C and then began to decline. Charring for 12 hrs with a final temp. of 400°C yielded 28%. This charcoal contained: fixed carbon = 71.71, volatile substances = 27.43, and ash = 0.86%.

13705. OLLILA, OLLI AND HARVA, OLAVI. **The use of waste lignin from wood hydrolysis for the production of activated carbon and the characteristics of the carbon obtained. I.** *Suomen Kemistelehti* 21A, 42-53 (1948).—*C.A.* 42, 8445^e.

The activated carbon was prepd. by soaking waste lignin in the desired soln. overnight and heating the mixt. for 1 hr at 80°-90°C, after which the soln. was decanted; the waste lignin was dried for 1 day at 120°-30° and carbonized at 500°C. The product was washed with concd. HCl at 70°-80°C, washed 8-10 times with water to remove HCl, dried, and weighed. Yields of 50.8-70% of activated carbon were obtained when the impregnating soln. was $ZnCl_2$, d. 1.17-1.90, the impregnation ratios were 100-152%, and the time of heating was 1-4 hrs. The adsorption of methylene blue was 13-379 mg/g carbon. With H_3PO_4 as an impregnating agent and a temp. of 700°C, an activated carbon with an adsorption value of 695 mg/g was obtained. Best results were obtained with 1.70-1.82 d. $ZnCl_2$, an impregnating ratio of 270%, and a temp. of 500°C.

13706. RUESS, G.L. AND RUSTON, W.R. **Electron microscopic investigation of activated charcoals.** *Monatsh* 78, 193-9(1948).—*C.A.* 42, 7957^g.

The electron microscope was used to confirm the production of small pores of charcoal during activation in CO_2 at 950°C. The pore structure of an active carbon (Noritsupm) was coarser than that of a good gas-adsorbing charcoal (Degea 106) or of an activated sugar charcoal.

13707. SCHLAPFER, P. AND BROWN, R. **The structure of charcoals.** *Eidegenoss. Materialpruf. u. Versuchsanstalt Ind. Bauw. u. Gewerbe, Zurich No.* 153, 121 pp. (1948).—*C.A.* 44, 308*i*.

Twenty-one Central European woods and the resulting charcoals obtained both at 400°C and at 1000°C were described, identified, and illustrated with 69 photomicrographs.

13708. SZUBA, JERZY. **Activated carbon.** *Przemysl Chem.* 4, 307-9(1948).—*C.A.* 42, 9122*i*.

The manuf. and applications of activated carbons were reviewed.

13709. TACHIBANA, TARO AND ICHIKAWA, HIROMASA. **Hydrothermal change of sugar with inorganic salts.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 69, 81-4(1948).—*C.A.* 44, 9222*a*.

The effects of inorg. salts on the carbonization of sugar solns. were studied in the light of hydrothermal reactions. Inorg. salts effective in carbonization of sugar solns. also promoted resin formation in furfural. The action of the inorg. salts was caused by the H ions formed by hydrolysis of the salts as well as by the catalytic action of the salts themselves. The no. of colloidal particles in the sugar solns. was measured. The purity of sugar was detd. by the fluorescence in ultraviolet light.

13710. TAKAHASHI, HARUO. **Carbonization phenomena. III. Carbonization of carbohydrates.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 69, 97-100(1948).—*C.A.* 44, 9222*b*.

The relation between the residue from the carbonization of polyhydroxy compds. and their mol. structure was studied. Sugars and acids underwent carbonization, but alcs. did not. Thermal changes (dehydration and esterification) occurring in a part of the mol. made the residual OH radicals removable, and condensation resulted. Polysaccharides were believed to carbonize after being decompd. into monosaccharides.

13711. TAKAHASHI, HARUO. **Carbonization phenomena. IV. Carbonization of mixtures of polyhydroxy compounds with organic acids, proteins, and dyes.** *J. Chem. Soc. Japan*, Pure Chem. Sect. 69, 100-2(1948).—*C.A.* 44, 9222*d*.

When acetic, oxalic, molonic, succinic, glutaric, adipic, maleic, fumaric, malic or tartaric acid was added to mannitol, glucose, or fructose with a mol. ratio of 1:1, the mixts., except with acetic, oxalic, and malonic acids, underwent carbonization.

13712. DUBININ, M.M. AND ZAVERINA, E.D. **Sorption and structure of active carbons. V. Active carbons from tar coke.** *Zhur. Fiz. Khim.* 23, 993-1004 (1949).—*C.A.* 44, 899*i*.

Charcoal prepd. by heating birch tar to 500°-550°C was heated in a current of CO_2 at 850°C; the rate of wt-loss was small (0.6%/hr) when the yield of charcoal from tar was great (46%; specimen *I*), medium (6%/hr) when the yield was 19-23% (*II* and *III*), and great (11%/hr) when tar was heated with H_3PO_4 (IV). *I* was inactive. *II* and *III* were active; when the duration of heating in CO_2 was such that wt loss from crude charcoal was small (less than 5-10%), the adsorption of AcOH was greater than that of $EtCO_2H$, valeric, and heptanoic acids. Other soln. systems were used to evaluate the products.

13713. GUPTA, N.N. **A new spacing in carbonized organic substances.** *J. Sci. Ind. Research (India)* 8B, No. 12, 237-8(1949).—*C.A.* 44, 5562*i*.

Sawdust and shellac were carbonized at 800°-1000°C under 100 atm. pressure of A. X-ray diffraction studies showed the strongest band at 6 to 4.8 A. spacing with av. at about 5 A. in agreement with similar band found in some types of coal. The shift with temp. was assumed due to change of particle size. Future work to 1000 atm. and 3000°C was indicated.

13714. KAZAKOV, E.I. **Investigation of the process of low-temperature decomposition of the constituent components of peat.** *Izvest. Akad.*

Nauk S.S.S.R. Otdel. Tekh. Nauk 1949, 1219-30.—*C.A.* 45, 6821*d*.

Waxes, resins, cellulose, water-sol. substances, lignin, and humic acids were dry distd. to det. yield and compn. of primary tars. With increasing degree of change of peat, the amt. of carbohydrates and lignin therein decreased while that of bitumens and humic acids increased relatively. Therefore the formation of primary tar from carbohydrates and lignin was directly proportional to the degree of change of peat, while for bitumens and humic acids, it was inversely proportional.

13715. MASLENIKOV, M.S. **Optimum conditions of producing carbon black.** *Legkaya Prom.* 9, No. 7, 25-8(1949).—*C.A.* 47, 1913*f*.

Results of 311 analyses of flue gases made during various conditions of operation (combustion of oil) of carbon-black furnaces were used to det. yield of carbon black as a function of excess air, O_2 concn., and temp. of combustion.

13716. MUKHERJEE, SUDHAMOY AND BHATTACHARYA, SUKHAMOY. **Effect of chemical treatments on the properties of activated charcoal.** *J. Am. Chem. Soc.* 71, 1725-9 (1949).—*C.A.* 43, 6396*c*.

The ash contents, bulk density, and adsorption of methylene blue, caramel, I_2, and HOAc were studied for charcoals prepd. from groundnut hull and coconut shell with $ZnCl_2$, $CaCl_2$, H_2SO_4, and NaOH for pre-digesting the raw material, followed by carbonization at 600-800°C. Pre-digestion with acidulated $ZnCl_2$ generally produced the most active charcoals if present in the raw material during carbonization. Pre-digestion with the other reagents gave a charcoal of low adsorptive power, although the $CaCl_2$-treated sample adsorbed caramel well.

13717. WOTSCHKE, J. AND PAASCH, K. **Acetylene black, an industrial example of a turbulent flame reaction.** *Schweiz. Arch. angew. Wiss. u. Tech.* 15, No. 6, 175-87(1949).—*C.A.* 44, 6105*c*.

The physicochem. principles of the production of C_2H_2 black were discussed in some detail. Lab., pilot-plant, and industrial methods for carrying out the reaction were described.

13718. AHMED, MOFIZUD-DIN AND KINNEY, CORLISS R. **Pyrolysis of humic acids prepared from oxidized bituminous coal.** *J. Am. Chem. Soc.* 72, 556-9 (1950).—*C.A.* 45, 1323*a*.

The pyrolysis of the humic acidlike oxidation products from a bituminous coal converted about 13% of the C to volatile substances, CO_2, CO, and CH_4. The amt. of CO_2 corresponded to an equiv. wt of 242. Neither fusion nor the evolution of volatile aromatic fragments was observed.

13719. AHMED, MOFIZUD-DIN AND KINNEY, CORLISS R. **Ozonization of humic acids prepared from oxidized bituminous coal.** *J. Am. Chem. Soc.* 72, 559-61(1950).—*C.A.* 45, 1323*b*.

Both carbonic and oxalic acids were primary products in the ozonization of the humic acids and accounted for about 65% of the carbon. Practically all of the remaining carbon was converted into almost colorless, water-sol., O_3-resistant acids. Although carbon black and graphite oxide did not react with O_3 appreciably, the brown water-sol. acids prepd. by oxidizing carbon black with HNO_3 did react like the humic acids, giving carbonic, oxalic, and O_3-resistant acids.

13720. ALBERTI, HANS JOACHIN V. **The behavior of sulfur in the low-temperature carbonization of lignite.** *Bergbau u. Energiewirt.* 3, 159-64 (1950).—*C.A.* 45, 6365*i*.

The ratio of the total S in the coke to the total S in the coal was const. The Fischer carbonization usually gave lower yields for volatile S as well as for S of the coke ashes in the retorts than the carbonization process with recycled gases. The quality of the lignite itself, the carbonization temp. and the operation of the oven had a very great influence on the behavior of the S. The combustible S content in the coke could be controlled by raising the carbonization temp. and lowering the vol. of the cooling gases.

13721. ALINARI, ERNESTO. **Carbonization and dry distillation of wood.** *Italia forest. mont.* 5, 136-41(1950).—*C.A.* 44, 11066*a*.

In the manuf. of wood charcoal the av. yield (in vol.) from coniferous plants was 60%, that from *latifoliae* 50%; the av. yield in wt was 20-25%. A rapid carbonization may lower the yield even 15% (in wt).

13722. ASAOKA, NOBUTOSHI AND ISHIBASHI, WATARU. **The preparation of active carbon from lignite.** *J. Fuel Soc. Japan* 29, 117-20(1950).—*C.A.* 44, 10301*b*.

The active carbon prepd. from the portion of lower sp. gr. by carbonizing and activating with steam was superior in adsorption power to that from the other fraction. Comparative tests were also carried out on the adsorption power of active carbons from the wood as well as coal lignites, and wood lignite was more satisfactory than the coal lignite. A satisfactory active carbon could be made by choosing a lignite rich in the so-called woody structure.

13723. BARKER, H. **Unusual phosphatic material in the Sutton Hoo ship burial.** *Nature* 166, 348(1950).—*C.A.* 45, 915*c*.

Chem. investigation of a fragment thought to be unburnt bone revealed it to be essentially a hydrated ferric phosphate. A probable mechanism for its formation was suggested by the proximity of Fe fragments of the ship, the phosphate ion being formed from soln. of bone remote from the Fe. The combined action thus formed a cast of the bone fragment.

13724. BEUSCHLEIN, WARREN L. **Production of wood coke from waste wood.** *Univ. Washington Eng. Expt. Sta. Bull.* No. 117, 9-39(1950).—*C.A.* 47, 3544*h*.

The wood dried in a rotary, direct-fired, counter-current drier, and distd. in a Stafford retort, yielded charcoal 38, condensate 42, and gases 20%. The liquid condensate products were concd. in a pot still and mixed with the pulverized charcoal. The mixts. were molded under a pressure of 5000 p.s.i. resulting in briquets of d. 0.62-0.65 and crush resistance of 330-400 p.s.i. The briquets were coked at 650°C for about 30 min.

13725. Cox, John T. Jr. **High quality-high yield carbon black.** *Chem. Eng.* 57, No. 6, 116-17 (1950).—*C.A.* 44, 8225*b*.
The manuf. of channel-type carbon black was described.

13726. Doss, K.S.G. and Singh, Ajit. **Activated carbon from molasses.** *Proc. Sugar Technol. Assoc. India* 19, 230-2(1950).—*C.A.* 46, 3781*d*.
A high-class decolorizing carbon was prepd. by mixing molasses and $CaCl_2$ in the ratio 1:1 by wt, igniting in a closed retort to expel volatile matter, and leaching with acid to remove ash constituents.

13727. Dubinin, M.M. and Zaverina, E.D. **Sorption and structure of active carbons. VIII. Structure of active carbons obtained by using inorganic activating substances.** *Zhur. Fiz. Khim.* 24, 470-8(1950).—*C.A.* 44, 8195*a*.
Carbons were prepd. by heating sucrose with various proportions of $ZnCl_2$ at 600°C for 1 hr and washing with 3 *N* HCl and then with H_2O. The yield (25-35%) of carbon activated by $ZnCl_2$ was 15 times that obtained in activation by CO_2. Activation with $ZnCl_2$ at 850°C gave almost identical results.

13728. Gernert, Georg. **Bone as raw material.** *Seifen-Ole-Fette-Wachse* 76, 509-12, 531-3(1950). —*C.A.* 45, 2688*h*.
Procedures were described to obtain fat from bones by boiling with water, treatment in an autoclave, and solvent extn., use of glue-contg. bone meal as feed, for the production of gelatin and glue, and use of glue-free bone meal as fertilizer. The prepn. of bone char, bone ash, and exts. for medicinal purposes were mentioned.

13729. Giuntini, L. **Utilization of petroleum coke in the gas industry.** *Riv. combustibili* 4, 347-55(1950).—*C.A.* 45, 847*d*.
Petroleum coke as produced in a refinery was a product which varied widely in characteristics depending on quality of treated crude, the temp. of processing, and the cycle time. The residue from distn. was useful for manuf. of electrodes in various industries when ash plus S content was less than 1%, and volatile matter under 1%. Particular attention should be paid to S content, since too high a content (2-5%) would require an addnl. purification process.

13730. Grohma, Otto. **Preparation of activated carbon from peat.** *Gas, Wasser, Wärme* 4, 1-10 (1950).—*C.A.* 44, 5567*e*.
Comparison was made of activated carbons prepd. from peat by 4 procedures: (1) heating peat without air; (2) activating with steam; (3) coking and activating with air; and (4) combining steam and air activation. The combined steam-air activation improved the quality of the coke. Washing the activated coke with HCl to remove minerals and reduce the ash content was found to have little effect on the activity.

13731. Jones, G.W.; Kennedy, R.E.; Spolan, I., and Scott, G.S. **Carbon blacks formed by decomposition of mixtures of acetylene with a hydrocarbon or other gas at elevated pressures.** *U.S. Bur. Mines, Rept. Invest.* No. 4695, 9 pp. (1950).—*C.A.* 44, 6104*i*.
Definite mixts. of the exothermic gas C_2H_2 and the endothermic gas to be tested were exploded in a high-pressure bomb. The gaseous decompn. products were analyzed, the deposit of carbon black was collected and its phys. properties detd. The test gases included CH_4, natural gas, N_2, He, CO_2, C_2H_6, C_3H_8, and C_4H_{10}. Ninety percent or more of the carbon in the test mixts. was converted to carbon black. Certain C_2H_2-CO_2-hydrocarbon mixts. were exploded at elevated pressures to give gaseous products composed esssentially of 2 parts of H_2 and 1 part of CO.

13732. Khan, H.A.; Datar, D.S., and Zahear, S. Husain. **Activated charcoal from groundnut hulls.** *J. Sci. Ind. Research* (India) 9B, 236-7 (1950).—*C.A.* 45, 5391*b*.
A process for the prepn. of activated charcoal from groundnut hulls was developed. A 44% yield of charcoal was obtained by heating the powd. hulls at 320°C for 4 hrs. The charcoal had an adsorption value of 616 mg of I_2 per g of charcoal. The yield of charcoal decreased with increasing temp. of carbonization, but the activity increased to a max. at a carbonization temp. of 500°C, and decreased at still higher temps.

13733. Kipling, J.J. **Carbonization of coal in relation to the production of active charcoals.** *Fuel* 29, No. 2, 42-7(1950).—*C.A.* 44, 3235*c*.
The properties of activated charcoals prepd. from coal depended on the carbonizing conditions. For a particular blend of 2 coals, slow carbonization gave cokes which could be activated to charcoals having higher adsorptive capacity for gases and vapors and lower mech. strength than those resulting from fast carbonization. Passage of steam through the coal during carbonization affected the coke properties, but had little effect on the charcoal properties. When these cokes were further heated to 890°C and kept at this temp. for 30 min., a considerable loss in material occurred, and the cokes increased in hardness, apparent density, moisture satn. value, and decrease in pore vol.

13734. Korver, J.A. **Production of ash-free, active charcoal.** *Chem. Weekblad* 46, 301-2 (1950).—*C.A.* 44, 7465*i*.
Large amts. of ash-free charcoal could be made by steeping in 35% HF (4 liter per kg) for several days in a paraffined vessel. After washing with strong HCl, 25% NH_3, and water until chloride free, the ash content of the charcoal was about 0.08%.

13735. Kotelkov, N.Z. **Active carbon from some industrial wastes.** *J. Applied Chem. U.S.S.R.* 23, 1387-92(1950) (Engl. translation).—*C.A.* 46, 8351*f*.
Active carbon was produced from castor-seed and sunflower-seed husks(wastes from oil-extn. plants) and from the wastes of furfural manuf. from the sunflower-seed husks. Both carbonization (dry distn.) and activation were effected in cylindrical iron retorts with a capacity of 230 ml, a diam. of 3.7 cm, and a wall thickness of 2 mm, heated in a tubular elec. furnace with temp. regulator. A distn. temp. of 700-800°C for 5-6 hrs appeared to be most suitable for all of these wastes. Copious wetting of the crude carbon with water followed by calcining for 5-6 hrs at 750-

800°C was an effective method of activation. Repeated moistening and calcining enhanced the activity of carbon prepd. by preliminary activation. Preliminary treatment with H_2SO_4 and steam was beneficial. The presence of moisture during activation eliminated local overheating and regulated the reaction rate; this gave a more uniform product.

13736. MUKHERJEE, SUDHAMOY AND BHATTACHARYA, SUKHAMOY. **Influence of oxidizing agents on the adsorptive power of charcoal. II. Potassium dichromate.** *J. Indian Chem. Soc., Ind. & News Ed.* 13, 13-17(1950).—*C.A.* 45, 332*f*.

Treatment of $ZnCl_2$-activated charcoal with approx. 0.02, 0.05, 0.1, 0.2, 1.0, and 4.0 *N* solns. of acidified $K_2Cr_2O_7$ resulted in increased adsorptive power for methylene blue, I_2, and caramel at low $K_2Cr_2O_7$ concns. The activity was max. at 0.05 *N* and decreased at higher concns. Treatment of nonactivated charcoal with 0.02, 0.1, and 1.0 *N* acidified $K_2Cr_2O_7$ showed a similar effect, with max. activity at 0.1 *N*. The adsorptive power of activated charcoal was increased by 0.05 and 1.0 *N* neutral $K_2Cr_2O_7$, the adsorption of methylene blue and I_2 being less, and of caramel greater, for 1.0 than for 0.5 *N*.

13737. MUKHERJEE, SUDHAMOY AND BHATTACHARYA, SUKHAMOY. **Influence of oxidizing agents on the adsorptive power of charcoal. III. Bromine, perchloric acid, and potassium persulfate.** *J. Indian Chem. Soc., Ind. & News Ed.* 13, 18-23 (1950).—*C.A.* 45, 332*i*.

Treatment of activated charcoal with various concns. of Br_2 water in the cold and with boiling $HClO_4$ and $K_2S_2O_8$ solns. resulted in an initial increase in adsorptive power for methylene blue, I_2, and caramel with concn. of the oxidizing agent, and then a decrease at higher concn., max. adsorption usually occurring at approx. 0.05 *N*. With $K_2S_2O_8$, however, max. adsorptivity for methylene blue and I_2 corresponded with the max. concn. of persulfate used, 0.467 *N*. No clear max. in the adsorptive power of nonactivated charcoal was indicated, although for methylene blue and I_2, it was considerably increased by treatment; caramel was not adsorbed at all by nonactivated charcoal, treated or untreated.

13738. ORESHKO, V.F. **Ignition temperature of coals.** *Doklady Akad. Nauk S.S.S.R.* 71, 331-3 (1950).—*C.A.* 44, 10295*e*.

"Ignition temp." of coal was detd. by plotting wt of coal against temp. during continuous heating. The temp. of max. wt of coal corresponded to the transition from the period of controlled oxidation, accompanied by formation of solid CO-complexes and increase in wt to the period of low-temp. burning, accompanied by smoke and ash formation and rapid loss of wt. "Ignition temp." was defined as the temp. of max. wt.

13739. RAKOVSKIĬ, V.E. AND RIVKINA, KH. I. **The nature of the mechanical strength of peat.** *Torfyanaya Prom.* 27, No. 1, 29-30(1950).—*C.A.* 45, 845*e*.

The conversion of high-mol.-wt acids in peat into bivalent (Ca) salts and trivalent (Fe and Al) salts contributed to the decreased sizing action of these materials. Lower peat had poorer mech. strength than upper peat owing to a predominance of salts in the lower layers and of free compds. in the upper layers.

13740. SAKIKAWA, NORIYUKI. **Organic geochemical reactions. I. The role of mineral waters in the formation of coal.** *J. Chem. Soc. Japan,* Pure Chem. Sect. 71, 295-7(1950).—*C.A.* 45, 4424*e*.

The acidic mineral waters formed by the oxidation of sulfide ores reacted with peat and as a result of this reaction, humic acids contained in the peats were fixed and then changed to lignite or bituminous coal by thermal and catalytic actions.

13741. TERRES, ERNEST. **The coking process.** *Gas- u. Wasserfach* 91, No. 19 (Gas), 229-38(1950).—*C.A.* 45, 1325*c*.

Photomicrographs of coke sections at various carbonization stages showed how types of coal changed on heating. The swelling of the coal charge during carbonization was detd. by its petrographic compn.; sufficient of the dull coal was required in a predominantly bright coal blend to prevent excessive swelling and undue pressure on the walls of the carbonizing equipment. An app. was described for detg. swelling pressures during carbonization at const. vol.

13742. BAFNA, S.L.; PAI, M.U., AND SHAH, H.A. **Carbonaceous exchangers by sulfonation of Indian coal.** *Current Sci.* (India) 20, 233 (1951).—*C.A.* 46, 2717*e*.

The prepn. of a cation exchanger by sulfonation of a semi-bituminous Indian coal was described. Exchange capacities as high as 1.55 meq./g were obtained.

13743. BHATNAGAR, M.S. AND NIGAM, P.C. **Organic adsorbents from Indian tannins. I. Preparation, activation, and relative adsorptive powers.** *J. Applied Chem.* (London) 1, 517-20(1951). —*C.A.* 46, 2873*h*.

Katha and cutch (edible exts. of catecholtype tannins) were sulfonated and condensed with formalin. The products adsorbed, resp., 95% and 65% fatty acids from 0.01 *M* soln. Resins obtained by sulfonation showed little adsorption of acids. Resins obtained by direct condensation of katha and cutch with formalin showed 15% and 0% adsorption, resp., of benzoic acid. Resins were comparable with Amberlites, Zeo-carbs, and Ionac resins.

13744. BITTENCOURT, BENOUR C. AND HOEFEL, HELIO A. **Black acacia charcoal.** *Anais assoc. quím. Brasil* 10, 277-94(1951).—*C.A.* 47, 5665*b*.

The bark of black acacia (*Acacia decurrens var. molissima*), a tree originating in Australia, was a source of tanning material in Rio Grande Do Sul, leaving the wood to be used as a fuel, either as such or as charcoals. The charcoals were evaluated in accordance with applicable ASTM methods and U.S. Federal Specification L-L-L-C-251 (1933).

13745. BURGOYNE, J.H. AND RICHARDSON, J.F. **Influence of zinc chloride on the ignition of Scotch pine and its charcoal.** *Fuel* 30, No. 1, 13-16 (1951).—*C.A.* 45, 2181*d*.

The effect of impregnation with various proportions of $ZnCl_2$ upon the pyrolysis and ignition of Scotch pine sawdust was examd. The presence of the salt lowered the temp. at which carbonization began, increased the yield of charcoal at a given temp., and raised the ignition temp. of the charcoal as detd. after cooling. The impregnation of preformed charcoal with $ZnCl_2$ also raised its ignition temp.

13746. Kosaka, Yujiro. **Ion exchangers prepared from coals. III-VI.** *J. Fuel Soc. Japan* **30**, 179-89(1951).—*C.A.* 46, 1668*i*.

Ion exchangers prepd. by the H_2SO_4 treatment of coal were used as the catalyzers of esterification of higher fatty acids, and as the exchange columns in the percolating method for desalting hard water. The cation exchangers were used as the catalyzers of ethyl and butyl esterification of hardened soybean-oil fatty acids; the sulfonic acids groups of the exchangers were found to have catalytic activity. Desalting tests of the artificial hard water in the percolating method were carried out, the pH values of effluents being measured, and the variation of the pH values of supplied water as well as the variation of activity of the exchanger in the successive uses were studied.

13747. Kramers, W.J. **The preparation of highly reactive chars from coal and their interaction with sulfur.** *J. Applied Chem.* (London) 1, 189-95 (1951).—*C.A.* 45, 7774*g*.

Carbonized coal briquets were produced which were highly reactive to S and promising as a substitute for wood charcoal in the manuf. of CS_2. The influence of the process variables on the strength and reactivity of the product was discussed. These included the nature of the coal and its modification, mineral matter and moisture in coal, coal size and size distribution, prepn. of raw briquets, rates of carbonization, atm. of carbonization, and temp. of carbonization.

13748. Romwalter, A. and Fekete, A. **Removal of ash formers from mineral coal by nitric acid.** *Acta Tech. Acad. Sci. Hung.* 2, No. 1, 59-72 (1951).—*C.A.* 46, 11630*c*.

One treatment with HNO_3 reduced ash formation in coal as much as repeated treatments with HCl. However, the HNO_3 severely modified the character of the coal. It lost its ion-exchange capacity, was sol. in alkali and NH_4OH, and reduced silicate ash formers, in addn. to limonite and $CaCO_3$. The method may serve for the production of huminate and humic acid, which in turn serves as a source of PhOH and carbohydrates, a process 10 times as efficient as tar distn.

13749. Anon. **Carbon recovery from black ash.** *Chem. Eng.* 59, No. 3, 206-9(1952).—*C.A.* 46, 4200*f*.

The process used for recovering carbon for production of activated carbon from black ash (incinerated "black liquor" formed after cooking pulpwood with an alk. liquor by the soda or sulfate process) was described.

13750. Arthur, J.R.; Kapur, P.K., and Napier, D.H. **Carbonaceous deposits from hydrocarbon diffusion flames.** *Nature* 169, 372-3(1952).—*C.A.* 46, 5292*b*.

Expts. were described in which normal and reversed diffusion flames of gaseous hydrocarbons were allowed to form carbonaceous deposits. The nature of these varied with the flame arrangement and the location of the cooled target.

13751. Behrens, Hans. **Soot formation and radical equilibria in flames.** *Z. physik. Chem.* **199**, 1-14(1952).—*C.A.* 46, 11633*f*.

Radical equilibria in flames were discussed extensively on the basis of observations of luminosity owing to soot formation. The soot formed by the reaction: $CO + H = C_{(solid)} + OH$ followed by $CO + OH = CO_2 + H$ or $H_2 + OH = H_2O + H$. The fine structure of the luminosity from faintly luminous C_2H_2 flames, in which the soot formation was close to thermodynamic equil., could be analyzed in terms of variations of the (H)/(OH) ratio from the equil. value. An enhanced luminosity in a zone just after the flame front was assocd. with rapid recombination of OH radicals in two-body processes, contrasted with slower recombination of at. H in three-body processes, the result being that the (H)/(OH) ratio was increased in this region. This favored soot formation.

13752. Dubinin, M.M. and Zaverina, E.D. **Control of the structure of active carbons from sugar.** *Doklady Akad. Nauk S.S.S.R.* 84, 93-6 (1952).—*C.A.* 46, 8457*f*.

Sucrose carbons, activated with CO_2 at 850°C to wt-losses of 6, 11, 19, 41 or 62%, had micropore vols. of 0.09, 0.20, 0.28, 0.50, 0.81 ml/g, resp., and intermediate-pore vols. of 0.01, 0.01, 0.01, 0.02, 0.7 ml/g. A concd. soln. of sucrose and $ZnCl_2$ was evapd., the residue carbonized in an inert medium, and washed. The type of porosity obtained in this way was detd. by the dispersity of the salt upon evapn. of the soln. which could be controlled by the viscosity of the soln. Addn. of carbonates yielded carbons with a large vol. of intermediate pores, characterized by a steep rise of the adsorption isotherm for C_6H_6 vapor at high relative pressures; the vol. of the intermediate pores obtained 0.30-0.85 ml/g, as compared with only 0.1 ml/g for carbons of low intermediate porosity.

13753. Hassler, John W. **Active carbon.** *Northeastern Wood Utilization Council Bull.* No. 37, 93-101(1952).—*C.A.* 46, 4200*e*.

Methods for production of active carbon, and of industrial applications of active carbon were reviewed. The amt. of active carbon produced from charcoal was small.

13754. Kitagawa, Mutsuo and Narita, Isao. **Active carbon activated from zinc chloride. III. Relation of the decolorizing power to the apparent density, combustion loss (yield), and ashes.** *Sci. Ind.* 26, 334-7(1952).—*C.A.* 47, 2960*c*.

Pine sawdust was baked in aq. $ZnCl_2$ to 2 types of active carbon, namely (1) above 600°C that adsorbed methylene blue and I_2 strongly, and (2) above 730°C with 80% $ZnCl_2$ that decolorized caramel but adsorbed the above less.

13755. Kratzl, Karl. **Thermal treatment of wood with water.** *Mitt. österr. Ges. Holzforsch.* 4, 45(1952).—*C.A.* 46, 9298*f*.

Spruce was heated in H_2O at 200°C for 20 hrs. A "polymer of phenolic units" was formed which was the main carrier of the MeO groups. Isolated lignin when heated under similar conditions with or without water gave similar results. On heating wood at 200°C in the absence of H_2O, a residue was obtained having a higher potential vanillin and lower content of the above polymer. Cross sections of wood heated in H_2O showed an intense darkening in those places where lignin was concd. (middle lamella, ray cells).

13756. Othmer, Donald F. **History and present status of the industry-continuous carbonization, the Mellman retort.** *Northeastern Wood Utilization Council Bull.* No. 37, 49-65(1952).—*C.A.* 46, 4195*d*.

The chemical by-products (MeOH, HOAc, acetone) did not compete pricewise with their synthetic counterparts, but charcoal remained in command of its market because it could not be synthesized economically. Current practice was toward charcoal production without by-product recovery, whereby plant investments were reduced appreciably. The Mellman retort, for the continuous production of charcoal without recovery of chemicals, was described in detail.

13757. Puri, Balwant Rai; Lakhanpal, M.L., and Varma, Balvir. **Preparation of active carbon from a few indigenous sources and comparative efficiency of different activation treatments.** *Research Bull. East Punjab Univ.* No. 19, 1-11 (1952)(in English).—*C.A.* 47, 6636*b*.

Active carbon was prepd. from acacia and pine wood, cotton stalks, coconut shells, and sugar carbonized at 550-600°C. In each case the chars were activated by 3 methods: mixing with H_3PO_4 and heating 9 hrs at 950°C in N_2, mixing with 50% $ZnCl_2$ soln. and heating for 5 hrs at 650°C, and treating with steam for 10 hrs at 950°C. The cotton-stalk char yielded the best adsorbent and also showed the highest relative increase in true d. and the largest relative decrease in apparent d. on activation. In general, the higher the d. the better the adsorptive properties of the active carbon. On activation all of the carbon tended to become more hydrophilic and less organophilic.

13758. Shearon, Will H. Jr., Reinke, R.A., and Ruble, T.A. **Oil black.** *Ind. Eng. Chem.* 44, 685-94(1952).—*C.A.* 46, 7314*c*.

In a typical oil-black process, thermally cracked recycle oil high in aromatic content was vaporized and cracked by burning gas-air mixts. below 2600°F. The resulting mixt. was quenched by water sprays and cooled, and the carbon removed by electrostatic precipitators and cyclones. The collected black was agglomerated in mills to 0.02-in pellets of d. 24.5-25.5 lb/cu. ft.

13759. Suzuki, Zenro. **Chemical studies on active carbon. I. Mechanism of single heating activation.** *J. Chem. Soc. Japan,* Pure Chem. Sect. 73, 478-81 (1952).—*C.A.* 47, 4582*h*.

Active carbon prepd. from various plants was calcined at 650°, 750°, 850°, and 950°C. The alky. of the soln. obtained by leaching the active carbon with water, as well as the adsorbing power of the active carbon for methylene blue, increased with the rise of the temp. of calcination.

13760. Venkatraman, R.S.; Khan, H.A.; Datar, D.S., and Zaheer, S.H. **Activated charcoal from groundnut hull.** *Chem. Age* (India) Ser. 6, 119-20(1952).—*C.A.* 47, 3544*f*.

Expts. showed that powd. hulls predigested with 40% of $ZnCl_2$ (based on the wt of the hulls) and heated at 320°C *in vacuo* gave 55.5% yield of charcoal. A yield of 36.6% charcoal was obtained with 60% $FeCl_3$ under the same conditions. The higher results over previously published data were due to carbonization at a lower temp. in complete absence of air and cooling in the absence of air. Low-temp. carbonization was found to favor color adsorption. Slight alterations in carbonization conditions varied the adsorption capacity of the final product.

13761. Comerford, F.M. **Carbon particle formation in a gaseous fuel.** *Fuel* 32, 67-76(1953).—*C.A.* 47, 2953*i*.

C_3H_8 was passed through an elec. tube furnace under controlled soot-forming conditions (temp. and aeration). The emissivity in the visible spectrum of a layer of soot-bearing gas 1 cm thick increased rapidly with temp. above 950°C, reaching 0.9 at 1100°C for a heating time of 1 sec. A higher temp. was required to produce the same emissivity in less time. Premixing air with C_3H_8 reduced the emissivity for the same time and temp., although it was still appreciable after 1 sec. at 1050°C with 1/5 of the air required for a stoichiometric mixt.

13762. Garner, F.H.; Long, R., and Throp, N. **Carbon formation in hydrocarbon diffusion flames.** *Fuel* 32, 116-17(1953).—*C.A.* 47, 2960*e*.

Aromatic, naphthenic, and paraffinic fuels were burned in diffusion flames and the soot formed was collected and extd. by solvents. The major products extd. from the soot, assumed to be intermediates in carbon formation. were sepd. into groups by steam distn. and by chromatography. Many of the fractions thus isolated from the different types of fuel were similar to one another. It seemed probable that the carbon was formed through the production and further reaction of a diene. This intermediate would have only a transient existence and would readily give rise to fulvenes and polymers of fulvenes.

13763. Hadzi, D. **Structure of possible intermediates in carbon formation during pyrolysis of organic compounds.** *Fuel* 32, 112-13(1953).—*C.A.* 47, 2960*g*.

An intermediate stage in the formation of carbon from simple compds. in the condensed state may consist in the formation of large, noncondensed polycyclic mols. which subsequently dehydrogenate to graphitic lamellas. Asphaltenes were isolated from the solid products of thermal decompn. of polyvinyl chloride and β, β-dinaphthylsulfone, from pyrolysis products of C_6H_6 and 1,2,3,4-tetrahydronaphthalene at 700-800°C and dihydroanthracene at 400°C, and finally from the products of the reaction of naphthalene and anthracene, resp., with anhyd. $AlCl_3$ at 190°C. Infrared spectra were detd. for a no. of these exts.: all of them showed the same characteristic bands, with similar intensities, indicating that the materials examd. possessed basically similar structure. These fractions may be common intermediates in the formation of graphitizing carbons.

SOURCES OF BIBLIOGRAPHY

The books listed below on various topics of adsorption phenomena have been examined for scientific literature references. These books have been arranged alphabetically with regard to the authors or editors.

Babbitt, H. E. and Doland, J. J., *Water Supply Engineering*, 3d edition, McGraw-Hill Book Co., Inc., New York, 1939.

Barrer, R. M., *Diffusion in and Through Solids*, Cambridge University Press, England, 1941, The MacMillan Co., New York, 1941.

Bell, H. S., *American Petroleum Refining*, 3d edition, Chapter 25, D. Van Nostrand Co., Inc., New York, 1945.

Bikerman, J. J., *Surface Chemistry for Industrial Research*, 464 pp., Academic Press Inc., New York, 1948.

Block, Richard J.; LeStrange, Raymond, and Zweig, Gunter, *Paper Chromatography. A Laboratory Manual*, 195 pp., Academic Press Inc., New York, 1952.

Brimley, R. C. and Barrett, F. C., *Practical Chromatography*, 128 pp., Reinhold Publishing Corp., New York, 1953.

Busche, Robert M.; Batchelder, Howard R., and Armstrong, Willard P., *Selected Bibliography of Coal Gasification*, 28 pp., Bureau of Mines, Report of Investigations 4926, U. S. Department of Interior, November 1952.

Buzzard, R. W. and Cleaves, H. E., *Hydrogen Embrittlement of Steel, Review of the Literature*, Natl. Bur. Standards Circ. 511, Superintendent of Documents, Washington 25, D. C., 1951.

Cassidy, Harold G., *Technique of Organic Chemistry, Volume V, Adsorption and Chromatography*, 1st edition, 360 pp., Interscience Publishers, Inc., New York, 1951.

Dawidowsky, F., *Die Leim und Gelatine Fabrikation*, 336 pp., A. Hartleben's Veilag, Wien und Leipzig, 1925.

Discussions of the Faraday Society, No. 4, *The Physical Chemistry of Process Metallurgy*, 344 pp., Gurney and Jackson, London, 1948. Contributing authors: Chipman, John; Kitchener, J. A.; Bockris, J. O'M.; Liberman, A.; Lumsden, John; Barrer, R. M.; Goodeve, Charles; Jack, K. H.; Dastur, Minu N.; Ellingham, H. J. T.; Rey, M.; Richardson, F. D.; White, J.; Dannatt, C. W.; Pourbaix, M. J. N.; Rorive-Bouté (Madame) C. M.; Rose, B. A.; Davis, G. J.; Anderson, J. S.; Peretti, E. A.; Woods, S. E.; Juliard, A.; Rayet, R.; Lude, A.; Pidgeon, L. M.; King, J. A.; Gross, P.; Campbell, C. S.; Kent, P. J. C.; Levi, D. L.; Warrington (Mrs.) M.; Ignatowicz, S.; Tomlinson, J. W.; Willis, G. M.; Murray, P.; Fornander, S., and Carter, P. T.

Discussions of the Faraday Society, No. 7, *Chromatographic Analysis*, 336 pp., Gurney and Jackson, London, 1949. Contributing authors: Claesson, Stig; Glueckauf, E.; Offord, A. C.; Weiss, Joseph: Smit, W. M.; Zechmeister, L.; Brockmann, H.; Stewart, A.; Hale, D. K.; Reichenberg, D.; Kressman, T. R. E.; Kitchener, J. A.; Duncan, J. F.; Lister, A. J.; Kunin, Robert; Myers, Robert J.; Mongar, J. L.; Wassermann, A.; Levi, Alfred A.; Gordon, A. H.; Barrer, R. M.; Weiss, D. E.; Synge, R. L. M.; Robinson, F. A.; Schwab, George-Maria; Sacconi, Luigi; Burstall, F. H.; Davies, G. R.; Wells, R: A.; Elbeih, I. I. M.; McOmie, J. F. W.; Pollard, F. H.; Flood, H.; Robinson, G.; Barker, K. H.; Kitt, G. P.; Spedding, Frank H.; Tompkins, Edward R.; Phillips, C. S. G.; Lawrence, A. S. C.; Barby, D.; Cassidy, Harold G.; Nestler, F. H. Max; Williams, K. A.; Hirst, E. L.; Jones, J. K. N.; Sheppard, Charles C.; Jones, Tudor S. G.; Partridge, S. M.; Reichstein, T.; Shoppee, C. W.; Leigh, T., Martin, A. J. P.; Tiselius, Arne, and Lester Smith, E.

Dushman, Saul, *Scientific Foundations of Vacuum Technique*, 882 pp., John Wiley & Sons, Inc., New York, 1949, Chapman & Hall, Ltd., London, 1949.

Emmett, Paul H., Editor, *Catalysis, Volume I, Fundamental Principles (Part 1)*, 394 pp., Reinhold Publishing Corporation, New York, 1954. Contributing authors: Ries, Herman E., Jr.; Laidler, Keith J.; Innes, W. B.; Ciapetta, F. G.; Plank, C. J.; and Selwood, P. W.

Feigl, Fritz, *Chemistry of Specific, Selective and Sensitive Reactions*, 740 pp., Academic Press Inc., New York, 1949. Translated to English by Ralph E. Oesper.

Feigl, Fritz, *Spot Tests*, 4th English edition, *Volume I: Inorganic Applications*, 530 pp., *Volume II: Organic Applications*, 452 pp., The Elsevier Press, Houston, Texas, 1954. Translated by Ralph E. Oesper.

Frankenburg, W. G.; Komarewsky, V. I., and Rideal, E. K., Editors, *Advances in Catalysis and Related Subjects, Volume I*, 321 pp., Academic Press Inc., New York, 1948. Contributing authors: Eley, D. D.; Emmett, P. H.; Fankuchen, I.; Griffith, R. H.; Ipatieff, V. N.; Jellinek, M. H.; Pines, Herman; Schmerling, Louis; Storch, H. H., and Taylor, Hugh S.

Frankenburg, W. G; Komarewsky, V. I., and Rideal, E. K., Editors, *Advances in Catalysis and Related Subjects, Volume II*, 292 pp., Academic Press Inc., New York, 1950. Contributing authors: Beeck, Otto; Ipatieff, V. N.; James, T. H.; Kemball, Charles; Mittasch, Alwin; Schmerling, Louis; Schwab, George-Maria; Seitz, Frederick, and Simons, J. H.

Frankenburg, W. G.; Komarewsky, V. I., and Rideal, E. K., Editors, *Advances in Catalysis and Related Subjects, Volume III*, 360 pp., Academic Press Inc., New York, 1951. Contributing authors: Haensel, Vladimir; Kirkpatrick, William J.; Krieger, K. A.; Maxted, E. B.; Milliken, T. H., Jr.; Mills, G. A.; Oblad, A. G.; Rushton, J. Henry; Selwood, P. W.; Trapnell, B. M. W., and Wheeler, Ahlborn.

Frankenburg, W. G.; Komarewsky, V. I., and Rideal, E. K., Editors, *Advances in Catalysis and Related Subjects, Volume IV*, 457 pp., Academic Press Inc., New York, 1952. Contributing authors: Baxendale, J. H.; Bell, R. P.; George, Philip; Halsey, George D.; Hansford, R. C.; Hill, Terrell L.; Pichler, Helmut; Ries, Herman E., Jr., and Weiss, Joseph.

Frankenburg, W. G.; Komarewsky, V. I., and Rideal, E. K., Editors, *Advances in Catalysis and Related Subjects, Volume V*, 487 pp., Academic Press Inc., New York, 1953. Contributing authors: Anderson, Robert B.; Christiansen, J. A.; Field, E.; Gulbransen, Earl A.; John, G. S.; Katz, Morris; Lieber, Eugene; Morritz, Fred L.; Nielsen, Anders; Orchin, Milton; Rhodin, T. N., Jr., and Tolpin, J. G.

Gomer, Robert and Smith, Cyril Stanley, *Structure and Properties of Solid Surfaces*, 491 pp., The University of Chicago Press, Chicago. A conference arranged by The National Research Council, Lake Geneva, Wisconsin, September 1952.

Gregg, S. J., *The Surface Chemistry of Solids*, 1st edition, 297 pp., Reinhold Publishing Corp., New York, 1951.

Harned, H. S. and Owen, B. S., *The Physical Chemistry of Electrolytic Solutions*, Reinhold Publishing Corp., New York, 1943.

Hassler, John W., *Active Carbon*, 1st edition, 384 pp., Chemical Publishing Co., Inc., New York, 1951.

Kelley, Walter P., *Cation Exchange in Soils*, A. C. S. Monograph No. 109, 144 pp., Reinhold Publishing Corp., New York, 1948.

Kolthoff, I. M. and Sandell, E. B., *Textbook of Quantitative Inorganic Analysis*, 116 pp., The MacMillan Co., New York, 1945.

Kraemer, Elmer O., Chapter XX, *Taylor's, A Treatise on Physical Chemistry, Volume 2*, pp. 1567-1721, D. Van Nostrand Co., Inc., New York, 1931.

Kraemer, Elmer O., Editor, *Advances in Colloid Science, Volume I*, 434 pp., Interscience Publishers, Inc., New York, 1942. Contributing authors: Anderson, Thomas F.; Edsall, John T.; Emmett, P. H.; Eyring, Henry; Hauser, Ernst A.; Heitel, K. L.; Kraay, G. M.; McBain, James W.; Meyer, Kurt H.; Milligan, W. O.; Myers, Robert J.; Powell, R. E.; Sullivan, R. R.; Tiselius, Arne; Van Gils, G. E., and Weiser, Harry B.

Kunin, Robert and Myers, Robert J., *Ion Exchange Resins*, 1st edition, 212 pp., John Wiley & Sons, Inc., New York, 1950.

Lederer, Edgar and Lederer, Michael, *Chromatography*, 478 pp., The Elsevier Press, Houston, Texas, 1953.

Ledoux, Edward, *Vapor Adsorption*, 360 pp., Chemical Publishing Co., Inc., New York, 1945.

Mantell, C. L., *Adsorption*, 386 pp., McGraw-Hill Book Co., Inc., New York, 1945.

Mantell, C. L., *Industrial Carbon. Its Elemental, Adsorptive, and Manufactured Forms*, 2d edition, 472 pp., D. Van Nostrand Co., Inc., New York, 1946.

Miner, Roy Waldo; Cassidy, Harold G., and Salin, Lothar, Editors, *Chromatography*, Annals of the New York Academy of Sciences 49, 143-325 (1948). A conference including papers by the following authors: Cassidy, Harold G.; Applezweig, Norman; Claesson, Stig; Deitz, Victor R.; Mair, Beveridge J.; Martin, A. J. P.; Moore, Stanford; Peck, Robert L.; Schroeder, W. A.; Shedlovsky, Leo; Stein, William H.; Thomas, Henry C., and Zechmeister, L.

Marshall, C. Edmond, *The Colloid Chemistry of the Silicate Minerals*, 230 pp., Academic Press Inc., New York, 1949.

Nachod, Frederick C., *Ion Exchange Theory and Application*, 411 pp., Academic Press Inc., New York, 1949.

Robinson, Clark Shove, *The Recovery of Vapors*, 273 pp., Reinhold Publishing Corp., New York, 1942.

Ross, Clarence S. and Hendricks, Sterling B., *Minerals of the Montmorillonite Group. Their Origin and Relation to Soils and Clays*, U. S. Department of the Interior, Geological Survey Professional Paper 205-B, pages 23-79, 1943-44.

Russell, Allen S., *Alumina Properties, Technical Paper No. 10*, 35 pp., Aluminum Company of America, Pittsburgh, Pa., 1953.

Samuelson, Olof, *Ion Exchangers in Analytical Chemistry*, 1st edition, 291 pp., John Wiley & Sons, Inc., New York, 1953.

Sobotka, Harry and 26 other authors, *Ion Exchange Resins in Medicine and Biological Research*, Annals of the New York Academy of Sciences **57**.

Tendeloo, H. J. C., *Hydrophobic Colloids*, p. 83, Nordemann Publishing Co., 1937.

Tiselius, Arne, *Advances in Protein Chemistry, Volume III, Adsorption Analysis of Amino Acid Mixtures*, pp. 67-93, Upsala, Sweden.

White, Howard J., Jr. and Eyring, Henry, *The Adsorption of Water by Swelling High Polymeric Materials*, Textile Research J. **17**, 523-53 (1947).

Zechmeister, L., *Progress in Chromatography 1938-1947*, 1st edition, 368 pp., Chapman and Hall Ltd., London, 1950.

Zechmeister, L. and Cholnoky, L., *Principles and Practice of Chromatography*, 3d edition, 361 pp., John Wiley & Sons, Inc., New York, 1951. Translated from the second and enlarged German edition by A. L. Bacharach and F. A. Robinson with a Foreword by I. M. Heilbron.

LIST OF COMMERCIAL SOLID ADSORBENTS

In presenting a tabulation of the proprietary adsorbents that are available to industry, no claim is made for completeness. An effort has been made to contact the various manufacturers in this country, and the following table is based largely on their replies. No evaluation among the entries by the National Bureau of Standards should be implied, and the uses and applications are given as represented by the manufacturers.

Absorbo	An oil and grease granular adsorbent and floor cleaner. Offered by Fidelity Chemical Products Corp., Newark, N. J.
Acid Silicic	A 100-mesh, analytical reagent, for chromatographic analysis by the method of Ramsey and Patterson; made by Mallinckrodt Chemical Works, St. Louis, Mo.
Acid-Washed Alumina	A product produced for chromatographic analysis by Merck & Co., Inc., Rahway, N.J.
Activated Aluminas	Porous adsorptive forms of aluminum oxide produced by Aluminum Company of America, Pittsburgh, Pa. Available as crystalline and gel types in granular, ball and powder forms. Various grades cover a wide range of surface areas and adsorptive properties. All grades may be reactivated by the application of heat. Used as dehydrating agents for air, commercial gases and many organic liquids; for chromatographic separations and as catalysts or catalyst supports in organic reactions.
Activated Carbon	This term is generally considered to be synonymous with activated charcoal, active carbon, adsorbent carbons, decolorizing carbons, and vegetable carbons. Proprietary names included in this summary are: Adsorbite, Aqua Nuchar, Carbex, Carbo-Dur, Cliff-Char, Columbia Activated Carbons, Darco Activated Carbons, Dehydrite, Deodorite, Filtchar, Girdler Charcoal, H-VW-M Activated Carbon, Minchar, Norit, Nuchar, Pittsburgh Activated Carbons, and Suchar.
Activated Magnesia	Various grades (2665, XP, Sea Sorb, 2652, Elguanite, Periclase Pebbles, Remosil and Remoflur) available from Westvaco Mineral Products Division, Food Machinery & Chemical Corp., New York, N. Y.
Adsobarb	A mixture containing 1/8 grain of magnesium phenobarbital, 6 grains of magnesium trisilicate, and 1/300 grain of atropine sulfate used in medicine. Made by Carroll Dunham Smith Pharmacal Co., New Brunswick, N. J.
Adsorbite	A series of activated carbons prepared by the high temperature steam activation of nutshells by Barnebey-Cheney Co., Columbus, Ohio, since 1919. Suitable for air conditioning, gas purification, pollution elimination, gas masks, solvent recovery, liquid purification, waste disposal, water treatment, catalysis, and chemical separations.
Adsorbol Clays	An adsorption clay available in both the natural and activated states. Its chief uses are in decolorizing vegetable, marine, nut, and petroluem oils. Manufactured by the Sierre Talc & Clay Co., Los Angeles 22, Calif.
Alba-Floc	A finely divided calcium sulfate manufactured by the U. S. Gypsum Co., Chicago 6, Ill., and used as a filter and filtering medium.
Alexite	A vermiculite mica derivative used to adsorb grease and oil. Available in many particle sizes. Alexite Engineering Co., Colorado Springs, Colo.
Alon	Fine aluminum oxide about 200 A. units in particle size. Offered by Godfrey L. Cabot, Inc., Boston, Mass.
Alumina	Adsorbents which may be conveniently classified under this term are: Acid-Washed Alumina, Activated Aluminas, Alon, Alumina Gel Desiccant, Alumina-Tabular (Porous), Aluminum Oxide, Aluminum Oxide Tablets, Aluminum Oxide-Woelm, Alundum, Crystolon, Cyclocel, Driocel, Florite, Florite Desiccant, Houdry Hard Alumina, Houdry Type M and Type S, Isocel, Milwhite Bauxite, Porocel, and Puralox.
Alumina Gel Desiccant	An efficient dehydrating agent (surface area about 400 m^2/g) and available as microspheres, 3/16-in. pellets, and various mesh-size granules. Also used as catalyst base. Filtrol Corp., Los Angeles, Calif.
Alumina-Tabular (Porous)	A porous, granular form of aluminum oxide produced by Aluminum Company of America, Pittsburgh, Pa. This material is of high purity and is well suited for catalytic applications that require rugged, low surface area catalysts.

Aluminum Hydroxide	Prepared by many pharmaceutical firms such as Eli Lilley & Co., Indianapolis, Ind., John Wyeth, Philadelphia, Pa., and W. H. Rorer, Inc., Philadelphia, Pa.
Aluminum Oxide	Adsorbent suitable for chromatographic analysis, Merck & Co., Inc., Rahway, N. J.
Aluminum Oxide Tablets	Aluminum oxide in the form of cylindrical tablets of equal length and diameter used as catalysts, catalyst supports, and drying agents. Available from the Harshaw Chemical Co., Cleveland, Ohio.
Aluminum Oxides-Woelm	Adsorbents suitable for chromatographic analysis: Basic aluminum oxide (cationotropic), (2) nonalkaline (almost neutral) aluminum oxide, and (3) acid aluminum oxide (anionotropic) with highest activity (grade I according to Brockmann) and constant standardized properties. Ready for use. Offered by Alupharm Chemicals, Elmont, Long Island, N. Y.
Aluminum Silicate Pigments	Kaolin refined by a water-washing method and classified by water fractionation into various micron size, cream to white in color, inert and non-abrasive. It is available from Minerals & Chemicals Corporation of America, Metuchen, N. J.
Alundum	Catalyst supports made in sphere, ring, and pellet forms. Fused magnesia, zirconia, and mullite porous supports also available. See also Crystolon. Manufactured by Norton Co., Worcester 6, Mass.
Amberlite Ion Exchange Resins	A series of resinous Ion exchange materials manufactured by the Rohm & Haas Co., Resinous Products Division, Philadelphia, Pa.: Amberlite IR-120, strong acid resin; Amberlite IRC-50, weak acid resin; Amberlite IR-4B, weak base, phenol formaldehyde resin; Amberlite IR-45, weak base resin; Amberlite IRA-400 and IRA-410, strong base resin; Amberlite IRA-401 and IRA-411, strong base porous resin; Amberlite MB-1 and MB-3, mixtures of fully regenerated strong acid cation and strong base anion resin. With the exception of Amberlite IR-4B, IRA-410, and IRA-411, all exchangers listed are available in analytical grades. The above products vary in particle size between 16 and 50 mesh. The fine-particle-size resins, approximately 100 to 400 mesh, are XE-69, strong acid resin; XE-97, weak acid resin; XE-59, weak base resin; XE-119, strong base resin.
Anex	A series of anion exchanging resins. Offered by Infilco Inc., Tucson, Ariz.
Anhydrone	The G. Frederick Smith Chemical Co., Columbus, Ohio. A dehydrating agent consisting of anhydrous magnesium perchlorate.
Anthrafilt	A screened anthracite coal produced by The Hudson Coal Co. and sold by the Palmer Filter Equipment Co., Erie, Pa. Anthrafilt is used in rapid, gravity, pressure, and slow filters, hot and cold process softening filters, oil-removal filters, alkali and acid filters.
Aquadag	A colloidal dispersion of electric-furnace graphite in distilled water, having a solids content of 22% by weight. It has been used as a "getter" in the fabrication of vacuum tubes. Manufactured by Acheson Colloids Co., Port Huron, Mich.
Aquagel	A gel-forming, colloidal Wyoming bentonite clay used in oil-well-drilling fluids to produce high-viscosity and reduce filtrate volume when added to drilling fluids. Manufactured by Baroid Sales Division, National Lead Co., Houston, Tex.
Aqua Nuchar	A grade of powdered activated carbon prepared for removal of taste and odor from municipal and private water supplies. This grade of carbon has been used since 1931 and is supplied by the West Virginia Pulp & Paper Co., New York 17, N. Y.
Aqua Palex	A water-treating coagulant available from The Milwhite Co., Inc., Houston 20, Tex.
Asbestine	Natural, pure-white, fibrous magnesium silicate, 99% of which passes through a 325-mesh screen. Used as a pigment and as a filler in paper. Offered by International Talc Co., Inc., New York, N. Y.
Asbestos	Adsorbents which may be classified for convenience under this term are: Asbestos-Filter Aid, Asbestos-Sorb, Ascarite, and Precoat 564-Filter Aid.
Asbestos	Chrysotile, Amosite, and Crocidolite available from Johns Manville Corp., Manville, N. J. Diatomite-asbestos mixtures are also available.
Asbestos-Filter Aid	Powhatan Mining Corp., Inc., Woodlawn, Baltimore, Md.
Asbesto-Sorb	An oil and grease absorbent prepared from asbestos. Philip Carey Manufacturing Co., Lockland, Cincinnati 15, Ohio.
Ascarite	A sodium hydroxide-asbestos adsorbent supplied in three mesh grades: 8-20 mesh, 12-20 mesh, and 20-30 mesh. Used as an absorbent for carbon dioxide in laboratory work. Manufactured exclusively for Arthur H. Thomas Co., Philadelphia 5, Pa.

LIST OF COMMERCIAL SOLID ADSORBENTS

Atomite	Mechanically-ground calcium carbonate ($CaCO_3$) substantially free from particles larger than 10 microns in diameter. Thompson-Weinman & Co., Cartersville, Ga.
Attaclay	A sorptive powder derived from Attapulgite, the principal mineral of Georgia-Florida clay. It is used as a carrier and diluent for insecticides, herbicides, and fungicides. Minerals & Chemicals Corp. of America, Philadelphia 5, Pa.
Attapulgus Clay	A clay mined at or near Attapulgus, Georgia, from 1905 to 1922, by the Atlantic Refining Co., and since 1922 by the Attapulgus Division of Minerals & Chemicals Corporation of America, Philadelphia 5, Pa. There are about 60 different preparations available, including "A" nonextruded, "AA" extruded, and "AAA" extruded. All three are available in both granular and finely ground grades. Attasorb is finely divided, free-flowing powder.
Attasol	Colloidal attapulgite, the principal mineral constituent of the Georgia-Florida Fuller's earth clay. Attapulgus Division of Minerals & Chemicals Corporation of America, Philadelphia 5, Pa.
Attasorb	An extremely finely divided sorbtive powder derived from Attapulgite, the principal mineral of Georgia-Florida clay. It is used as a carrier, conditioning agent, filler and in certain types of paper and rubber. Minerals & Chemicals Corp. of America, Philadelphia 5, Pa.
Barium Perchlorate	An adsorbent of this composition is known as Dessichlora.
Basex	Glauconite mineral greensand zeolite, mined in Sewell, N. J. and used for water purification by Hungerford & Terry, Inc., Clayton, N. J. A more porous and higher capacity greensand zeolite known as Hi-Basex "A" is also available.
Basic Calcium Phosphates	Adsorbents which may be classified for convenience under this term are: Bone Char, Fluo-Karb, Fluorex, Phosphodust, and Synthad.
Bentonite	In granular and powdered forms. Tamms Industries, Inc., Chicago, Ill. See also names listed under Clay.
Bleaching Clay No. 260	A natural, acid pH, free-flowing powder produced in 200 mesh and 325 mesh fineness. Used as selective adsorbent of fruit sugars, diluent for antibiotics, and refining of vegetable oils. Industrial Minerals & Chemical Co., Berkeley 10, Calif.
Bone Char	This material is essentially a residue from the pyrolysis of animal bones. It is manufactured by the American Agricultural Chemical Co., Detroit, Mich. since 1872; by Baugh & Sons Co., Philadelphia, Pa. since 1880; by British Charcoals & Macdonalds, Ltd., Glasgow, Scotland, since 1825; by Consolidated Chemical Industries, New York, N. Y., since 1878, and by Wed. P. Smits & Zoon, Utrecht, Holland. It is principally used in sugar refining, as a pigment, and to a limited extent in petroleum refining.
Cab-O-Sil	Fine silica (99% SiO_2) produced by a high temperature flame process. Used as a white pigment easily dispersed. Godfrey L. Cabot, Inc., Boston, Mass.
Calcium Alumino-Silicate	See Linde Molecular Sieves.
Calcium Carbonate	Adsorbents which may be classified for convenience under this term are: Atomite, Snowflake, and Witcarb R.
Calcium Silicate	Adsorbents which may be classified for convenience under this term are: Micro-Cels and Silene EF.
Calcium Sulfate	Adsorbents which may be classified for convenience under this term are: Alba-Floc and Drierite.
Carbex	A series of activated carbons produced from vegetable sources by Barnebey-Cheney Co., Columbus, Ohio, especially for the decolorization and deodorization of liquids.
Carbo-Dur	A granular activated carbon of high capacity, high density and rapid wetting. The Permutit Co., New York, N. Y.
Carbon Blacks	*Binney & Smith Co.:* Furnex, Lakoblak, Micronex, Raven, Royal Spectra, Superba, Supertex, Velvetex.
	Godfrey L. Cabot, Inc.: Carbolac 1, Carbolac 2 or 46, Carbolac 2 or 48, Carbovar, Elf, Elf 4, Gastex, Kalista, Mogul, Monarch 71, Monarch 74, Monarch 76, Monarch 78, Pelletex, Spheron 4, Spheron 6, Spheron 9, Spheron C, Spheron N, SRF 3, Sterling 99, Sterling 105, Sterling I, Sterling K, Sterling L, Sterling NS, Sterling R, Sterling S, Sterling SO, Sterling V, Super Carbovar, Vulcan 3.

Carbon Blacks—Con.	*Columbian Carbon Co.; Binney and Smith Co.:* Conductex, Excelsior 6 and 12, Furnex, Lakoblac, Micronex, Micronex II, Micronex HPC-MK 11, Micronex Mark II, Micronex Standard, Micronex W-6, Mollacco, Neo-Spectra II, 999, Peerless, Raven, Raven 15, RMV, Royal, Royal Spectra, Standard Micronex, Statex 93, Statex A, Statex B, Statex K, Statex M, Statex R, Superba, Superba No. 503, Super Spectra, Velvetex.
	Continental Carbon Co.; Witco Chemical Co.: Continental A, Continental AA, Continental Channel Blacks, Continental F, Continental R-40, Continex HAF, Continex HMF, Continex SRF, Disperso, Dustless, Extra Super, Extra Witco, Hi-Tone, Kosmos-F-4, Standard, Super, Witco No. 1, Witco No. 12, Witco 50, Witco 100, Witcolac, Witco Lampblack, Witcolith, Witco Regular.
	General Atlas Carbon Co.; Herron Bros., and Myer: Gastex.
	J. M. Huber, Inc.: Wyex, Arrow, HX, a series of channel blacks of medium oil-absorption. Modulex, Essex, a series of low-oil-absorption furnace blacks. Aromex, Arovel, a series of high oil-absorption furnace blacks.
	Imperial Oil & Gas Products Co.: Eureka, Excello, Excello 2XX, Excello No. 5, Flotone, Intenso, Intenso No. 402, Kohinoor, Kohinoor No. 21, Nos. 88 and 50, No. 902, Special Flow, Supertex No. 50, Supertone or No. 302, Supreme MM, Supreme SH, Supreme VF.
	Jefferson Lake Sulfur Co.: Seminex.
	C. E. Johnson Co.: Atlantic 98, Atlantic 115, Atlantic 120, Atlantic 125, Atlantic 130, Atlantic E-42, Atlantic HPC-98, Atlantic MPC-95 (and 75-109).
	Monsanto Chemical Co.: Monsanto No. 10; also grades of Lampblack.
	Phillips Petroleum Co.: Philblack, Philblack A, Philblack O.
	Shawinigan Chemicals Ltd.: Acetylene Black, Hiflo Acetylene, Standard Acetylene.
	Shell Chemical Co.; R. W. Greef & Co., Inc.: Shell, Carbon.
	Thermatomic Carbon Co.; R. T. Vanderbilt Co.: P-33, Thermax, Thermax Stainless.
	United Carbon Co.: A, 15-A, Arrow TX, BB, Carbon 1, Carbon No. 2, Carbon Special No. 2, Carbon 5, Carbon 10, Carbon B, Carbon EP, Carbon, Ordinary, Carbon R, Carbon W, Dixicell, Dixie 5, Dixie 15-A, Dixie 20, Dixie 35, Dixie 40, Dixie 50, Dixie 60, Dixie 70, Dixie 85, Dixie 105, Dixiedensed, Dixiedensed 77, Dixiedensed HM, Dixiedensed S, Dixiedensed S-66, Dixie Perfecto, Dixie Special 102, Dixifluo A, Dixigloss, F-4, FEF Special, Kosmink, Kosmobile 66, Kosmobile 77, Kosmobile HM (and S-66), Kosmobile S, Kosmofine, Kosmolake, Kosmos 3 x B, Kosmos 15-A, Kosmos 15-D, Kosmos 20, Kosmos 35, Kosmos 40, Kosmos 50, Kosmos 60, Kosmos 70, Kosmos 85, Kosmos 97, Kosmos 102, Kosmos B, Kosmos BB, Kosmos F-4, Kosmovar, New M-1, Nuvofecto, Perfecto, Triangle, Voltex.
Carborundum	Various grades and types of porous pellets in poly-surface, cylindrical and spheroidal shape, principally ceramically bonded aluminum oxide and silicon carbide, from the Carborundum Co., Perth Amboy, N. J.
Caroxite	Absorbent for carbon dioxide, developed by Fisher Scientific Co. in cooperation with steel laboratories. It contains an indicator to show when the absorbent is exhausted and is available in two granulations: 8-20 mesh and 20-30 mesh.
Catex 12 and Catex 55	Ion-exchange materials prepared from sulfonated coal. Infilco Inc., Tucson, Ariz.
Celatom	A wide variety of natural and calcined diatomaceous earth powders and aggregates, with low density and high absorption characteristics. Celatom products are produced from a deposit at Clark, Nev. by the Eagle-Picher Co., Cincinnati 1, Ohio.
Celite	A group of filter aids prepared from the diatomaceous earth mined at Lampac, Calif. They are manufactured by the Johns Manville Corp., New York, N. Y., in nine grades intended for specific filtration conditions: Filter-Cel, Celite No. 505, Standard Super-Cel, Celite No. 512, Hyflo Super-Cel, Celite No. 501, 503, 535, and 545. Also, Celite No. 521 acid washed, and preformed catalyst carriers Celite 408 and 410.
Celite 560	Fastest flow rate diatomaceous filter aid yet developed--not yet commercially available. Johns Manville Corp., New York, N. Y.
Celite Analytical Filter Aid	A highly purified diatomaceous earth, standardized for exacting laboratory requirements. Widely used in chromatographic adsorption work, as well as a filter aid for analytical work. Johns Manville Corp., New York, N. Y.

LIST OF COMMERCIAL SOLID ADSORBENTS

Celkates	Synthetic hydrated magnesium silicates, all active adsorbents. Johns Manville Corp., New York, N. Y.
Cellulose	Adsorbents which may be classified for convenience under this term are Krafelt, Solka-Floc, and Chromatographic Cellulose Powder.
Chempro	Chempro C-20, a high capacity multi-purpose cation exchanger, sulfonated polystyrene type. Chemical Process Co., Redwood City, Calif.
Chromatographic Cellulose Powder	This is made by W. & R. Balston, Ltd. (the Whatman Filter Paper), and sold in the U. S. A. by Fisher Scientific Co., New York, N. Y.
Chromia	Principally Cr_2O_3 available from C. K. Williams & Co., Easton, Pa., East St. Louis, Ill., and Emeryville, Calif.
Clay	Adsorbents which may be classified for convenience under this term are: Adsorbol Clay, Aluminum Silicate Pigments, Aquagel, Attapulgus Clay, Attasol, Bleaching Clay No. 260, Bentonite, Desiccite, Dixie Clay, Dri-Flor, Filtrol, Florex, Floridin, Florigel, Florisil, Fuller's Earth, Hydratex Clay, Kaoklay, Kaolloid Clay, Kaolin Clays, Milwhite Bentonite, Milwhite Salt Water Gel, Palex Clay, Retrol, Silimagi, Snobrite Clay, Super Mil Sorb, Tonsil, Turcosorb, Witco Bentonite, Volclay, and Zeogel.
Cliff Char	Activated carbon produced from hardwood charcoal. Various granular sizes and powder. Used for water purification, for sterile air in fermentive processes, deodorization of gases, catalyst manufacture. Produced since 1932. Cliffs Dow Chemical Co., Marquette, Mich.
Cochroanex Ion Exchange Materials	Cation exchangers: Cochranex CCA sulfonated coal or carbonaceous exchanger; Cochranex CG low capacity greensand; Cochranex CGH high capacity greensand; Cochranex CSL synthetic gel; Cochranex CRH-L medium capacity styrene resin, and Cochranex CRZ-W high capacity styrene resin. Anion exchangers: Cochranex AF-N weakly basic phenolic type; Cochranex AH-W weakly basic styrene type; Cochranex AT-AL Type I strongly basic type, and Cochranex AP-AQ Type II strongly basic type. Available from the Cochrane Corp., Philadelphia 32, Pa.
Columbia Activated Carbons	These gas-adsorbing carbons have been used in this country since 1919 for solvent recovery, gas-mask charcoal, air purification, catalysts, and purification of gases. They are prepared by the Carbide & Carbon Chemicals Co., New York, N. Y., from coconut shells and from other materials for special grades. A variety of grades are available for special applications to various gases.
Crystalite	Sodium aluminosilicate, a water softener. Offered by Infilco Inc., Tucson, Ariz.
Crystolon	Various grades and types available in granular form from Norton Co., Worcester, Mass.
Cyclocel	A granular bauxite manufactured for use as a cracking and cyclization catalyst. It is produced by the Porocel Corp., a subsidiary of Minerals & Chemicals Corporation of America, Philadelphia 5, Pa.
Darco Activated Carbons	Manufactured at Marshall, Tex., by Atlas Powder Co., Wilmington, Del. Powdered grades include: Darco S-51 (since 1921) used in decolorizing sugar liquors, vegetable oils and organic chemicals; Red Label Darco S-51 used to remove grease, oil, soap, and colloids from electroplating solutions; Darco G-60 (since 1931) used for drug and chemical purification; Darco DC (since 1923) for removal of bleeding dyes, odors, and fatty acids from dry cleaning solvents; Darco BG for removing from beer the impurities which cause chill-haze; and Darco KB, a highly activated carbon, for treatment of certain liquid sugars, pectin, glutamic acid, and wines. Granular grades: Hydrodarco for water purification in fixed filtration units; Granular Darco in several mesh sizes for treatment of liquids by percolation.
De-Acidite	A synthetic anion exchange resin, weakly basic, manufactured by the Permutit Co., New York, N. Y. Original quality introduced in 1937 and current quality in 1941. Improved in 1949. Used in demineralizing and in industrial process work.
Decalso	A group of synthetic zeolites produced by precipitation from sodium silicate, sodium aluminate, and aluminum sulfate since 1925 by the Permutit Co., New York, N. Y. Used in water softening, particularly in household softeners.
Defluorite	See Fluorex.
Dehydrite	Anhydrous, granular magnesium perchlorate. It absorbs water to form $Mg(ClO_4)_2.6H_2O$, which, in turn, may be dehydrated to the anhydrous form by heating for 10 hours at 250°C under a vacuum. Manufactured since 1935 by The G. Frederick Smith

Dehydrite—Con.	Chemical Co., Columbus, Ohio, exclusively for the Arthus H. Thomas Co., Philadelphia 5, Pa.
	Activated nutshell carbon impregnated with an inorganic dehydrating agent. Manufactured by Barnebey-Cheney Co., Columbus, Ohio, since 1922. This product is suitable for industrial dehydration and also for simultaneous dehydration and deodorization.
Deodorite	A series of activated carbons manufactured by Barnebey-Cheney Co., Columbus, Ohio, since 1922, for deodorizing gases. It is especially suitable for air conditioning, gas purification, and atmospheric pollution control.
Desiccite	A dehydrating agent offered by the Filtrol Corp., Los Angeles, Calif. as an adsorbent for vapors and gases.
Dessichlora	A dehydrating agent consisting of barium perchlorate. Manufactured since 1935 by The G. Frederick Smith Chemical Co., Columbus, Ohio.
Dialyte	A soft, water-polished pumice (complex silicates of aluminum, potassium, and sodium of volcanic origin). James H. Rhodes & Co., Chicago, Ill.
Diatomaceous Earths	Adsorbents which may be classified for convenience under this term are: Celatom, Celite, Celite 560, Celite Analytical Filter Aid, Dicalite, Filter-Cel Standard, Fossilite, Multicel, Precoat 564-Filter Aid, and Sorbo-Cel.
Dicalite	A group of filter aids prepared from the diatomaceous earth mined near Terrebonne, Oreg., and Torrance, Calif. They are manufactured by the Dicalite Division, Great Lakes Carbon Corp., Los Angeles 17, Calif. Available in 30 or more different grades among which are: Dicalite Superaid, Dicalite UF, Dicalite Speedflow, Dicalite Special Speedflow, Dicalite 20, Dicalite Speedplus, Dicalite Speedex, Dicalite 40, Dicalite 4200, Dicalite Elx, and Dicalite M-23, the latter being a decolorizing mixture of diatomaceous earth and activated carbon introduced in 1940.
Diluex, Diluex "A"	An adsorbent-type carrier for pesticide formulations extensively used as a base for liquid toxicant formulations and as a grinding aid for organic pesticides manufactured by Floridin Co.,Tallahassee, Fla.
Dixie Clay	A hard-type, white-to-cream-colored kaolin, a mineral filler for rubber compounding, a filtering material mentioned in 1935 by the R. T. Vanderbilt Co., New York, N. Y.
Doucil	A zeolite ion exchange material composed of a double silicate of sodium and aluminum, used for water purification. Supplied in two size ranges: No. 830, through 8 mesh and retained on 30 mesh; and No. 1040, through 10 mesh and retained on 40 mesh. Offered by the Philadelphia Quartz Co., Philadelphia, Pa.
Dowex Ion Exchangers	Dowex 50 (Nalcite HCR), sulfonated hydrocarbon; Dowex 50W, a light-colored form of Dowex 50; Dowex 3 (Nalcite WBR), weakly basic; Dowex 1 (Nalcite SBR), strongly basic; Dowex 2 (Nalcite SAR), strongly basic. The Dow Chemical Co., Midland, Mich.
Drierite	A dehydrating agent consisting of anhydrous calcium sulfate for the drying of solids, liquids, and gases. Available with or without color indicator for revealing the presence of moisture. It may be regenerated by heating at 235° to 250°C. Available in various mesh sizes. Manufactured by the W. A. Hammond Drierite Co., Xenia, Ohio.
Dri-Flor	Granular, mineral-base adsorbent for use in adsorbing spillage of water and oil on floors. Offered by Turco Products, Inc., Los Angeles, Calif.
Driocel	A drying adsorbent prepared from activated bauxite and regenerated by heating at 300-500°F. It is produced by the Porocel Corp., a subsidiary of Minerals & Chemicals Corporation of America, Philadelphia 5, Pa.
Duolite	A series of ion exchange and adsorbent resins manufactured by Chemical Process Co., Redwood City, Calif. Weak base anion exchangers: Duolite A-1, A-2, A-4, A-5, A-6, A-7; intermediate base anion exchangers: Duolite A-30, A-70; strong base anion exchangers: Duolite A-40, A-41, A-42, A-43; weak acid cation exchangers: Duolite CS-100, CS-101; strong acid cation exchangers: Duolite C-10, C-3, C-25, C-26 and Chempro C-20; oxygen adsorbent: Duolite S-10; chlorine adsorbent: Duolite S-20; general resinous adsorbent: Duolite S-30
Dustex Micro-Silica	An amorphous silica containing 98.5 to 99.5% silica. It has a particle size range of 1 to 15 microns, 98% of which is less than 10 microns. Tamms Industries, Inc., Chicago 1, Ill.

Elguanite	A magnesia product used to defecate sugar solutions. Elguanite Corp., New York, N. Y.
Ferrosand	An iron and manganese zeolite for removal of iron and manganese from water. Hungerford & Terry, Inc., Clayton, N. J.
Fibrous Glass	Fibers ranging from 0.00005 in. to 0.010 in. have been produced commercially in staple, curly and continuous filament types and in a variety of fabricated forms, e.g., bulk, loose batts, bonded mats and batts, papers, woven textiles. An acid-leached form having uniform pores of the order of 20 A. adsorbs water and hydrocarbons. A partial list of suppliers include Pittsburgh Plate Glass Co., Owens-Corning Fiberglas Corp., Libbey-Owens-Ford and Gustin-Bacon Manufacturing Co. The H. I. Thompson Co. produces the acid-leached fiber.
Filtchar	The first commercial decolorizing carbon in the United States, manufactured between 1914 and 1918 by the West Virginia Pulp & Paper Co., New York 17, N. Y., from sulfite waste liquors in paper-pulp manufacture. It was applied to the oil, fat, and chemical industries, but was replaced by a product known as Superfiltchar. This was manufactured from 1918 to 1921 when it, too, was replaced by others known as the Nuchar carbons.
Filter-Cel Standard	A selected uniform laboratory standard for the diatomite industry and used extensively as the filter aid in "filtrability" testing. Johns Manville Corp., New York, N. Y.
Filtrol	A series of activated clay products of montmorillonite structure, manufactured at Jackson, Miss., Salt Lake City, Utah or Vernon, Calif., by the Filtrol Corp., Los Angeles 23, Calif. These clays are used: (1) as adsorbents in the refining of petroleum oils, fatty oils, sulfur, etc., and (2) as powdered and pelleted catalysts for the catalytic conversion of petroleum oils. Adsorbents: Super Filtrol Grade 1, Special Filtrol Grade 4, Retrol Grade 6, DC Filtrol Grade 7 and Neutrol Grade 40. Catalysts: Montmorillonite and SR type grades.
Filtros	A porous, acid-proof brick made by bonding sand (99.8% SiO_2) with a silicate and firing at 2020°F. Produced in various grades of porosity. Porous carbon, clay and mullite are also available. A porous quartz catalyst carrier is manufactured. It is crushed to irregular shapes and classified in various mesh sizes. Filtros Inc., East Rochester, N. Y.
Florex	An adsorptive clay mined near Quincy, Fla., originally known as Floridin, later improvements in efficiency noted by the trade name Florex, available in granular meshes and finely divided grades for wide applications in adsorption practices. Manufactured by Floridin Co., Tallahassee, Fla.
Floridin	A mineral product based primarily on Florida Fuller's earth commonly known as the mineral attapulgite, produced at Quincy and Jamieson, Fla., for the Floridin Co., Tallahassee, Fla.
Florigel	A hydrated form of Fuller's earth also colloidal (natural attapulgite), used for dispersions with stability in electrolytes manufactured by Floridin Co., Tallahassee, Fla.
Florisil	A synthetic gel extensively used in chromatography, highly selective adsorptive characteristics manufactured by Floridin Co., Tallahassee, Fla.
Florite	An activated bauxite specifically selected for refinery applications, service life and adsorption capacity, processed at Sweet Home, Ark., by Floridin Co., Tallahassee, Fla.
Florite Desiccant	An activated bauxite specifically selected for desiccating properties, extensively used for natural gas dehydration or pipeline transmission. Also in general use as a rugged, solid adsorbent drying agent processed at Sweet Home, Ark., by Floridin Co., Tallahassee, Fla.
Fluo-Karb	A granulated heat-treated bone. The Permutit Co., New York, N. Y.
Fluorex	A tricalcium phosphate preparation used since 1938 for water purification. Distributed by Infilco Inc., Tucson, Ariz., and manufactured by Victor Chemical Works. Also known before 1940 as Defluorite.
Fossilite	A diatomaceous earth for filtering. Offered by L. A. Salomon & Bro., New York 38, N. Y.
Fuller's Earth	A porous, adsorptive clay consisting of hydrated aluminum and magnesium silicates. See for example Floridin Co., Tallahassee, Fla.; Minerals & Chemicals Corporation

Fuller's Earth—Con.	of America, Philadelphia, Pa., and Tamms Industries, Inc., Chicago, Ill. See also names listed under Clay.
Girdler Catalysts	G-19 Steam-Hydrocarbon Reforming Catalyst, a nickel base catalyst containing approximately 20% nickel active in the reforming of hydrocarbons with steam, carbon dioxide, or with steam and air at 1300° to 1850°F. G-29 Steam-Hydrocarbon Reforming Catalyst, a nickel base catalyst containing approximately 27% nickel active in the reforming of hydrocarbons at 1100° to 1850°F. G-3 Carbon Monoxide Shift Catalyst, a chromium promoted iron oxide catalyst used in ammonia and hydrogen plants for the conversion of carbon monoxide by steam at elevated temperatures to carbon dioxide with the formation of hydrogen. G-12, a highly active nickel hydrogenation catalyst; G-15 reduced nickel hydrogenation catalyst, electrolytically precipitated nickel on kieselguhr catalyst; G-16 unreduced nickel hydrogenation catalyst, nickel hydroxide on kieselguhr; G-13 copper chromite hydrogenation catalyst containing about 50 weight percent copper oxide; G-22 barium-promoted copper chromite hydrogenation catalyst containing about 40 weight percent of copper oxide; G-23 cobalt molybdate hydrogenation catalyst, alumina supported, of about 10 weight percent of cobalt molybdate; G-21, G-24, and G-28, selective acetylene hydrogenation catalysts; G-8, a copper-chromium-promoted iron catalyst for desulfurization; G-20, a chromia-alumina desulfurization catalyst; G-11 deoxidation catalyst, copper impregnated on a natural carrier; G-5, an iron oxide base, copper promoted deoxidation catalyst. Offered by the Girdler Co., Louisville 1, Ky.
Girdler Charcoal	Manufactured by the Girdler Co., Louisville 1, Ky.
Glauconite	A natural zeolite; also known as greensand. Cochrane Corp., Philadelphia 32, Pa.
Hi-Sil 101, **Hi-Sil 233,** **Hi-Sil X303**	Synthetic hydrated amorphous particulate silica (150 m^2/g). Columbia-Southern Chemical Corp., subsidiary of Pittsburgh Plate Glass Co., Pittsburgh 22, Pa.
Houdry Hard Alumina	An hard extrudate available in various diameters and surface areas for use as catalyst supports, drying and dehydrating agents. Houdry Process Co., Marcus Hook, Pa.
Houdry Type M and Type S	Porous silica-alumina compositions for use as catalytic cracking catalysts, catalyst supports, drying agents. Houdry Process Co., Marcus Hook, Pa.
H-VW-M Activated Carbon	This activated carbon is offered to the electroplating industry by the Hanson-Van Winkle-Munning Co., Matawan, N. J., for use in purifying acid and alkaline electroplating solutions.
Hydratex Clay	A creamy-white colored, low-mica-content, hydrous aluminum silicate clay, available in lump form, and as pulverized and air-floated powders. Hydratex-R is a low-mica clay refined by water flotation. Suprex Clay, a hydrous aluminum silicate clay in the form of a creamy-white, air-floated powder. J. M. Huber, Inc., New York, N. Y.
Impermex	A water-dispersible, pulverized, organic colloid added to oil-well drilling muds to decrease the filtrate volume. Manufactured by Baroid Division, National Lead Co., Houston, Tex.
Infilco	CATEX, cation exchangers; ANEX, anion exchangers; CRYSTALITE, sodium aluminosilicate; FLUOREX, tricalcium phosphate. Infilco, Inc., Tucson, Ariz.
Inulin	Fisher Scientific Co., New York, N. Y.
Ionac Exchangers	Ionac C-200, phenol formaldehyde sulfonate; Ionac C-284, a cation-exchange resin as black particles; Ionac A-293, an acid-absorbing, anion-exchange resin; Ionac A-293 M, melamine-guanidine-formaldehyde resin; Ionac A-300, medium basic. The American Zeolite Co. and The Ionac Co., Ltd., New York 36, N. Y.
Ion Exchanger Resins	Adsorbents which may be classified for convenience under this term are: Amberlite Ion Exchange Resins, Anex, Catex 12 and Catex 55, Chempro, Cochranex Ion Exchange Materials, De-Acidite, Dowex Ion Exchangers, Duolites, Infilco, Ionac Exchangers, Ion-X Resins, Kyrite, Liquonex Ion Exchangers, Nalcite, Permutit, and Zeo-Karb.
Ion-X Resins	These are identical with Dowex 50. Distributed by Microchemical Specialties Co., Berkeley 3, Calif.
Iron Oxide	Natural pigment in red, yellow or brown. Tamms Industries, Inc., Chicago, Ill.

Iron Oxide—Con.	Contains Fe_2O_3 above 99%. C. K. Williams Co., Easton, Pa., East St. Louis, Ill., and Emeryville, Calif.
Isocel	This product is aluminum chloride impregnated on activated bauxite and used as a catalyst for isomerization reactions. Attapulgus Division of Minerals & Chemicals Corporation of America, Philadelphia 5, Pa.
Kadox-15	A finely divided zinc oxide manufactured by the New Jersey Zinc Co., New York 38, N. Y.
Kaoklay	Fine kaolinite of about 1-micron particle size. Godfrey L. Cabot, Inc., Boston, Mass.
Kaolin Clays	A full range of air-floated and water-washed kaolins of very fine to coarse particle size, from high to low adsorbencies. Available from J. M. Huber Corp., New York 17, N. Y.
Kaolloid Clay	A high absorption type of high brightness Georgia kaolin, with an average particle size of about one micron. Manufactured by Thompson-Weinman & Co., Cartersville, Ga.
Kieselguhr	See Diatomaceous Earth.
Krafelt	A bulky and highly-absorptive type of wood fiber supplied either in the form of pulp or finished paper. Manufactured by Krafelt Co., Wilmington, Del.
Kyrite	A synthetic adsorbent resin deposited upon a diatomaceous filter aid. It was proposed by the Dicalite Co., New York, N. Y. in 1941 for treatment of low-grade sugar products such as affination and granulated sirups.
Lampblack	These are carbon blacks manufactured by burning petroleum oils, tars and aromatic residues in special burning pans. Although lampblack is properly classified as a carbon black it is considered by industry in a separate category and is not covered in this tabulation.
Linde Molecular Sieves	Highly porous crystals in pellets or powder used for selective adsorption processes. They are made by removing the water of hydration from a sodium or calcium aluminosilicate. Available in two porosities: Type 4A sodium aluminosilicate (4 A.), Type 5A calcium aluminosilicate (5 A.). Manufactured and sold by Linde Air Products Co., a Division of Union Carbide and Carbon Crop., New York 17, N. Y.
Liquonex Ion Exchangers	Liquonex CG, stabilized greensand; Liquonex CGH, high capacity greensand (glauconite); Liquonex CSL, synthetic gel sodium alumino-silicate; Liquonex CRM; Liquonex CRP; Liquonex CRQ, phenol-formaldehyde resins containing sulfonic acid groups; Liquonex CRW, sulfonated polystyrene resin; Liquonex AD, strongly basic aliphatic amine resin; Liquonex AF, polyalkylene polyamine resin. Liquid Conditioning Corp., now owned by Cochrane Corp., Philadelphia, Pa.
Magnesia	A powdered adsorptive magnesia prepared by dehydration of the hydroxide by Westvaco Mineral Products Division, Food Machinery & Chemical Corp., New York, N. Y.; also Micron Brand Magnesium Oxide, Nos. 2641 and 2642 and Sea Sorb 43. Adsorbents which may be classified for convenience under this term are: Activated Magnesia, Elguanite, Periclase-S93, Remoflur, Remosil, and Sea Sorb 43.
Magnesium Perchlorate	An adsorbent of this composition is known as Anhydrone.
Magnesium Silicate No. 34	Philadelphia Quartz Co., Ltd., Berkeley, Calif.
Magnesium Silicates	Adsorbents which may be classified for convenience under this term are: Asbestine, Celkates, Magnesium Silicate No. 34, and Magnesol.
Magnesium Trisilicate	A medicinal adsorbent manufactured by the Mallinckrodt Chemical Works, St. Louis, Mo., and by the Philadelphia Quartz Co.,Berkeley, Calif.
Magnesol	An adsorptive synthetic hydrated magnesium silicate available in several modifications for specific applications. Manufactured by Westvaco Chlor-Alkali Division, Food Machinery & Chemical Corp., New York, N. Y. It is used for purifying dry cleaning and other solvents, as a filler in phenolic and other plastics, as an anti-caking agent and flow promoter for solids, as a carrier for perfumes and flavors, for purifying petroleum products, oils, fats and waxes, as a catalyst and catalyst-carrier, and as a chromatographic separation agent.

Metals, Porous	Porous metallic carrier of 18-8 stainless steel, Monel, Hastelloy and other alloys available from Micro-Metallic Corp., Glen Cove, Long Island, N. Y.
Mica	Adsorbents which may be classified for convenience under this term are: Alexite, Mica-Wet Ground, Super-Adsorbit, and Zonolite.
Mica-Wet Ground	Used in chromatographic columns and in corrosion protective systems to improve sealing against moisture penetration. Wet Ground Mica Association, Inc., New York 17, N. Y.
Micro-Cels	Synthetic hydrated calcium silicate products of different degrees of fineness, absorptive capacity, etc. Designated as No. 800, 801, 803, 900, etc. Johns Manville Corp., New York, N. Y.
Milwhite Bauxite	An activated bauxite obtained from Arkansas and used for petroleum processes related to decolorizing and catalysis. It is a granular product available in different mesh sizes from The Milwhite Co., Inc., Houston 20, Tex.
Milwhite Bentonite	Montmorillonite which may be activated to produce a high adsorbent decolorizer and also used as a drilling mud additive. A product "Mil Bond" is used for foundry bentonite and a binder for pelletized livestock feed. It is available from The Milwhite Co., Inc., Houston 20, Tex.
Milwhite Salt Water Gel	An attapulgite-type clay used for a colloid in salt water drilling mud, and also available as a decolorizing medium for contact and percolation processes and as an insecticide carrier. It is available from The Milwhite Co., Inc., Houston 20, Tex.
Minchar	A granular filter medium in which activated carbon has been deposited by the action of superheated steam at a temperature above 675°C. Produced by the Minchar Manufacturing Co., Elmira, N. Y., from a carbonaceous material of an aluminum silicate structure. Used for water purification since 1923 and for the removal of emulsified and free oils from distillates since 1916. Used as an adsorbent and catalyst.
Mineral Feed Black	A pigment that contains principally aluminum silicate 61.8%, carbon 22.1%, sulfur 1.2%, iron oxide 5.1%, silica 5.7%, lime (calcium oxide) 0.6%, and magnesia 1.0%. Tamms Industries, Inc., Chicago, Ill.
Mineral Zeolites	Adsorbents which may be classified for convenience under this term are: Basex, Crystalite, Decalso, Doucil, Ferrosand, Glauconite, Nalcolite, Refinite ZN, and Zeo-Dur.
Multicel	A diatomaceous earth offered in three grades (617, 680 and 000) by the Tamms Industries Inc., Chicago, Ill.
Nalcite	Nalcite SBR, strongly basic anion exchange resin. Nalcite HCR, styrene type cation exchange resin. Nalcite SAR, strongly basic anion exchange resin. Nalcite WBR, weakly basic anion exchange resin of polystyrene-polyamine type. National Aluminate Corp., Chicago 38, Ill.
Nalcolite	Synthetic inorganic exchanger. National Aluminate Corp., Chicago 38, Ill.
Neutrol Grade 40	An acid activated, highly processed adsorbent made from the mineral montmorillonite; used for bleaching fatty oils. Filtrol Corp., Los Angeles 23, Calif.
Norit	Activated carbons for decolorizing and many other purposes manufactured since 1934 by the American Norit Co., Inc., Jacksonville, Fla. Norit activated carbons, including granular carbons for gas adsorption and solvent recovery, are also manufactured by the General Norit Co., Amsterdam, Holland, since 1918.
Novacite	Finely divided alpha-quartz in well rounded crystalline discs containing minute cracks and fissures. In 7 grades having particle diameters ranging from 160 to 3.4 microns. Malvern Mineral Corp., Hot Springs, Ark.
Nuchar	A group of decolorizing carbons manufactured since 1922 by the West Virginia Pulp and Paper Co., New York 17, N. Y., from rotary black ash incident to paper-pulp manufacture. Aqua Nuchar is chiefly used in water purification and Suchar in sugar refining. Other grades of Nuchar are used for treatment of oils, fats, beverages, foods, and in the general chemical industries. See also Filtchar.
Nylon Fibers	Used as a filter aid and available from the E. I. du Pont de Nemours & Co., Wilmington 98, Del.
Palex Clays	Adsorbent clays of several grades used for decolorizing mineral, vegetable, and animal oils. They are available from The Milwhite Co., Inc., Houston 20, Tex.

LIST OF COMMERCIAL SOLID ADSORBENTS

Palladium and Platinum	These catalysts on various carriers are available with varying percentages of platinum metal. The American Platinum Works, Newark 5, N. J.
Periclase-S93	Catalyst support, principally of MgO, manufactured by Westvaco Mineral Products Division, Food Machinery & Chemical Corp., New York, N. Y.
Permagel	A solid thickening agent derived from refined Attapulgite, the principal mineral of Georgia-Florida clay. It is used in both aqueous and organic media to obtain stable and thixotropic gels and as a suspending agent. Minerals & Chemicals Corp. of America, Philadelphia 5. Pa.
Permutit Ion Exchangers	Manganese Permutit, Permutit A, Permutit Folin, Permutit H-70, (carboxylic), Permutit Q (sulfonated styrene cation exchanger), Permutit S—various types (quaternary amine, anion exchanger), Permutit W (weakly basic), Permutit CCG, Permutit DR (Asmit), Permutit H, Zeo-Karb, Zeo-Dur, Decalso, and De-Acidite. Made by The Permutit Co., New York, N. Y.
Phosphodust	A-325 mesh Florida land-pebble phosphate used as an insecticidal carrier dust. The American Agricultural Chemical Co., New York, N. Y.
Pittsburgh Activated Carbons	A series of granular and pulverized adsorbents manufactured from coal since 1939 by Pittsburgh Coke & Chemical Co., Pittsburgh, Pa. A number of grades are available, each having controlled pore structure, surface area, and mesh size for specific applications. Liquid-phase applications: decolorization and purification in sugar refining, water purification, beverages, organic chemicals and pharmaceuticals. Vapor phase applications: solvent recovery, gas stream purification, air conditioning, catalysis, and hydrocarbon separations.
Porocel	An activated bauxite from Arkansas produced since 1937 by the Porocel Corp., subsidiary of Minerals & Chemicals Corporation of America, Philadelphia, Pa. It is for use in petroleum refining, catalysis, and also for sugar refining.
Precoat 564 Filter Aid	An asbestos-diatomaceous filter aid used for adsorption and "polish" filtrations. Johns Manville Corp., New York, N. Y.
Protek-Sorb	A silica gel in various mesh sizes. Davison Chemical Corp., Baltimore 3, Md.
Pumice	This is used chiefly as a catalyst support. Imported by K. F. Griffith Co., Inc., Newark, N. J. from Lipari Island, Italy.
Puralox	Activated aluminum oxide (Al_2O_3) in tablet form. Harshaw Chemical Co., Philadelphia 7, Pa.
Refinite ZN	A processed zeolite clay from natural bentonites. The Refinite Corp., Omaha, Nebr.
Remoflur, Remosil	See Activated Magnesia.
Retrol	An acid-activated, highly-processed adsorbent made from the mineral montmorillonite and employed in re-refining used petroleum oils. (See Filtrol.)
Santocel	A silica aerogel produced by Monsanto Chemical Co., Inorganic Chemical Division, St. Louis, Mo. Grades: Santocel C and Santocel 54, medium oil absorbing, and Santocel A for use in thermal insulation.
Sea Sorb 43	See Activated Magnesia.
Separan 2610	Dow Chemical Co., Midland, Mich.
Silene EF	A white synthetic, hydrated amorphous calcium silicate (80 m^2/g). Columbia-Southern Chemical Corp., subsidiary Pittsburgh Plate Glass Co., Pittsburgh, Pa.
Sil-Flo Filter Aids	An alumina-silica mixture offered by the Sil-Flo Corp., Fort Worth, Tex.
Silica	Granular and powdered in the following sizes: floated, about 240 mesh; powder, about 140 mesh; granular, fine, for water analysis (80-120 mesh); granular, fine (sand); and granular, coarse, about 4 mesh. Offered by the Fisher Scientific Co., New York, N. Y.
Silica	Adsorbents which may be classified for convenience under this term are: Cab-O-Sil, Filtros, Hi-Sil 233, Hi-Sil X303, Novacite, Santocel, Silica-Amorphous, Silica-Crystalline, and Silica-Fine Sizes.
Silica Alumina Catalyst	Type MS-F-1 and others available from Davison Chemical Co., Baltimore, Md. Type MS-Al and MS-B and others available from American Cyanamid Co., New York, N. Y. Type MS-2, A, B, C, and others available from National Aluminate Corp., Chicago, Ill.

Silica-Amorphous	Velveteen "R" Silica—an amorphous silica fines 95 to 97% thru 325 mesh. OO Silica Smoke—an amorphous silica fines 99.5% thru 325 mesh. Gold Bone "R" Silica—an amorphous silica fines 98 to 99% thru 325 mesh. Tamms Industries, Inc., Chicago, Ill.
Silica-Crystalline	No. 68 Silica Flour—a crystalline silica fines 96% thru 140 mesh. No. 10 Silica Flour—a crystalline silica fines 98% thru 200 mesh. No. 400 Silver Bond "B" Silica—a crystalline silica fines 99.5% thru 325 mesh. Tamms Industries, Inc., Chicago, Ill.
Silica Gel	Known also as Protek-Sorb, produced from sodium silicate and sulfuric acid since 1919 by the Davison Chemical Co., Baltimore, Md.
Silica-Fine Sizes	Non-crystalline white powders of varying particle sizes from 6 to 20 microns (also known as Syloid 244). The Davison Chemical Co., Baltimore, Md.
Silicate Carriers	Various types available: Peerless No. 1, kaolin; Continental, kaolin; "Pyrax" B, pyrophyllite; Nytal, talc; Cherokee, kaolin; "Veegum". R. T. Vanderbilt Co., Inc., New York 17, N. Y.
Silicic Acid	The meta-precipitated form, H_2SiO_3, of a reagent grade is offered by the Fisher Scientific Co., New York, N. Y.
Silimagi	A natural clay of high pH value and showing substantial thixotropy. Produced as a free-flowing powder for use in preparation of emulsions and as a substitute for bentonite where varying pH of water disturbs thixotropic behavior of bentonite. Industrial Minerals & Chemical Co., Berkeley 10, Calif.
Snobrite Clay	A high absorption type of high brightness Georgia kaolin, with an average particle size of about one micron. Manufactured by Thompson-Weinman & Co., Cartersville, Ga.
Snowflake	Mechanically-ground calcium carbonate ($CaCO_3$) substantially free from particles larger than 25 microns in diameter. Thompson-Weinman & Co., Cartersville, Ga.
Sodium Alumino-Silicate	See Linde Molecular Sieves.
Solka-Floc	Purified wood cellulose of several grades, mesh size and density; manufactured by Brown Co., Boston 14, Mass. A non-abrasive, combustible filter aid.
Sorbo-Cel	An activated and chemically treated diatomaceous filter aid, used particularly for its adsorptive as well as filter-aid action. It is used principally for fine oil-in-water emulsions and other dispersions. Manufactured by Johns Manville Corp., Manville, N. J.
Suchar	One of the Nuchar carbon adsorbents. Suchar Engineering and Sales Co., New York, N. Y.
Super-Absorbit	See Alexite. Alexite Engineering Co., Colorado Springs, Colo.
Super Mil Sorb	A granulated attapulgite-type clay for use as a water, oil and grease absorbent, and as a carrier for insecticides. It is available from The Milwhite Co., Inc., Houston 20, Tex.
Synthad	A granular adsorbent containing principally a basic calcium phosphate, a clay binder, and a carbonaceous residue. Used as a replacement for bone char. Manufactured by Baugh & Sons Co., Philadelphia, Pa.
Talc	Purified powder U. S. P. grade. Fisher Scientific Co., New York, N. Y.
Tonsil	Manufactured in Germany and distributed in the United States by L. A. Salomon & Bro., New York 38, N. Y. These include several powdered, acid activated clays for use in decolorizing of many solutions, such as vegetable, animal, and mineral oils, etc.
Turcosorb	Granular, mineral-base adsorbents for use in adsorbing spillage of water and oil on floors. It is offered by Turco Products, Inc., Los Angeles, Calif.
Volclay	A Wyoming bentonite used as a bleaching clay in the following grades: 200 mesh, 325 mesh, KWK 33, MX 80, BC, and Minus 625. It is manufactured by the American Colloid Co., Chicago 54, Ill.
Witcarb R	Ultrafine particle size precipitated calcium carbonate. It is used chiefly in paints. Witco Chemical Co., New York 17, N. Y.

Witco Bentonite	A bentonite offered by the Witco Chemical Co., New York 17, N. Y.
Zeo-Dur	A mineral zeolite, a species of greensand, mined in New Jersey and used for water purification by the Permutit Co., New York, N. Y., since 1917. An activated variety known as Super Zeo-Dur has been available since 1935.
Zeogel	A special colloidal attapulgite clay used as a suspending agent in saline or fresh water oil-well drilling muds. Manufactured by Baroid Division, National Lead Co., Houston, Tex.
Zeo-Karb	A carbonaceous zeolite produced since 1936 from coal and sulfuric acid by the Permutit Co., New York, N. Y. It is used in water treatment, demineralizing, and in industrial processes.
Zeolex	A series of sodium and sodium calcium silico-aluminates, in 20 to 50 millimicron particle size, with high adsorbencies, used as conditioners and anti-caking agents. J. M. Huber Corp., New York 17, N. Y.
Zinc Oxide	An adsorbent of this composition is known as Kadox-15.
Zonolite	Vermiculite, sold directly as ore, and as an exfoliated product. Various classifications are given the processed material based on particle size. Zonolite Co., Chicago 3, Ill.

AUTHOR INDEX

SUBJECT INDEX

ABBREVIATIONS USED IN ABSTRACTS *

A.	Angstrom unit(s)
abs.	absolute
Ac	acetyl (AcOH, acetic acid)
a.c.	alternating current
addn.	addition
alc.	alcohol, alcoholic
alk.	alkaline
amp.	ampere(s)
amt.	amount
anhyd.	anhydrous
app.	apparatus
approx.	approximate, approximately
aq.	aqueous
assoc.	associate(s)
at.	atomic
atm.	atmosphere(s), atmospheric
at. wt.	atomic weight
av.	average
Bé.	Baumé
B.E.T.	Brunauer, Emmett & Teller
biol.	biological
B.O.D.	biochemical oxygen demand
b.p.	boiling point
B.t.u.	British thermal unit
Bu	butyl (normal)
Bz	benzoyl (BzOH, benzoic acid)
°C	degree Celsius
cal	calorie(s)
calc.	calculate
calcd.	calculated
calcn.	calculation
c.d.	current density
c.f.s.	cubic foot per second
chem.	chemical
cm	centimeter(s)
cm^2	square centimeter
cm^3	cubic centimeter
coeff.	coefficient
combn.	combination
compd.	compound
compn.	composition
conc.	concentrate
concd.	concentrated
concn.	concentration
cond.	conductivity
const.	constant
contg.	containing
co-pptd.	co-precipitated
co-pptn.	co-precipitation
crit.	critical
cryst.	crystalline
crystd.	crystallized
d.	density
d.c.	direct current
decompd.	decomposed
decompn.	decomposition
deriv.	derivative
det.	determine
detd.	determined
detn.	determination
diam.	diameter
dil.	dilute
dild.	diluted
diln.	dilution
dissoc.	dissociate(s)
distd.	distilled
distn.	distillation
dm	decimeter(s)
elec.	electric, electrical
e.m.f.	electromotive force
equil.	equilibrium
equiv.	equivalent
Et	ethyl
e.v.	electron volts
evap.	evaporate
evapd.	evaporated
evapn.	evaporation
examd.	examined
examn.	examination
expt.	experiment
exptl.	experimental
ext.	extract
°F	degree Fahrenheit
f.p.	freezing point
ft	foot
ft^2	square foot
ft^3	cubic foot
g	gram(s)
gal	gallons(s)
geol.	geological
g.p.m.	gallons per minute
g.p.s.	gallons per second
ha.	hectare
hr	hour
in.	inch(es)
$in.^2$	square inch
$in.^3$	cubic inch
inc.	increase
indep.	independent
inorg.	inorganic
insol.	insoluble
°K	degree Kelvin
kc	kilocycle
kcal	kilocalorie(s)
kg	kilogram(s)
km	kilometer(s)
kv.	kilovolt(s)
lab.	laboratory
liq	liquid
log	logarithm
lb	pound

---

*The abbreviations are mostly those used by the American Chemical Society.

m	meter(s)
m^2	square meter
m^3	cubic meter
M	molar
μ	micron
μ^3	cubic micron
ma.	milliampere(s)
manuf.	manufacture
math.	mathematical
max.	maximum
Me	methyl
measd.	measured
mech.	mechanical
meq.	milliequivalent
mg	milligram(s)
min.	minimum (also minute(s))
mixt.	mixture
ml	milliliter(s)
mm	millimeter
mm^2	square millimeter
mm^3	cubic millimeter
$m\mu$	millimicron
mol.	molecule, molecular
m. p.	melting point
mv.	millivolt(s)
n	index of refraction
N	normal

N.T.P.	normal temperature and pressure
neg.	negative
no.	number
org.	organic
oz	ounce
p.d.	potential difference
phys.	physical
physiol.	physiological
pos.	positive
powd.	powdered
p.p.m.	parts per million
ppt.	precipitate
pptd.	precipitated
pptn.	precipitation
Pr	propyl
prep.	prepare
prepd.	prepared
prepn.	preparation
pres.	pressure
p.s.i.	pounds per square inch
p.s.i.g.	pounds per square inch gage
qt	quart
qual.	qualitative
quant.	quantitative
resp.	respectively

sat.	saturate
satd.	saturated
satn.	saturation
sec	second
sep.	separate
sepn.	separation
sol.	soluble
soln.	solution
soly.	solubility
sp	specific
sp.gr.	specific gravity
sq	square
St.	Stammer
subst.	substance
sym.	symmetrical
tech.	technical
temp.	temperature
v.	volt(s)
v.p.	vapor pressure
vol.	volume
w.	watt(s)
wt	weight
yd	yard
yd^2	square yard
yd^3	cubic yard
yr	year

U. S. GOVERNMENT PRINTING OFFICE: 1956 O— 349129